



Foothill Yellow-legged Frog at Carson Falls

2019 MMWD Frog Docent Program Season Summary

Alexander Johanson, Watershed Stewards Program

Rana boylei, or the Foothill Yellow-legged Frog (FYLF), is a species of long-legged frog native to the west coast of North America. Traditionally found in coastal drainages between the Cascade Foothills of the Willamette River System in western Oregon to the San Gabriel River System in Los Angeles, California, this is the only frog species that exclusively lays its eggs in warm, slow-moving streams with plenty of stable boulders and cobbles for them to anchor their egg masses^{1,2}.

While there have been many different extant populations of FYLF identified throughout Marin County, only two breeding populations currently persist on land maintained by the Marin Municipal Water District (MMWD). These two genetically distinct populations can be found on Mt. Tamalpais and were first reported at Big Carson Creek in 1996 and at Little Carson Creek in 1997. These two populations have persisted while most other populations throughout Marin have disappeared³. As recently as 2018, a third population was found on Mt. Tamalpais in Cascade Canyon Preserve, which is under the jurisdiction of Marin County Parks (MCP).



Photo 1. Adult FYLF (Jeff Schoppert, Frog Docent)

Conservation efforts for this species are difficult because of the significant differences between their aquatic juvenile phase and their terrestrial adult phase. FYLF were classified as *Near Threatened* by the IUCN in 2004, and have been listed as a *Species of Special Concern* in California since 1996¹. The major cause of decline for the FYLF in Marin County has yet to be identified, but ongoing threats include habitat alteration and fragmentation, predation by non-native bullfrogs and signal crayfish, and the potential risks from climate change resulting in alterations to the temperature, timing, and amount of water in the creek^{3,4}. The FYLFs appear to be surviving at a stable level, but due to the isolated nature of the two breeding populations at Little Carson Creek and Big Carson Creek, they are at increased risk from inbreeding and complications from threats such as prolonged drought or fire⁴.

FYLFs require warm, slow-moving water to safely lay and rear their eggs. This makes Little Carson Creek, and especially Carson Falls, an ideal location for breeding. The water is oxygenated and in direct sunlight, and the falls are harder to access for crayfish that would travel up from Kent Lake to eat both eggs and tadpoles. The pools of the falls also offer optimal habitat for algae to grow, which is the primary food source for tadpoles before metamorphosis^{1,2}. However, the pools at Carson Falls are not just ideal for frogs – they're ideal for hikers, dogs, and other native wildlife that may need an opportunity to cool off in the water.



Figure 1. Historic Range FYLF in North America (California Herps)

One of the biggest threats to the FYLF population at Carson Falls is the use of the falls and pools by hikers and their dogs, due to the potential to dislodge egg masses that are anchored to rocks along the edges of the water. In order to protect and preserve the FYLFs, MMWD created the Frog Docent Program – to give voices to the frogs that visitors may not know are in danger of being extirpated from Mt. Tam. Since the program’s inception in 2005, Frog Docents have spent over 2,300 hours at Carson Falls, working roughly four hours per shift on Saturdays or Sundays from March into June, during the critical breeding season for FYLFs. While stationed at the falls, docents share information with visitors on the biology and status of the FYLFs, show visitors where to find them and what they look like using binoculars and spotting scopes, and describe what measures MMWD is currently taking to protect them. They also record data on all the frogs, egg masses, and tadpoles they see, to help with MMWD’s community science monitoring project.



Photo 2. Carson Falls at Little Carson Creek

In 2019, 16 docents spent a total of 172 hours at Carson Falls. Due to the extensive rainfall from March-May, docents spent less time at Carson Falls in 2019 than average. However, in that time, docents saw 607 visitors, spoke with 79% of them, and recorded seeing adult frogs 207 times. 10 docents were returning volunteers and 6 were new; they covered 66% of available shifts. Active docents took on one to four shifts.

MMWD has also been contracting with the environmental consulting firm *Garcia and Associates* (GANDA) since 2004 to help with the biological monitoring of the FYLFs at Big Carson and Little Carson Creeks. During their surveys in 2019 GANDA, reported 37 adult males, 22 adult females, and 18 unknown adults in Little Carson Creek. In 2019 they observed 12 egg masses in Little Carson Creek, which is down from 17 in 2018. **Figure 2** shows the changes over time at Little Carson Creek in both the total number of egg masses (left axis) and total number of adults (right axis) reported by GANDA during their surveys. **Figure 3** shows the total number of dogs reported by docents at Carson Falls in 2019.

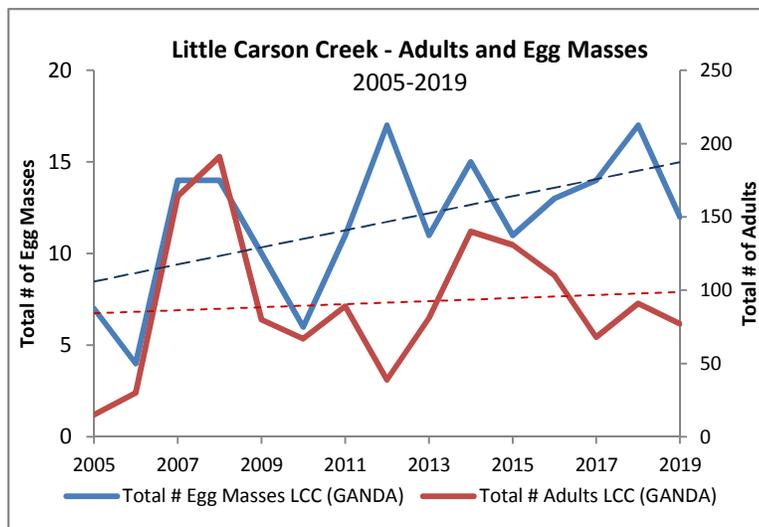


Figure 2. Changes in reported frog numbers in Little Carson Creek - 2005-2019

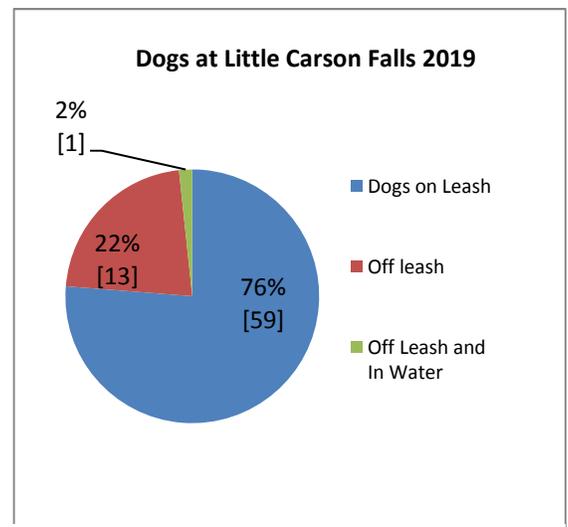


Figure 3. Total number of dogs seen by Docents at Little Carson Creek - 2019

2019 had only 73 dogs reported at the falls, and even fewer off leash or in the water than in previous years. GANDA reported fewer egg masses and fewer adults counted than in previous years, which would imply a decline in the overall population of FYLF at Carson Falls. However, based on the trendlines in **Figure 2**,



Photo 3. FYLF Egg Mass
(Karla Marlow, GANDA)

while the overall number of adults at Little Carson Creek is fairly stable, it is trending slightly up, and more egg masses are being laid over time. The One Tam Peak Health report from 2016 states that the current population trend of FYLFs on Mt. Tam is stable, but isolating the data from Little Carson Creek, there is a potential increase in reproductive success at Carson Falls⁴. Big Carson Creek had more egg masses and adults, raising the overall 2019 total to 26 egg masses and 77 adults. Of the 12 egg masses laid at Carson Falls, a total of 301 tadpoles were counted. However, 300 tadpoles were counted on April 29th, and on the last survey conducted by GANDA on May 28th, only one tadpole was seen. This is most likely due to the significant storm event that occurred from May 15th-21st, which brought over seven inches of rain to Marin County⁵. Such an event likely brought flows up high enough to wash out egg masses and recently-hatched tadpoles from the pools at Carson Falls.

FYLFs have a life history that makes them able to combat poor reproductive years. Juveniles don't reach sexual maturity until six-months to two years after they transition from tadpoles and leave their natal streams. Their maximum life-span is currently unknown, but GANDA has tracked one known individual living up to 11 years. This species has also been shown to be resilient to the amphibian disease *chytridiomycosis*, caused by the chytrid fungus, which has decimated amphibian populations around the world. Two individuals collected from Carson Falls in 2009 were carrying the disease, but appeared to have little to no detrimental health effects from the infection³. One year with poor reproductive recruitment does not mean the frogs will disappear from Carson Falls, and there's still hope that the population will continue to trend upwards. In 2010, GANDA conducted a study assessing the feasibility of reintroducing FYLFs around the Mt. Tam watershed. This study identified Cascade Canyon as one of the most ideal locations to produce a pioneer effort to reintroduce FYLFs back to a potentially previously-occupied habitat and without any assistance from conservation efforts, FYLFs managed to migrate into Cascade Canyon and began reproducing on their own. This led to the creation of MCP's very own Frog Docent Program that began surveying Cascade Canyon this year.



Photo 4. FYLF Amplexus
(Karla Marlow, GANDA)

While conservation of any wild species with a varied life history can be difficult, the benefits of the monitoring work done by firms such as GANDA and the education and outreach done by the MMWD Frog Docents cannot be overstated. Without the help of either of these teams, FYLFs would be at a greater risk of becoming extirpated entirely from Mt. Tam, so we at MMWD would like to thank Karla Marlow and Joe Drennan of GANDA for their hard work surveying all known breeding populations during the 2019 season and all of the 2019 Frog Docents who volunteered their time to help protect the frogs at Carson Falls: Peggy Della Valle, Lorri Gong, Jeff Schoppert, Rob Ruiz, Frederic Leist, Petey Knudsen, Tatiana Manzanillo, Cindi Darling, James and Ethan Fair, Marguerite Murphy, Janet Bodle, Rich Cimino, Pierre Minhondo, Jasmine Wallsmith, & Sara Leon Guerrero. Thank you all for all the hard work that you did this year. The information obtained is invaluable, and we hope to be lucky enough to work with you all again in 2020.



References:

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