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A fish out of water: rewilding the Pahrump poolfish in Las Vegas, Nevada, USA

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Introduction

The Springs Preserve (Preserve) is a 73 ha urban park known as the birthplace of Las Vegas, Nevada, USA. Historically, the Preserve contained three springs that flowed into riparian meadows. These spring systems were once inhabited by the Las Vegas dace (*Rhinichthys deaconi*), an extinct species described from museum specimens (Miller, 1984). Today, the Preserve is privately-owned by the Las Vegas Valley Water District (LVVWD), the local municipal water purveyor. As part of ongoing restoration efforts, ponds were constructed at the Preserve to rewild the federally endangered Pahrump poolfish (*Empetrichthys latos*), a species considered critically endangered by the IUCN. This endemic fish was extirpated in 1975 from Manse Spring in Pahrump Valley, Nye County, Nevada. Although Manse Spring was lost to groundwater pumping for agriculture, some fish were translocated proactively to establish three refugia populations (Minckley & Deacon, 1968). Recently, two of these refugia were decimated by the illegal introduction of non-native species, in particular Goldfish (*Carassius auratus*), Western mosquitofish (*Gambusia affinis*), and Red swamp crayfish (*Procambarus clarkii*). The establishment of a population at the Preserve further protects the species from stochastic events that can lead

Pahrump poolfish adult (above) and fry (bottom)
© Aaron Ambos

to extinction.

Goals

- Obtain regulatory and legal agreements, permissions, and permits necessary for private land owners to conduct actions that may contribute to the recovery of species listed as endangered or threatened under the U.S. Endangered Species Act.
- Design and construct a pond mesocosm suitable for Pahrump poolfish.
- Establish a self-sustaining population of Pahrump poolfish.
- Increase the geographic distribution and total population count to increase species resilience to stochastic events.
- Educate public about the plight of the Pahrump poolfish and foster community support.

Success Indicators

- Ratification of federal Pahrump poolfish Safe Harbor Agreement.
- Establishment of pond mesocosm at the designated site.
- Obtain and translocate Pahrump poolfish.
- Pahrump poolfish population becomes self-sustaining.
- Implement public education programing on conservation efforts.

Project Summary

Feasibility: To assist with conservation of the critically endangered Pahrump poolfish, additional public education and refugia populations are required. The Preserve was identified as a potential translocation site because: 1) it is a secure property that will reduce the likelihood of illegal introductions of non-native species, 2) it hosts two museums that promote conservation and public education, and 3) it is only about 65 km from Manse Spring. The Preserve, however, encompasses a 44 ha operational groundwater well-field that provides water to meet Las Vegas' peak municipal demands. In order to maintain operations of the active well-field, while ensuring the safety of an endangered Pahrump poolfish population, a 15-year Safe Harbor Agreement was ratified in 2017 by LVVWD and the US Fish and Wildlife Service (USFWS). The legally-binding document spelled out the rights, responsibilities, and obligations of both parties (LVVWD & USFWS, 2017).

Implementation: The design and construction of a pond mesocosm suitable for Pahrump poolfish was potentially the most challenging part of the project. At the Preserve, 10 previously-built ponds were evaluated for their potential suitability for Pahrump poolfish and imperiled Relict leopard frogs (*Rana onca*). Three ponds were selected because of their larger sizes and/or ease of access for future public education, although none had supplemental aeration or filtration. The suitability of these ponds was tested for Pahrump poolfish by first introducing approximately 50 Moapa White River springfish (*Crenichthys baileyi moapae*) into each pond in August 2013. Although the fish thrived initially, the death of large quantities of

green algae (*Chara* sp.) in the fall of 2013 led to anaerobic water conditions in the test ponds. Trapping surveys in November 2013, revealed that only two of the fish had survived in a single pond. Supplemental aeration and filtration was necessary in order to establish refugia populations at the Preserve.

Mark-recapture survey at pool habitat
© Aaron Ambos

In order to move forward with the Pahrump poolfish refugium at the Preserve, two other existing ponds were chosen because of the availability of power for aeration and filtration systems. These ponds had not been selected previously because of the effects of decomposing leaves from overhead Cottonwood trees (*Populus fremontii*) on water quality. Once additional funding and approvals were secured, a new low-maintenance pond mesocosm was designed in August 2016. The new design included two interconnected concrete ponds with shared aeration systems (i.e., bubblers, waterfalls) and both natural filtration (i.e., emergent macrophytes) and mechanical filtration (i.e., high-capacity skimmer baskets, settling basin). The intricacies of the unique aeration and filtration systems were detailed in Wallace (2018). By May 2018, the system was working as designed and plans for the translocation of a Pahrump poolfish population were made. In late May 2018, the Nevada Department of Wildlife (NDOW) translocated a total of 290 Pahrump poolfish from the Shoshone Ponds refugia to the Preserve.

Post-release monitoring: Since the ponds can be visited regularly by staff, post-release monitoring has occurred almost daily. Following the translocation of 290 adult Pahrump poolfish on 29th May 2018, the first fry were observed on 18th June 2018. Fry continued to be observed throughout the summer. Between 3rd - 9th October 2018, a mark-recapture survey was conducted using standard fisheries methods. The survey revealed that an estimated 386 (95% CI: 278 - 605) Pahrump poolfish inhabited the ponds, an increase of 25% (N=96 fish) in a little over four months. From 8th October to 27th November 2018, at least 5.5% (n=22) of the population died from a virulent attack by a flavobacterium and secondary fungal infection. A federal fish pathology laboratory concluded that “immunosuppressed mature fish were succumbing to opportunistic aquatic bacteria and fungi.” The pathologists speculated that the pathogens were the result of two confounding stressors: 1) *Environmental:* Water temperature dropped by 7°C (i.e., from 22°C to 15°C between the 1st and 2nd capture sessions); and, 2) *Anthropogenic:* trapping, handling, and marking during a mark-recapture survey.

Pahrump poolfish pond habitat
© Raymond A. Saumure

Mark-recapture surveys in June and September 2019 documented an estimated 173 (95% CI: 131 - 232) and 164 (95% CI: 120 - 232) Pahrump poolfish in the ponds. Although the population size stabilized in 2019, it represents a 58% decline from the October 2018 survey. This may be partially explained by the presence of hundreds of imperiled Relict leopard frog (*Rana onca*) tadpoles in 2019, which may have altered the primary productivity, and thus carrying capacity, of the system. As of 27th November 2019, there has been no observed recurrence of mortalities as a result of immunosuppressed Pahrump poolfish. Recruitment is still occurring, as schools of Pahrump poolfish fry were observed from 14th May until 3rd October 2019.

Major difficulties faced

- Prior to the addition of aeration and filtration systems, there was an unanticipated decline in water quality because of large quantities of decomposing leaves in the fall and winter.
- Mature fish were succumbing to opportunistic aquatic bacteria and fungi. Fish pathologists speculated that mortalities were likely the result of the synergistic effects of anthropogenic (i.e. mark-recapture survey) and environmental (i.e. drastic temperature drop) stressors.
- Manse Spring was a thermal system with a constant spring pool temperature of 24°C; however, translocated fish were known to survive temperatures as low as 4°C under ice (Selby, 1977). The two Preserve ponds are not heated and dropped to 0.5 and 1.5°C during the unusually cold winter of 2018 - 2019.
- The mechanical aeration system (i.e., bubblers) had to be adjusted so that the bubbles did not prevent falling leaves from reaching two large skimmer baskets. Given the closed nature of the system, large quantities of decomposing leaves could still potentially lead to water quality issues.

Major lessons learned

- Small pond mesocosms require supplemental aeration and filtration.
- Mark-recapture surveys must occur before precipitous seasonal declines in water temperature, which can compromise the immune system of Pahrump

poolfish. This recommendation was implemented in 2019 and no further post-handling mortalities were documented.

- The rewilding of the Preserve generated a surprising amount of positive local media coverage. This media coverage was leveraged to educate the public about the plight of endangered species and the damage caused by the illegal introduction of non-native species to native fauna.

Success of project

Highly Successful	Successful	Partially Successful	Failure

Reason(s) for success:

- The initial buy-in and subsequent commitment from partner agencies to see the project through, despite temporary setbacks, was critical to the success of the project.
- The pond was redesigned to be a low-maintenance mesocosm that provided redundant natural and mechanical aeration and filtration systems.
- Managed the outbreak of a virulent pathogen and adapted procedures and protocols to decrease the likelihood of a recurrence in subsequent years.
- Public education followed a multifaceted approach, including interpretive panels, site tours, and public television. These activities resulted in additional reporting in local print and social media, generating even more public interest.

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