

State of California
Department of Fish and Wildlife
Memorandum

Date: 26 March 2024

To: Leslie Alber;
Senior Environmental Scientist;
Sierra District Supervisor;
North Central Region Fisheries

From: Isaac Chellman, Environmental Scientist;
High Mountain Lakes;
North Central Region Fisheries

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Subject: Native amphibian restoration in the Grouse Ridge Non-Motorized Area, Tahoe National Forest, Nevada County:

- **Five Lakes Basin post-fish-removal monitoring**



SUMMARY

Between July 2020 and September 2022, CDFW staff used monofilament gill nets to remove introduced Brook Trout (*Salvelinus fontinalis*; BK) and Rainbow Trout (*Oncorhynchus mykiss*; RT) from Five Lakes Basin. Staff continuously gillnetted five formerly fish-containing waterbodies. Staff also gillnetted five additional small ponds for shorter periods of time, none of which resulted in fish captures. The last fish captures in the basin occurred in Glacier Lake on 12 July 2021, when staff captured two BK. With no additional fish captures during continuous gillnetting from July 2021 to September 2022, CDFW determined that available evidence suggests Five Lakes Basin is now fishless. Therefore, in late September 2022, staff removed all gill nets from the site. In 2023, CDFW revisited the site to conduct visual encounter surveys (VES) for amphibians and spot check for fish in some of the former fish removal lakes using gill nets set for two nights. CDFW caught no fish during overnight net sets in 2023. In 2024 or 2025 (depending on funding availability and capacity at zoos), CDFW plans to collect early life stage Sierra Nevada Yellow-legged Frogs (*Rana sierrae*; SNYLF) from the nearby Rattlesnake Creek area for captive-rearing. These frogs would be raised to maturity at the zoos, then released into Five Lakes Basin the summer after reaching maturity.

ENVIRONMENTAL SETTING

The Grouse Ridge Non-Motorized Area contains hundreds of small lakes and ponds, roughly bounded by Lake Spaulding, Bowman Lake, and Fordyce Lake (**Figure 1**). Elevations in the Five Lakes Basin area range between about 8,000 feet (ft; 2,483 meters [m]) at the summit of Black Buttes to 6,140 ft (1,872 m) at Faucherie Lake. Most visitors access the area via Forest Road 14 (off Bowman Lake Road), which leads to the trailhead near Grouse Ridge Campground. Tahoe National Forest (TNF) manages the surrounding land.

BACKGROUND

The California Department of Fish and Wildlife (CDFW) manages fish and wildlife resources in Five Lakes Basin as part of the Aquatic Biodiversity Management Plan for the South Yuba River Management Unit (ABMP; CDFW 2014). Within the ABMP, CDFW identifies Five Lakes Basin as a Native Species Reserve (NSR) and highlights the basin as a priority area for non-native fish removal to help reestablish SNYLF (CDFW 2014, pgs. 58–60). Five Lakes Basin is also highlighted as a “frog conservation area” (FCA) in the Conservation Strategy for Mountain Yellow-legged Frogs (*R. sierrae* and *R. muscosa*) in the Sierra Nevada (Strategy; MYLF ITT 2018). The Strategy is an adaptive plan that sets the management framework and conservation priorities for SNYLF. The Strategy lists non-native fish removal and SNYLF translocations to Five Lakes Basin as part of the frog conservation area descriptions and species conservation action plan (MYLF ITT 2018; Attachments 1 and 2, respectively).

In summer 2018, CDFW staff conducted visual encounter surveys (VES) for amphibians throughout most of the Five Lakes Basin and French Lake FCAs. During the same trip, CDFW also conducted overnight gill net fish sampling and a site assessment to inform proposed fish removal work. For details on those VES, pre-fish removal surveys, and Five Lakes Basin site assessment, please consult the memorandum “[Five Lakes Basin *Rana sierrae* and fish monitoring; Site assessment to determine feasibility of non-native trout removal for *Rana sierrae* restoration](#)” (CDFW 2019b). In brief, current VES data suggest that SNYLF have likely been extirpated from the Five Lakes area. Therefore, reestablishing a SNYLF population will require translocations from a suitable donor population. The ABMP and Strategy both propose using SNYLF translocated from the Mossy Pond area as a potential source for reestablishing SNYLF in Five Lakes Basin.

Given these considerations, CDFW collaborated with TNF partners in spring 2018 and drafted a grant proposal to conduct the fish removal work and future translocation of SNYLF from the Mossy Pond population. This proposal was selected for funding consideration in spring 2019. In December 2019, U.S. Fish and Wildlife Service (USFWS) awarded CDFW funds through the endangered species recovery grant program (Section 6 of the U.S. Endangered Species Act of 1973; Federal Grant Award #F19AP00750) to carry out non-native trout removal in Five Lakes Basin and conduct the frog translocation once fish removal is completed. CDFW field staff began fish removal work in July 2020 (**Figure 2**).

CDFW has completed a capture-mark-recapture (CMR) study of the Mossy Pond SNYLF population, which is located about 8 kilometers (km) southeast of the Black Buttes Area and [discussed in a separate memorandum](#) (CDFW 2019a; **Figure 1**). The CMR study occurred from 2014–2018 and preliminary data suggested that the Mossy Pond SNYLF population was large enough to provide adult frogs for translocation to nearby sites. However, surveys in the Mossy Pond area from 2020 to 2023 resulted in staff detecting fewer SNYLF when compared with surveys conducted from 2013 to 2019. The reason for fewer detections is unclear, but the end result is that CDFW needs to adjust strategies, and instead plan on [captive-rearing SNYLF](#) for future reintroduction back into Five Lakes Basin. CDFW plans to collect these frogs as eggs, tadpoles, or young metamorphs from the Rattlesnake Creek area (**Figure 1**) in 2024 or 2025, depending on funding availability and zoo capacity ([more discussed below](#)).

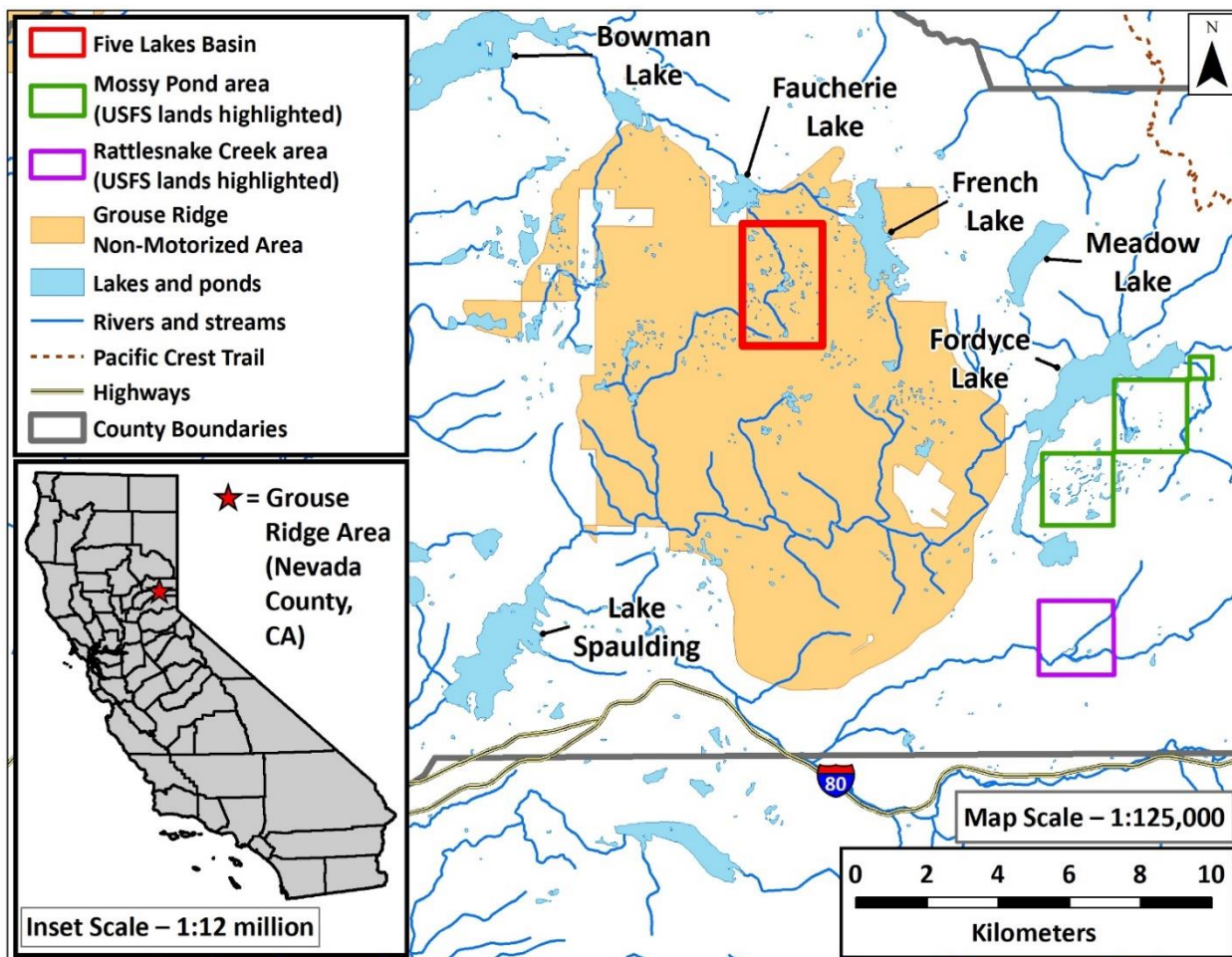


Figure 1. Grouse Ridge Non-Motorized Area, Nevada County, CA. Five Lakes Basin, where the California Department of Fish and Wildlife (CDFW) removed non-native trout between 2020 and 2022, is outlined in red. The Mossy Pond area, in part of which CDFW conducted a five-year capture-mark-recapture (CMR) study of Sierra Nevada yellow-legged frogs (*Rana sierrae*; SNYLF), is outlined in green. The Rattlesnake Creek area, from which CDFW plans to collect early life stage SNYLF for captive-rearing and later release into Five Lakes Basin, is outlined in purple.

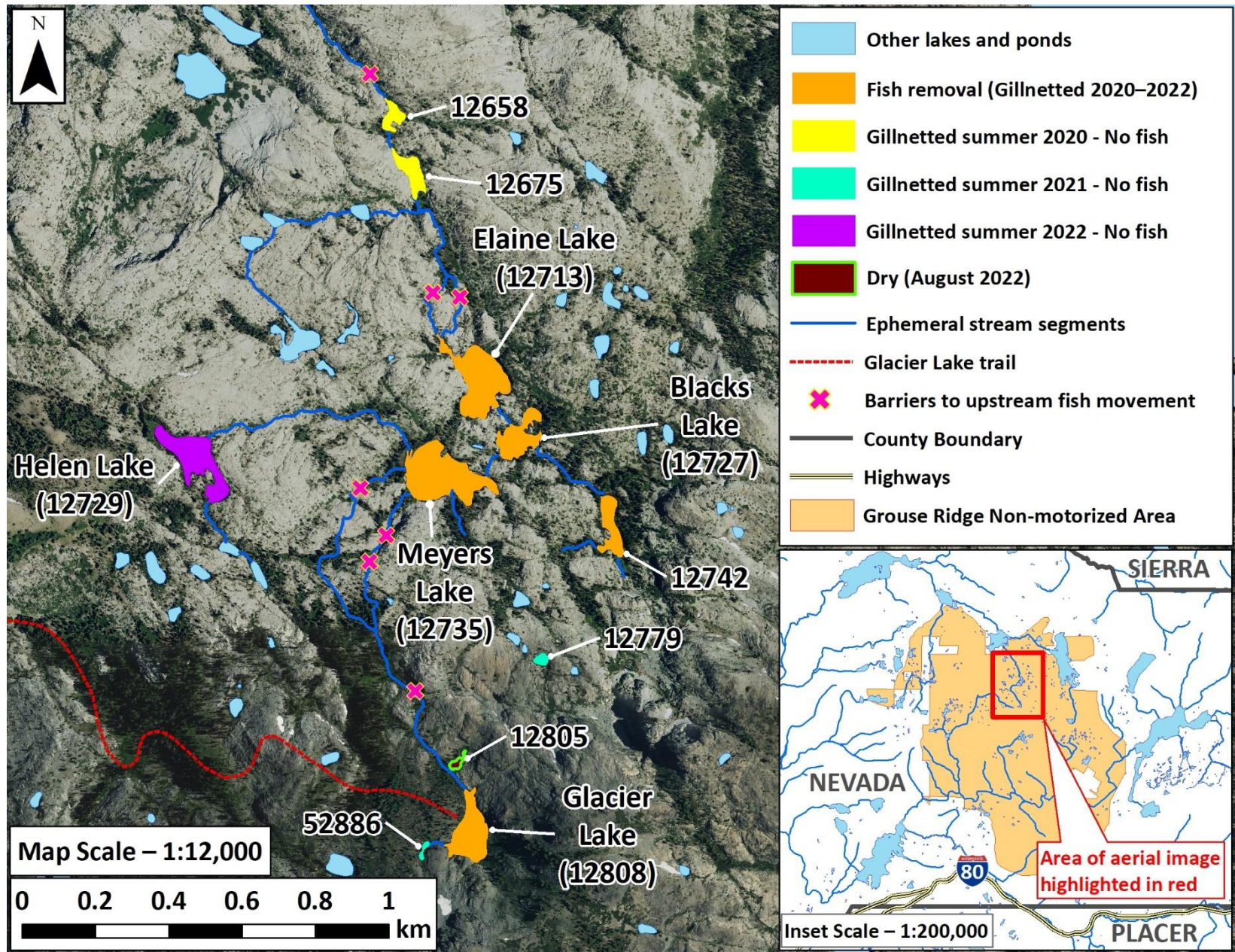


Figure 2. [See figure caption at the beginning of the next page.]

Figure 2 (continued). Five Lakes Basin, Nevada County, CA. Between July 2020 and September 2022, California Department of Fish and Wildlife (CDFW) staff removed non-native trout from Elaine Lake (Site ID 12713), Blacks Lake (Site ID 12727), Meyers Lake (Site ID 12735), Glacier Lake (Site ID 12808), and an unnamed, connected pond (Site IDs 12742) using monofilament gill nets. Additionally, staff set gill nets for shorter periods of time (length of time shown parenthetically after each Site ID on the next lines) to spot check for fish at the following five locations: Site IDs 12658 and 12675 (three months in 2020, respectively), Helen Lake (Site ID 12729; two nights in 2022), Site ID 12779 (one night in 2021), and Site ID 52886 (two months in 2021). Staff captured zero fish during net sets at each of these additional five locations spot-checked via gill net. As of fall 2022, CDFW removed all trout from the basin. Natural barriers to upstream fish movement—shown as pink X’s—will prevent fish from regaining entry into Five Lakes Basin. CDFW restored aquatic habitat to benefit Sierra Nevada Yellow-legged Frogs (*Rana sierrae*; SNYLF), a federally endangered and state threatened species. CDFW uses the five-digit Site IDs to partition waterbodies for data collection. During most water year types, all streams in Five Lakes Basin stop flowing by mid-summer, leaving small, intermittent pools between the larger lakes and ponds. During particularly dry water years, such as 2020–2022, nearly all intermittent stream pools dry entirely by early fall. The only known exception is a small section at the upstream end of the Site ID 12742 outlet stream, which appears to receive a small amount of groundwater flow (**Figure 2a**). Although this section may desiccate completely by mid-autumn during dry water years, CDFW has not yet observed the section completely dry.



Figure 2a. Location that retains water at the upstream end of the Site ID 12742 outlet stream, on 2 September 2021. (CDFW)

FISH REMOVAL

Background and Summary

CDFW stocked Blacks Lake, Meyers Lake, and Helen Lake with BK from about 1938–2000. Additionally, CDFW stocked Blacks Lake and Meyers Lake with Lahontan Cutthroat Trout (*Oncorhynchus clarkii henshawi*; LCT) in 1969 and 1970. CDFW stocked Elaine Lake with BK from 1941–1967, and subsequently stocked the lake with RT from 1968–2000. CDFW stocked Glacier Lake with BK until 1965 and later stocked only California Golden Trout (*Oncorhynchus aguabonita*; GT) from 1968–2008. Finally, CDFW conducted single year stocking of RT at three sites: Helen Lake in 1996, and Site IDs 12704 and 12742 in 1997 (**Figure 2**).

Overnight gill net surveys conducted by CDFW occasionally between 2001 and 2019 revealed self-sustaining trout presence in Elaine Lake (RT), Blacks Lake (BK and RT), Site ID 12742 (BK and RT), and Glacier Lake (BK and GT). CDFW field staff also observed two adult BK in the small pond (Site ID 12805) below Glacier Lake, and one BK in a small pond along the outlet stream of Elaine Lake (Site ID 12658). Trout prey on SNYLF and are a potential source of competition for food (e.g., benthic macroinvertebrates). The presence of self-sustaining trout was a threat to SNYLF reintroduction. Therefore, CDFW began implementing physical trout removal.

CDFW initiated fish removal in Five Lakes Basin in early July 2020. Fish removal areas included Elaine Lake (Site ID 12713), Blacks Lake (Site ID 12727), Meyers Lake (Site ID 12735), a stream widening that seasonally floods into a shallow pond (Site ID 12742), two ponds on Elaine Lake's outlet stream (Site IDs 12675 and 12658, respectively), Glacier Lake (Site ID 12808), a pond on Glacier Lake's outlet stream (Site ID 12805), a small pond west of Glacier Lake (Site ID 52886), and any pools that may remain during summer in the stream sections that connect these waterbodies (**Figure 2**). In late September 2020, CDFW removed the nets set in Site IDs 12675 and 12658, after zero fish captures at these locations all summer. These two ponds become very small and shallow by late summer, so continued gill net sets would have likely resulted in excessive bycatch (e.g., diving birds and gartersnakes), which CDFW did not deem worthwhile, given the lack of any fish caught after 2.5 months of gill net presence.

CDFW staff returned to Five Lakes Basin in mid-June 2021 to pull overwinter nets and set summer nets. During the initial visit in mid-June, CDFW removed 29 BK carcasses from the overwinter gill nets in Glacier Lake. These BK captures were the only fish caught in overwinter gill nets set in Five Lakes Basin from October 2020 to June 2021. During summer and fall 2021, CDFW staff visited Five Lakes Basin to check gill nets eight times. In total, CDFW captured two BK from summer gill nets set from mid-June to mid-October 2021, both of which were caught in Glacier Lake during the first summer net set period. During the final visit to Five Lakes Basin of 2021, CDFW staff set gill nets in each waterbody in the main fish removal area (Elaine Lake, Blacks Lake, Meyers Lake, Glacier Lake, and Site ID 12742; **Figure 2**) to capture fish overwinter.

CDFW staff returned to Five Lakes Basin in mid-June 2022 to pull overwinter nets and set summer nets in lower Five Lakes Basin (i.e., all sites with the exception of Glacier Lake). Due to time constraints, CDFW staff postponed checking winter gill nets in Glacier Lake until the following site visit. During the next site visit in late July 2022, staff checked overwinter gill nets in Glacier Lake, then reset additional nets for the summer. Additionally, during the third site visit in August 2022, staff temporarily removed two gill nets from Meyers Lake (in which no trout captures occurred during the entire fish removal project from 2020–2022), and placed the nets into Helen Lake (Site ID 12729; **Figure 2**) for two nights to spot check for trout. After the two-night set, staff reset gill nets back into Meyers Lake.

CDFW did not capture any fish in Five Lakes Basin in 2022, including from the 2021–2022 overwinter gill net sets, or nets set during summer and early fall 2022. During the final site visit in late September 2022, CDFW staff used a backpack electrofishing unit to spot-check for fish among any remaining water in the ephemeral stream channels within the main project area. Staff found very small pools present in three locations: below Site ID 12742 (**Figure 2a**), in the main Glacier Lake outlet channel, and in the main outlet of Elaine Lake. Staff electrofished each of these areas, none of which provides suitable habitat for trout. As expected, staff did not detect any sign of fish while electrofishing these marginal stream habitats. Additionally, given very low water levels, staff also electrofished Site ID 12742, which becomes a narrow, shallow channel by late summer. Site ID 12805 was completely dry by late summer 2022.

During the final visit to Five Lakes Basin in 2022, CDFW staff removed all remaining gill nets from the restoration area (Blacks Lake, Elaine Lake, Glacier Lake, Meyers Lake, and Site ID 12742; **Figure 2**). Additionally, CDFW removed all public notification signs, which staff had posted near shorelines in numerous commonly accessed locations to inform the public about the project, and warn about the presence of gill nets in the lakes (**Figure 3**). Staff had also placed these signs at the Grouse Ridge Trailhead, and at two points along the route to Five Lakes Basin, including at an old sign board adjacent to the trail on the hillside below Grouse Ridge, and at the junction of the Sand Ridge and Glacier Lake hiking trails.



Figure 3. A project notification sign displayed at Glacier Lake (Site ID 12808) in Fall 2021. (CDFW)

Based on sampling before staff began fish removal in summer 2020, CDFW expected low fish densities in Five Lakes Basin. Following three seasons of fish removal work (three summers and two winters), even fewer fish were present than CDFW had anticipated. Of the 174 trout captured during the project, CDFW captured 143 (82%) during the first four months of gillnetting in 2020. During the 2022 field season, CDFW caught no fish during constant gillnetting in the basin. These results followed the 2021 field season, during which CDFW only caught 31 trout, all of which staff captured in Glacier Lake during the first two trips of the season. All subsequent trips resulted in zero fish captures (**Figure 4**). Therefore, CDFW estimates that, as of mid-summer 2021, no trout remained in the Five Lakes Basin restoration area. Now that non-native trout have been removed, CDFW plans to begin translocating SNYLF into Five Lakes Basin during summer 2024 or 2025.

Full details about fish removal work in Five Lakes Basin can be found in [last year's memorandum](#) (CDFW 2023a).

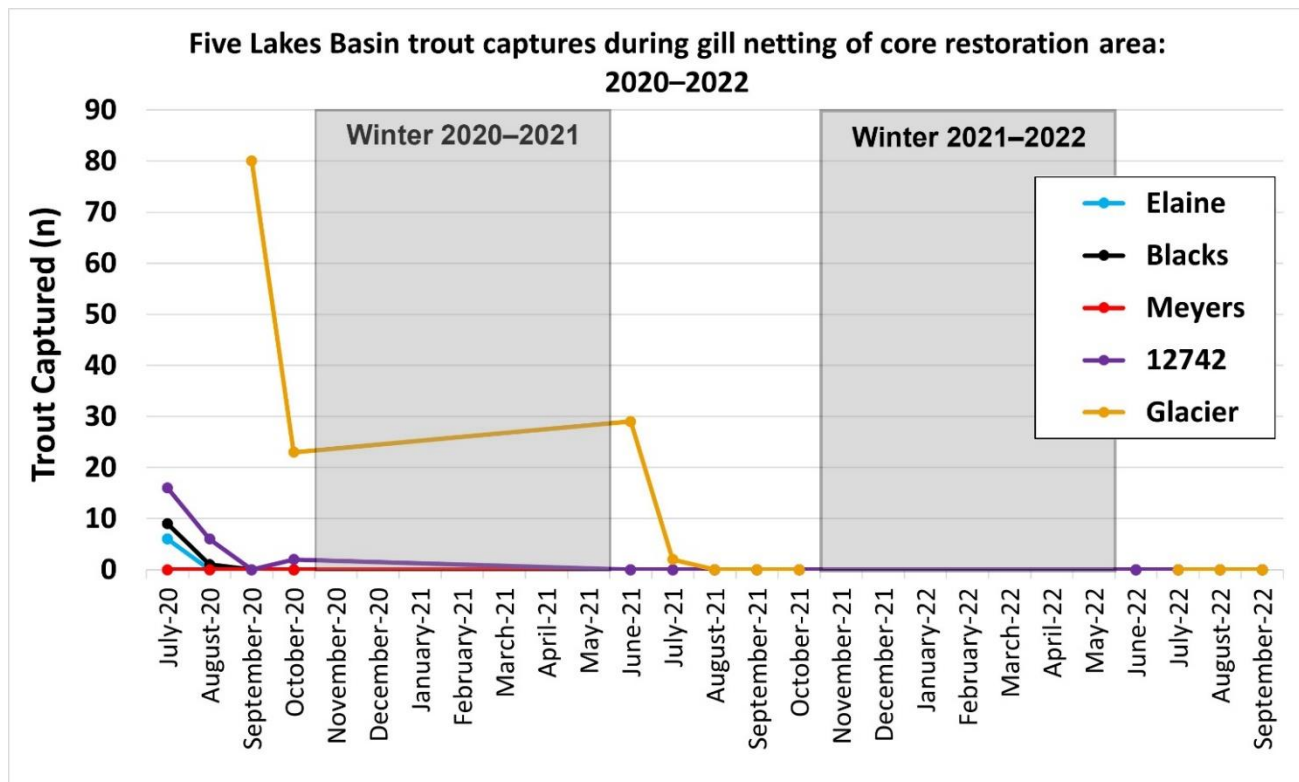


Figure 4. Trout captures during gillnetting of the five primary fish removal lakes in Five Lakes Basin, July 2020 to September 2022 (Blacks Lake, Site ID 12727; Elaine Lake, Site ID 12713; Glacier Lake, Site ID 12808; Meyers Lake, Site ID 12735; and Site ID 12742). Following the initiation of gillnetting, trout captures rapidly declined. Apart from Glacier Lake, trout captures ceased in all waterbodies before winter 2020–2021 (i.e., lower Five Lakes Basin was fishless after only one summer of gillnetting). Glacier Lake retained trout until early summer 2021, after which California Department of Fish and Wildlife staff captured no more fish during 14 months of gillnetting.

2023 UPDATES

In early fall 2023, CDFW staff visited the Five Lakes Basin area to conduct VES for amphibians and use overnight gill nets to spot check for trout in several of the former fish removal lakes. Staff were present at the site from 25–27 September. During the visit, staff set overnight gill nets into Glacier Lake (n = 2), Elaine Lake (n = 1), and Blacks Lake (n = 1). Each net was set for two nights, then pulled from the lakes, and removed from the site. Staff caught no trout during gill net sets in 2023.

VES focused on lower Five Lakes Basin, several small ponds south of lower Five Lakes Basin, the Mont and Kaneen Lakes area (Site IDs 12881 and 12855; **Figure 5**), and the French Lake ponds (Site IDs 12771 and 12775; **Figure 6**). These focal survey areas include most locations at which CDFW has detected SNYLF during surveys in the 2000's–2010. The most recent confirmed SNYLF detections in the area were as follows: Blacks Lake (Site ID 12727; **Figure 7**), one subadult seen in 2004; Site ID 12844, four adults seen in 2005; Elaine Lake (Site ID 12713), one subadult seen in 2008; Site ID 12771 (**Figure 8**), one adult seen in 2009; Kaneen Lake (Site ID 12855; **Figure 9**), one adult seen in 2010; and Site ID 12775, one adult seen in 2010. Staff surveyed all but one of the aforementioned sites (staff did not survey Site ID 12844), plus 12 additional lakes and ponds during the site visit on 26–27 September 2023 (**Figure 6**). Staff did not detect any SNYLF during these VES efforts.



Figure 5. Mont Lake (Site ID 12881) on 27 September 2023. (CDFW)

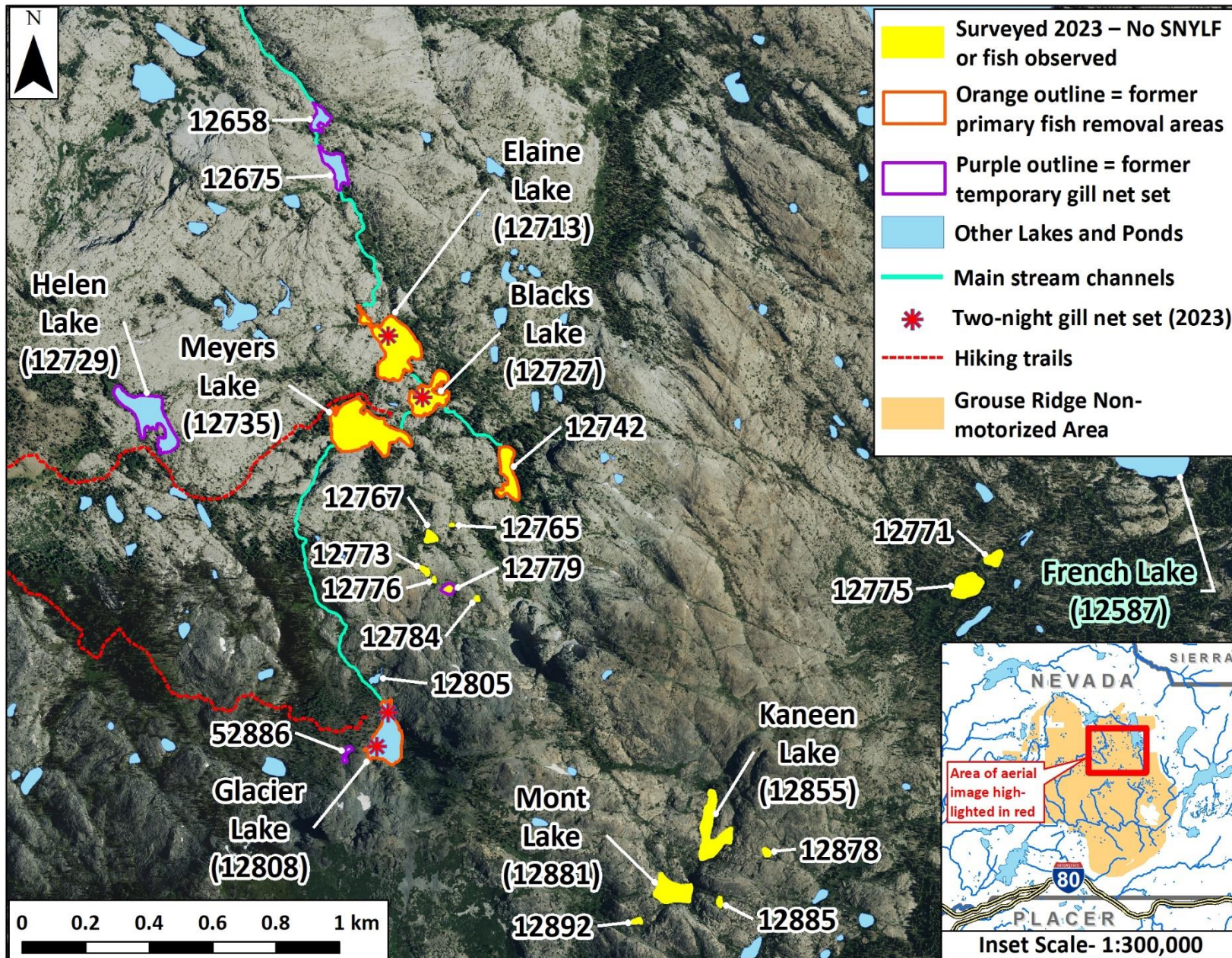


Figure 6. [See figure caption at the beginning of the next page.]

Figure 6 (continued). In late September 2023, CDFW staff surveyed 17 lakes and ponds in the Five Lakes Basin area. The goal of these surveys was to conduct visual encounter surveys (VES) for amphibians and aquatic reptiles, and spot-check for any potential fish presence. As part of these monitoring efforts, staff set gill nets into Elaine Lake (Site ID 12713; one net), Blacks Lake (Site ID 12727; one net), and Glacier Lake (Site ID 12808; two nets) for two nights. Staff did not capture any fish from these overnight gill net sets. Most smaller ponds in Five Lakes Basin desiccate entirely by late summer or early fall during dry water years, such as 2020–2022. However, 2023 followed a winter with well above average snow water content and precipitation in the northern Sierra Nevada (CDECa, b). Additionally, more rain fell in the region in August and September 2023 than typically occurs during late summer in the northern Sierra Nevada (CDEC 2024c). These summer rains likely helped maintain water levels in high elevation ponds. Staff did not detect SNYLF while surveying the Five Lakes Basin area in 2023.



Figure 7. Blacks Lake (Site ID 12727) on 26 September 2023. (CDFW)



Figure 8. Site ID 12771 on 27 September 2023. (CDFW)



Figure 9. Kaneen Lake (Site ID 12855) on 27 September 2023. (CDFW)

LOOKING AHEAD: 2024

Under original terms of the endangered species recovery grant (Federal Grant Award #F19AP00750) for the Five Lakes Basin non-native trout removal and SNYLF reintroduction, CDFW planned to translocate SNYLF back into Five Lakes Basin during summer 2022, using adult frogs collected from the Mossy Pond area. However, VES in the Mossy Pond area in late summer and fall 2021, early summer 2022, and late summers 2022 revealed fewer adult SNYLF than anticipated (see last year's [Mossy Pond and Rattlesnake Creek areas memorandum](#) for details; CDFW 2023b). CDFW and TNF staff detected <70 total adult SNYLF during VES. Since CDFW planned to collect at least 20 adult SNYLF to undertake the translocation effort, and the grant terms dictate that no more than 20% of adults observed during VES will be collected, CDFW would need to detect at least 100 adult SNYLF in the Mossy Pond area, during a single round of surveys soon before the planned translocation, in order to collect adults for translocation to Five Lakes Basin. In 2023, SNYLF detections continued to be low: CDFW and TNF staff detected <50 total adult SNYLF in the greater Mossy Pond area during surveys from 22–24 August.

Given these recent VES results and need to limit unnecessary risk to the source population, CDFW will be pursuing an alternative option for reintroducing SNYLF to Five Lakes Basin. After discussion with the CDFW Statewide Amphibian and Reptile Conservation coordinator,

supervisory staff in the Region 2 Fisheries Program, TNF partners, and USFWS, CDFW plans to collect early life stage SNYLF (egg masses, tadpoles, and/or recent metamorphs) from Rattlesnake Creek (**Figure 1**) for captive-rearing and later release into Five Lakes Basin. Rattlesnake Creek is a site at which CDFW and TNF staff consistently observe SNYLF (**Figure 10**), including occasionally observing large numbers of SNYLF tadpoles, some of which have required rescue from tiny, shallow, rapidly drying pools during late summer in dry water years (CDFW 2021). Rattlesnake Creek would be a preferred alternative to Mossy Pond for collecting early life stage SNYLF because CDFW and TNF staff have detected comparatively far fewer tadpoles in the Mossy Pond area, most of which have been observed in a small stream channel that flows into the eastern end of Fordyce Lake. Given consistent SNYLF breeding at Rattlesnake Creek and ability to more easily collect early life stages, CDFW would plan to collect portions of egg masses (if detected during late spring) or a subset ($\leq 20\%$) of tadpoles through recent metamorphs observed during VES in late summer, which staff would conduct soon before a potential tadpole collection.

Captive-rearing would be undertaken by local zoo partners with the San Francisco Zoo, who have staffing, facilities, and experience rearing SNYLF. Captive-reared SNYLF would be raised to maturity, PIT-tagged, and released as adults into Five Lakes Basin. CDFW has funding available for this work (state contract Agreement Number D2380005). Currently, CDFW plans to collect a subset of tadpoles for captive-rearing in late summer or early fall 2024. Otherwise, staff will plan to collect early life stage SNYLF from Rattlesnake Creek in 2025.



Figure 10. A large adult and subadult Sierra Nevada Yellow-legged Frog (*Rana sierrae*) seeking shelter in a rock crevice above a pool in Rattlesnake Creek, September 2022. (CDFW)

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