

**2022 Annual Summary of Activities**  
**Pahrump Poolfish Safe Harbor Agreement**

**By**

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The following report is an annual summary of activities under Enhancement of Survival Permit # TE17874C-0 issued to the Las Vegas Valley Water District (LVVWD) by the US Fish and Wildlife Service (USFWS). This permit was granted in 2017 under the Safe Harbor Agreement for Pahrump poolfish at the 180-acre Springs Preserve (Enrolled Property) in Clark County, Nevada.

### Executive Summary

In 2022, Pahrump poolfish fry were first observed in May and new cohorts continued to be observed into August. The estimated number of Pahrump poolfish in July 2022 is unchanged in the Downstream Pond as compared to September 2021. For the Upstream Pond, the estimated number was 64% higher than in 2021 and comparable to population estimates in 2019 and 2020.

### Population Surveys

Beginning in 2022, at the request of Southern Nevada Water Authority (SNWA), the Pahrump Poolfish Recovery Implementation Team (RIT) agreed to move the annual mark-recapture surveys for the Springs Preserve refugium to July. The Springs Preserve ponds are unheated mesocosms; consequently, their thermal profiles differ markedly from natural geothermal springs. This change was suggested because the capture and/or recapture rates in 2018, 2020, and 2021 were poor in the Downstream Pond, so much so that a third capture session had to be added to calculate a population estimate (**Table 1**). Essentially, the Springs Preserve population becomes inactive and/or dormant before Pahrump poolfish in naturally heated geothermal springs. This temporal shift in survey timing is a perfect example of data-driven adaptive management.

The Nevada Department of Wildlife (NDOW) conducted the July 2022 survey with the assistance of USFWS, SNWA, and Springs Preserve colleagues:

- On July 20, 2022, a total of 107 Pahrump poolfish were captured and marked in the two ponds following previously established trapping protocols. Of these fish, 86 were captured and marked in the Upstream Pond (Pond NF-1b) and 21 in the Downstream Pond (Pond NF-1a).
- On July 27, 2022, a total of 75 Pahrump poolfish were captured in the two ponds during the recapture session. For the Downstream Pond, 22 fish were captured, of which 16 were recaptures; whereas, in the Upstream Pond 53 fish were captured, of which 44 were recaptures.
- It should be noted that on Dec 1, 2021, 10 adult Pahrump poolfish were caught in the Downstream Pond settling basin and relocated to the Upstream Pond. The settling basin is a part of the passive filtration that the fish can enter from the bottom drain but may not be able to escape.

Population estimates and 95% Confidence intervals (CI) for years 2018–2022 calculated by the Nevada Department of Wildlife (NDOW) for the two ponds are presented below (**Tables 1–2**). The estimated number of Pahrump poolfish in July 2022 appear unchanged in the Downstream Pond as compared to September 2021 (**Table 1**). However, since 10 fish, about a third of the 2021 estimated population size, were moved to the Upstream Pond, the seemingly unchanged 2022 estimate could reflect a 33% increase. For the Upstream Pond, the estimated number was 64% higher than in 2021 and comparable to population estimates in 2019 and 2020 (**Table 2**). Again, we must account for the translocation/addition of 10 adult fish to the Upstream Pond.

**Table 1. Downstream Pond:** Population size estimates and 95% Confidence Intervals (CI) of Pahrump poolfish captured in North Fork Pond 1a in 2018–2022 at the Springs Preserve, Las Vegas, Clark County, Nevada, USA.

Year	No. Surveys	Population Size Estimate	95% CI
2018	3	134	63 – 310
2019	2	65	46 – 96
2020	3	93	41 – 232
2021	3	31	21 – 50
2022	2	29	18 – 50

**Table 2. Upstream Pond:** Population size estimates and 95% Confidence Intervals (CI) of Pahrump poolfish captured in North Fork Pond 1b in 2018–2022 at the Springs Preserve, Las Vegas, Clark County, Nevada, USA.

Year	No. Surveys	Population Size Estimate	95% CI
2018	2	252	215 – 295
2019	2	99	74 – 136
2020	2	98	72 – 137
2021	3	67	49 – 94
2022	2	104	77 – 142

### Recruitment

A concerted effort was made in 2022 to remove most of the stonewort (*Chara* sp.) growing within the ponds. This macroalga had grown into dense mats that decreased livable habitat for Pahrump poolfish, clogged filtration, and may have facilitated predation throughout the water column by dragonflies and damselflies (Horn et al. 1994). The removal of most of the stonewort began on May 24, 2022 and continued until July 12, 2022. Thereafter, any

new stonewort growth was removed from the ponds at least twice per month. Henceforth, pond maintenance includes the removal of any new stonewort growth on a weekly or bi-monthly basis (as needed) during the growing season. Conversely, mats of filamentous alga growing on the pond’s surface were left to grow as they provided food, cover from avian predators, and a thermal buffer.

Several cohorts of Pahrump poolfish fry were documented in both ponds from May through August 2022. The population estimates for July 2022 (**Table 1–2**) suggest that successful recruitment into the adult population is occurring. Most of the fish that hatched in 2022, however, were likely too small to be trapped during the July 2022 mark-recapture survey. Encouragingly, on October 11, 2022, approximately 300 Pahrump poolfish were counted in the two ponds by an experienced fish surveyor during a nocturnal relict leopard frog (*Rana onca*) survey (Ambos, pers. comm.).

### Mortalities

No dead Pahrump poolfish were observed in 2022. Moreover, no signs of disease were noted on any of the fish observed in the ponds.

### Environmental Conditions

Water quality measurements were recorded on an hourly basis by a submerged datalogger with probes for water temperature, pH, and conductivity (**Table 3–5**).

The average water temperatures in the pond remain remarkably consistent from year-to-year, within 0.2°C (**Table 3**). Similarly, maximum water temperatures have not exceeded 29°C (84°F) and stayed within a 2.1°C range, despite air temperatures in Las Vegas reaching 45–47°C (114–116°F). Water temperatures are no doubt tempered by the canopy of large Fremont’s cottonwood (*Populus fremontii*) over the ponds.

**Table 3.** Average, minimum, and maximum hourly temperatures in degrees centigrade (°C) for downstream refugium pond (NF-1a) at the Springs Preserve, Las Vegas, Clark County, Nevada, USA.

Year	Average	Minimum	Maximum
2020	16.0	3.9	26.9
2021	15.9	3.6	29.0
2022	15.8	2.7	28.2

The pH in the ponds appears to be increasing (**Table 4**), but this may simply be an artifact of the probe requiring more frequent calibration, which will be investigated in 2023. Other causes of increasing pH may be related to water evaporation, as well as algal blooms and the photosynthetic cycle.

**Table 4.** Average, minimum, and maximum hourly pH for downstream refugium pond (NF-1a) at the Springs Preserve, Las Vegas, Clark County, Nevada, USA.

Year	Average	Minimum	Maximum
2020	8.6	8.0	9.4
2021	9.0	8.4	9.7
2022	9.34	8.7	9.9

As with water temperatures, conductivity values are remarkably constant (**Table 5**). Water changes conducted each spring to decrease tannins, which are leached from decaying cottonwood leaves, likely contribute in part to stable conductivity values. Conductivity is known to increase as water temperatures increase, which is reflected in the annual minimum and maximum values.

**Table 5.** Average, minimum, and maximum hourly conductivity in microsiemens per meter ( $\mu\text{S}/\text{m}$ ) for downstream refugium pond (NF-1a) at the Springs Preserve, Las Vegas, Clark County, Nevada, USA.

Year	Average	Minimum	Maximum
2020	1,092	997	1,211
2021	1,065	841	1,216
2022	1,109	1,004	1,182

## Education

Information about the Pahrump poolfish is shared on the Springs Preserve [website](#). Guests visiting the ponds can read interpretive panels about the history of the Pahrump poolfish and some of the threats the species faces. Conservation messaging was shared during small group tours. Education efforts offered online through social media platforms included:

- Twitter. March 3, 2022. World Wildlife Day.  
<https://twitter.com/SpringsPreserve/status/1234873439904768007?s=20&t=iAVeZwY1Re4FzSVBRbE-9g>

Lastly, the Springs Preserve was awarded an Outside Agency Grant by Clark County to create new interpretive panels for the future South Fork refugium pond system. These panels will be completed in 2023.

## Literature Cited

Horn, M.J., P.C. Marsh, G. Mueller, and T. Burke. 1994. Predation by odonate nymphs on larval razorback suckers (*Xyrauchen texanus*) under laboratory conditions. *Southwestern Naturalist* 39:371–374.