U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: Stygobromus kenki

COMMON NAME: Kenk's amphipod

LEAD REGION: 5

INFORMATION CURRENT AS OF: August 2010

STATUS/ACTION

___ Species assessment - determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to Candidate status
_X_ New candidate
___ Continuing candidate
__X_ Non-petitioned
___ Petitioned - Date petition received:
_ 90-day positive - FR date:
_ 12-month warranted but precluded - FR date:
_ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:
a. Is listing warranted (if yes, see summary of threats below)?
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions?
c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded.

___ Listing priority change
Former LP: ___
New LP: ___

Date when the species first became a Candidate (as currently defined): N.A.

___ Candidate removal: Former LPN: ___
___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.
___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
___ F – Range is no longer a U.S. territory.
___ I – Insufficient information exists on biological vulnerability and threats to support listing.
___ M – Taxon mistakenly included in past notice of review.
___ N – Taxon does not meet the Act's definition of "species."

___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Crustaceans, Crangonyctidae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Virginia, District of Columbia

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: District of Columbia, Maryland (Montgomery County)

LAND OWNERSHIP: 60 percent Federal [Rock Creek Park], 20 percent County, and 20 percent private. The sites known to support the species consist of five small seeps/springs and their outflows; total surface water area of all of them is less than 1 acre. The acreage needed to protect the recharge areas of these springs is not known, but is certainly much greater.

LEAD REGION CONTACT: Martin Miller, 413-253-8615, Martin_Miller@fws.gov

LEAD FIELD OFFICE CONTACT: Andy Moser, 410-573-4537, andy_moser@fws.gov

BIOLOGICAL INFORMATION

Species Description and Taxonomy: Kenk's amphipod (*Stygobromus kenki*) was first collected in 1967 by Roman Kenk from a spring in Rock Creek Park, Southeast of North National Parks headquarters in Washington, D.C. It was formally described by J.R. Holsinger (1978, pp.39-42). This is a moderately small groundwater species, with largest male specimens reaching 3.7mm and largest females 5.5mm.

This amphipod is a member of the Spinosus Group of *Stygobromus* which includes two other closely related species, *S. spinosus* and *S. pseudospinosus*. It is distinguished from those two species on the basis of various morphological features (Holsinger 1978, p.39). These include the palmar margin of gnathopod 1, which is nearly straight, and the rudimentary ramus of uropod 3, which is only about 1/8 length of the peduncle. It is further distinguished from *S. spinosus* by less spinose uropods of the male and shorter telson spines of both sexes. It is further distinguished from *S. pseudospinosus* by the telson which is proportionately shorter and more spinose (Holsinger 1978, p.39). We have carefully reviewed the available taxonomic information to reach the conclusion that *S. kenki* is a valid species.

Habitat/Life History: Amphipods of the genus *Stygobromus* occur in groundwater or groundwater-related habitats (e.g. caves, seeps, small springs, wells, interstices, and rarely deep lakes) and have modified morphology for survival in these subterranean habitats. They are generally eyeless and unpigmented, and frequently have attenuated bodies (Holsinger 1978, pp.1-2). Members of this genus occur only in freshwater and belong to the family Crangonyctidae, the largest family of freshwater amphipods in North America. *Stygobromus kenki* occurs in seeps and springs and was historically reported (tentative identification) from a well in northern

Virginia (Holsinger 1978, p.39). It can be found in dead leaves or fine sediment submerged in the waters of its spring/seep outflows (Holsinger 1978, p.130).

Historical Range/Distribution: All current and historic occurrences of Kenk's amphipod are from the Potomac River watershed in or near the District of Columbia. At the time of its description, this amphipod was known from two seeps/springs in Rock Creek Park in the District of Columbia and one shallow well in Fairfax County in northern Virginia (Holsinger 1978, p.39). The identification of the species from the Fairfax County site is considered uncertain because it was based on a single immature male specimen. A sexually mature male would be needed to confirm the specific identity of this population. Its identity may never be determined with certainty, because the Fairfax County site (where the specimen was collected in 1973) has probably been destroyed by subsequent residential development (Holsinger, p.184, *in* Terwilliger 1991; Feller 1997, p.7).

Current Range/Distribution: The species is currently known only from five spring/seep sites in Washington D.C. and Montgomery County, Maryland (Feller 2005). These are the only known sites for the species despite extensive surveys for the species in the District of Columbia and Montgomery County, Maryland (Feller 1997 and 2005, Culver and Sereg 2004). Groundwater amphipod surveys in Arlington and Fairfax Counties, Virginia, also failed to detect this species (Hutchins and Culver 2008). Four of the known sites are within the Rock Creek drainage; three within Rock Creek Park in Washington, D.C. (Kennedy Street Spring, East Spring, and Sherrill Drive Spring) ; the fourth (Coquelin Run Spring) in Montgomery County, Maryland, not far from the District line. The fifth known site (Burnt Mill Spring #6) is within the Northwest Branch drainage in Montgomery County, Maryland, approximately three miles from the District line. Thus, the current range of this species is limited to Federal land and private property (one site) adjacent to approximately four linear miles of Rock Creek, and a single site to the east, on county parkland adjacent to Northwest Branch. Kenk's amphipod co-occurs with the Federally-listed Hay's Spring amphipod at one site, Kennedy Spring.

Population Estimates/Status: There is recent evidence of survival of the species at each of the five sites referred to under "Current Range/Distribution" (Feller 2005, pp. 5-7, and Culver and Sereg 2004, p.18). However, there are no reliable population numbers for these sites because of the difficulty of sampling them and the uncertainty concerning what portion of the population remains out of reach in the groundwater supplying the seep/springs at these sites (Feller 2005, p.10). The species is typically found in small numbers and then only when groundwater levels are high and springs are flowing freely. Given the small size of the shallow groundwater aquifers occupied by this species and the known characteristics of subterranean invertebrates, it is probable that each of the five populations is small (Hutchins and Culver 2008, pp. 3-6).

SIGNIFICANT PORTION OF THE RANGE (SPR): Not applicable since the species is being recommended for candidate status throughout its entire range.

THREATS

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

General: Within the limited area encompassing the current range of this species, the vast majority of potential expanses of habitat large enough to support this species has been significantly impacted or completely destroyed by urban and suburban development (Feller 2005, p.11). Kenk's amphipod is vulnerable to threats because of its limited geographic distribution and the infringement of urban development both outside and within Rock Creek Park (Feller 2005, p.1). Due to large scale hydrologic changes associated with intensive urban development, all groundwater species within the District of Columbia are potentially threatened (Feller 1997, p.1). New construction surrounding Rock Creek Park, increased land use outside the park, internal park maintenance operations, and intensive recreational use all pose threats to the seep/spring habitats of this species. Potential risks to the park habitats are toxic spills (e.g., oil, gas), non-point source inputs (e.g., fertilizer and pesticides), additional land disturbance, sanitary sewer leaks, and excessive storm water flows that might affect groundwater and related habitats (Culver and Sereg 2004, p.13). Similar threats are present at the two Montgomery County, Maryland, sites known to support this species, which were found since the completion of Culver and Sereg's 2004 report. These two sites are within the Rock Creek and Northwest Branch watersheds (subunits of the Potomac watershed). Green space in the Rock Creek and Northwest Branch watersheds in Montgomery County is limited largely to county parks which experience intense recreational use with 13 million people visiting Montgomery County Parks annually (Feller 2005, p.2).

Water Quality Degradation: Water quality degradation may be an important factor in the rarity of Kenk's amphipod in Rock Creek Park. This is especially likely to the north of Military Road, in the four springs extending from Sherrill Drive Spring to Holly Street Spring. Sherrill Drive Spring is highly vulnerable to degradation because it is located at the base of the 16thStreet embankment near the edge of the park (Feller 1997, p.37). Threats include those associated with immediate proximity to heavily used roads and urban residential development. Urban runoff (containing high levels of cadmium, zinc, and nitrates) and erosion in the vicinity of this spring are real threats to the water quality and stability of this spring. The nearby sanitary sewer line is structurally unsound and is subject to leakage (Feller 1997, p.37). This threat is present at many locations within Rock Creek Park and the County parks supporting this species, because these are linear parks established along stream valley corridors which also function as conduits for buried sewer and water lines (Feller 2005, p.2). Adverse effects of groundwater pollution, including sewage contamination, on amphipods and other invertebrates were documented by Simon and Buikema (1977), Sket (1977), and Culver and Holsinger (1992).

Culver and Sereg (2004) indicate that Kenk's amphipod is barely surviving in Sherrill Drive Spring and is absent from the other three springs [studied by Culver and Sereg]. Given the springs' geographic proximity to each other, the increases in heavy metal concentration and other water quality concerns in the springs' habitat likely explains the absence of this amphipod from the other three springs (Culver and Sereg 2004, p.73). The toxicity of heavy metals, especially cadmium and zinc, to amphipods and other aquatic crustaceans has been well documented and has been shown to result in mortality and sublethal effects at low concentrations (Eisler 1985, Eisler 1993, Gossiaux et al 1992, Brumec-Turk 1998). In addition to heavy metal concentrations, Culver and Sereg 2004 (p.69) also found that Sherrill Drive Spring consistently

had the highest conductivity (a measure of salinity) and nitrate values. Therefore, Sherrill Drive Spring shows anthropogenic influence and, consequently, greater degradation in water quality than the other four springs with extant, high numbers of *Stygobromus* species (Culver and Sereg 2004, p.69).

Water Quantity and Hydrology: At East Spring, in Rock Creek Park, further development of the park lands above and around the spring upwelling constitutes a potential threat to the species as do the existing extensive parking area, tennis courts, and lawn areas there (Feller 1997, p.25). The amount of impervious cover from residential and commercial development (buildings, parking lots, etc,) changes the hydrology of the watershed by preventing groundwater recharge, resulting in decreased flows in the springs and seeps supporting this species. In addition, the run-off that does come from those areas and drains into the aquifers and seep/spring habitat of Kenk's amphipod is often contaminated. Such adverse effects on subterranean aquatic invertebrates from changes in hydrology have been documented in the literature (Datry et al. 2005, Culver and Holsinger 1992).

Coquelin Run Spring, in Montgomery County, is immediately adjacent to an unnamed intermittent tributary of Coquelin Run (a tributary of Rock Creek). This unnamed tributary drains a residential development and occasionally floods the spring/seep emergence (Feller 2005, pp. 5-6). This site is at high risk of hydrologic changes and pollution because it is on private land closely situated to extensive impervious surfaces and periodically subjected to runoff from residential development (Feller 2005, p.9).

In summary, the present and threatened destruction or modification of this species' habitat or range, particularly from water quality and quantity degradation, is the principal threat to this species. It is especially vulnerable to this threat because of its small range and the small size of the surface water catchment areas supporting each of the spring/seeps it inhabits.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

This is not known to be a factor threatening Kenk's amphipod. Most recent collections of this species were made during surveys funded by the National Park Service or the U.S. Fish and Wildlife Service, as documented in Feller 1997, Culver and Sereg 2004, and Feller 2005. These surveys have been conducted to evaluate the distribution of the species (three new sites have been discovered) and have involved the collection of very small numbers of Kenk's amphipod. Thus, negative effects of these collections on its populations are extremely unlikely.

C. Disease or predation.
This is not known to be a factor threatening Kenk's amphipod.

D. The inadequacy of existing regulatory mechanisms.
District of Columbia law currently provides no protection for this invertebrate species. However, Maryland has recently listed *S. kenki* as a state endangered species. Therefore, state regulations will provide the species some protection at Maryland sites, but, unlike Federal law, will not protect the species' habitat (Feller 2009, pers. comm.).

Some protection for the habitat at the three spring/seep sites supporting this species in Rock Creek Park is provided by the National Park Service (NPS). Within the Park, NPS has made a concerted effort to protect the habitat of this species (see Conservation Measures Planned or Implemented section below for specifics); designation as a candidate or Federal listing is expected to enhance the agency's ability to take protective actions. However, the NPS cannot provide protection of any seep recharge areas which extend outside Park boundaries.

Therefore, we conclude that the protections from existing regulatory mechanisms are not adequate to alleviate the threats to Kenk's amphipod.

E. Other natural or manmade factors affecting its continued existence.
Because all known occurrences of this species occur in wooded areas, widespread use of Dimilin to control gypsy moth outbreaks on public land in Maryland is of particular concern, as small concentrations of this pesticide are known to cause crustacean mortality (Feller 2009, pers. comm.). Dimilin has been shown to be especially toxic to freshwater amphipods (Fischer and Hall 1992, p.45). Most of the sites supporting this amphipod are not subject to this threat because the National Park Service does not permit the spraying of Dimilin in Rock Creek Park. Fragmentation of habitat, as a result of groundwater pollution and loss of groundwater recharge, is also a factor affecting the species (See first paragraph of discussion under Factor A).

Climate change has the potential to adversely affect the species, particularly if it results in a significant change in the amount of precipitation in the Washington metropolitan area. Decreases in precipitation within the species' range may result in the drying up of springs/seeps while increases in precipitation may result in washing away of important surface features or excessive erosion at spring/seep sites. However, we do not have enough information at this time to conclude that this is a significant threat to this species.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED: As stated above, the NPS has made a concerted effort to protect the habitat of this species within Rock Creek Park. This has included working with the District Department of Transportation so that design of their 16th Street road reconstruction and storm drainage project incorporated the construction of a storm sewer under Sherill Drive, resulting in the elimination of a major outfall at the Kenk's amphipod Sherill Drive spring site. However, this park must still continually deal with water quality threats from outside the park, as well as the demand for additional recreational features within this heavily used park. For the two recently discovered spring/seep sites outside Rock Creek Park, we are not aware of any conservation measures that have been planned or implemented.

SUMMARY OF THREATS: The principal threats to this species are modification of the hydrology and degradation of water quality at the springs/seeps and spring runs providing its habitat. Although all but one of the sites supporting this species are on park land, significant threats remain, in part because of the activities occurring on the private lands surrounding these narrow linear parks. Of particular concern are effects on the springs' recharge areas which may extend well beyond the boundaries of the parks. In addition, some of the recreational activities and past and future developments within the park lands have the potential to threaten the species.

With only five small sites, in a relatively small geographic area, known to support this species, it is highly vulnerable to the threats to the hydrology and water quality of its spring/seep habitats. Therefore, we find that Kenk's amphipod should be listed throughout its entire range and that further analysis is unnecessary to determine whether it is threatened or endangered in a significant portion of its range.

RECOMMENDED CONSERVATION MEASURES: Measures are recommended to maintain the water quality and quantity at the springs and seeps supporting this species. These include:

1) Maintaining a buffer around each of the springs/seeps and associated spring runs where recreational activities, construction activities including new trails, and other harmful activities are prohibited or discouraged.
2) Avoiding any increase in impervious surfaces, loss of forested areas, road salting, and pesticide spraying in the catchment basins of each of the springs/seeps.
3) Carrying out studies to delineate recharge zones of each of the springs known to support this species; this might be combined with a similar study of the endangered Hay's Spring amphipod's spring sites in Rock Creek Park. Once this delineation is complete, designate areas within the parks to protect and manage these recharge zones.
4) Redirecting existing artificial surface flows away from springs and spring runs supporting the species.
5) Initiating an outreach program for surrounding landowners within the catchment basins to educate them in regard to minimizing groundwater pollution and flow alterations.

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	**Imminent**	Monotypic genus	7
		Species	8*
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude: All five known sites of occurrence face threats to the hydrology and water quality of their springs. However these threats are chronic in nature and appear to be increasing only gradually.

Imminence: Pollution and/or hydrologic changes are already occurring at the majority of springs supporting this species.

Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed? Yes.

Is Emergency Listing Warranted? No. Emergency listing of Kenk's amphipod is not warranted at this time because the main threats to the species are chronic in nature and appear to be increasing only gradually. Extinction is not imminent because there are five extant sites and the intensity of threats at each of these sites varies considerably. Furthermore, because these threats are, for the most part, not amenable to law enforcement action or under the control of Federal agencies, listing would not afford immediate protection from these threats.

DESCRIPTION OF MONITORING: Regular monitoring of spring/seep flows and population numbers has not been implemented for this species. Methods/procedures to monitor flows and population numbers should be explored. However, meaningful population monitoring may not be possible since the majority of the population is likely to be underground at any given time and the number of individuals captured appears to depend more on flow levels than actual population levels. Current sampling is primarily aimed at determining presence/absence at individual springs when they are flowing. In March 2005 flow rates in the two Montgomery County sites supporting the species were estimated at 1 gallon per minute (Feller 2005, pp.5-6). Springs in Rock Creek Park had an average flow of 2.4 gpm during March and April [generally the wettest time of year] (Feller 1997, p.11).

COORDINATION WITH STATES
Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:
The state of Maryland's Wildlife and Heritage Program provided comments on this candidate assessment. National Park Service biologists provided comments relating to the District of Columbia portion of Kenk's amphipod range, since all known District of Columbia sites are found within Rock Creek Park.

Indicate which State(s) did not provide any information or comments: None.

LITERATURE CITED

Culver, D., W.Jones, J.Holsinger, J. 1992. Biological and hydrological investigation of the Cedars, Lee County, VA., an ecologically significant and threatened karst area. In J.A. Stanford and J.J. Simons, eds. Proceedings of the first international conference on groundwater ecology,

pp.281-90. American Water Resources Assoc., Bethesda, MD.

Culver, D.C. and I. Sereg. 2004. Kenk's Amphipod (*Stygobromus kenki* Holsinger) and Other Amphipods in Rock Creek Park, Washington, DC. Environmental Studies Program, American University. Unpublished report to the National Park Service. 147 pp.

Datry, T., F. Malar, and J. Gibert. 2005. Response of invertebrate assemblages to increased groundwater recharge rates in a phreatic aquifer. Journal of the North American Benthological Society, 24, 461-77.

Eisler, R. 1985. Cadmium Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. U.S.F.W.S. Biol. Rep. 85(1.2). 46pp.

Eisler, R. 1993. Zinc Hazards to Fish, Wildlife, and Invertebrates A Synoptic Review. U.S. F.W.S. Biol. Report 10, U.S. Department of the Interior, Washington, DC. 106pp.

Feller, D. 1997. Aquatic Subterranean Macroinvertebrate Survey of Rock Creek and Associated National Parks, Washington, D.C. Heritage and Biodiversity Conservation Programs Technical Report. Maryland DNR, Annapolis, MD. Unpublished report. 38pp.

Feller, D. 2005. A Distributional Survey of Kenk's Amphipod (*Stygobromus kenki* Holsinger) in Maryland. Maryland Natural Heritage Program, Maryland DNR. Unpublished report to the U.S. Fish and Wildlife Service. 25pp.

Fischer, S.A. and L.W. Hall. 1992. Environmental Concentrations and Aquatic Toxicity Data on Diflubenzuron (Dimilin). Critical Reviews in Toxicology Vol. 22, No. 1: pp.45-79.

Holsinger, J.R. 1978. Systematics of the Subterranean Amphipod Genus *Stygobromus* (Crangonyctidae), Part II: Species of the Eastern United States. Smithsonian Contributions to Zoology No. 266. 144 pp.

Hutchins, B. and D.C. Culver. 2008. Investigating Rare and Endemic Pollution-sensitive subterranean Fauna of Vulnerable Habitats in the NCR. Unpublished Report to the National Park Service, National Capital Region. 80pp.

Simon, K.S and A.L.Buikema,jr. 1997. Effects of Organic Pollution on an Appalachian Cave: Changes in macroinvertebrate populations and food supplies. Am. Midl. Nat. 138:387-401.

Sket, B. 1977. Gegenseitige Beeinflussung der Wasserpollution und des Hohlenmilieus. Proceedings of the 6th International Congress of Speleology, Olomouc, CSSR, 1973: 4, 253-62.

Terwilliger, K. 1991. Virginia's Endangered Species, Proceedings of a Symposium. McDonald

and Woodward, Blacksburg, VA. 672 pp.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: _____ Date: 5/26/10

Acting Regional Director, U.S. Fish and Wildlife Service

Concur: _____ Date: October 22, 2010

ACTING

Director, Fish and Wildlife Service

Do not concur: _____

Director, Fish and Wildlife Service Date

Director's Remarks: