5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Idaholanx fresti* (Banbury Springs limpet)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:
Initiation of 5-year status reviews of 133 species in Oregon, Washington, Idaho, Montana, California, Nevada, Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands. Federal Register (88:17611–17614, March 23, 2023)

Lead Region/Field Office:
Region 1/Idaho Fish and Wildlife Office, Boise, Idaho

Name of Reviewer(s):
Alyssa Bangs, Idaho Fish and Wildlife Office, Fish and Wildlife Biologist
Tracy Melbihess, Idaho Fish and Wildlife Office, Assistant State Supervisor
Sandi Fisher, Idaho Fish and Wildlife Office, Deputy State Supervisor

Methodology used to complete this 5-year review:
This review was conducted by staff of the Idaho Fish and Wildlife Office (IFWO) of the U.S. Fish and Wildlife Service (Service or USFWS), beginning on March 23, 2023. The review was based on a synthesis of current, available information since the last 5-year review for the Banbury Springs limpet in 2018 (USFWS 2018, entire). Information considered includes Endangered Species Act Section 7(a)(1) consultation documents, such as biological opinions, assessments, and letters of concurrence; comments submitted in response to the March 23, 2023, Federal Register notice of initiation of 5-year status reviews (88 FR 17611–17614); and annual monitoring reports and other data collected by IFWO. The evaluation conducted by IFWO biologists was reviewed by the Assistant State Supervisor before submission to the Idaho Deputy State Supervisor for approval.

Background:
For information regarding the species listing history and other facts, please refer to the Service's Environmental Conservation On-line System (ECOS) database for threatened and endangered species (https://ecos.fws.gov/ecp/).

Review Analysis:
This 5-year review considers new information and data collected after completion of the 2018 5-year review (USFWS 2018, entire) and focuses on pertinent updates that reflect the current status of the species starting in 2018. No new threats or significant new information regarding the species biological status have come to light since listing to warrant a change in the Federal listing status of the Banbury Springs limpet.

New Taxonomic Information:
At the time of the Banbury Springs limpet's discovery, the species was placed into the genus *Lanx*, with a temporary assignment of *Lanx* (n.) sp., as a congener with two other *Lanx* species. An unpublished genetic and morphological analysis by S.A. Clark in 2007 supported the

Banbury Springs limpet as a unique species and suggested a level of differentiation that might warrant the erection of a separate genus. Despite this work, the species remained undescribed until a recent, more thorough investigation by Campbell et al. (2017, entire), who analyzed genetic sequences from four DNA regions from samples of the three described lancine species as well as samples from the four known populations of Banbury Springs limpet. Comparisons with other members of the subfamily included differences in shell shape, shape and location of the columnar musculature, and genital morphology, all of which support Clark's earlier taxonomic analysis and placement of Banbury Springs limpet within its own genus. The updated nomenclature of *Idaholanx fresti* was adopted by the Service in 2023 (88 FR 7134–7177, February 2, 2023).

New Status Information:

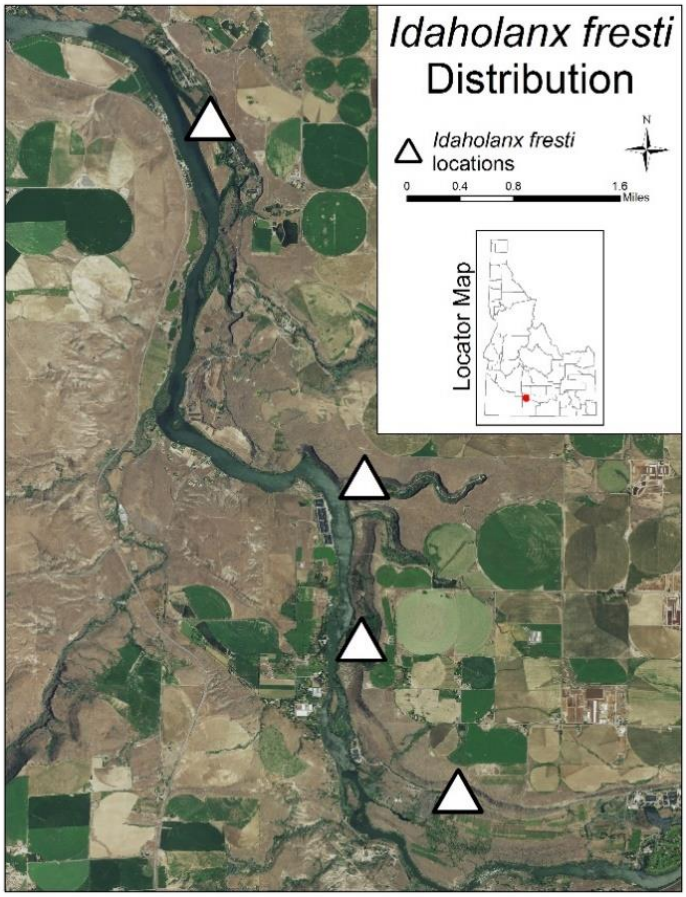

Figure 1. Map of the four known Banbury Spring limpet populations near the Snake River, Idaho. From north to south, the populations are Thousand Springs, Box Springs, Banbury Springs, and Briggs Springs.

For this status review, we assessed data from 2018 to 2024; we include data from prior years to provide context for discussion of changes to the species abundance during this time span.

Banbury Springs limpets are known from four populations in the Snake River and its tributaries: Briggs Springs, Banbury Springs, Box Canyon Springs, and Thousand Springs (Figure 1). Annual population monitoring has occurred at all four populations since 2012, although

monitoring at Banbury Springs utilized a different survey methodology until 2019; as of 2019, the survey method at this site has been consistent with the other three sites. Since the 2018 5-year review (USFWS 2018, entire), the number of occupied springs has not changed. However, populations initially increased but have since declined during that time frame to near or below 2017 levels, based on estimated limpet density during annual monitoring (Figure 2).

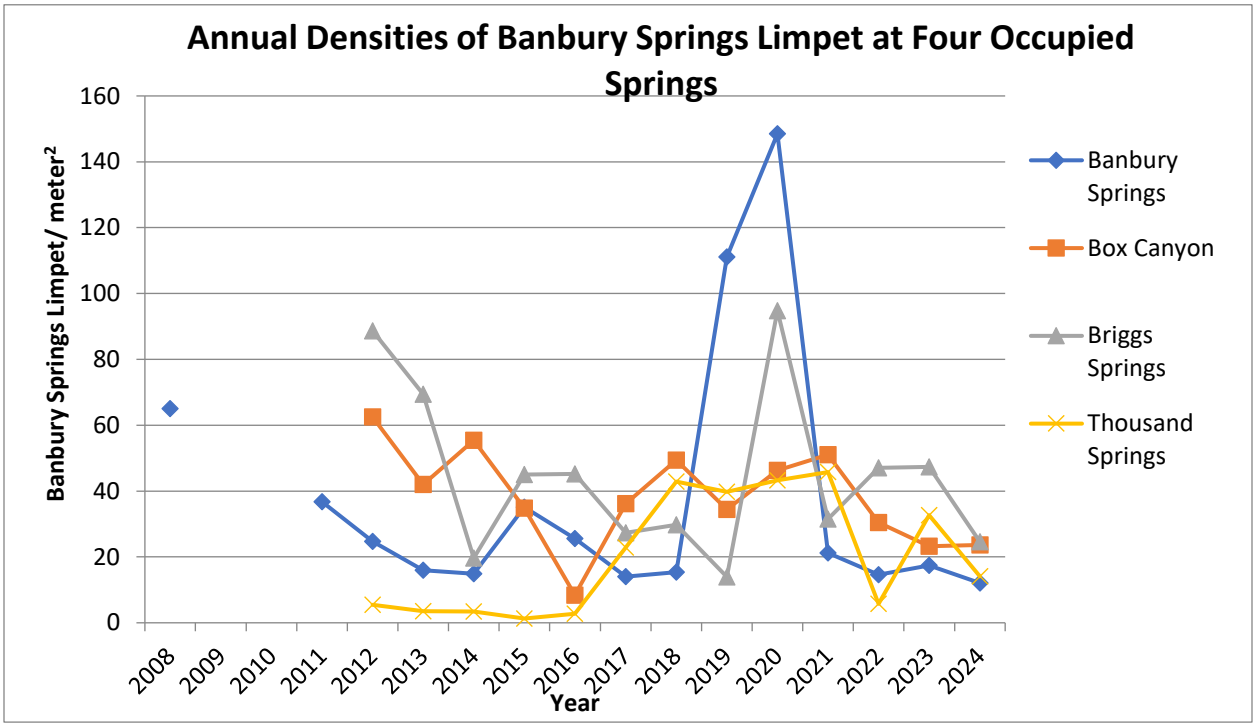

Figure 2. Limpet density (Banbury Springs limpet/m^2) for cobble count surveys at the four populations between 2012 and 2024. Prior to 2019, Banbury Spring surveys were completed by quadrat counts; Banbury Springs densities for 2019 and later use the cobble count method to better represent limpet densities and allow for comparison between sites. Data from USFWS annual limpet monitoring.

Thousand Springs:

Limpet densities at Thousand Springs were stable between 2018 and 2021, but have declined between 2021 and 2024, reaching near pre-translocation levels in 2022 (Figure 2). The increase in limpet densities between 2016 and 2018 was associated with a single translocation of limpets from Banbury Springs to the Thousand Springs colony in 2016 (Burak and Hopper 2020, entire). This translocation led to a drastic increase in both the total number of limpets found during surveys and limpet density at this site until 2021 (16 limpets were found in 2016 versus 141 in 2021). Annual summer macrophyte (aquatic vegetation) removal has occurred at this population since the 2016 translocation; macrophytes can grow over exposed rocky substrate and facilitate sediment capture, reducing available limpet habitat. However, macrophyte removal was delayed in 2020 due to the COVID-19 pandemic. When USFWS biologists arrived at the site in late June 2020, macrophytes had fully covered the majority of the suitable habitat at the historical epicenter of the limpet colony (Figure 3). A partial survey after the macrophytes were removed found only three limpets. A survey later in 2020 found additional limpets in the upstream portion of the survey area, where there was less macrophyte growth. Summer macrophyte removal has maintained clean cobble habitat at the historical epicenter of the population since 2020, but no

limpets have been found in this downstream area since 2021; all limpets are now found upstream. Additionally, an increase in bull rush encroachment into the spring has been observed, with the total disappearance of an unoccupied side channel in the last three years. Although the increase in bull rush has not yet impacted the existing population, it may in the near future as bull rush encroaches upon occupied habitat, facilitating the deposition of sediment and the growth of other macrophytes.

Figure 3. Upper photo shows the 2020 pre-weeding area with the purple oval illustrating the area with the highest densities of limpets in prior years (epicenter). The red circle and oval denote reference boulders. The lower photo shows the post-weeding effort to expose the overgrown cobble habitat with the reference boulders noted. Only 3 limpets were found during this survey. Photo credits: USFWS IFWO.

Box Canyon:

Banbury Springs limpet densities were increasing in the Box Canyon Springs colony until 2021, with the third-highest limpet densities found since monitoring began in 2021. However, densities have declined every year since 2021. Some of this decline may be due to increased visitor use

beginning in 2020, which can cause an increase in sediment and nutrients in the waterway or the direct crushing of individuals via human access to occupied areas. Prior to 2020, visitors had to hike approximately 0.64 miles to access the viewing platform at the head of the canyon and another 2 miles to reach the pool upstream of the Banbury Springs limpet colony. In 2020, visitation to Box Canyon Springs increased, both due to Idaho Department of Parks and Recreation (IDPR) adding a paved entrance and parking area near the viewing platform as well as a COVID-19-associated increase in outdoor recreation. In 2021, Banbury Springs limpet surveyors noticed evidence of increased human traffic along the creek near the limpet colony, including several eroding banks along the creek upstream of the limpet colony, as well as evidence of makeshift toilet facilities adjacent to the survey area. USFWS coordinated with IDPR to install seasonal restrooms near the pool access to reduce human impacts near the limpet colony.

Banbury Springs:
Within Banbury Springs, Banbury Springs limpet is only found in the southernmost spring complex and is found at its highest densities in the lower portion of the complex. A long-term 80 m^2 monitoring site established in 2008 was utilized to estimate local population size from 2008-2019 (Fig. 4, Lysne *in litt.* 2008, pp. 1-2, for monitoring design). Within this monitoring site, monitoring was limited to areas largely composed of suitable habitat; Banbury Springs limpets are found primarily on clean lithic surfaces (lacking dense growth of filamentous algae or bryophytes) and do not frequently occupy areas of submerged aquatic vegetation (USFWS 2018, p. 4).

In 2019, cobble counts were conducted in addition to the quadrat method described above at Banbury Springs. This was done primarily to standardize survey methodologies between limpet populations at all four known sites. In 2020 and subsequent years, only cobble counts were performed to allow for density comparisons between populations and a more accurate density estimate at each population. Starting in 2020, cobble counts at Banbury Springs were expanded into suitable habitat adjacent to the 80 m^2 monitoring site to more accurately represent the limpet population (Figure 4). Over the last five years, suitable habitat seems to have declined due to the encroachment of aquatic and riparian vegetation and increased sediment accumulation. In 2020, an estimated 61% of the 80 m^2 monitoring site was occupied by macrophytes (USFWS 2020 *in litt.*, p. 10), increasing to approximately 75% in 2024 (USFWS, unpublished data). Limpet densities within Banbury Springs have been declining for the last five years and were drastically lower in 2021 - 2024 than in 2019 and 2020 (Figure 2).

Approximately 50 meters of spring-fed creek directly upstream of the Banbury Springs monitoring site were surveyed for listed snails in 2008. Banbury Springs limpets were found at low densities scattered throughout the surveyed area (Lysne *in litt.* 2008, pp. 2-3). This stretch of creek was resurveyed in 2022 utilizing the same random cobble count method as the 2008 survey. Banbury Springs limpets were found at similar densities and distribution to the 2008 surveys; there was no noticeable increase in macrophytes in this surveyed reach when compared to photos from the 2008 survey. This suggests that declining limpet numbers within the monitoring site may be partially related to sediment accumulation and associated habitat loss through vegetation/macrophyte encroachment into the monitoring site and the filling of interstitial spaces used by Banbury Springs limpet. Sediment accumulation within the lake may

also be causing the intrusion of slower lake water into the downstream portion of the monitoring site, increasing the rate of sedimentation and reducing flow and dissolved oxygen levels.

Figure 4. Aerial view of the 80 m^2 monitoring site for Banbury Springs limpet at Banbury Springs, utilized from 2008-2019, depicted by the dashed grey line. The yellow polygon, covering approximately 178 m^2, delineates the 2008 estimate of suitable habitat within the population based on 2007 aerial imagery provided by Idaho Power Company; this polygon also represents the expanded area of surveys since 2020 (Figure courtesy of Idaho Power Company).

Briggs Springs:

Within Briggs Springs, Banbury Springs limpets were historically found throughout the spring both up- and downstream of the uppermost road crossing of Briggs Springs, where the U.S. Geological Survey has a permanent stream gage (USGS gage 13095175) to monitor spring discharge. Two sites within Briggs Creek with historically dense colonies are surveyed annually. In 2020, an additional population was discovered across the stream from the upper site. Visual snorkel surveys are performed biennially at this new site to document continued presence while minimizing impacts to this population. As this survey method is not comparable to the cobble count method used for estimating density, this site is not included in population density calculations.

Limpets at the lower Briggs Springs site have not been found since 2021; in that year, 14 limpets were found clustered in a small area of clean cobbles. No limpets were found in the remainder of the lower site that year, including in the deeper portions at the downstream end of the survey plot, an area typically inhabited. Since 2019, macrophyte density has been increasing; as of 2024, macrophytes cover the majority of the lower site, greatly limiting the availability of clean cobbles as suitable habitat for limpets. Limpet densities in the upper monitoring site have

declined since 2021 (Figure 5). This may be due to unexpected clearing of riparian vegetation and addition of riprap on the bank adjacent to the upper population in late 2020, which caused an increase in embedded cobbles and light penetration at the site. Since then, limpets have been found primarily within a small eddy near the center of the creek, and an increase in aquatic vegetation throughout the site has been observed.

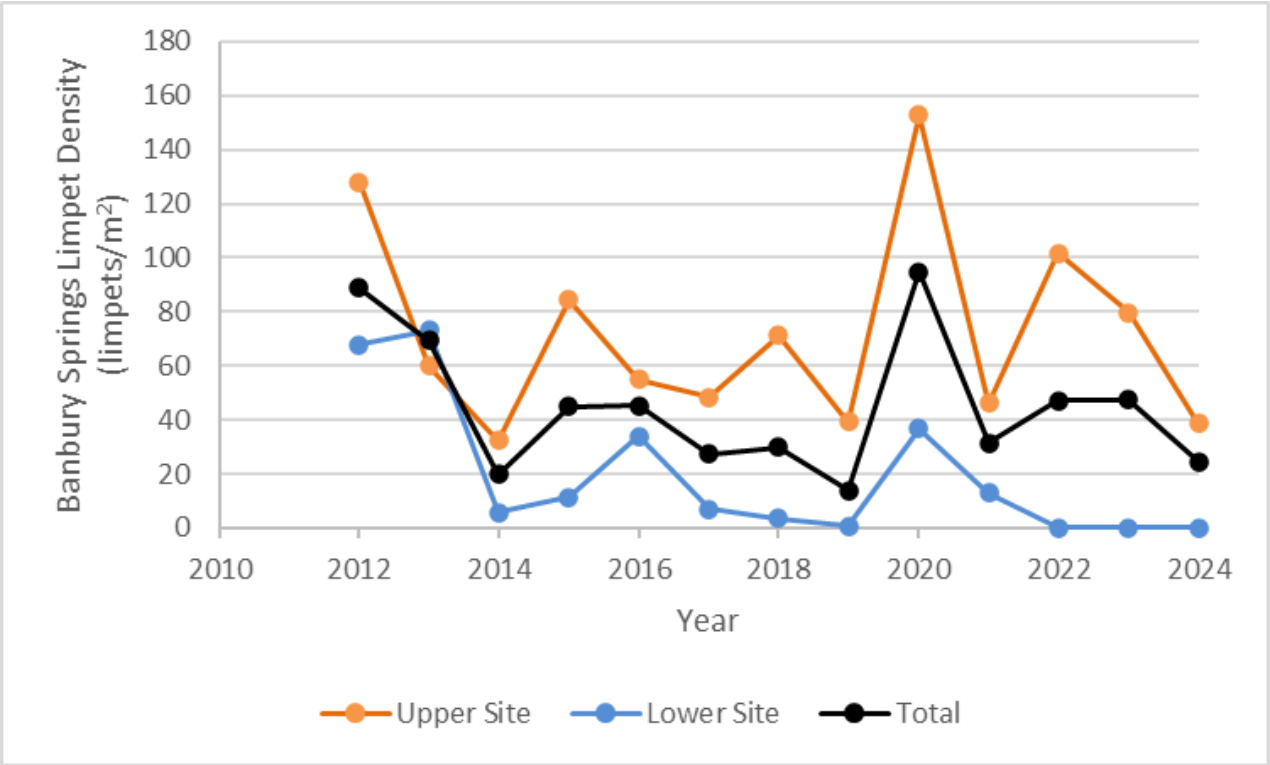

Figure 5. Banbury Springs limpet densities (limpets per square meter) for the two monitoring sites at Briggs Springs and for both sites combined from 2012 to 2024. The high densities measured in 2020 may be due to biologists sampling fewer cobbles at both the upper and lower site compared to other years or to sampling error, as several new biologists were being trained on sampling methods.

New Management Actions:

Captive Population:

The 2006 and 2018 5-year status reviews recommended establishing a propagation program for Banbury Springs limpets (USFWS 2018, p. 31-32). The USFWS partnered with the University of Idaho (University) to establish a snail propagation program at the Hagerman Experimental Fish Station near Hagerman, Idaho in 2021. This facility is located approximately 0.9 miles (1.51 km), measured directly, from occupied Banbury Springs limpet springs, and utilizes water from a spring stemming from the Eastern Snake River Plain Aquifer (ESPA). After several successful tests in 2021 and 2022 maintaining a conspecific pebblesnail (*Fluminicola* sp.), a small number of limpets were brought into the hatchery. Ultimately, limpets were maintained for several months during 2022 and 2023, with one surviving 6 months, but no reproduction was observed. However, data was collected on limpet feeding and movement, which was previously undocumented. Deceased limpets were stored for future genetic analysis.

Groundwater Recharge:
Spring discharge from the ESPA is correlated with ground water table elevations; water levels in the ESPA and associated springs have been declining, although a short-term increase in water level was seen after a large water year in 2017 (Bates 2023, p. 40-50). The State of Idaho and private parties began a recharge program to add water to the ESPA in 2014. The recharge sites managed by the Idaho Water Resource Board are upgradient of Banbury Springs limpet-occupied springs. Continued recharge efforts into the future may benefit the Banbury Springs limpet by limiting groundwater decline in the ESPA and therefore maintain flow in occupied springs.

Status of Recovery Criteria:
As stated in the 1995 final Recovery Plan, "The 5 federally listed snails outlined in the Snake River Aquatic Species Recovery Plan (Plan) may be reclassified or recovered by implementing various conservation measures that preserve and restore main stem Snake River and tributary cold-water spring habitats. These habitats are essential to their survival within the specified recovery areas described below. The Plan includes short-term recovery goals that will provide specific downlisting/delisting criteria for the listed species."

Specific to the Banbury Springs limpet:

- Recovery will be based on detection of increasing, self-reproducing colonies at pre-selected monitoring sites within each species recovery area for a 5-year period. Monitoring sites will be selected in areas of known live snail collections from the past 15 years and generally represent the outer most boundaries of the recovery area for each species.

- Suitable habitats will include well-oxygenated, clear, cold (15-16 degrees Celsius [ºC] (59-61 degrees Fahrenheit [F]) water on boulder or cobble substrate. The recovery areas and monitoring sites for the Banbury Springs lanx (limpet) are tributary cold-water spring complexes to the Snake River between river kilometer (RKM) 941.5 to 948.8 (river mile (RM) 584.8 to 589.9): 1) at Banbury Springs RKM 948 (RM 589), 2) at Box Canyon Springs RKM 947 (RM 588), and 3) at Thousand Springs RKM 941 (RM 584).

- Standards for habitat conditions would be based on state (Idaho) water quality standards for cold-water biota including annual water temperatures that average below 18 ºC (64.4º F); dissolved oxygen (DO) concentrations greater than 6 parts per million (ppm); and pH levels that are within the range of 6.5 to 9.5 milligrams/liter (mg/L).

It is important to note that annual monitoring provides an index of population density and trends, not population or rangewide abundance estimates, although it does provide information sufficient to assess whether recovery criteria are being met. At the time of listing, the Briggs Creek population had not yet been discovered, so was not included in the 1995 recovery criteria for the species although we include it here.

<u>Population Criterion:</u>
All four monitoring sites are surveyed annually; surveyed populations include the outermost known boundaries of the species' range. While all known populations of Banbury Springs

limpets are self-reproducing, annual monitoring data indicate that Banbury Springs limpet densities at all four populations have declined or are not stably increasing over the last five years. Therefore, the demographic criterion for this species has not been met.

Water Quality Criterion:

Water quality data collected at the four springs continues to indicate that water quality values are within those specified by the water quality criterion. Various water quality parameters are measured at three of the four occupied springs (Banbury Springs, Box Canyon Springs, and Thousand Springs) as part of Idaho Power Company's Bliss Rapids snail monitoring efforts (Bates 2023, pp. 21-32). Measurements of pH at three of the four springs have registered between 7.08 and 9.25 mg/L since 2010 and DO has not dropped below 6 ppm (Bates 2023, p. 22). Similarly, although some springs exhibit more daily and seasonal fluctuations in water temperature than others, none of the sampled springs have exceeded either the 18 ºC annual average water temperature or 19 ºC daily mean temperature required by the Idaho cold-water standards (Bates 2023, p. 26). Although Idaho's cold-water standards are assumed to meet Banbury Springs limpet habitat requirements, the water quality needs of this species are still unknown. Banbury Springs limpets are assumed to have high DO requirements, as they uptake oxygen solely through a heavily vascularized mantle (USFWS 2006, p. 16); it is unknown what level of DO is necessary for Banbury Springs limpet survival, but it is almost certainly higher than the limit in the water quality criterion, which is based primarily on data for gilled animals. Similarly, measurements of pH above 9 mg/L have not been recorded in any monitored spring prior to 2022 (Bates 2023, p. 22) but were recorded in both Banbury and Thousand Springs in 2022. As changes in pH may be attributed to differences in a variety of conditions at the time of sampling, it is unknown whether these are actual changes in water quality or normal seasonal or environmental variation. If the former, it is unknown what impact pH may be having on Banbury Springs limpets.

Increasing nutrients such as nitrates and orthophosphate have been documented within the four known occupied springs, which is likely affecting the species and its habitat (Bates 2023, pp. 28-32). While it is unknown what direct effects nitrates have on the Banbury Springs limpet, nitrates are known to have negative impacts on invertebrate species when their concentrations increase past certain thresholds (Camargo et al. 2005, p. 1255). In addition, increasing nitrate concentrations may be driving macrophyte growth (Mebane et al. 2013, p. 154) at several springs occupied by the Banbury Springs limpet, which prefer clean cobble to boulder habitat relatively free of macrophytes. Increasing levels of macrophytes have been noticed at all four occupied springs in the last five years (see discussion in Thousand Springs status section).

The maintenance of sufficient volumes of spring water to maintain suitable habitat conditions for the Banbury Springs limpet is not adequately captured in existing recovery criteria for the species. Based on water level sampling in ESPA throughout the Thousand Springs area, aquifer levels are continuing to decline from a peak in 2019 (Bates 2023, p. 31, 41-48); this will likely impact spring flow, water quality, or habitat availability to some extent moving into the future.

Recovery Status:

Overall, the downlisting goals for this species have not been met, as populations have not maintained an increasing trend for a period of 5 years, and suitable clean boulder and cobble

habitat is declining in several sites (Thousand Springs, Banbury Springs). Therefore, *Idaholanx fresti* remains endangered.

Recommendations for Future Actions:

- Continue efforts to determine conditions needed to maintain and breed Banbury Springs limpet in captivity.

- Perform additional research to assess how emerging contaminants, water quality parameters, and nutrients can affect the species. Results should inform any updated water quality criteria included in an updated recovery plan.

- Update/revise the Snake River Aquatic Species Recovery plan to include new information that has been learned since the plan was completed in 1995. We also recommend that the recovery criteria within a revised plan be updated to make them more objective and measurable.

- Annual monitoring of the four occupied springs complexes should be continued. Additionally, we also recommend implementing monitoring of macrophyte presence and trends at the 4 spring complexes to investigate whether macrophytes are increasing and further limiting suitable habitat availability for the species. Macrophyte removal should occur at all four springs where needed.

- In 2016, we translocated 19 individual Banbury Springs limpets into Thousand Springs from Banbury Springs (Burak and Hopper 2020, entire). This effort, in conjunction with macrophyte control, likely led to finding an increased density for this population until 2022. Given this, we recommend implementing additional translocations as needed in the future. In addition, we also recommend consideration for translocation of the species into protected coldwater spring habitats not currently occupied by the species. Translocation strategies and objectives would be considered in a revised recovery plan for the species.

- Increased human impacts within or near occupied springs has been documented in the last five years. Efforts to reduce human impacts, such as signage or restricting access, should be implemented where deemed necessary.

- Continue work with partners on monitoring populations and planning and contributing to implementation of ecosystem-level restoration and management to benefit this species.

References:

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USFWS. 2020. 2020 Banbury Springs limpet range-wide monitoring. Boise, Idaho. 25 pp.

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Idaholanx fresti* (Banbury Springs limpet)

Pre-1996 DPS listing still considered a listable entity? __N/A_____

Recommendation resulting from the 5-year review:

_____ Delisting
_____ Reclassify from Endangered to Threatened status
_____ Reclassify from Threatened to Endangered status
___X___ No Change in listing status

State Supervisor, Idaho Fish and Wildlife Office

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