5-YEAR REVIEW

California freshwater shrimp (*Syncaris pacifica*)

GENERAL INFORMATION:

Species: California freshwater shrimp (*Syncaris pacifica*)
Date listed: October 31, 1988
Federal Register (FR) citation: 53 FR 43884 (Service 1988)
Classification: Endangered

State Listing:
The California freshwater shrimp was listed by the State of California as endangered in 1980.

BACKGROUND:

Most recent status review:

U.S. Fish and Wildlife Service. 2011. California Freshwater Shrimp (*Syncaris pacifica*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, Sacramento, California. 27 pp.

We did not recommend a status change in the 2011 status review.

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. We did not receive information from the public regarding California freshwater shrimp in response to the notice.

ASSESSMENT:

Information acquired since the last status review:

The U.S. Fish and Wildlife Service's (Service) Sacramento Fish and Wildlife Office conducted this 5-year review. The Service solicited data for this review from interested parties through a Federal Register notice announcing this review on May 20, 2021 (Service 2021, p. 27463). We also contacted the National Park Service, the Sonoma County Water Agency, and researchers at San Diego State University to request any data or information we should consider in our review. Additionally, we conducted a literature search and a review of information in our files including reports from survey and monitoring efforts.

Overall, the statuses of the species, its threats, and its recovery have not changed significantly following the Service's issuance of the previous 5-year review (Service 2011, entire).

Distribution

At listing, the species was present in 12 streams across four drainages in coastal Northern California (Point Reyes, Salmon Creek, San Francisco Bay, and Russian River; Service 1988; p. 43884). At the time of the species' first 5-year review in 2007, the species was present in 23 streams across these four drainages (Service 2007, p. 3). At the time of the most recent 5-year review in 2011, the species remained present in these same 23 streams (Service 2011, p. 6). Currently, the species is present in 25 creeks across these four drainages. Following the Service's 2011 5-year review for the species, the Sonoma County Water Agency identified California freshwater shrimp along Hudspeth Creek near its confluence with Jonive Creek in the Russian River drainage unit (Sonoma County Water Agency 2016, p. 1) and Prunuske Chatham, Inc. identified California freshwater shrimp along an unnamed tributary to Redwood Creek where the species was not previously known to occur also in the Russian River drainage unit (Prunuske Chatham, Inc. 2017, p. 3). These new localities are tributaries to creeks where the species was previously known to occur (Jonive and Redwood Creeks, respectively) and are nearby previous observations of the species. Therefore, these observations do not alter the overall status of the species from the Service's 2011 5-year review.

Genetic and taxonomic information

The Service's Recovery Plan for the California Freshwater Shrimp presumed that populations of each drainage had evolved genetic differences from each other because of the geographic isolation between populations of each drainage (Service 1998, p. 68). However, the Service's 2007 5-year review for the species presented preliminary genetic analyses of 12 California freshwater shrimp which indicated that mitochondrial DNA genetic variation in the species was not divided by drainage and consequently recommended further genetic analyses of populations within each drainage (Service 2007, p. 7). Following the Service's 2007 and 2011 5-year reviews for the species, Ada conducted a nuclear DNA genetic survey of 95 individuals from all four drainages and found strong nuclear genetic divisions between drainages which indicate that little if any contemporary gene flow occurs between drainage units (Ada 2021, p. 10). These results support the assumptions used to develop the Service's 1998 Recovery Plan and do not alter the overall recovery of the species.

Additionally, phylogenetic analyses of family Atyidae subsequent to the Service's 2011 5-year review for the species have revealed that the California freshwater shrimp is basal to all other Atyid shrimps and may instead be most closely related to family Xiphocarididae (von Rintelen *et al.* 2012, p. 91). This taxonomic revision does not alter the status of the species.

Abundance

The listing rule for the species did not provide abundance estimates for populations, however the species' Recovery Plan provided information on abundance and length of distribution (Service 1998; Table 2) from all 17 streams known to be occupied at the time of the Recovery Plan. The Service's 2007 5-year review noted a lack of data from streams other than Lagunitas Creek in the Point Reyes drainage but reported an increase in abundance from 1,878 in 1991 to 4,407 in 2000 across six sampling sites in Lagunitas Creek following an increase in available habitat within the stream after 1997 (Service 2007, p. 6). The Service's 2011 5-year review noted that long term

monitoring data was again unavailable outside of the Point Reyes drainage and that the increase in the number of known occupied streams following listing may not reflect an increase in abundance of the species (Service 2011, p. 6).

Currently, there are no range-wide abundance surveys for the California freshwater shrimp. The Point Reyes drainage is surveyed for California freshwater shrimp much more frequently than the other three drainages that the species occupies. Serpa (2015, p. 20) in 2015 re-surveyed the six sites in Lagunitas Creek he had previously surveyed in 2000 and found only 644 shrimp, a decrease he attributes to a reduction in available habitat and limited survey effort in 2015. The Marin Municipal Water District conducts annual electrofishing and snorkeling surveys of 13.4 km of Lagunitas Creek, 7.2 km of San Geronimo Creek, and 3.3 km of Devil's Gulch in the Point Reyes drainage unit. The purpose of these surveys is to observe juvenile salmonid abundance however the surveyors note observations and bycatch of California freshwater shrimp. Following the species' previous 5-year review in 2011, Marin Municipal Water District has observed the following counts of the species during these surveys (Table 6; Marin Municipal Water District 2020):

Table 1. Marin Municipal Water District California freshwater shrimp counts from Point Reyes drainage unit (Table 6; Marin Municipal Water District 2020).

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Count	4	9	3	11	11	4	4	10	13

Golden Gate National Recreational Area (2020, p. 8) surveyed Olema Creek in the Point Reyes drainage in 2018 and 2019 and found that the distribution of the species in Olema Creek had increased following previous survey efforts in Olema Creek over 20 years ago. Additionally, Golden Gate National Recreational Area (2020, p. 8) used a habitat modeling approach to estimate an abundance of 3,383 shrimp (95% confidence interval: 643 to 7846) within the Olema Creek basin at the time of sampling.

Following the species' 2011 5-year review the Service has also received survey reports from the San Francisco Bay and Russian River drainages. Targeted surveys in various portions of the Napa River in the San Francisco Bay drainage did (LSA 2018, p. 2) and did not (Stillwater Sciences 2016, Appendix A p. 2; Napa County Resource Conservation District 2020, p. 1) detect the species. Surveys in the Russian River drainage identified two new occupied streams as discussed above in the Distribution Section (Sonoma County Water Agency 2016, p. 1; Prunuske Chatham, Inc. 2017, p. 3). However, these surveys were not intended for long-term population monitoring and we do not have population abundance trend data from these drainages. Overall, the Service has limited information of species abundance trends outside of the Point Reyes drainage. We recommend establishing a long-term population monitoring plan in each of the four drainages to assess population abundance over time and inform the next 5-year review.

Threats

The Service's 1988 listing rule for the species identified livestock, agricultural activities and development, residential development, water pollution, heavy earthmoving equipment, water diversions, temporary summer dams and associated chemical purification of impounded water,

siltation from poor soil conservation practices, silvicultural practices, flood control and channelization projects, predation by introduced fish species, inadequacy of existing regulatory mechanisms, and vandalism as threats to California freshwater shrimp (Service 1988, p.43887). The Service's 1998 recovery plan for the species identified additional threats from gravel mining, water development, and urban runoff (Service 1998, p. 27). The Service's 2007 5-year review for the species additionally identified climate change as a threat to the species (Service 2007, p. 14). The Service's 2011 5-year status review identified additional threats to the species from salmonid habitat restoration and small population sizes (Service 2011, pp. 10 and 15).

Each of the threats listed above continue to threaten the species with the exception of vandalism, which has not been reported to the Service since 1987 (Service 2011, p. 14). However, the magnitude of these threats also has not increased to the Service's knowledge and in general the magnitude and variety of threats to the species remain similar to the threats discussed in the Service's 2011 5-year review.

Recovery Criteria

The Service's 1998 Recovery Plan for the species presented criteria for downlisting and delisting of the species, which we summarize and discuss here:

Downlisting Criterion #1: Prepare and implement watershed plans for all streams occupied by the species. This criterion remains valid. This criterion has been partially met with watershed plans implemented for almost all occupied streams. The Service's 2011 5-year review stated that watershed management plans had been developed for 20 of 23 known occupied streams at the time of the review; with the exceptions of Austin, East Austin, and Franz Creeks (Service 2011 p. 16). Following the Service's 2011 5-year review, the Sonoma County Planning Commission has developed a management plan for Franz Creek (Sonoma Resource Conservation District 2015, entire). However, a management plan for Austin and East Austin Creeks has not progressed beyond the Laurel Marcus and Associates' 2005 watershed assessment (Laurel Marcus and Associates 2005, p. 1). Additionally, the species is now known from two new streams within the Russian River drainage unit. These streams are tributaries to Jonive and Redwood Creeks and are included in the Upper Green Valley Creek watershed plan developed by the Gold Ridge Resource Conservation District (Gold Ridge Resource Conservation District 2010, p. 7). Therefore, at the current time watershed plans are implemented for 23 of 25 streams occupied by the species.

Downlisting Criterion #2: Assure long-term protection of at least one occupied stream in each of the four drainages where the species is found. This criterion remains valid and has been partially met. As described in the previous 5-year review, only the Point Reyes drainage has long-term protection of an occupied stream where 7 miles of Lagunitas Creek flows through California Department of Parks and Recreation and National Park Service lands (Service 2011, p. 17). Additionally, small portions of occupied streams within the Salmon Creek and San Francisco Bay drainages are within public lands owned by the Sonoma County Department of Parks and Recreation and the State Land Commission, respectively (Service 2011, p. 17). To our knowledge, there is no occupied portion of the Russian River drainage that is under long-term protection.

Downlisting Criterion #3: The abundance of California freshwater shrimp approaches carrying capacity for all streams occupied by the species. As described in the Service's 2011 5-year review, this criterion is no longer valid though the intent of the criterion remains valid specifically to maximize the number of California freshwater shrimp each occupied stream is capable of supporting. The Service's 2011 5-year review for the species suggested defining specific criteria to determine when threats to the species have been adequately reduced or managed and when habitat quality, quantity and availability have been optimized (Service 2011, p. 17). To date, the Service has not revised this criterion.

Delisting Criterion #1: Prepare and implement watershed plans for all streams occupied by the species. This criterion is identical to Downlisting Criterion #1.

Delisting Criterion #2: Assure long-term protection of at least one occupied stream in each of the four drainages where the species is found. This criterion is identical to Downlisting Criterion #2.

Delisting Criterion #3: Occupied streams have California freshwater shrimp over 5 miles of potential habitat, or in all potential habitat if the occupied stream is less than 5 miles long. As described in the Service's 2011 5-year review for the species this criterion is no longer valid. The term potential habitat is not defined, and the specific habitat requirements of the species result in a sporadic, rather than continuous, distribution of the species in occupied streams (Service 2011, p. 18). To date, the Service has not revised this criterion.

Delisting Criterion #4: The abundance of California freshwater shrimp approaches carrying capacity for all streams occupied by the species for at least 10 years. As described above for Downlisting Criterion #3, this criterion is no longer valid.

Conclusion:

After reviewing the best available scientific information, we conclude that the California freshwater shrimp remains an endangered species. The species remains sporadically distributed throughout four geographically distinct drainages which face a variety of persistent threats. To date, the species has partially met its downlisting criteria and delisting criteria.

RECOMMENDATIONS FOR FUTURE ACTIONS:

Here we propose several habitat conservation and ecological research recommendations which will aid in the recovery and conservation of the California freshwater shrimp. Some of these recommendations have already been discussed in previous recovery documents (Service 2007, pp. 15–16; Service 2011, pp. 19–20) and remain valid.

1. *Conduct a habitat assessment of Santa Rosa Creek to determine if there is suitable habitat for reintroduction*.
2. *Develop a range wide monitoring and survey program to determine the current distribution of the species, assess habitat conditions, and assess population trends*. This range-wide monitoring and survey program has not yet been developed or implemented.
3. *Identify areas where restoration actions could improve habitat quality and quantity*. To the Service's knowledge, there has been no concerted effort to identify such areas, though

successful restoration has occurred in a few areas (e.g., Stemple Creek; Martin *et al.* 2009, p. 603).

4. *Revise downlisting criterion 3 and delisting criteria 3 and 4* (Service 1998, pp. 54 and 55; Service 2011, pp. 19–20).

Field Supervisor, Sacramento Fish and Wildlife Office

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Approve _____ **Date** _____

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