State of California

Memorandum

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Ec: CDFW Document Library

Cc: Region 2 Fish Files

Subject: Native amphibian monitoring in Desolation Wilderness;

Gertrude Lake area *Rana sierrae* monitoring.

INTRODUCTION

The Gertrude Lake area contains a very small population of Sierra Nevada Yellow-legged Frogs (SNYLF; *Rana sierrae*). California Department of Fish and Wildlife (CDFW) and U.S. Forest Service staff have detected SNYLF in the area since the mid 1990's. The small population size, isolation, and potential for extirpation make the Gertrude Lake drainage SNYLF population of interest to CDFW.

ENVIRONMENTAL SETTING

Gertrude Lake is located in the Desolation Wilderness, northeast El Dorado County (Figure 1). The lake sits within a granite basin at approximately 8,000' above mean sea level and drains west into Jones Fork Silver Creek. Eldorado National Forest manages this section of Desolation Wilderness and the surrounding land. Gertrude Lake is accessed via the Rockbound Trailhead, which is located off the northwest side of Wrights Lake.

During baseline lake surveys for the High Mountain Lakes project in 2002, CDFW crews observed a single adult SNYLF in Gertrude Lake. The Aquatic Biodiversity Management Plan for the Desolation Wilderness Management Unit (CDFW 2012) identifies Gertrude Lake (Figure 2), two adjacent unnamed ponds (Figures 3 and 4), a portion of the Gertrude Lake outlet stream (Figures 5–7), Tyler Lake, and several additional unnamed fishless ponds in the immediate area as a Native Species Reserve (NSR) for SNYLF (Figure 8).

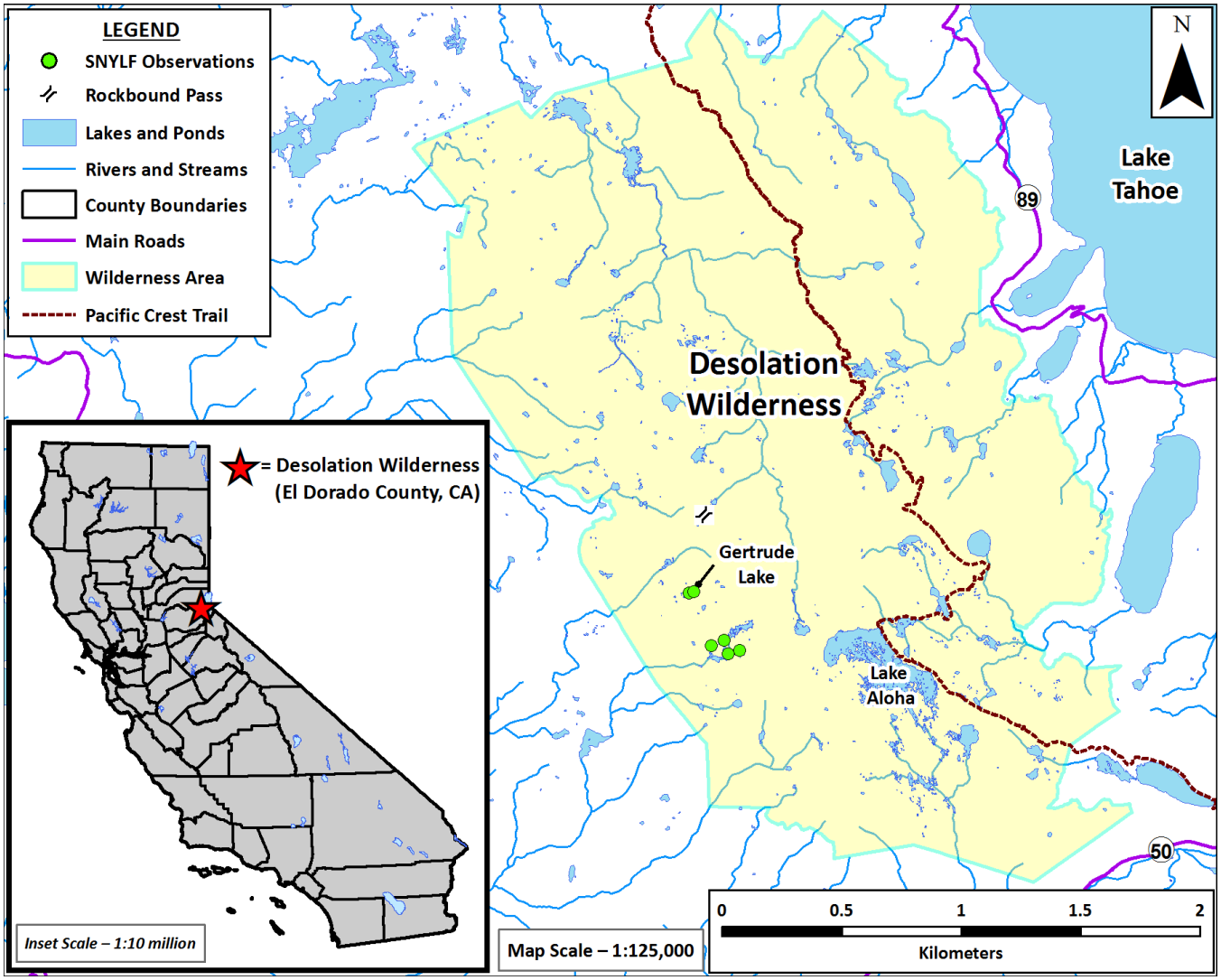


Figure 1: Desolation Wilderness, El Dorado County, CA. Green dots showing *Rana sierrae* (SNYLF) sites include positive detections by CDFW crews in the area of interest during recent visual encounter surveys (VES). Green dots to the south of Gertrude Lake basin are SNYLF locations in the Island Lake area, which is the closest neighboring SNYLF population to Gertrude Lake basin.

Figure 2: Gertrude Lake (Site ID 14121) in summer 2012, looking south. (CDFW)

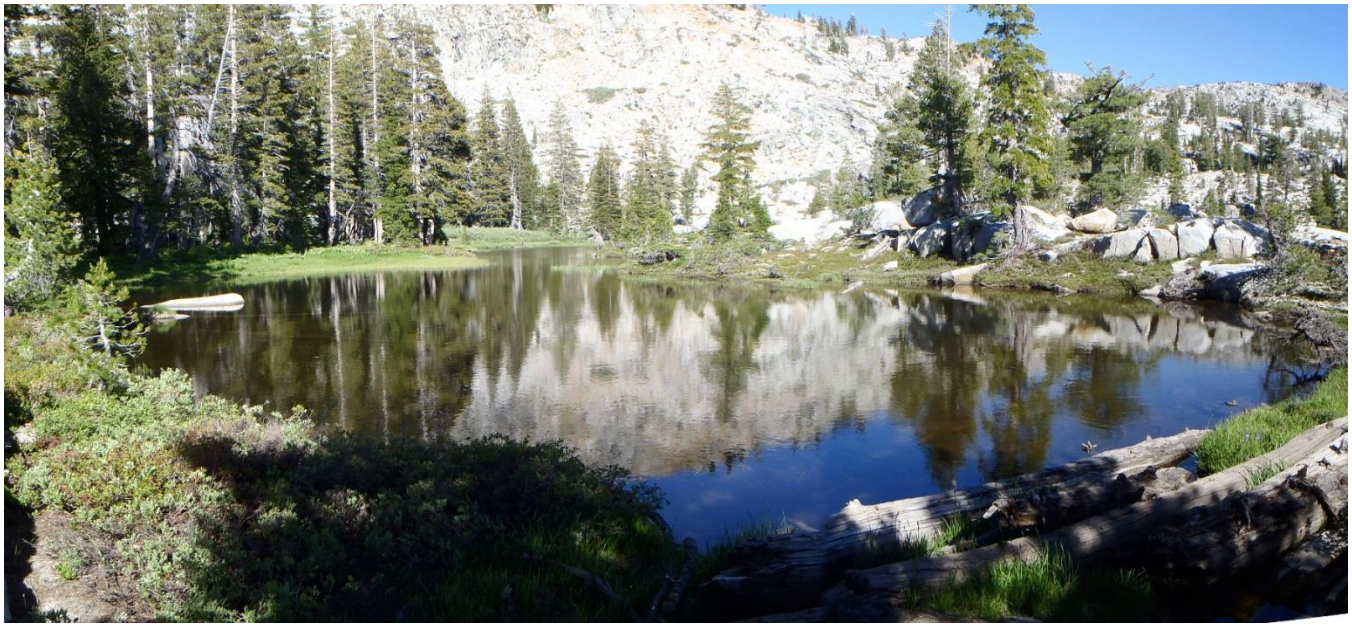


Figure 3: Unnamed pond (Site ID 14116), just north of Gertrude Lake, in summer 2012, looking east. (CDFW)

Figure 4: Small unnamed pond (Site ID 14122), directly adjacent to Gertrude Lake, in summer 2012, looking north. (CDFW)

Figure 5. Upper section of stream 50120, in August 2017, looking east. (CDFW)

Figure 6. Lower section of stream 50120, in August 2017, looking east. (CDFW)

Figure 7. Bottom stream widening section of stream 50120, in August 2017, looking west. (CDFW)

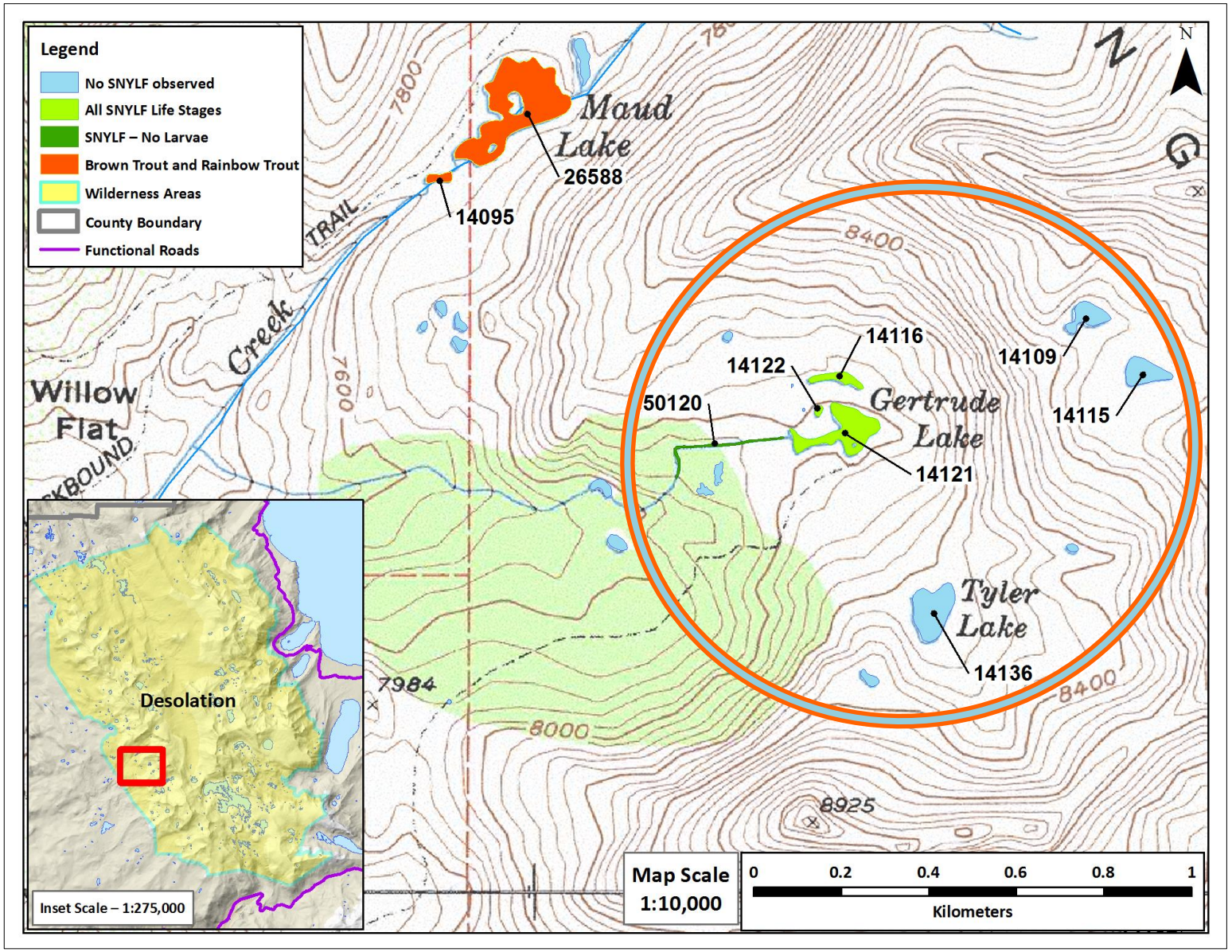


Figure 8: Trout and Sierra Nevada yellow-legged frog (SNYLF) occupancy in the Gertrude Lake area, Desolation Wilderness. CDFW crews have observed low numbers of SNYLF in Gertrude Lake and a few small ponds in the basin. Lakes and ponds showing SNYLF occupancy are from CDFW visual encounter surveys (VES). All flowing waters drain southwest into Jones Fork Silver Creek. Encircled area is the Native Species Reserve (NSR) as identified in the Aquatic Biodiversity Management Plan for the Desolation Wilderness (CDFW 2012). Displayed numbers are CDFW Site IDs.

THREATS

- ***Loss of Genetic Diversity*** – Like many SNYLF populations in the northern Sierra Nevada, the population in Gertrude Lake basin is very small and isolated. Although there is a SNYLF population in relatively close proximity (i.e., Twin/Island Lakes basin), the rugged landscape of Desolation Wilderness likely precludes the opportunity for gene flow from a source outside of Gertrude Lakes. The nearest location with widespread SNYLF occupancy is Desolation Valley, which is about four kilometers to the east, on the opposite side of the Crystal Range. In addition to the threats presented by stochastic environmental events when a population is geographically isolated (e.g., drought or especially harsh winter), genetic isolation can lead to factors such as inbreeding depression, genetic drift, fixation of deleterious alleles, and loss of genetic diversity, all of which are population genetic factors exacerbated in small populations like those in the Gertrude Lake area (Frankham et al. 2009).

- ***Marginal Habitats*** – SNYLF are persisting in extremely low numbers at several small ponds in Gertrude Lake basin (Figure 8). Any disturbance, natural or otherwise, that results in changes to the hydrology or limnology of the habitat poses a potential extirpation risk to the population. Potential risks include severe winter conditions, extended drought, or anthropogenic habitat disturbances.

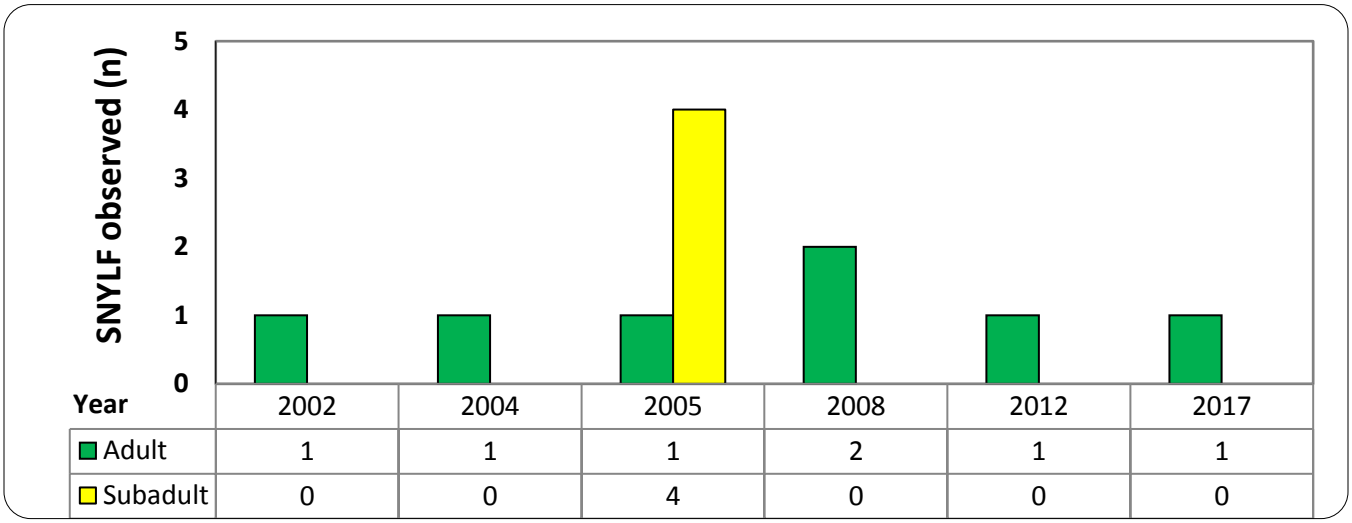
- ***Disease*** – All SNYLF populations in El Dorado County from which field crews have collected epithelial swabs are positive for chytrid fungus (*Batrachochytrium dendrobatidis*; *Bd*). CDFW field crews have not collected epithelial swabs from SNYLF in the Gertrude Lake basin. However, given the widespread distribution of *Bd* in the northern Sierra Nevada, CDFW assumes the population is currently *Bd* positive.

- ***Introduced Fish*** – CDFW stocked Gertrude Lake with brook trout from 1950 until 1965. Later, between 1968 and 2000, CDFW stocked the lake with golden trout (*Oncorhynchus mykiss aguabonita*). Overnight gill net surveys in 2002 retrieved both brook trout and golden trout. The last fish detected during gill netting surveys was a single brook trout captured in July 2004. CDFW field crews did not capture any fish during an overnight gill net survey in July 2008. Based on current data, it appears that trout populations were not self-sustaining, and there are no longer fish in Gertrude Lake. Although trout may no longer be present in Gertrude Lake basin, introduced fish were likely preventing SNYLF from successfully reproducing in the area for many decades. Trout predate SNYLF and are a potential source of competition for food (e.g., benthic macroinvertebrates).

POPULATION STATUS

During the past decade, CDFW field crews have only observed a few SNYLF individuals in Gertrude Lake basin (Figure 9). All available survey results suggest the SNYLF population is tiny and highly susceptible to extirpation. Given few detections, little can be determined about the population trends in the Gertrude area, but continued monitoring may allow CDFW to better assess the long-term status and trends of the SNYLF population.

The absence of trout may now allow the SNYLF population to begin slowly expanding. However, as discussed in the Aquatic Biodiversity Management Plan for the Desolation Wilderness (CDFW 2012), SNYLF reintroductions may eventually be necessary to reestablish the SNYLF population and minimize the potential for genetic bottlenecking. The nearest extant SNYLF population to the Gertrude Lake area is found in the Island/Twin Lakes drainage, which is located just over the ridgeline southeast of Gertrude Lake basin. CDFW is currently undertaking fish removal efforts in Island Lake to improve habitat for SNYLF and other native species. The goal is to restore an interconnected network of high quality aquatic habitat and provide a better chance for long term persistence of a robust SNYLF population. If CDFW achieves this goal, the Island Lake basin SNYLF population may serve as a future source population for translocating frogs to Gertrude Lake area. Other potential source populations in the nearby proximity include the Clyde Lake drainage and Desolation Valley, both of which currently contain relatively large SNYLF populations. These methods, including fish removal efforts, translocations, and reintroductions, are all actions specifically recommended by the Interagency Conservation Strategy for Mountain Yellow-legged Frogs in the Sierra Nevada (USFWS 2018) for restoring SNYLF populations.



Year	2002	2004	2005	2008	2012	2017
Adult	1	1	1	2	1	1
Subadult	0	0	4	0	0	0

Figure 9: Number of adult and subadult SNYLF detected during visual encounter surveys (VES) in the Gertrude Lake drainage. CDFW field crews have detected very few SNYLF in the basin. Field crews have also occasionally detected a small number of SNYLF tadpoles in Gertrude Lake and two adjacent ponds (Site IDs 14116 and 14122). Non-native trout were present in the basin until recent years. Trout presence likely prevented any successful SNYLF recruitment.

LITERATURE CITED

CDFW. 2012. Aquatic Biodiversity Management Plan for the Desolation Wilderness Management Unit. California Department of Fish and Wildlife, Rancho Cordova, CA. Available from: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=59961

Frankham, R., J.D. Ballou, and D.A. Briscoe. 2009. Introduction to Conservation Genetics. Cambridge University Press, New York, NY, USA.

United States Fish and Wildlife Service (USFWS). 2018. Interagency conservation strategy for mountain yellow-legged frogs in the Sierra Nevada (*Rana sierrae* and *Rana muscosa*). Administrative draft.