Hay's spring amphipod
(Stygobromus hayi)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Chesapeake Bay Field Office
Annapolis, Maryland
May 2020

5-YEAR REVIEW
Hay's spring amphipod/*Stygobromus hayi*

GENERAL INFORMATION

Species: Listed as a species.
Date listed: February 5, 1982
FR citation(s): 47 FR 5425
Classification: Endangered Species
Critical habitat/4(d) rule/Experimental population designation/Similarity of appearance listing: N/A
Methodology used to complete the review: An analysis of the species' biology, its current condition, and factors affecting it was conducted as part of a biological report (see attached). The review was conducted by Julie Slacum (Recovery lead) and Kathleen Cullen (Endangered Species biologist) of the Chesapeake Bay Field Office. The review is based on the last 5-year review conducted in 2007; data collected by Maryland Department of Natural Resources, Dr. Culver and Dr. Fong (American University); information from National Park Service staff from Rock Creek Park; and published literature.

In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a 5-year review is to assess each threatened species and endangered species to determine whether its status has changed and if it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants. The U.S. Fish and Wildlife Service (Service) evaluated the biology and status of the Hay's spring amphipod as part of a SSA to inform this 5-year review.

The Chesapeake Bay Field Office developed the biological report (USFWS 2020). The biological report represents our evaluation of the best available scientific information, including the resource needs and the current condition of the species. We also discussed viability of the species in the future.

FR Notice citation announcing the species is under active review: September 4, 2019, FR 84, No. 171

REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) policy
The species is not a vertebrate.

Is there relevant new information for this species regarding the application of the DPS policy?
N/A

Recovery Criteria

Recovery Plan or Outline:

The Hay's Spring amphipod was exempted from the requirement that a recovery plan be developed because the Service determined that management options were so limited that no conservation benefits would ensue from a recovery plan. A recovery outline will be developed by the end of FY20.

Updated Information and Current Species Status

Biology and Habitat: See chapter 2 of the biological report. A recent hydrogeology study that was conducted at Rock Creek Park (Staley 2016) indicated that there are a series of cracks and fissures that occur in the bedrock that underlies the shallow groundwater habitat and clay layer. Individuals may occupy this deeper subterranean habitat during low flow conditions, which are observed commonly during the summer and fall months, and for a longer duration in years with lower precipitation.

Genetic information: See chapters 2.1 and 4.4 of the biological report. Niemiller et al. (2017, entire) developed taxon specific primers and probes for several *Stygobromus* species to amplify *Stygobromus* DNA using qPCR to see if they could detect environmental DNA (eDNA) from the Hay's spring amphipod, in water samples collected from 10 seepage springs. For this study, the authors constructed a Bayesian consensus CO1 gene tree from mitochondrial DNA. The Hay's spring amphipod was most closely allied with *Stygobromus allegheniensis*, exhibiting 4.9 percent uncorrected sequence divergence between the two taxa. *S. allegheniensis* is a member of the *Stygobromus tenuis* group but occurs in the Appalachian karst region within the Valley and Ridge physiographic province. It ranges almost 600 linear km (372.8 miles) from central and eastern New York to northeastern West Virginia, where it is common in caves and other ground water related habitats (Holsinger 1967, p. xx; Holsinger 1978, p. xx). The Hay's spring amphipod and *S. allegheniensis* clade was a sister group to the clade containing the Potomac groundwater amphipod (*Stygobromus tenuis potomacus)* but also *Stygobromus pizzinii* (Niemiller et al. (2017, p. 252). The Potomac groundwater amphipod was found to have cryptic diversity, meaning that significant sequence differentiation was found within the species when sampled from multiple locations (Niemiller et al. 2017, p. 252). The available data does not support this conclusion for the Hay's spring amphipod, but this is likely due to individuals being collected from only one site, and the fact that the Hay's spring amphipod has a range of 2.5 miles (4 km) and the Potomac groundwater amphipod has a range of 4,350 miles (7,000 km).

Historical and Current Distribution/Abundance: See chapter 2.3 of the biological report. The species was discovered in a small spring (Hay's Spring) on the south end of the National Zoological Park in the District of Columbia in 1930 (Hubricht and Mackin 1940, p. 205). It was then discovered in West Rapid Spring and Ross Drive Spring at the National Park Service's Rock Creek Park by Maryland Department of Natural Resources in 1995 (Feller 1998 pers. comm.). The species was then discovered at three additional sites in 2001 and 2003 (Kennedy Street Spring, Carter Barron Spring, and Police Station Spring) (Culver and Sereg 2004, p. 88-100) also located within Rock Creek Park.

Despite repeated surveys conducted over time, individuals have not been observed at Hay's Spring since 1978. Carter Barron Spring also only has a record for the species from 2003, and

therefore, we consider the status of these two sites "unknown." There was an individual collected in 2003 from an interstitial sample from the sediments of Rock Creek, near Rapid Bridge that was thought to be the Hay's spring amphipod, but this was not confirmed through identification, therefore, we consider this site "probable" (Culver and Sereg 2004, p. 16). Since the last 5-year review, extensive surveys occurred in 2016 along with an eDNA study (Niemiller et al. 2017, entire) which resulted in the discovery of individuals at an upper seep at Kennedy Street Spring (Upper Kennedy Street Spring), thus, resulting in a new site (Fong 2017 pers. comm.). While individuals have not been collected at Park Police Station Spring since 2001, six out of eight eDNA samples were positive for the species, therefore, we consider the species "extant" at this site. A positive eDNA sample (one out of eight samples) was collected from East Spring, but since we have not collected an individual from that site, we are also considering that site "probable." Sites where we have observed persistence over several decades, include West Rapid, Kennedy Street, and Ross Drive springs. Therefore, we consider the current range of the species to be five sites that are "extant," two sites that have "unknown" status, and two sites that are "probable" but not confirmed through individual identification. Collectively, all of the sites ("extant," "unknown," and "probable" status) occur within a 2.5-mile (4.02 kilometers (km)) area of Rock Creek Park and the National Zoo located in the 12-digit HUC Lower Rock Creek watershed, which ultimately flows into the Potomac River.

Contemporary collections of the Hay's spring amphipod have typically been made during the winter and spring months when the springs come to the surface (also referred to as a seepage spring) and amphipods can be collected by hand on the leaf litter. Sampling events that occur just where the water exits from underground likely serve as an indicator of presence rather than abundance. We therefore do not have an overall population estimate for the species.

Threats Analysis (threats, conservation measures, and regulatory mechanisms):

The purpose of a 5-Year Review is to recommend whether a listed taxon continues to warrant protection under the ESA and, if so, whether it should be reclassified (from threatened to endangered or from endangered to threatened). This task requires that the analysis of the threats to the species be performed while assuming that the species is not receiving the regulatory protections, funding, recognition, and other benefits of ESA listing. Summaries of ongoing applications of ESA protections may shed light on some future activities that constitute threats to the species. However, the analysis under Factor D (Inadequacy of Existing Regulatory Mechanisms) focuses on the adequacy of existing alternative (i.e., non-ESA) mechanisms to address the continuing and foreseeable threats.

The primary threat likely to have population or species-level effects include changes to groundwater quality and quantity (Factors A and E)(See chapter 3 of the biological report). We identified development (impervious surface) as a primary source of changes in water quantity and water quality degradation. We explored numerous other factors (e.g., climate change, effects of small population size, collection, predation, hybridization, disease, recreation, forest management, and other conservation efforts) and determined that when they were analyzed independently they had little or no measureable impact on the species (See appendix A of the biological report). Factors such as climate change and conservation efforts (Factor E) do contribute (positively and negatively) to the impacts of water quality and quantity on the species.

While increased temperatures and droughts will occur in the future and could affect the water quantity available, potentially harming the species' population growth during the summer and fall months, that may be balanced by increased precipitation during the spring and winter months when reproduction occurs. Climate change is likely to increase the amount of storms with intense precipitation (Melillo et al. 2014, p. 374), leading to increased runoff and higher levels of water quality degradation. Stormwater management projects, such as bio-retention or infiltration practices, are an example of potential conservation efforts that could improve water quality and quantity for the species. Within Rock Creek Park (managed by the National Park Service) and the National Zoological Park (managed by the Smithsonian Institution), policies of the managing agencies, provides adequate authority to protect the species from any threats originating from within the boundaries of these parks (Factor D). However, the high level of impervious surface (40.2 percent) that exists in the 12-digit HUC drainage area (Lower Rock Creek) has and will continue to impact water quality and water quantity. Regulatory programs that address water quality and quantity do exist to meet federal requirements under the Clean Water Act. While not eliminating impacts to water quality and quantity of the springs, they likely contribute to minimizing impacts.

Synthesis

Current Condition/Status: See chapter 4 of the biological report. After evaluating threats to the species and assessing the cumulative effect of the threats under the section 4(a)(1) factors, we evaluated the Hay's spring amphipod's current viability to determine if it meets the definition of an endangered species. The population size of the Hay's spring amphipod is unknown. Its entire range is limited to 2.5 miles (4 km) of the Lower Rock Creek watershed in the District of Columbia with seven extant populations (redundancy), and two populations that are probable but unconfirmed. The species has been collected from three different habitat types (representation). Demographic information from surveys was evaluated in addition to factors that influence water quality and water quantity for seven analytical units (the "unknown" and "extant" springs and associated recharge area). Two of seven analytical units are in high condition which aids the species in withstanding stochastic events (resiliency). We assume that due to the high level of development (the primary driver influencing water quality and quantity) that has occurred in the District of Columbia and surrounding areas over time, that the species retains much less resiliency, little to no redundancy, and decreased representation from the historical condition. Overall, resiliency is currently low due to the low number of sites (seven) with only four sites in high or moderate condition, and the remaining three in low condition. There is little redundancy, as all of the sites occur in the same 12-digit HUC watershed. Representation is also extremely limited by the small range of the species. We do not expect an increase in impervious surface in the Lower Rock Creek watershed which is highly developed (40.2 percent impervious surface), and resiliency could increase slightly at three sites where a bioretention project was recently constructed to improve water quality and water quantity. However, climate change in the future could lead to more frequent storm events, which could increase the magnitude and severity of threats to the species by further impacting water quality and water quantity. We also assume that the probability of a catastrophic event occurring increases over time, leading to a higher risk of decreased viability due to the species lack of redundancy. The species displays adaptive capacity through the use of different habitat types and the ability to disperse to wet microclimates under drought conditions. This adaptive capacity is likely to help the species sustain populations at the

sites that are considered to be in high or moderate condition (four sites) into the future. Based on the current condition of the species and a projection of how the magnitude and severity of threats may increase in the future from more frequent storm events, we still conclude that the Hay's spring amphipod meets the definition of an endangered species.

RESULTS

Recommended Classification: *Given your responses to previous sections, particularly section 2.4. Synthesis, make a recommendation with regard to the listing classification of the species*

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

New Recovery Priority Number *(indicate if no change; see 48 FR 43098, September 21, 1983 & 48 FR 51985, November 15, 1983 - Correction)*: 5 (no change).

Brief Rationale: The recovery priority number is unchanged because this species continues to be the subject to a high degree of threat with low recovery potential.

Listing and Reclassification Priority Number, if reclassification is recommended *(see 48 FR 43098, September 21, 1983)*

Reclassification (from Threatened to Endangered) Priority Number: ____
Reclassification (from Endangered to Threatened) Priority Number: ____
Delisting (Removal from list regardless of current classification) Priority Number: ____

Brief Rationale:

RECOMMENDATIONS FOR FUTURE ACTIONS

- Conduct surveys at all the sites with repeated visits at the two sites with "unknown" status and the two sites with "probable" status in FY21.
- Continue to collect eDNA samples at sites to better understand how well it supports presence.
- Evaluate additional conservation actions or projects that might be implemented adjacent to recharge areas recently delineated by the Service to further improve water quality and quantity.
- Continue to investigate the extent of groundwater watersheds at each spring in order to

get a more accurate representation of drainage areas.

- To the extent possible, prevent any increase in impervious surfaces or clearing of forest within the recharge areas supporting the species.
- Work with the National Park Service and Smithsonian Institution to ensure that recreational activities and construction activities (including new trails), and activities adversely affecting water quality and quantity in recharge areas are discouraged (i.e. application of pesticides, changes in surface or subsurface flows). Continue to support deer management at Rock Creek Park.
- Develop a recovery outline for the species by the end of FY20 and if deemed appropriate as a consequence of the analysis in the recovery outline, develop a recovery plan in FY21.

REFERENCES – See biological report.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of the Hay's spring amphipod

Current Classification:

Recommendation resulting from the 5-Year Review:

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

Appropriate Listing/Reclassification Priority Number, if applicable:

REGIONAL OFFICE APPROVAL:

Assistant Regional Director, Fish and Wildlife Service

Approve PAMELA TOSCHIK Digitally signed by PAMELA TOSCHIK Date: 2020.07.15 14:14:29 -04'00' Date _____