

State of California
Department of Fish and Wildlife
Memorandum

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**Subject: Native amphibian restoration in Five Lakes Basin (Grouse Ridge
Non-Motorized Area, Tahoe National Forest, Nevada County)**

- **Five Lakes Basin fish removal**



SUMMARY

In early July 2020, CDFW field staff began removing introduced Brook Trout (*Salvelinus fontinalis*; BK) and Rainbow Trout (*Oncorhynchus mykiss*; RT) from six waterbodies in Five Lakes Basin using monofilament gill nets. These efforts continued through summer and fall 2021. Between 14 June and 12 October 2021, CDFW staff removed 31 BK, all from Glacier Lake (Site ID 12808). Staff left 20 gill nets in five of the waterbodies to capture fish overwinter. CDFW plans to continue fish removal work through 2022. Once fish removal is complete, CDFW plans to reintroduce Sierra Nevada Yellow-legged Frogs (*Rana sierrae*; SNYLF) into Five Lakes Basin, using adult frogs translocated from the nearby Mossy Pond area.

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 survey (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 very few—if any—SNYLF remain in the greater 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 suggest that the Mossy Pond SNYLF population is large enough to provide adult frogs for translocation to nearby sites. These results, combined with more recent VES of the greater Mossy Pond area SNYLF metapopulation, will allow CDFW to estimate the number of post-metamorphic frogs to remove during future translocation efforts, per recommendations of the Strategy (MYLF ITT 2018).

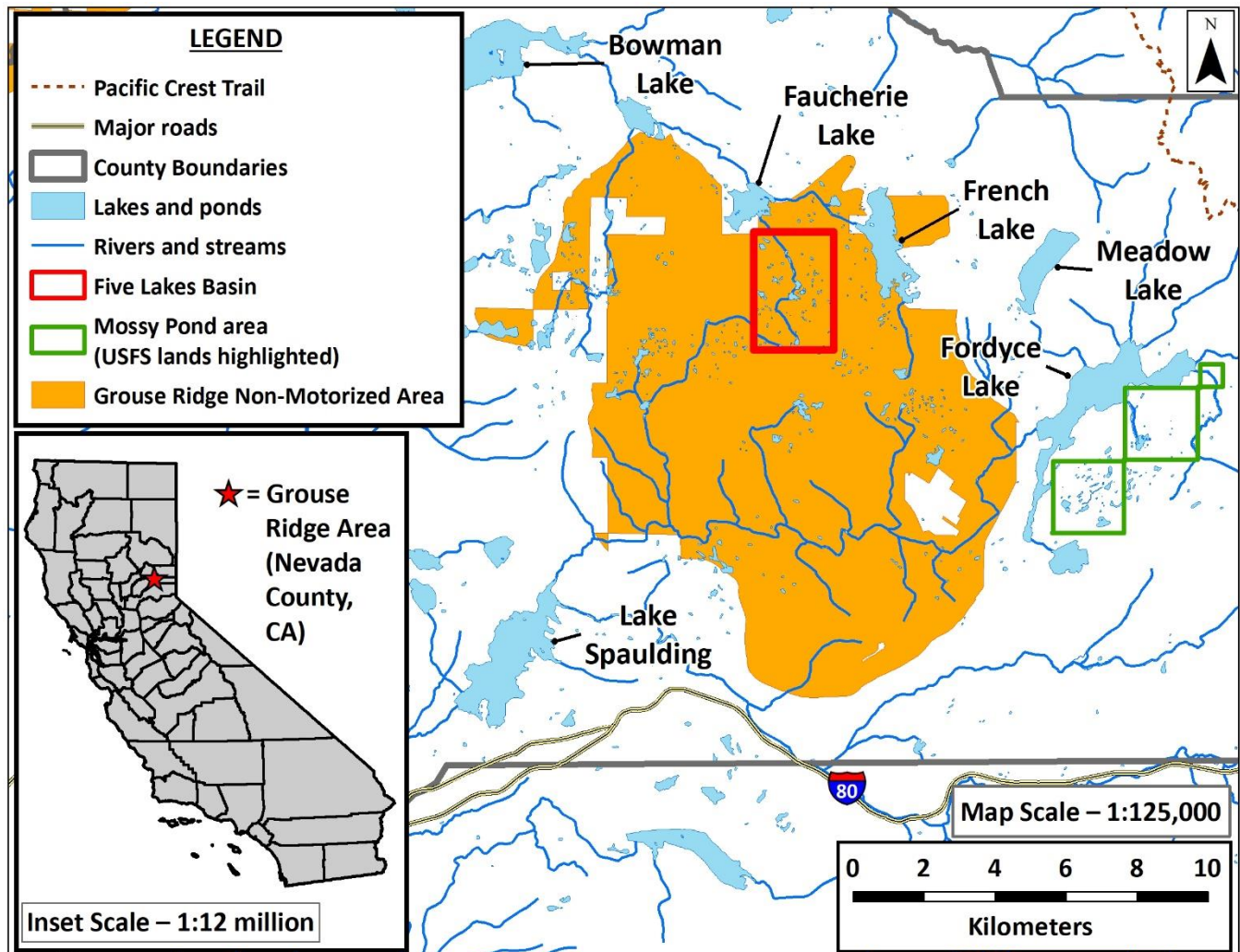


Figure 1. Grouse Ridge Non-Motorized Area, Nevada County, CA. Five Lakes Basin, where the California Department of Fish and Wildlife (CDFW) began removing non-native trout in 2020, is outlined in red. The Mossy Pond area, in part of which CDFW concluded a five-year capture-mark-recapture (CMR) study of Sierra Nevada yellow-legged frogs (*Rana sierrae*; SNYLF), is outlined in green. CDFW anticipates that the Mossy Pond metapopulation will serve as a source to reestablish SNYLF in Five Lakes Basin.

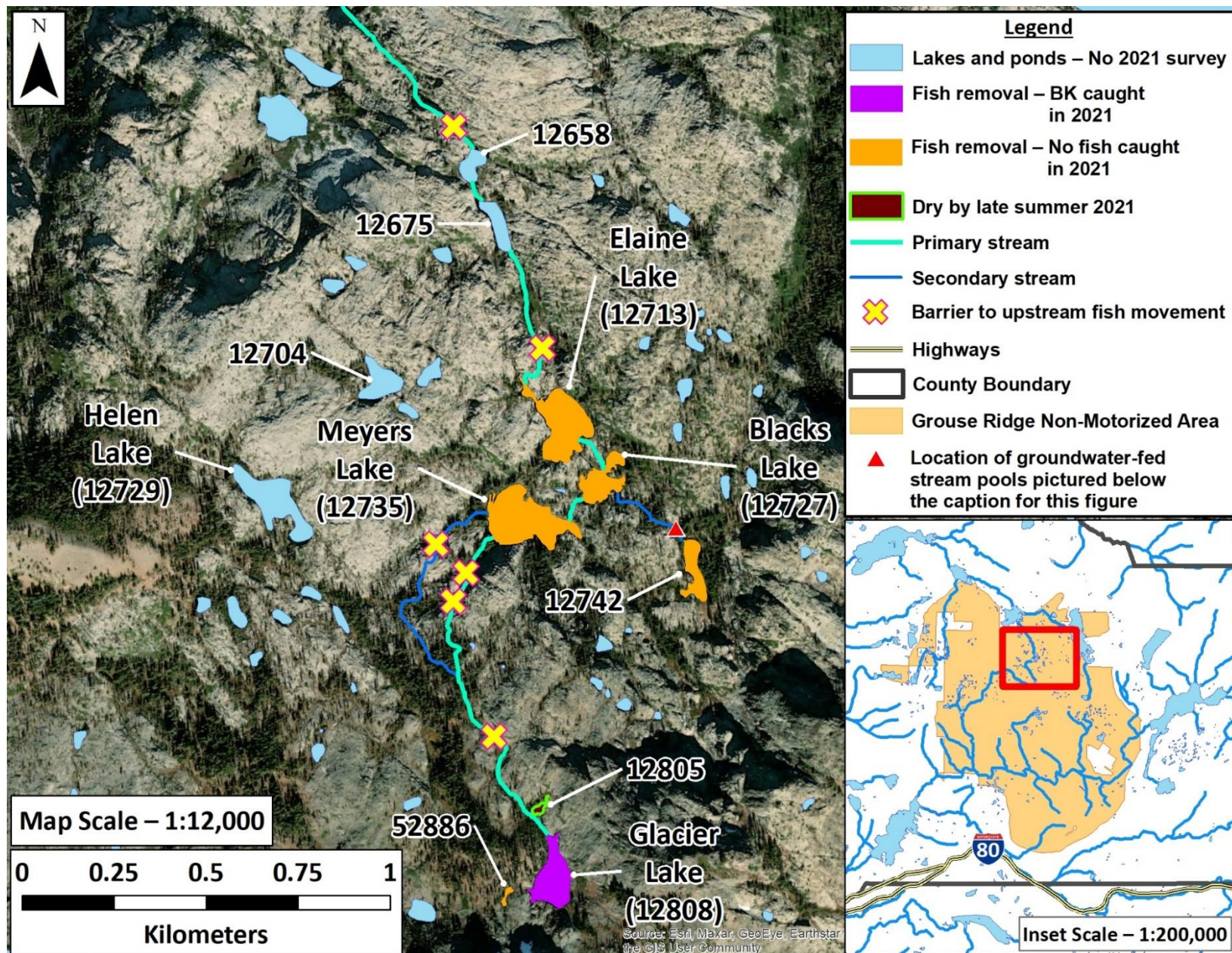


Figure 2. [See figure caption at the beginning of the next page.]

Figure 2 (continued). Five Lakes Basin, Nevada County, CA. In July 2020, California Department of Fish and Wildlife (CDFW) staff began removing non-native trout from Elaine Lake (Site ID 12713), Blacks Lake (Site ID 12727), Meyers Lake (Site ID 12735), and several unnamed, connected ponds (Site IDs 12742, 12658, and 12675) using monofilament gill nets. In September 2020, CDFW staff began implementing the same methods in Glacier Lake (Site ID 12808). CDFW is restoring aquatic habitat to benefit Sierra Nevada Yellow-legged Frogs (*Rana sierrae*; SNYLF), a federally endangered and state threatened species. Once all non-native trout are removed, natural barriers to upstream fish movement—shown as yellow X’s—will prevent fish from regaining entry into Five Lakes Basin. CDFW uses the five-digit Site IDs to partition waterbodies for data collection. CDFW continued these efforts in 2021. In 2020, CDFW caught zero fish in stream-widening ponds 12658 and 12675. In late summer, these two small ponds become very shallow, which increases the chance of capturing non-target species (e.g., birds). Therefore, given lack of any fish captures in 2020, CDFW did not set gill nets at ponds 12658 and 12675 in 2021. 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 and 2021, the intermittent stream pools dry almost 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, depicted by a red triangle in **Figure 2**, on 2 September 2021. (CDFW)

FISH REMOVAL

Background

CDFW stocked Blacks Lake, Meyers Lake, and Helen Lake with BK from about 1938 until 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 until 1967, and subsequently stocked the lake with only RT from 1968 until 2000. CDFW stocked Glacier Lake with BK until 1965 and later stocked only California Golden Trout (*Oncorhynchus aguabonita*; GT) from 1968 until 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 prior to SNYLF reintroduction efforts.

CDFW initiated fish removal in Five Lakes Basin (**Figure 3**) in early July 2020. Fish removal areas include Elaine Lake (Site ID 12713; **Figure 4**), Blacks Lake (Site ID 12727; **Figure 5**, Meyers Lake (Site ID 12735; **Figure 6**), a stream widening that seasonally floods into a shallow pond (Site ID 12742; **Figures 7 and 8**), two ponds on Elaine Lake's outlet stream (Site IDs 12675 and 12685; **Figures 9 and 10**, respectively), Glacier Lake (Site ID 12808, **Figure 11**), a pond on Glacier Lake's outlet stream (Site ID 12805; **Figure 12**), a small pond west of Glacier Lake (Site ID 52886; **Figure 13**), and any pools that may remain during summer in the stream sections that connect these waterbodies. In late September 2020, CDFW removed the nets set in Site IDs 12675 and 12658, after zero fish captures at these locations all summer (**Figures 9 and 10**, respectively). These two ponds become very small and shallow by late summer, so continued gill net sets would likely result in excessive bycatch, which CDFW did not deem worthwhile, given the lack of any fish caught after 2.5 months of gill net presence. In early October 2020, CDFW staff set 20 gill nets (six in Glacier, five in Meyers, five in Elaine, three in Blacks, and one in Site ID 12742) to remain in Five Lakes Basin overwinter.



Figure 3. The core of Five Lakes Basin (excluding Glacier Lake) on 8 July 2020, looking north. (CDFW)



Figure 4. Elaine Lake (Site ID 12713) on 4 June 2021, looking north. (CDFW)



Figure 5. Blacks Lake (Site ID 12727) on 4 June 2021, looking southeast. (CDFW)



Figure 6. Meyers Lake (Site ID 12735) on 8 July 2020, looking northeast. Although California Department of Fish and Wildlife (CDFW) stocked Brook Trout (*Salvelinus fontinalis*; BK) into this site from 1938–2000, CDFW staff did not capture any fish at this location during a two-night gill net set in 2018 or during all of summer 2020 through fall 2021, during which CDFW had up to 10 gill nets set in the lake. It currently appears that trout extirpated from this site in the absence of stocking. (CDFW)



Figure 7. Site ID 12742 on 4 June 2021, looking south. Although this site is a shallow pond following snowmelt in spring and early summer, the site often dries to a narrow channel by late summer (see **Figure 8**). (CDFW)



Figure 8. Site ID 12742 on 2 September 2021, looking north. This location had retained self-sustaining Brook Trout (*Salvelinus fontinalis*; BK), despite becoming a shallow, narrow channel by late summer during dry years, such as 2020 and 2021. California Department of Fish and Wildlife (CDFW) only has a single stocking record for this location (a plant of 3,000 fingerling Rainbow Trout [*Oncorhynchus mykiss*; RT] in 1997), so BK likely originally entered this site by swimming up the ephemeral outlet stream, which connects directly to Blacks Lake (Site ID 12727) during high water. (CDFW)



Figure 9. Site ID 12675 in June 2019, looking east. This is a large stream pool below Elaine Lake that becomes small and shallow by late summer. This photo was taken early in the summer following a wet winter. (CDFW)

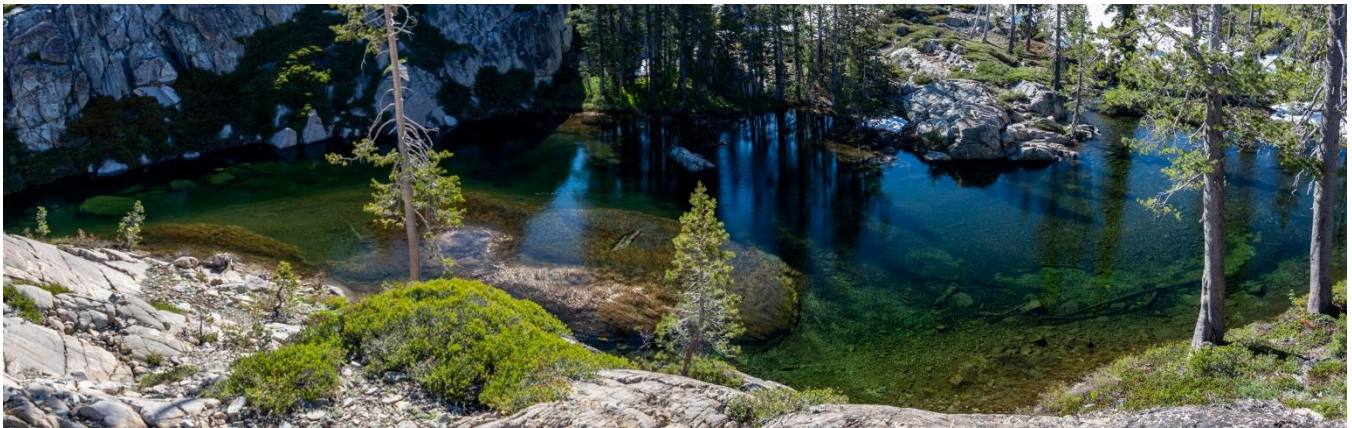


Figure 10. Site ID 12658 in June 2019, looking east. This is a large stream pool below Elaine Lake that becomes small and shallow by late summer. This photo was taken early in the summer following a wet winter. (CDFW)



Figure 11. Glacier Lake (Site ID 12808) on 8 July 2020, looking north. Glacier Lake is a site into which the California Department of Fish and Wildlife (CDFW) formerly stocked Brook Trout (*Salvelinus fontinalis*; BK) from at least 1938 until 1965, and then California Golden Trout (*Oncorhynchus aguabonita*; GT) from 1968 to 2008. During sampling in late July 2018, CDFW captured one GT and 12 BK from a single overnight gill net. However, during fish removal work in fall 2020 and summer 2021, CDFW only captured BK in Glacier Lake. In 2021, CDFW had ten gill nets set in Glacier Lake and staff checked those nets several times during the summer and fall 2021. Staff only caught BK during the 2020–2021 overwinter net set and during the first summer net set. Given that only BK were captured in 2020 and 2021, CDFW suspects that GT were likely extirpated from the site before fish removal began. (CDFW)



Figure 12. Pond 12805 on 25 September 2020, looking northeast. During high water, this small pond is directly connected to the outlet of Glacier Lake (Site ID 12808) and will occasionally hold Brook Trout (*Salvelinus fontinalis*). However, this site becomes disconnected from the outlet stream in early summer. In 2020 and 2021, this site was completely dry by late summer. (CDFW)



Figure 13. Site ID 52886 on 15 June 2021. This is a small, unmapped pond located approximately 40 m west of the southern end of Glacier Lake (see **Figure 2**). During snowmelt, this pond is connected to Glacier Lake via a short stream channel. From mid-June to early August 2021 (the time period when the pond was deep enough to retain a gill net), CDFW staff set one monofilament gill net at this location to check for presence of Brook Trout (*Salvelinus fontinalis*). The net set resulted in zero fish captures. (CDFW)

2021 Updates

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. After cleaning and repairing winter nets, staff set summer gill nets into each of following waterbodies: Meyers Lake (n = 7), Blacks Lake (n = 5), Elaine Lake (n = 11), Site ID 12742 (n = 3), Glacier Lake (n = 10), and Site ID 52886 (n = 1) (**Figure 2**). Gill net set and check dates, along with associated fish captures, are displayed in **Table 1**.

Table 1. Summary information for gill net sets and fish captures in Five Lakes Basin (Grouse Ridge Non-motorized Area, Tahoe National Forest) during summer and early fall 2021.

Site ID	Name	Summer nets (n)	Date of first net check	Date of last net pull	Net check events (n)	BK Total	RT Total	Over-winter nets (n)
12713	Elaine Lake	11	16 Jun '21	12 Oct '21	8	0	0	6
12727	Blacks Lake	5	16 Jun '21	12 Oct '21	8	0	0	3
12735	Meyers Lake	7	15 Jun '21	12 Oct '21	8	0	0	4
12742	None	3	16 Jun '21	12 Oct '21	8	0	0	1
12808	Glacier Lake	10	15 Jun '21	12 Oct '21	8	31	0	6
52886	None	1	15 Jun '21	4 Aug '21	2	0	0	0
TOTALS		37				31	0	20

During summer and fall 2021, CDFW staff visited Five Lakes Basin to check gill nets eight times (mid-June, mid-July, early August, early September, mid-September, late September, early October, and mid-October). During each site visit, staff checked all gill nets set in the basin and cleaned the nets of algae and fish. In total, CDFW captured two BK from summer gill nets set from mid-June to mid-October, both of which were caught in Glacier Lake during the first summer net set period (mid-June to mid-July) (**Table 1**).

In early August 2021, CDFW staff also visually surveyed 11 small ponds adjacent to the Five Lakes Basin fish removal area (**Figure 15**). The primary purpose of these surveys was to determine if the ponds would be capable of sustaining any previously undetected non-native fish. These ponds were never historically stocked with trout. However, given proximity to lakes that had been stocked with fish, and short term, seasonal connectivity to formerly fish-containing lakes, CDFW suspected there was a small probability that trout could occupy some of these ponds.

During late spring and early summer, as the snow is melting, brief hydrologic connectivity exists between these small ponds and Site ID 12742. This connectivity is highly ephemeral and usually dries up by early summer. Additionally, during surveys in early August, most of the ponds were very shallow, and two of the ponds were dry (Site IDs 12784 and 12733; **Figure 15**). However, one of the ponds (Site ID 12779; **Figure 14**) was deeper than the others, and likely perennial. Although there is no permanent connectivity between Site ID 12779 (**Figure 14**) and waterbodies known to have previously contained fish, staff set a gill net in this pond overnight (4–5 August 2021) to provide evidence of fish absence. The net set resulted zero fish captures.

Anecdotally, staff did not detect SNYLF in any of the 11 small ponds. However, given past survey results in Five Lakes Basin, CDFW expected this result. The same 11 sites have been surveyed for SNYLF in 2001, 2010, 2013, and 2018. During all of these earlier surveys, staff did not detect SNYLF. The nearest past SNYLF detections were in Elaine Lake (Site ID 12713; **Figure 15**) in 2008, and one adult observed briefly in the outlet stream of Elaine Lake in 2018 (CDFW 2019b).



Figure 14. Site ID 12779 on 4 August 2021. This is the one small pond outside the primary fish removal area in which California Department of Fish and Wildlife (CDFW) staff set an overnight gill net in 2021 to detect potential fish presence. The overnight net set resulted in zero fish captures. (CDFW)

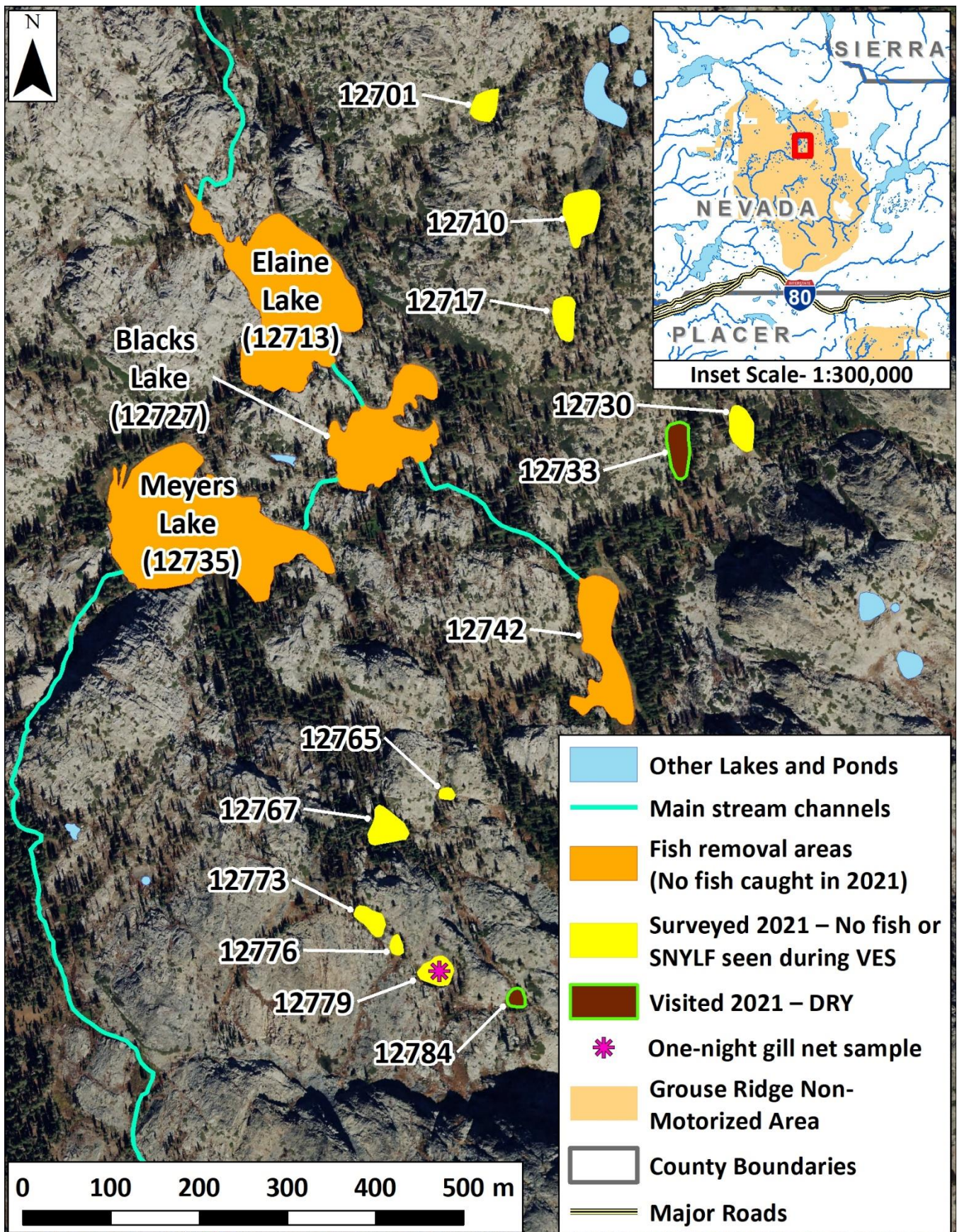


Figure 15. [See figure caption at the beginning of the next page.]

Figure 15 (continued). In early August 2021, CDFW staff visually surveyed 11 small ponds surrounding the fish removal area. The goal of these surveys was to spot-check for any potential fish presence. Surveys revealed that most ponds were very shallow and ephemeral. Most ponds shown in yellow likely dried entirely by late summer or early fall in 2020 and 2021. One exception was Site ID 12779, which was deeper than anticipated. Therefore, staff set an overnight gill net, which resulted in zero fish captures. Staff did not detect SNYLF while surveying any of the ponds shown.

At the end of each field season, CDFW staff set gill nets in each waterbody in the fish removal area (Elaine Lake, Blacks Lake, Meyers Lake, Glacier Lake, and Site ID 12742; **Figure 2**) to capture fish overwinter. Staff set the winter gill nets on 12 October 2021, and CDFW will check these nets in late spring or early summer 2022, once the area is accessible following snowmelt and thaw of lake ice. After cleaning and repairing the winter nets, staff will place the full suite ($n \approx 40$) of summer nets into Five Lakes Basin to attempt capturing any trout that may still be present. CDFW field staff plan to visit Five Lakes Basin regularly (at least once per month in mid-summer, and more often in the late summer and early fall) to check gill nets, sample stream pools with a backpack electrofishing unit, and conduct surveys for native amphibian species.

In summer 2022, CDFW plans to sample Helen Lake (Site ID 12729) and Site ID 12704 (**Figure 2**) with gill nets to obtain more recent data on potential fish occupancy. Based on the most recent data available, trout were likely extirpated from both sites in the absence of stocking. Helen Lake was last sampled for fish with two overnight gill nets in July 2010, neither of which resulted in any fish captures (CDFW 2014). Helen Lake is a small, shallow lake with an ephemeral outlet stream connected to Meyers Lake (Site ID 12735; **Figure 2**) during periods of high water. The lack of any trout captures in Meyers Lake in 2018 and 2020–2021 is additional anecdotal evidence suggesting that fish are likely absent from Helen Lake. However, CDFW will set a few gill nets into Helen Lake to add further evidence that trout are no longer present.

Site ID 12704 is a small pond that was only stocked once, in the late 1990's, with RT. Site ID 12704 has an ephemeral outlet stream, the confluence of which meets the upstream (southern) end of Site ID 12675, below the barrier to upstream fish passage north of Elaine Lake (**Figure 2**). Therefore, there is no direct connection between Site ID 12704 and Elaine Lake for any fish that may be present. However, CDFW has not previously sampled Site ID 12704 for fish, so staff will set at least one overnight gill net during summer 2022 to determine if any fish may still be present. Given that the pond is small and isolated, and only a single RT plant occurred approximately 25 years ago, CDFW does not expect to capture any fish in Site ID 12704.

Previous surveys of Five Lakes Basin have revealed that all streams in the basin appear to be ephemeral (CDFW 2019b). However, small pools persist in some areas, apart from the driest years, during which all streams may desiccate entirely by fall. Therefore, in late summer and fall 2022, CDFW plans to use a backpack electrofisher to check for trout in any water still present

along all stream channels connected to the Five Lakes Basin restoration area, particularly the stream reach that flows from Site ID 12742. The upstream end of this stream segment holds some water in late summer, even during dry years like 2020 and 2021 (see description in the caption of **Figure 2**).

Based on sampling conducted before fish removal work began in summer 2020, CDFW expected low fish densities in Five Lakes Basin. Following the first two years of fish removal work, even fewer fish were present than CDFW had anticipated. During the 2021 field season, CDFW only caught 31 fish, all of which occurred in Glacier Lake during the first two trips to the area. The following six trips resulted in zero fish captures in all of Five Lakes Basin. Therefore, CDFW estimates that trout may now be absent from the Five Lakes Basin restoration area. However, even if so, CDFW will continue gillnetting and electrofishing through fall 2022, to obtain reasonable confidence that fish have been eradicated from the restoration area. Now that fish captures have likely ceased, CDFW will consider beginning adult SNYLF translocation from the Mossy Pond area into Five Lakes Basin in summer 2022.

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