

5-YEAR REVIEW

Owens pupfish (*Cyprinodon radiosus*)

GENERAL INFORMATION

Species: Owens pupfish
Date listed: March 11, 1967
FR citation: 32 FR 4001
Classification: Endangered

BACKGROUND

Most recent U.S. Fish and Wildlife Service (Service) status review: U.S. Fish and Wildlife Service. 2009. Owens Pupfish 5-Year Review: Summary and Evaluation. Ventura Fish and Wildlife office. January 2009. 21 pp.

Most recent California Department of Wildlife (CDFW) status review: Report to the Fish and Game Commission Five-Year Species Review of Owens pupfish (*Cyprinodon radiosus*). 2020. California Department of Fish and Wildlife. 25 pp.

FR Notice citation announcing this status review: U.S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of 76 Species in California and Nevada. Federal Register 86: 27462-27464. May 20, 2021.

ASSESSMENT

In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (ESA), the purpose of a 5-year review (ESA 5-Year Review) is to assess a listed species' status to determine if it is the same or needs to change (*i.e.*, reclassification or removal from the List of Threatened and Endangered Wildlife and Plants). For the Owens pupfish, the U.S. Fish and Wildlife Service's (Service) Reno Fish and Wildlife Office evaluated the status of the species by evaluating all new information since the last ESA 5-Year Review. For this review, we solicited information from interested parties through the above-referenced Federal Register notice (86 FR 27462–27464). We also contacted state and local agencies, tribes, partners, stakeholders, and species experts to request data or information relevant to this effort. Lastly, we conducted a search of the literature and our files for information.

One of the most informative documents received was the most recent California Department of Fish and Wildlife (CDFW) 5-year status review, completed in 2020 (CDFW 2020; hereafter, CDFW Status Review). The California Endangered Species Act (Fish and Game Code § 2050 et seq.; Cal. Code Regs. tit. 14 § 670.2 for plants and § 670.5 for animals, subd. (a)(2)(K)) requires a status review every five years of species listed by the State as threatened or endangered (California Fish and Game Code § 2077, subd. (a)). Like our ESA 5-Year Review, the CDFW is required to evaluate and compile the best scientific information available and analyze whether the conditions that led to the original listing are still present. The CDFW Status Review includes the following information: species' population trend(s), range, distribution (including a detailed

distribution map), abundance, life history, factors affecting the species' ability to survive and reproduce, the degree and immediacy of threats, the impact of existing management efforts, the availability and sources of information, identified habitat essential for the continued existence of the species, and the CDFW's recommendations for future management activities and other recovery measures to conserve, protect, and enhance the species. Because this information is consistent with what we need for our ESA 5-Year Review, we relied on it heavily in drafting our document, and herein incorporate the CDFW Status Review by reference, and provide details below as needed.

As mentioned above, the CDFW Status Review discussed the new information available on Owens pupfish habitat, abundance, and distribution, including that since the most recent ESA 5-Year Review in 2009. This information can be found in Section III (C) Habitat Necessary for Species Survival, Section IV (A) Range and Distribution; and, Section IV (B) Population Trend and Abundance of CDFW (2020) and is summarized below.

Habitat, abundance, and distribution

There are currently six extant populations of Owens pupfish within Owens Valley, Mono and Inyo Counties, California (Figures 1 and 2). Five of these (BLM Spring, BLM Letter Ponds, Marvins Marsh, Mule Springs, and Well 368) were present when the CDFW Status Review published in March 2020 (Figure 1). Since then, another population of Owens pupfish has been established at the River Spring Lakes Ecological Reserve (RSLER) in Mono County, California (Figure 2). To establish this new population, pupfish were sourced from the five other extant populations and translocated to the approximately 650-acre (264-hectare) reserve.

Table 1. Extant Owens pupfish population information, status, and management.

Population	Land Owner	Population Manager(s)	Habitat Size in acres (hectares)	Population Size in individuals	Status/Trend
BLM Spring	BLM	CDFW	0.17 (0.07)	100–10,000	increasing/stable
BLM Pond	BLM	CDFW	0.01 (0.01)	100–1,000	stable
Marvins Marsh	LADWP	LADWP and CDFW	0.07 (0.03)	100–1,000	decreasing
Mule Springs	BLM	CDFW	0.01 (0.01)	3,000	stable
River Springs Lakes Ecological Reserve	CDFW	CDFW	650 (263)	unknown	unknown
Well 368	LADWP	LADWP and CDFW	0.05 (0.02)	100 – 1,000	stable

Three of the Owens pupfish populations are located within Fish Slough: BLM Spring, BLM Letter Ponds, and Marvins Marsh. The population at BLM Spring is estimated to be 1,000–10,000 individuals but stable. However, this population fluctuates due to the sporadic introduction of non-native predator fish such as largemouth bass (*Micropterus salmoides*). While the source of the introductions is unknown, largemouth bass are detected within BLM Spring multiple times a year. The removal of non-native predators is conducted by CDFW staff as needed. The population at the BLM Letter Ponds is stable and is approximately 100–1,000 individuals. The population at Marvins Marsh is approximately 100–1,000 individuals but declining due to desiccation of habitat.

Mule Springs is located on BLM property but managed by the CDFW. This the smallest occupied habitat, consisting of only 0.01 surface acres (0.01 hectares) of artificial habitat. The habitat is a single small plastic-lined pool that requires routine removal of emergent vegetation. Although Mule Springs is entirely artificial, the Mule Springs population is the second largest with approximately 3,000 individuals (CDFW 2020).

Well 368 is an artesian well located on LADWP-owned property. Owens pupfish occupy the outflow of the well and total habitat is about 0.05 acres. Owens pupfish were introduced here in 1988 and the population fluctuates between approximately 100–1,000 individuals and is considered to be stable (CDFW 2020).

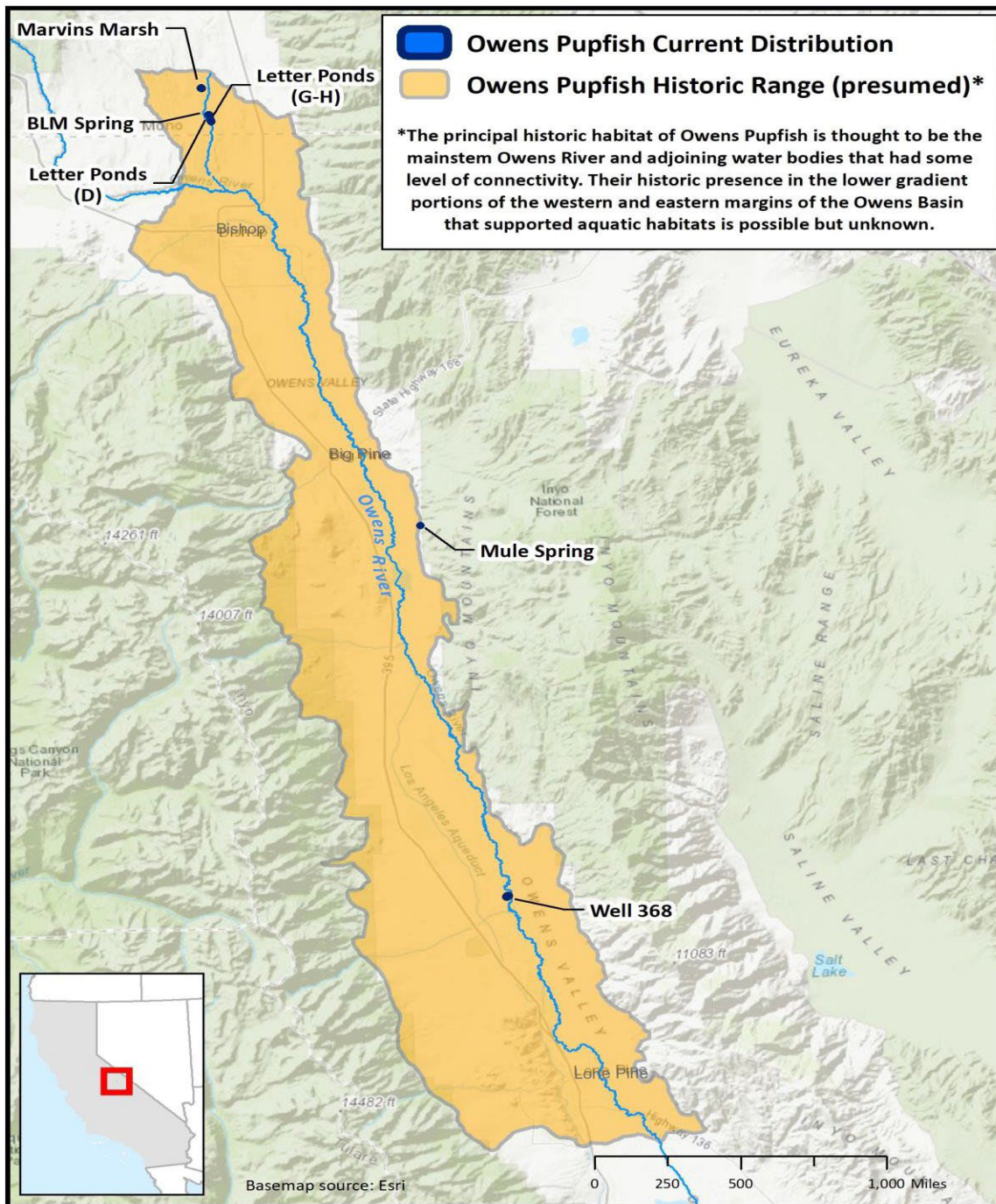
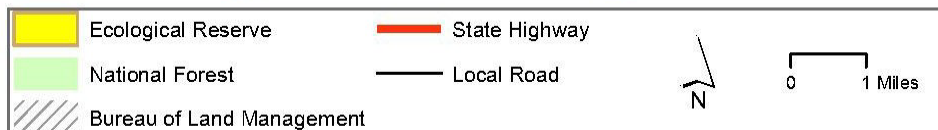
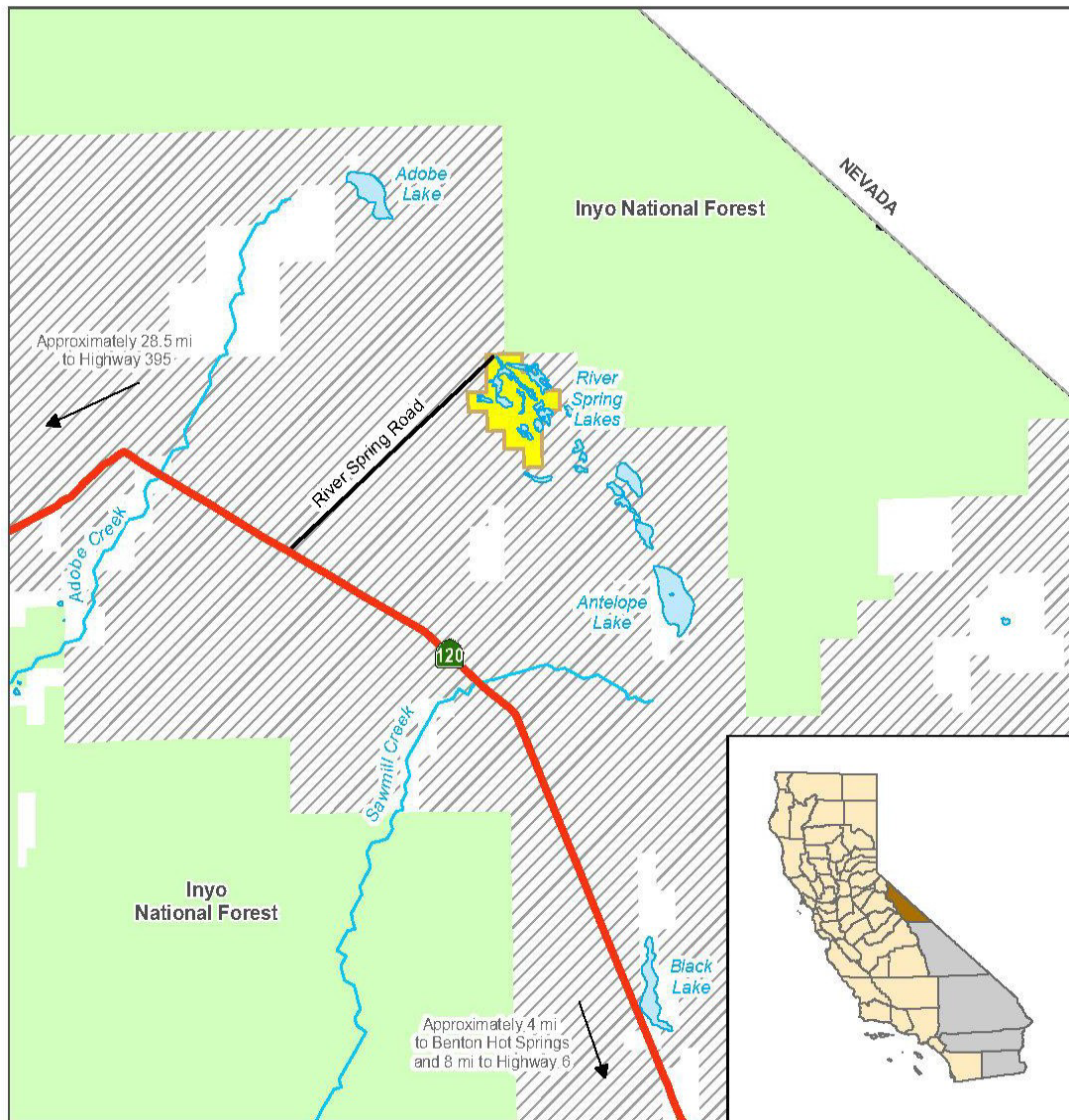


Figure 1. Map of historic range and current distribution of Owens Pupfish in Mono and Inyo counties, California (CDFW 2020).

California Department of Fish and Wildlife
Inland Deserts Region
RIVER SPRING LAKES ECOLOGICAL RESERVE
Mono County



Disclaimer: Boundaries are approximate.
Maps are intended for general purposes only.

November 2014 - WLB

Figure 2. Vicinity map of River Spring Lakes Ecological Reserve, approximately 19 miles (31 kilometers) east-southeast of Mono Lake in Mono County, CA (CDFW 2020).

Threats

All new information available on threats to Owens pupfish since our most recent ESA 5-Year Review in 2009 can be found in the CDFW Status Review in the following sections: Section V - Threats and Survival Factors Section V (A) - Factors Affecting Ability to Survive and Reproduce, and Section V (B) - Degree and Immediacy of Threats. Below we summarize this information by the five listing factors described in section 4(a)(1) of the ESA, which align very well with those that the California Fish and Game Commission considers when determining whether a species should be listed as threatened or endangered in California (Title 14, C.C.R. section 679.1(i)(1)(A)). The ESA did not exist when Owens pupfish were listed in 1967, therefore the listing rule does not address the 5 listing factors. However, the 5 listing factors are discussed in the Service's 2009 ESA 5-Year Review.

Factor A. Destruction, modification, or curtailment of habitat or range

Many aquatic habitats in the Owens Basin have been substantially degraded or lost due to introduction of non-native species, land use practices, and extensive water development activities. Historic maps of the area show extensive wetland complexes around the Owens River and its tributaries. Presently, Owens pupfish habitat continues to be adversely affected by aquatic plant encroachment and groundwater overdraft associated with agricultural or water export operations.

Aquatic plant encroachment

While *Typha* sp. (cattail) and other aquatic emergent vegetation are native to the area, active management of existing Owens pupfish habitats is required to prevent their encroachment; including routine manual removal and/or prescribed fires to maintain open water habitats that Owens pupfish require. Management activities are conducted routinely at Mule Springs and Well 368 by CDFW to maintain Owens pupfish habitat.

Groundwater pumping

Groundwater pumping for irrigation and municipal supply in the Owens Basin may result in overdraft of the aquifer in the Tri-Valley region of the Owens Valley Groundwater Basin area, which underlies the Benton, Hammil, and Chalfant valleys in Mono County. Spring discharge in Fish Slough has been declining for the last 80 years at a rate of 16–20 percent per decade (CDFW 2020). Discharge at Northeast spring, located in the northeast portion of Fish Slough, shows a steep decline in outflow, and CDFW estimates it will be dry by 2025 (Figure 3, CDFW 2020).

Groundwater monitoring wells to the north of Fish Slough in Chalfant and Hammil Valleys show a multi-decadal decline in groundwater surface elevation (CDFW 2020). Loss of Owens pupfish habitat at Fish Slough was noticeable in 2020 due to the declining discharge at Northwest spring (Figure 3, CDFW 2020). Two of the populations at Fish Slough, BLM Spring and BLM Ponds, were described as stable in 2020 (CDFW 2020). However, the third population at Marvins Marsh was described as declining (CDFW 2020).

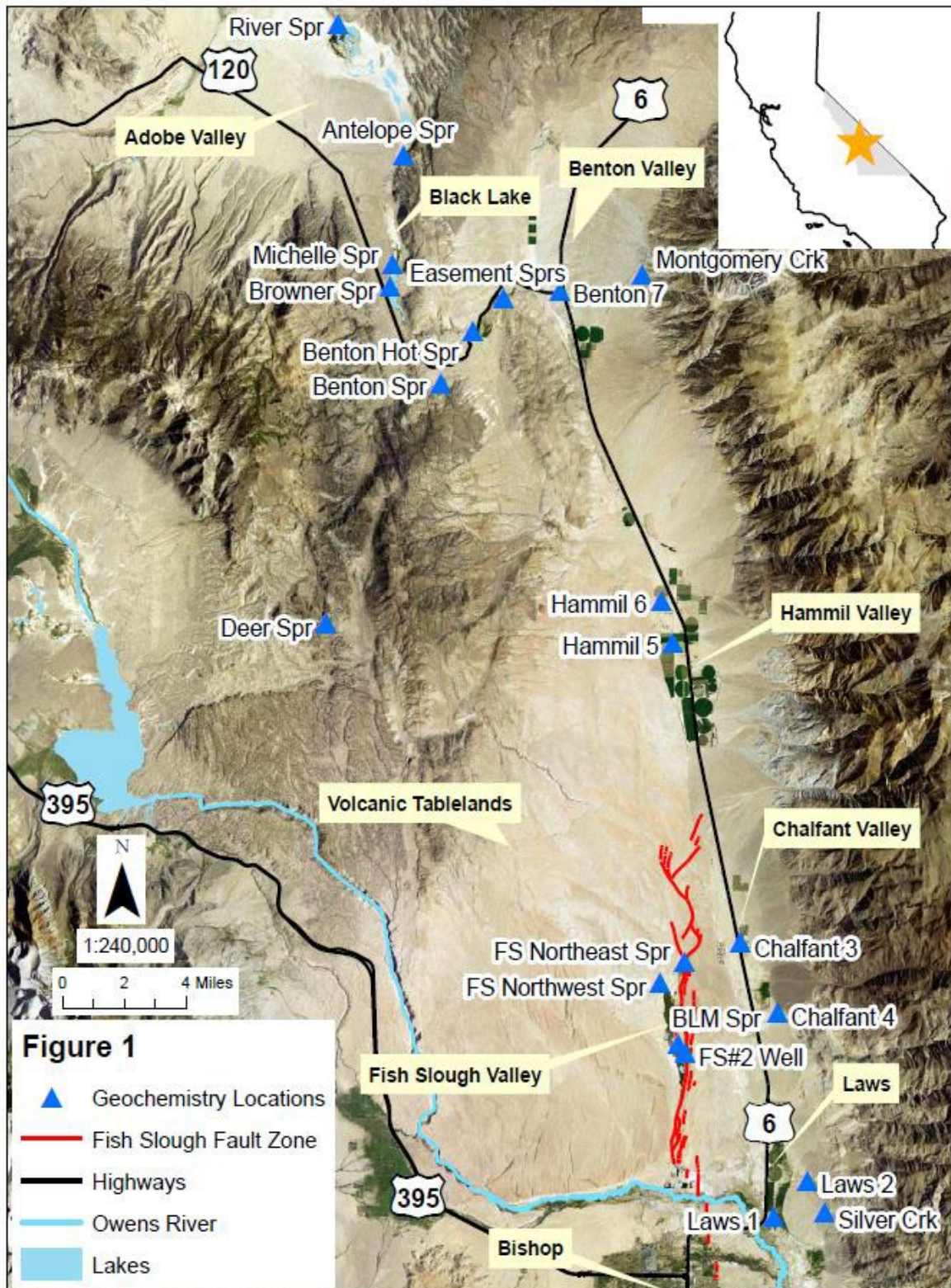


Figure 3. Map of the Owens Valley and locations of groundwater monitoring wells (CDFW 2020).

Factor B: Overutilization for commercial, recreational, scientific, or educational purposes

Overexploitation

Overexploitation because of commercial, recreational, scientific, or educational activities was not considered a threat at the time of the 2009 ESA 5-Year Review, and there is no information to suggest that it has become a threat.

Factor C: Disease or predation

Predation and Competition

Owens pupfish populations are particularly vulnerable to predation due to their behavioral traits and evolution in the absence of predators. For example, a single largemouth bass was documented to have reduced the Owens pupfish population in BLM Spring from an estimated 5,000 adults and juveniles in early 2017 to 12 observed adults and zero juveniles in early 2018 (CDFW 2020). All remaining populations may be threatened by the introduction of even a single predator.

Factor D: Inadequacy of existing regulatory mechanisms

Inadequacy of existing regulatory mechanisms was not considered a threat at the time of the 2009 ESA 5-Year Review, and there is no information to suggest that it has become a threat.

Factor E: other natural or manmade factors

Genetics

According to Finger *et al.* (2013), Owens pupfish are less genetically diverse than most other pupfishes of the desert southwest (including Amargosa, Desert and Sonoyta pupfishes). This study also indicated that Owens pupfish refuge populations have undergone extreme genetic bottlenecks in the past (*e.g.*, the observed overall population low in 1964 of approximately 200 individuals, from which all current populations are derived). Population bottlenecks occur when there is a drastic reduction in population size and often result in a loss of genetic variation. Bottlenecks are of conservation concern because they increase genetic drift and the chance of inbreeding, which can reduce diversity, fitness, adaptive potential, population viability and, by extension, increase the risk of extinction in small populations (Quattro and Vrijenhoek 1989; Frankham *et al.* 2002 in Finger *et al.* 2013). Additional findings indicated that all populations of Owens pupfish have differentiated (likely due to their complete isolation from one another and via the process of genetic drift), and they have also lost genetic diversity and will continue to do so without deliberate and ongoing intervention and management (Finger *et al.* 2013).

Perhaps of greatest concern is the fact that each population, with the apparent exception of the Well 368 population, possesses unique alleles. As such, intensive human intervention and intentional admixing of populations in accordance with a genetics management plan will be required to maintain maximum genetic diversity. Without this level of management, if any

subpopulation is lost or continues to diverge, that population will take with it a portion of the genetic diversity that has been lost by all others. Every extant population has been recently and artificially subdivided, and all are subject to potential extirpation, as witnessed at Warm Springs in the recent past (Finger *et al.* 2013). The extensive distribution of unique alleles among the existing populations, unless corrected, may lead to genetic problems that could undermine their long-term persistence. This situation necessitates the creation of additional, larger, and more diverse refuge habitats and associated pupfish populations.

Climate change

Increasing temperatures and more extreme weather patterns associated with climate change are likely to negatively affect Owens pupfish, which exist in an already arid region in the “rain shadow” of the Sierra Nevada. Owens pupfish habitats are fed by both aquifers and surface flow, which are dependent on snowmelt for recharge. Experts predict that climate change will lead to a reduction in snowpack throughout much of the Sierra Nevada due to warmer temperatures and a shift in precipitation toward rainfall in late winter and early spring months. Sierra Nevada snowpack levels are already variable from year to year, with some of the lowest levels in recorded history during the prolonged and severe drought from 2012 to 2016. However, the Owens Valley is at the base of the southernmost portion of the Sierra Nevada where the range attains maximum elevations. Thus, the effects of climate change may be mitigated, at least to some extent, by greater accumulation and retention of snowpack in this portion of the range (Moyle *et al.* 2015). However, Moyle *et al.* (2015) determined that other Owens Basin fish taxa; such as Owens speckled dace (*Rhinichthys osculus robustus*) and Owens sucker (*Catostomus fumeiventris*), are highly vulnerable to climate change, indicating extinction may occur if measures to counter climate change effects are not taken. Since Owens pupfish are similarly limited to a few populations, it is also likely highly vulnerable to the effects of climate change. Given the area’s history of water exportation and competing demands for remaining water supplies to meet agricultural, municipal, recreational, and ecological needs, future climate warming and increased variability and extremity of weather patterns will undoubtedly exacerbate existing challenges.

RECOVERY CRITERIA

Downlisting

The Service’s 1998 Recovery Plan outlines the following downlisting criteria for Owens pupfish:

- Establish reproducing populations in all three Conservation Areas in which threats are controlled for five consecutive years. Priority order for establishing Conservation Area populations is as follows: (1) Fish Slough, (2) Warm Springs, and (3) Round Valley. The area occupied by Owens pupfish within each of these Conservation Areas should approximate the amount shown in Table 1 (Service 1998).
- Each Conservation Area must have an approved management plan and implementing agreement between the landowner and the Service.

- Establishment of these populations will be considered successful when each year adults are more numerous in the spring and autumn, juveniles are more numerous in the early summer, and the biomass of Owens pupfish exceeds the biomass of deleterious non-native fish.

Table 2. Estimated area of potential native fish habitat in the Conservation Areas. (Service 1998)¹

Conservation Area	Water Surface Area Acres (hectares)	Linear Habitat Miles (kilometers)
Fish Slough	8 (3.2)	7 (11.2)
Round Valley	6 (2.4)	5 (8)
Warm Springs	5.5 (2)	2 (3)
Southern Owens	0.6 (1.6)	2 (3)
Mule Springs	0.01 (0.01)	0.01 (0.02)
Blackrock	500 (200)	5 (8)

2022 Downlisting Status: Not Achieved

Of the three Conservation Areas (Fish Slough, Warm Springs, and Round Valley) designated in the Recovery Plan, Owens pupfish are only present at Fish Slough. Of the three populations within Fish Slough, only BLM Springs and BLM Letter Ponds were described as stable in the CDFW 2020 status review, while the population at Marvins Marsh is declining. Mosquitofish (*Gambusia* sp.) are present at Marvins Marsh and at the BLM Letter Ponds, and largemouth bass are observed periodically within BLM Springs (CDFW 2020). The desiccation of Marvins Marsh has led to the decline in the population numbers of Owens pupfish, and when surveyed in 2020 and 2021, the number of mosquitofish greatly outnumbered Owens pupfish (Service, unpublished data 2020 and 2021). The biomass of mosquitofish exceeds the biomass of Owens pupfish at BLM Letter Ponds (Service, unpublished data 2020 and 2021), whereas the biomass of Owens pupfish exceeds that of any non-native fish at BLM Springs due to periodic invasive fish removal. Finally, CDFW has not developed management plans for any of the Owens pupfish Conservation Areas.

Delisting

The 1998 Service Recovery Plan outlines the following as the delisting criteria:

- Owens pupfish delisting may occur when reproducing populations are established as part of self-sustaining native fish assemblages in aquatic habitats in four Conservation Areas for a period of 7 consecutive years (Service 1998).
- The four Conservation Areas include all three required for downlisting, plus the Blackrock Conservation Area. The area occupied by Owens pupfish within each Conservation Area should be approximately the amount detailed in Table 1.
- Each Conservation Area must have an approved management plan and implementing agreement between the landowner and the Service.

¹ Southern Owens and Mule Springs Conservation Areas were added after the 1998 Recovery Plan was published.

- Establishment of these populations will be considered successful when each year adults are more numerous in the spring and autumn, juveniles are more numerous in the early summer, and the biomass of Owens pupfish exceeds the biomass of deleterious non-native fish.

2022 Delisting Status: Not Achieved

The criteria for downlisting have not been achieved (see *2022 Downlisting Status* above); therefore, the criteria for delisting have not been achieved.

Conclusion

The CDFW Status Review (2020) accurately describes the status of Owen pupfish and threats to its persistence. The translocation and establishment of the population at RSLER is the only change in status since the publishing of the CDFW Status Review. Changes since our last ESA 5-Year Review in 2009 include not only the very recent translocation of pupfish to RSLER, but also the apparent loss of the population at Warm Springs and a declining population at Marvins Marsh within Fish Slough. The threats facing Owens pupfish (*e.g.*, non-native predators and competitors, declining spring flows and loss of habitat from groundwater pumping and surface water diversions) have not been ameliorated and new threats are likely (effects related to climate change); and thus we recommend no change in the Endangered classification of Owens pupfish.

RECOMMENDATIONS FOR FUTURE ACTIONS

In the 2020 CDFW Status Review (Section VI (B) – Recommendations for Management Activities and Other Recommendations for Recovery of the Species), CDFW provides a number of recommendations which the Service hereby incorporates and recommends as the highest priority actions needed for the recovery of this species. These and an additional recommendation from the Service are discussed below.

CDFW Recommendations for Future Actions

The CDFW Status Review (2020) outlined the following recovery recommendations, which we hereby adopt:

1. Continue to maintain existing habitat and monitor populations:
 - Continue routine visual monitoring of occupied pupfish habitats and perform manual removal of emergent vegetation on an as-needed basis.
 - Continue population monitoring.
 - Continue visual surveys of BLM Spring to detect non-native fish introductions.
2. Expand existing distribution:
 - Reintroduce Owens Pupfish to the Owens Valley Native Fish Sanctuary and to Warm Spring (previous refuge habitats).
 - Prioritize and implement next steps in introducing Owens pupfish into the RSLER.

3. Develop and implement a genetic management plan to guide managed gene-flow between all populations:
 - Use a genetics management plan to inform Owens Pupfish translocations and for the purposes of potential future mixing of populations to ensure maximum genetic variation in all populations.
 - Integrate, where warranted and feasible, the findings and recommendations of Finger *et al.* (2013), including founding new populations composed of 30–50 founders from each of the extant populations and regularly translocating up to ten migrants per generation among stable populations.

U.S. Fish and Wildlife Service Recommendations

1. Reevaluate the Owens pupfish Conservation Areas for climate resiliency, long-term viability, and with the 3 R's (resiliency, redundancy, and representation) prioritized to ensure the chosen sites will be those best suited for the introduction and persistence of Owens pupfish.

RESULTS

Recommended Classification:

☐ **Downlist to Threatened**
☐ **Uplist to Endangered**
☐ **Delist** (*Indicate reasons for delisting per 50 CFR 424.11*):
 ☐ *Extinction*
 ☐ *Recovery*
 ☐ *Original data for classification in error*
☒ **No change is needed**

In completing this 5-Year Status Review for Owens Pupfish, the Service finds there is sufficient scientific information to indicate that the conditions that led to the listing of Owens pupfish as endangered are still present, and we recommend no change to the status of Owens pupfish at this time.

FIELD OFFICE APPROVAL:

Acting Field Supervisor, Reno Fish and Wildlife Office

Approve _____ Date _____

The lead Field office must ensure that other offices within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. The lead field office should document this coordination in the agency record.

LITERATURE CITED

- California Department of Fish and Wildlife (CDFW). 2020. Report to the Fish and Game Commission: Five-Year Species Review of Owens pupfish (*Cyprinodon radiosus*). 25 pp.
- Finger, A., S. Parmenter, and B. May. 2013. Conservation of the Owens Pupfish: genetic effects of multiple translocations and extirpations. *Transactions of the American Fisheries Society*. 142:1430-1443.
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- U.S. Fish and Wildlife Service. 2021. Owens pupfish survey data. Reno Fish and Wildlife Office. Unpublished. 2 pp.

Personal Communication

Phone conversation between Kaylan Hager (Service) and Rosa Cox (CDFW) on January 28, 2022, about the translocation of Owens pupfish at River Spring Lakes Ecological Reserve.