State of California
Department of Fish and Wildlife

M e m o r a n d u m

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Subject: Native amphibian restoration and monitoring in Lower Summit Creek Planning Watershed.
Action: Beebe Lake fish removal and *Rana sierrae* monitoring in surrounding area.

INTRODUCTION AND ENVIRONMENTAL SETTING
Lower Summit Creek Planning Watershed (PWS) is located on the western slope of the Sierra Nevada in the Mokelumne Wilderness, Alpine County between 1800 and 2900 meters elevation. Eldorado National Forest (ENF) manages the land and issues grazing permits in the area. California Department of Fish and Wildlife (CDFW) crews conducted baseline surveys in 2001 and 2002 and Sierra Nevada Yellow-legged Frogs (*Rana sierrae*, SNYLF) were observed at four sites in the PWS (Figure 1). All of these populations are small and isolated and the two northern sites may no longer support SNYLF (Figure 2).

The Aquatic Biodiversity Management Plan (ABMP) is currently being written, and Beebe Lake (Photo 1) is identified as a high priority Native Species Restoration site in the plan. Although Beebe Lake does not currently support a population of SNYLF, it is the only deep water habitat nearby and it offers the possibility of reconnecting the 14774 population with the 14802 and 14706 populations. It was stocked with brook trout (*Salvelinus fontinalis,* BK) from 1950 to 2000 and the trout population was found to be self-sustaining in surveys conducted by HML crews in 2010 and 2011.

Photo 1: Beebe lake looking north on September 30, 2014 (CDFW).

Figure 1: Beebe Lake and nearby sites with SNYLF, 2001-2002 survey findings.

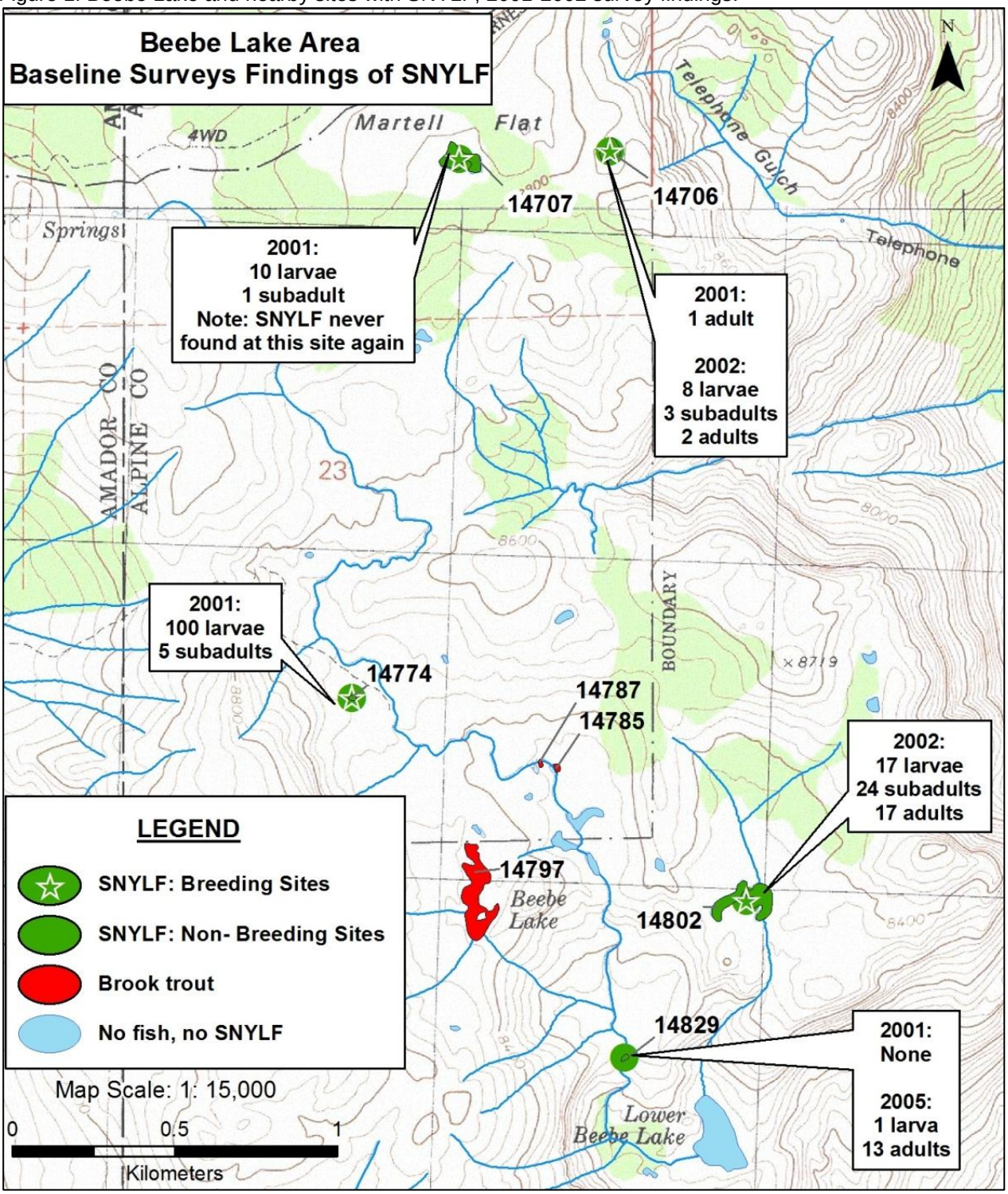
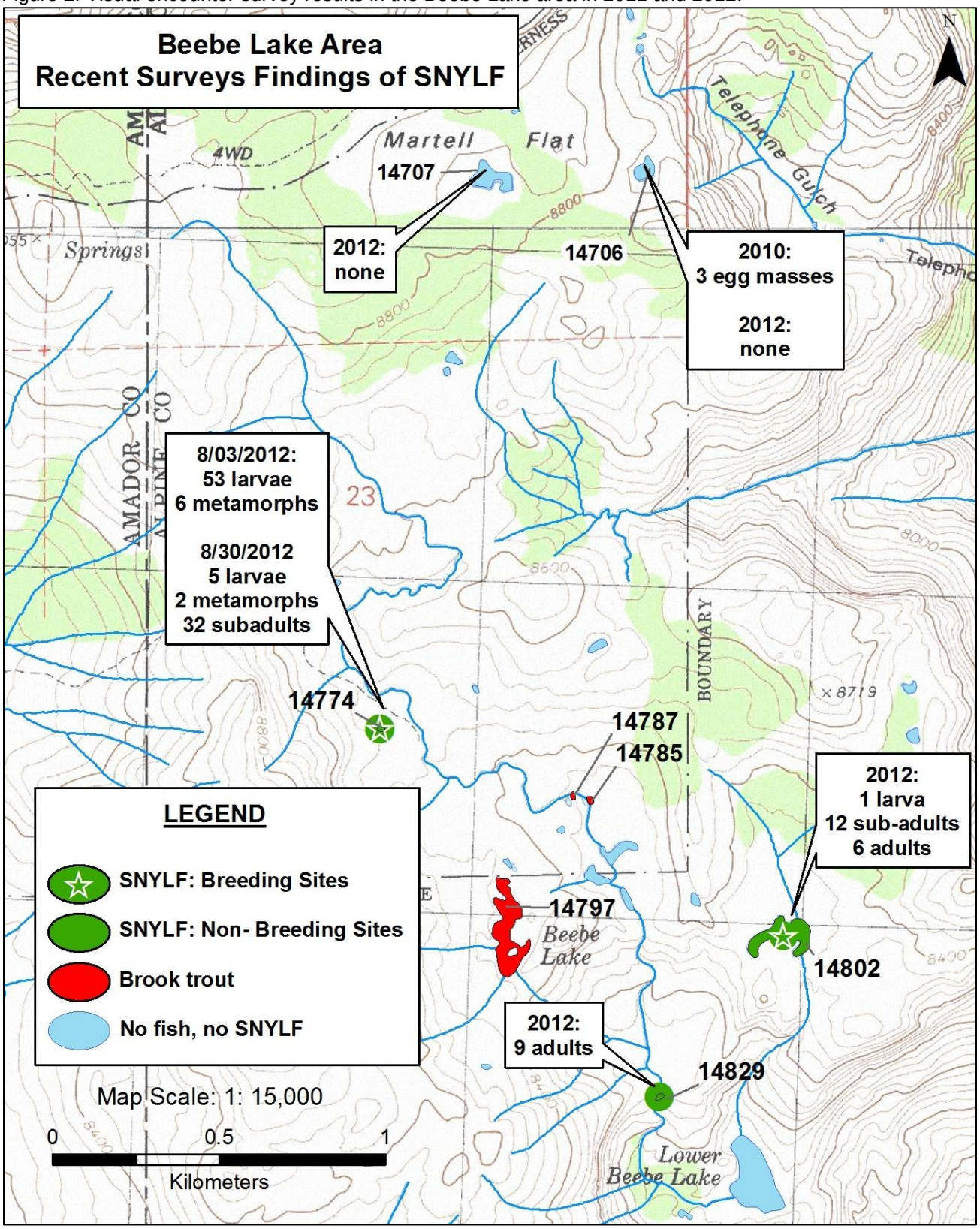


Figure 2: Visual encounter survey results in the Beebe Lake area in 2011 and 2012.



THREATS

- Disease – All SNYLF populations in the Mokelumne Wilderness are Bd positive. Lower Summit Creek PWS SNYLF sites were genetically sampled by epithelial swabs for the presence of Bd in 2008 and 2010. A total of eleven swabs were collected at sites 14774, 14829 and 14802. Results from both years detected levels of Bd DNA ranging from very light to moderate.

- Marginal Habitats – SNYLF populations in Lower Summit Creek PWS are persisting at small isolated ponds (Figure 1, Figure 2). Any disturbance, natural or otherwise, that threatens overwintering habitats presents a potential extirpation risk. Among the risks to the population are habitat disturbance by humans and possible exposure to severe winter conditions or desiccation that could eliminate the population.

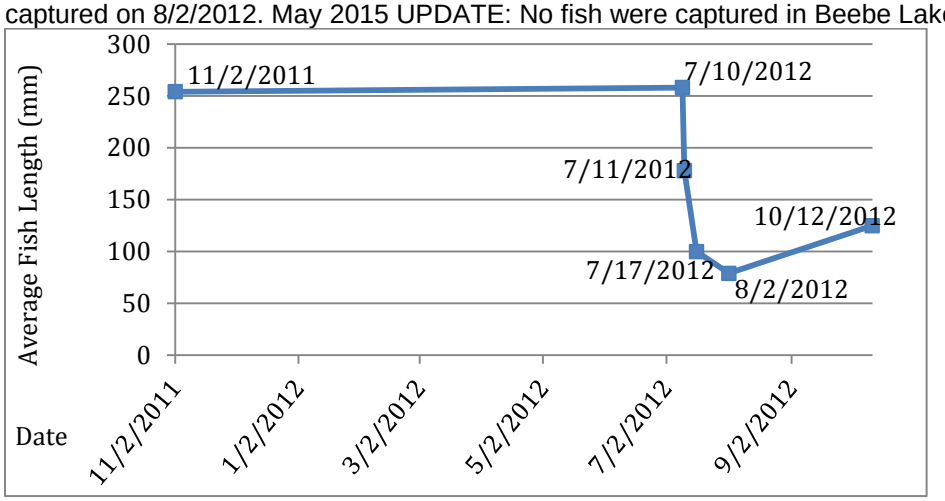
- Introduced Fish – All sites supporting SNYLF in Lower Summit Creek PWS are fishless, however fish are persisting in a nearby meadow/stream complex as well as in Beebe Lake (Figure 1). The only deep water habitat available in the PWS is at Beebe Lake. The stream that connects unnamed site 14787 to Lower Beebe Lake is seasonally flowing and dries to a series of deep tannin pools by late summer. It is not great trout habitat yet brook trout appear to be persisting and these streams my act as a sink for migrating SNYLF. CDFW will continue to monitor this area to determine the status of the fish population.

- Cattle Grazing – ENF manages grazing allotments in the area and cattle were present around Martell Flat during 2010 and 2012 surveys. Although studies on cattle impacts to SNYLF populations have not been done, ENF acknowledges cattle impacts to aquatic resources in the Mokelumne Wilderness (Eldorado, Stanislaus and Toiyabe National Forests, 1995).

FISH REMOVAL AT BEEBE LAKE

CDFW and USFS crews began fish removal at Beebe Lake in November 2011 and 257 fish were removed by fall 2012. In addition, fish surveys at Beebe Lake returned 17 brook trout in 1 net in 2001 and 37 BK in 1 net in 2010. A total of 143 brook trout were removed from Beebe Lake in early November 2011 and in 9 over-winter gill nets between 2011 and 2012. During summer of 2012 an additional 114 brook trout were removed and no adult fish were captured after August 2 (Figure 3). Fish are not expected to breed in fall 2012, and any remaining juvenile fish will be removed during summer 2013. As of fall 2012 9 over-winter gill nets are fishing in Beebe Lake. In a visual encounter survey performed by CDFW at Beebe Lake in 2001, no SNYLF were observed and none have been observed since.

Figure 3: Average size of fish captured in gill nets between 11/2/2011 and 10/12/2012. 69 fish are not included in this analysis because they were too deteriorated to determine size. A single adult (>250mm) was captured on 8/2/2012. May 2015 UPDATE: No fish were captured in Beebe Lake in 2013 or 2014.



POPULATION STATUS AND DISCUSSION

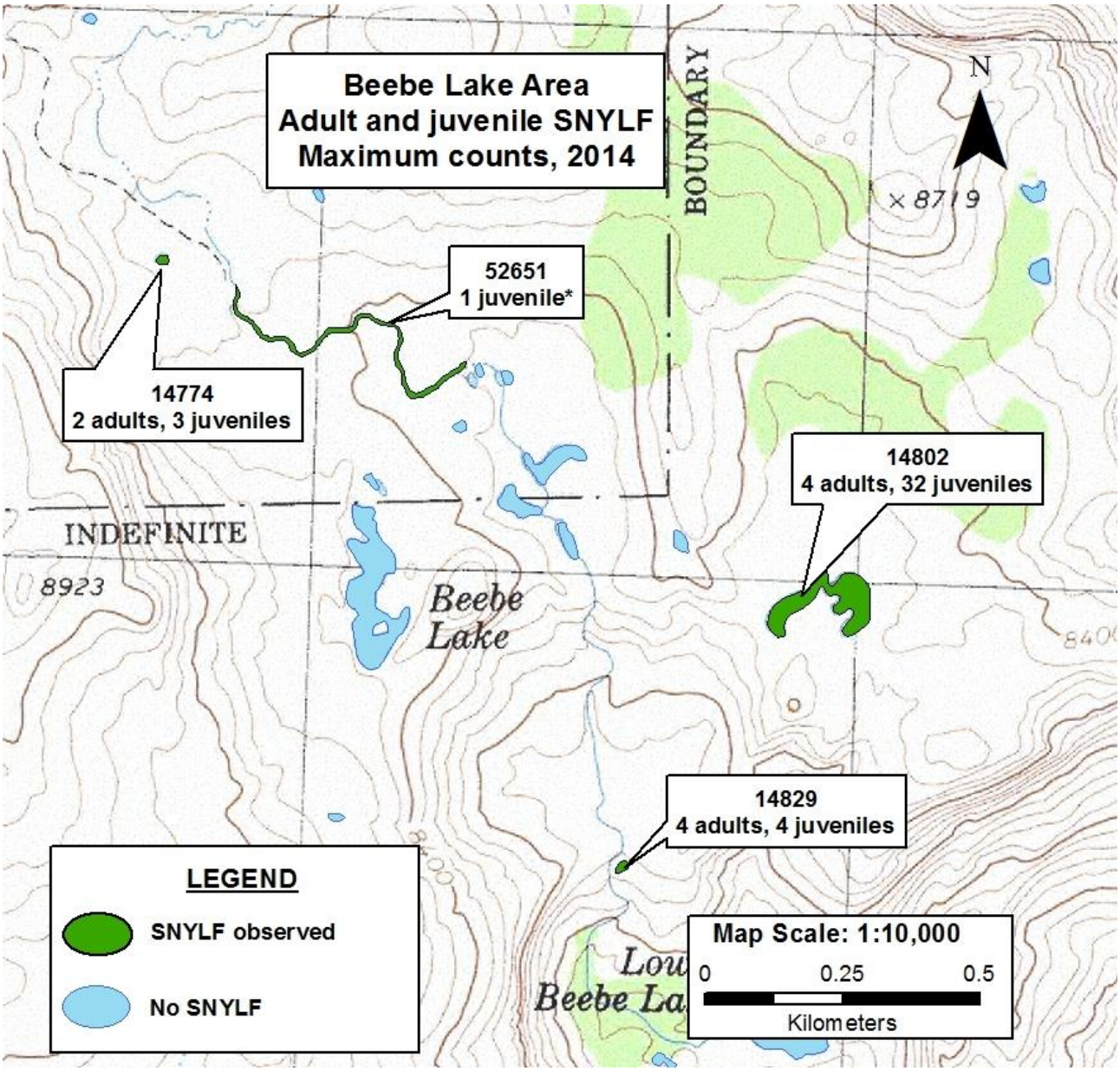
Approximately 20-40 breeding adults are present in the PWS and eleven years of monitoring data suggests these populations are either stable or declining slightly. Water in the PWS is dispersed and all streams are ephemeral making it likely that each group of SNYLF is isolated from the others and increasing the likelihood of extirpation at any particular site.

2014 FISH REMOVAL UPDATE

Overwinter gill nets were set in Beebe Lake by ENF personnel during the 2013 field season. No fish were captured in those nets and none were captured during multiple net sets over the course of summer 2014. On October 9, 2014 six full length gill nets were set in Beebe Lake; they will be pulled in June 2015. If no fish are captured in spring 2015 fish removal will be considered complete within Beebe Lake.

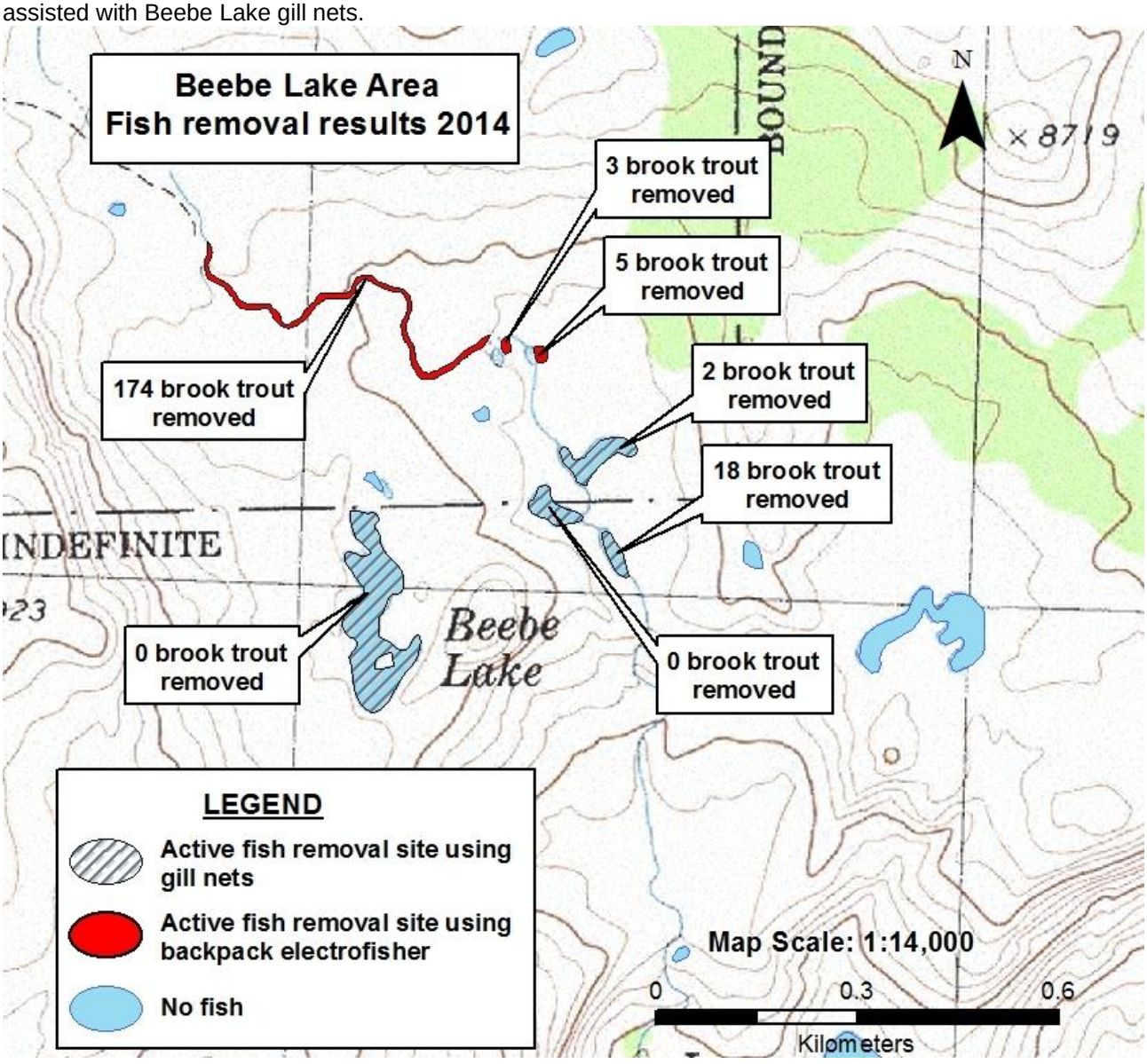
During the 2012 field season brook trout were observed in a small pond along a stream below Beebe Lake. Although not directly connected to the lake the topography in the area is so shallow that fish could possibly move from the stream back into Beebe Lake in a very large water year. In addition, a few adult and juvenile SNYLF were observed co-existing with fish in wetted sections of the stream. Due to exceptionally dry conditions CDFW believes that fish removal in the stream and meadow below Beebe Lake is currently mechanically feasible. Removing fish from the whole meadow/stream complex is highly desirable not only to prevent return of fish to Beebe in a high water year but also because remaining frog populations in the area are clustered in small sites around the meadow/stream and Beebe Lake (Figure 4). Eliminating fish from the meadow/stream will potentially reconnect all remaining SNYLF populations in the watershed. Additionally, frogs will have access to high quality fishless habitat consisting of meadow, ponds and stream.

Figure 4: Maximum counts of adult and juvenile SNYLF in the vicinity of Beebe Lake during summer 2014. *Not a formal VES; 1 juvenile observed while conducting fish removal activities.



Fish removal was implemented in the stream and meadow in July 2014 using gill nets and backpack electro-fishers. A total of 206 brook trout were removed from meadow ponds and wetted sections of stream, including young of the year, indicating that brook trout successfully bred in 2013 despite drought conditions (Figure 5). It is likely that enough adults were removed in 2014 to prevent spawning; regardless, fish removal activities will continue in summer 2015.

Figure 5: Number of fish removed from each active fish removal site during summer 2014. ENF personnel assisted with Beebe Lake gill nets.



Site ID 14802

First surveyed by CDFW in 2002, site ID 14802 (Photo 2) is a small lake approximately 600 meters east of Beebe Lake where CDFW survey crews consistently observe breeding SNYLF and long-toed salamander larvae (*Ambystoma macrodactylum*, AMMA). SNYLF appear to be declining here (Figure 4), although 27 SNYLF egg masses were observed on 7/26/2010 suggesting that at least 27 females are present in the area. Site ID 14802 is connected to site ID 14829 by a seasonal stream not shown on the map (Figure 2) and frogs may move between the sites.

Photo 2: Site 14802 has breeding SNYLF and AMMA (CDFW 2012).

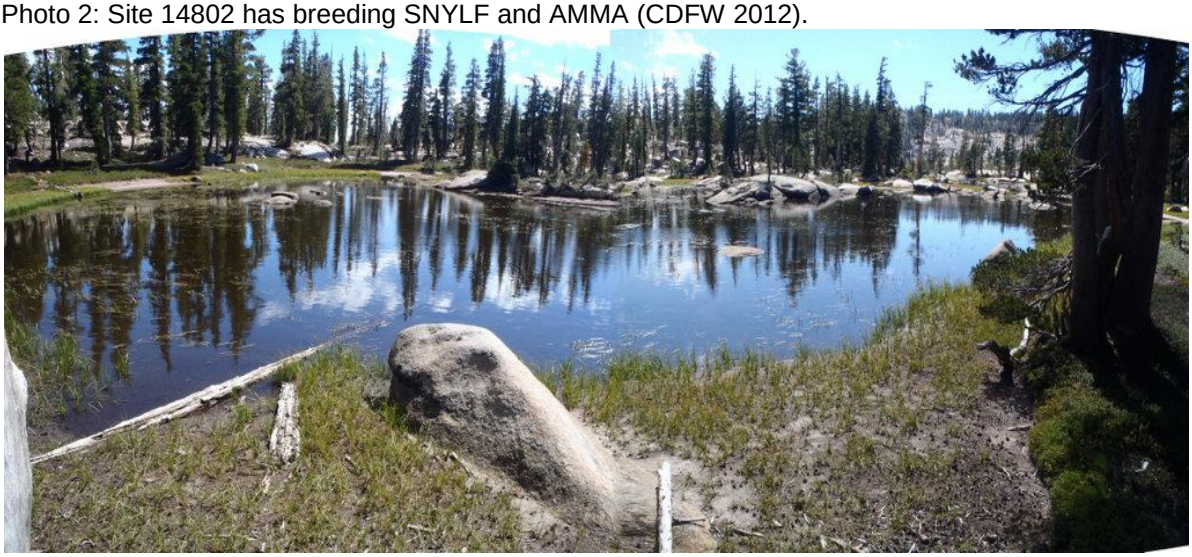
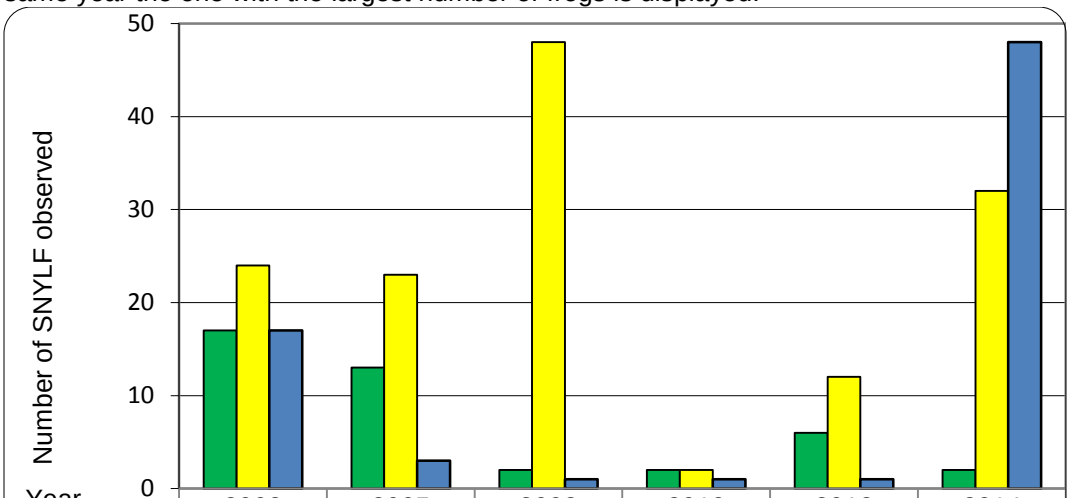


Figure 4: Maximum SNYLF counts by life stage at unnamed pond 14802. When 2 surveys were done in the same year the one with the largest number of frogs is displayed.



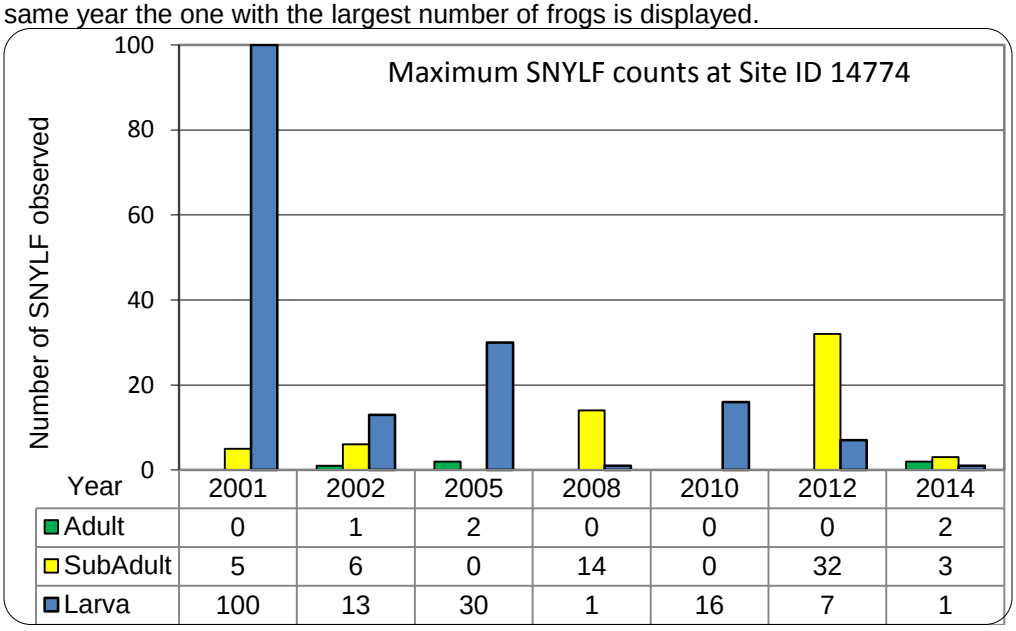
Year	2002	2005	2008	2010	2012	2014
Adult	17	13	2	2	6	2
SubAdult	24	23	48	2	12	32
Larva	17	3	1	1	1	48

Site ID 14774

14774 (Photo 3) is a small pond, approximately 500 meters northwest of Beebe Lake where CDFW crews have been monitoring a breeding SNYLF population and AMMA larvae. Eleven years of monitoring data suggest that this population is declining, however it is difficult to derive trends due to extremely small population size (Figure 5). AMMA is also present at the site.

Photo 3: Site ID 14774 has breeding SNYLF and AMMA (CDFW 2012).

Figure 5: Maximum SNYLF counts by life stage at unnamed site 14774. When 2 surveys were done in the same year the one with the largest number of frogs is displayed.

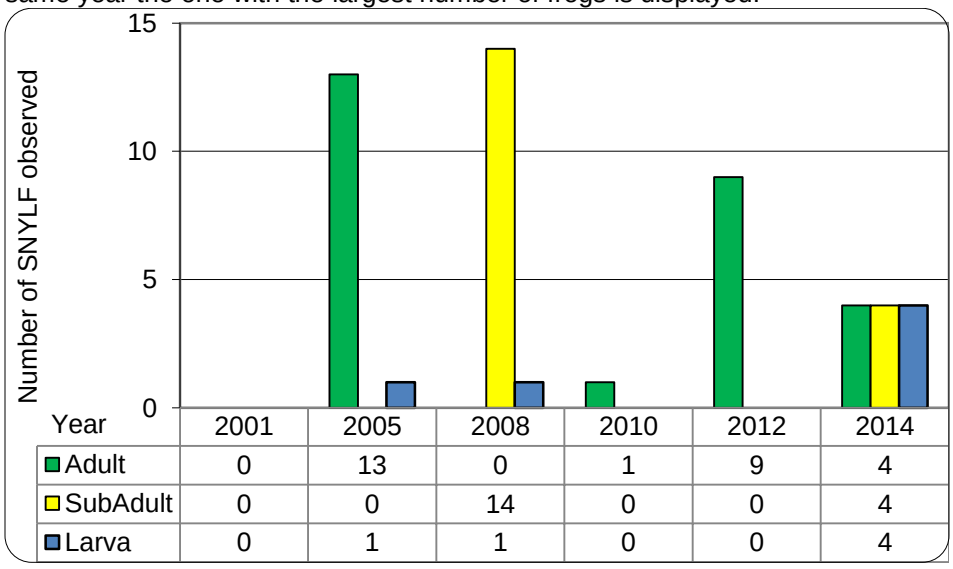


Year	2001	2002	2005	2008	2010	2012	2014
Adult	0	1	2	0	0	0	2
SubAdult	5	6	0	14	0	32	3
Larva	100	13	30	1	16	7	1

Site ID 14829

In the 2001 baseline survey for 14829, another small pond approximately 500 meters south of Beebe Lake, no SNYLF were found; however in 2005, 13 adults and 1 larva were found and adult SNYLF are consistently observed at the site (Figure 6), which is connected to 14802 by a seasonal inlet. It is difficult to derive population trends due to the small size of this population and the possibility that SNYLF are moving between the site and site 14802.

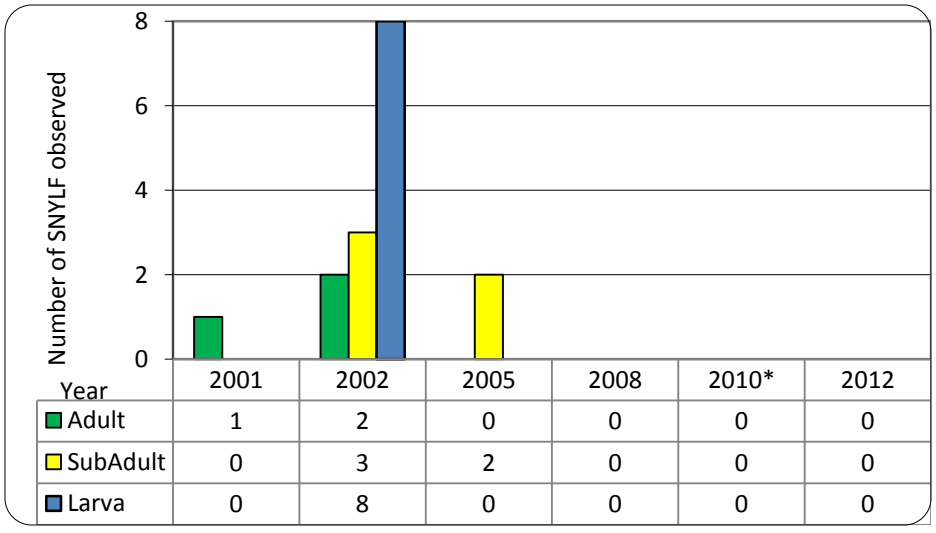
Figure 6: Maximum SNYLF counts by life stage at unnamed site 14829. When 2 surveys were done in the same year the one with the largest number of frogs is displayed.



Year	2001	2005	2008	2010	2012	2014
Adult	0	13	0	1	9	4
SubAdult	0	0	14	0	0	4
Larva	0	1	1	0	0	4

Site ID 14706

A single adult SNYLF was observed at unnamed site 14706 in 2001 (Figure 1). A few SNYLF were seen in 2002 and 2005 but no larvae or adults were observed in 2008, 2010 or 2012 (Figure 7) and CDFW considers this population extirpated although 3 SNYLF egg masses were observed in 2010.



Year	2001	2002	2005	2008	2010*	2012
Adult	1	2	0	0	0	0
SubAdult	0	3	2	0	0	0
Larva	0	8	0	0	0	0

Figure 7: Maximum SNYLF counts by life stage at 14706. *Three egg masses observed in 2010 are not displayed.

DISCUSSION

Beebe Lake presents a rare opportunity to remove fish from a site in Alpine County with a persistent SNYLF population in the vicinity. Opportunities to increase deep water habitat in a wilderness setting with low public use and nearby SNYLF populations are increasingly rare particularly in Alpine County. Three small SNYLF populations are extant in the area, all at shallow sites in danger of drying during a drought. Eleven years of monitoring data suggest these populations are slowly declining. Beebe Lake will provide deep water breeding habitat for SNYLF and potentially reconnect the three remnant populations in the area. CDFW believes that increasing available habitat and reconnecting isolated populations will improve the likelihood of persistent SNYLF in Lower Summit Creek PWS.

2014 DISCUSSION

Increasing evidence suggests the importance of stream habitat for SNYLF populations is much greater than previously thought. Drought has provided CDFW an opportunity to remove brook trout from a stream and meadow complex near Beebe Lake already being used by adult and juvenile SNYLF. Completing fish removal in this area will provide fish-free hydrological connections between the SNYLF populations in the vicinity of Beebe Lake as well as providing a habitat complex consisting of a mixture of meadow ponds, granite potholes, deep stream channels, springs, and Beebe Lake itself.

LITERATURE CITED

Eldorado, Stanislaus and Toiyabe National Forests, 1995. Mokelumne Wilderness Management Guidelines – Environmental Assessment #EO95-01. USDA Forest Service, September 1995.