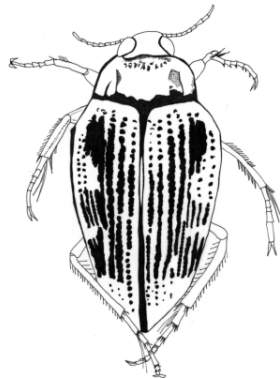


Hungerford's Crawling Water Beetle
(Brychius hungerfordi)

**5-Year Review:
Summary and Evaluation**



**U.S. Fish and Wildlife Service
East Lansing Field Office
East Lansing, Michigan**

5-YEAR REVIEW

Species reviewed: Hungerford's crawling water beetle (*Brychius hungerfordi*)

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5-YEAR REVIEW

Hungerford's crawling water beetle/*Brychius hungerfordi*

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office: Carlita Payne, Midwest Region, 612-713-5339

Lead Field Office: Barbara Hosler, East Lansing Field Office, 517-351-6326

1.2 Methodology used to complete the review

Barbara Hosler, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service (Service), East Lansing, Michigan Ecological Services Field Office prepared this 5-year review in coordination with the Midwest Regional Office. Through a *Federal Register* notice (75 FR 55820) initiating the 5-year review, the Service requested new scientific or commercial data and information that may have a bearing on the species' classification of endangered status. We reviewed past and recent literature, public comments, the final listing rule (59 FR 10580), the Hungerford's Crawling Water Beetle Recovery Plan (USFWS 2006), the prior 5-year review for the species (USFWS 2009a), and species information and data that has become available since the 2009 review. The Service's 2006 Interim 5-Year Review Guidance does not require peer review if a 5-year review results in a recommendation to leave the status unchanged because there was no new information, or all new information has undergone prior peer review. For this reason, we have not conducted a peer review.

1.3 Background

1.3.1 FR Notice citation announcing initiation of this review:

75 FR 55820 (September 14, 2010)

1.3.2 Listing history:

Original Listing

FR notice: 59 FR 10580

Date listed: March 7, 1994

Entity listed: Species

Classification: Endangered

1.3.3 Associated rulemakings: none

1.3.4 Review History:

August 28, 2009: Hungerford's crawling water beetle (*Brychius hungerfordi*) 5-Year Review. This 5-year review summarized all new information regarding the species status, distribution, and threats and recommended no change to the species' classification as endangered.

September 28, 2006: Hungerford's Crawling Water Beetle (*Brychius hungerfordi*) Recovery Plan. The recovery plan summarized the species' status, distribution, and recovery objectives described in the approved recovery plan.

1.3.5 Species' Recovery Priority Number at start of 5-year review: 5, indicating a high degree of threat and low recovery potential.

1.3.6 Recovery Plan:

Name of plan: Hungerford's Crawling Water Beetle (*Brychius hungerfordi*) Recovery Plan

Date issued: September 27, 2006

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate? No.

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

No. The species has an approved recovery plan, but the recovery criteria are interim because further research is necessary to make them fully measurable.

Reclassification from endangered to threatened may occur when:

1. Life history, ecology, population biology, and habitat requirements are understood well enough to fully evaluate threats, and
2. A minimum of five U.S. populations, in at least three different watersheds, have had stable or increasing populations for at least 10 years, and at least one population is considered viable.

Delisting may occur when the above criteria are met, plus:

3. Habitat necessary for long-term survival and recovery has been identified and conserved, and
4. A minimum of five U.S. populations, in at least three different watersheds, are sufficiently secure and adequately managed to assure long-term viability.

Survey efforts have expanded the known range of the species (see 2.3.1.5 below), but its life history and population biology are not known well. Recent surveys have aided in developing an understanding of the species' habitat requirements (Grant *et al.* 2011a), but habitat necessary for long-term survival has not been identified or conserved. None of the interim recovery criteria have been met.

2.3 Updated Information and Current Species Status

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history:

Although the dietary requirements for Hungerford's crawling water beetle (HCWB) are not fully understood, *Spirogyra*, lithophilic diatoms or *Cocconeis* are the most likely food sources for HCWB adults (Grant and Vande Kopple 2003). Further work by Grant and Vande Kopple (2009) utilized stable isotopes to analyze feeding behavior of HCWB. They found that an alga, *Dichotomosiphon*, represents the primary food choice for larval HCWB but adults feed more generally than do their larvae. Because the larvae are very dependent upon the occurrence of this specific alga taxon, which is widespread but rare, they hypothesized that this dietary preference might play a key role in regulating the species' distribution and explaining its rarity.

2.3.1.2 Abundance, population trends (e.g., increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

There are eleven streams range-wide with known populations of HCWB (see 2.3.1.5 below). Throughout the recognized range, we have very limited information on the abundance, population trends, and demographic features of this species. These factors are essential to understanding how HCWB may persist over time. The Recovery Plan identifies several recovery actions to help assess demographic features and trends (see section 4.0 below).

Understanding the population dynamics of HCWB requires knowledge of its reproductive patterns. Observations of HCWB in the East Branch of

Maple River suggest that they may have two generations per year, with adults emerging in early spring (May) and a second brood of adults emerging late in the season (August) (Grant *et al.* 2000; Bert Ebbers, Great Lakes Ecosystems, pers. comm. 2004). The emergence of adults in the spring from overwintering larvae is likely not synchronous, occurring over a period of weeks, dictated somewhat by local temperature conditions (Michael Grant, University of Michigan Biological Station, pers. comm. 2010). In addition, some adult beetles survive over the winter, even beneath ice cover (Grant *et al.* 2000). Thus, the timing and magnitude of peak population numbers undoubtedly changes from year to year, with the magnitude controlled somewhat by local climatic conditions and survivability of old adults (Grant, pers. comm. 2010).

The following provides a summary of the population status of HCWB in each of the known streams in which this species occurs:

Canada Creek – In June 2005, a new site was discovered that expanded the previously known range for this species. One adult beetle was discovered in Canada Creek, just upstream from the Bear Den Road crossing (Robert Vande Kopple, University of Michigan Biological Station, pers. comm. 2005; Bruce Walker, Michigan Department of Environmental Quality, pers. comm. 2005). It is possible that the beetle was washed from an area upstream to the location in which it was discovered, as the beetle was found following a significant rain event (Vande Kopple, pers. comm. 2005). In July 2007, two adults and one larva were found in Canada Creek, downstream of Highway 622 (Vande Kopple 2007).

Carp Lake River – Hungerford's was discovered at this site in 1997 when four adults were found below the culvert at the Oliver Road crossing. In 1998, the Emmet County Road Commission cleared the vegetation from the road ditches along Oliver Road, which resulted in increased erosion and sedimentation of the stream (Vande Kopple and Grant 2004). This led to a loss of some suitable habitat. Surveys conducted in 1998 did not find any HCWB. One adult was found in a survey in 1999 (Hinz, Jr. and Wiley 1999). None were found during surveys conducted in 2003 (Vande Kopple and Grant 2004). In 2004, only one adult HCWB was found at the Oliver Road crossing on two separate occasions in August and September, despite several hours of searching (Ebbers, pers. comm. 2004). In 2006, 28 beetles were collected from the Oliver Road site and were moved upstream to the Gill Road site as part of bridge construction at Oliver Road. Surveys in 2011 found four adult beetles at this site for the first time since construction of the new bridge in 2006 (Grant *et al.* 2011b).

The Gill Road site, approximately three miles upstream of Oliver Road, was discovered in September 2004. Suitable habitat for HCWB generally

extends from just upstream of Gill Road to approximately 0.8 mile downstream. The Gill Road pool is immediately downstream of the perched culverts at Gill Road where the original survey attempt in 2004 found five beetles in approximately ten minutes (Ebbers, pers. comm. 2004). Currently, the habitat at the Gill Road site is better overall and appears to support the greatest number of beetles in Carp Lake River (Ebbers, pers. comm. 2004). Recent surveys in 2009 have since found 29 adults at Gill Road and eight individuals upstream and downstream of Gill Road (Grant *et al.* 2009a).

The overall numbers of beetles in this stream, although small, appear to be stable. Because they are difficult to find during surveys and the Gill Road site has not yet been extensively surveyed, it is likely that there are at least dozens to hundreds of individuals throughout Carp Lake River within suitable habitat.

East Branch of Black River – This site is approximately 2.5 miles upstream from the Barber Bridge (Strand 1989). Only two adults were found during surveys in 1989 (Strand 1989). Surveys conducted by MNFI in 1996 found two adults at this same location and one adult farther downstream, closer to the Barber Bridge (Legge 1996). The current status of this site is unknown.

East Branch of Maple River – HCWB was originally discovered in the East Branch of Maple River in 1952 (Spangler 1954). The beetle is found in several areas of the river from the Douglas Lake Road crossing downstream for approximately 2.5 miles until near the pipeline crossing. The majority of occupied portions of this stream occur within and along the boundary of the University of Michigan Biological Station. The East Branch of Maple River is the best-studied site and has the largest known population of this species. The results of a mark-recapture study in one pool indicated population numbers near 1,000 (Grant *et al.* 2002). Because HCWB occurs in several pools in this system, we expect that the population in the East Branch of Maple River is greater than 1,000 individuals. Based on recent studies, populations of HCWB appear to be stable throughout the occupied portions of this stream.

Middle Branch of Big Creek – In August 2011, ten adults were found in the Middle Branch of Big Creek from the tail end of a plunge pool below the Farrington Road culvert to roughly 20 feet downstream from the culvert end (Grant *et al.* 2011a). The Big Creek record represents a new watershed (AuSable River) for HCWB, as well as an expansion of its geographic range beyond the outer Port Huron moraine (Grant *et al.* 2011a).

North Branch of Boyne River – A single HCWB larva was found near a beaver dam on the North Branch of Boyne River in April 2011 (Ebbbers, pers. comm. 2011). This was the first record for HCWB in this river. Although the identification of the larva as HCWB was confirmed, subsequent surveys failed to find more individuals—adults or larvae—of this species (Grant *et al.* 2011b). The status of HCWB in this system is uncertain.

North Saugeen River – In 1986, 42 specimens were collected at this site in Bruce County in south central Ontario, near the village of Scone (Roughley 1991). This location is downstream from a dam and below an old millrace (Roughley 1991). The last time the species was found was in 2001; this population may be extirpated (Colin Jones, Ontario Ministry of Natural Resources, pers. comm. 2010).

Rankin River – This site is below the Rankin Dam. A single adult specimen was found in a survey in 2005 and later identified as HCWB. When the site was visited again in August 2008, ten adults and three larvae were detected in four kick-samples with a D-net (Jones, pers. comm. 2010).

Saugeen River – Located at Hanover, this population was discovered in 2008. Only a few adults have been located per visit (Jones, pers. comm. 2010).

Stewart Creek – In July 2009, four adults were found in Stewart Creek upstream and downstream of the Blue Lakes Road crossing (Grant *et al.* 2009a). Searching was confined to the immediate vicinity of the road culvert.

Van Hetton Creek (Van Hellon Creek) – In July 1999, six adult beetles were found along a stretch of Van Hellon Creek. The beetles were dispersed along a stretch of creek several hundred meters in length (Grant *et al.* 2000), beginning approximately 30-50 yards downstream of a culvert and county road crossing (Vande Kopple, pers. comm. 1999). Three beetles were found in less than ten minutes at this site in 2004 (Carrie Tansy, U.S. Fish and Wildlife Service, pers. comm. 2004), and one was found during a brief survey effort in 2005 (Walker, pers. comm. 2005). The size of the population at the Roth Road crossing of Van Hellon Creek was recently estimated at 100 individuals (USFWS 2010). Prior to a road reconstruction and culvert replacement project, however, only three beetles could be located in the creek in the month of November (Grant, pers. comm. 2010). This may be related to fewer adults being present in early winter in addition to beetles being more widely dispersed, unlike when females are ovipositing in the *Dichotomosiphon* mats where they are highly concentrated (Grant, pers. comm. 2010). The three adult

beetles were removed from the site before construction and relocated 0.5 mile downstream. Post-construction surveys in 2011 found five adult beetles immediately below the new culvert (Grant *et al.* 2011b).

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.): There is no information on genetics, genetic variation, or trends in genetic variation for HCWB. No new information has become available.

2.3.1.4 Taxonomic classification or changes in nomenclature: At the time of the last 5-year review (USFWS 2009a), three valid species of *Brychius*, including *B. hungerfordi*, *B. hornii*, and *B. pacificus*, were recognized in North America. There have been no changes in taxonomic classification or nomenclature.

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g., increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g., corrections to the historical range, change in distribution of the species' within its historic range, etc.):

At the completion of the last 5-year review (USFWS 2009a), HCWB was known to occur in six streams, range-wide: East Branch of Maple River and Carp Lake River in Emmet County, Michigan; East Branch of Black River and Van Hetton Creek (also known as Van Hellon Creek) in Montmorency County, Michigan; Canada Creek in Montmorency and Presque Isle counties, Michigan; and North Saugeen River in Bruce County, Ontario, Canada. Since then, HCWB has been found in five new locations: Stewart Creek in Montmorency County, Michigan (Grant *et al.* 2009a); Middle Branch of Big Creek in Oscoda County, Michigan (Grant *et al.* 2011a); North Branch of Boyne River in Charlevoix County, Michigan (Ebbers, pers. comm. 2011); and Rankin River and Saugeen River in Ontario Canada (Jones, pers. comm. 2010). The Big Creek record represents a new watershed (AuSable River) for HCWB, as well as an expansion of its geographic range beyond the outer Port Huron moraine, which formed approximately 13,000 years ago from a glacial readvancement from the north (Grant *et al.* 2011a). This may have implications for understanding its historical biogeography, with the possibility that remnant HCWB populations may exist even farther south (Grant *et al.* 2011a).

The species was thought to be extant at all known sites, with the exception of the possible St. Clair River occurrence (USFWS 2009a). The status of the newly discovered HCWB population in the North Branch of Boyne River is unclear and may currently be extirpated (see 2.3.1.6 below). The HCWB population may also be extirpated at the North Saugeen River location in Ontario, Canada (Jones, pers. comm. 2011).

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

In general, HCWB occurs in areas of streams characterized by moderate to fast stream flow, good stream aeration, inorganic substrate, and alkaline water conditions (Wilsmann and Strand 1990). The adult beetles are often found in plunge pools created below road culverts and beaver dams, as well as in riffles and other well-aerated sections of streams that are relatively cool (15° C to 25° C) (Wilsmann and Strand 1990).

The habitat requirements of the species are not fully understood although additional survey work has shed light on HCWB habitat parameters. Water temperature and flow rate, substrate composition of gravel and cobble, and the presence of *Dichotomosiphon* algae appear to be the best predictors of HCWB presence in a stream section (Vande Kopple, pers. comm. 2010; Grant *et al.* 2011a).

The sections of Stewart Creek where HCWB adults were first found in 2009 exhibit many of these characteristics. The water temperature ranged from 15.5 – 21° C, and water flow was 3 – 10 cubic feet per second (cfs). The beetles were found primarily in mats of *Dichotomosiphon* algae (Grant *et al.* 2011c).

The beetles in Big Creek were captured from a plunge pool below a county road culvert to approximately 20 feet downstream of the culvert end. The water temperature was 19.5° C, and the flow rate measured 3 cfs. The stream substrate included a good quantity of gravel and cobble, but the larval food, *Dichotomosiphon tuberosus*, was not observed in the plunge pool (Grant *et al.* 2011a).

A HCWB larva was discovered in the North Branch of Boyne River in April 2011 near a small beaver dam located on the river; however, follow-up surveys in June and September 2011 did not find any additional larvae or adults (Grant *et al.* 2011b). The North Branch of Boyne River is fed principally by groundwater. Temperatures recorded during surveys ranged from 13 – 14° C, and no *Dichotomosiphon* colonies were noted. Prior to the June survey, a road culvert replacement project, including removal of an old beaver dam, occurred where the HCWB larva had been discovered. The small beaver dam may have warmed the water just enough to foster a small HCWB population or congregation in that area, but the road construction activity altered the habitat to a degree that the small local population there is currently extirpated (Grant *et al.* 2011b).

2.3.1.7 Other: The previous 5-year review (USFWS 2009a) reported one observation of flight in an adult HCWB. Flight is likely rare for this

species, as that was the first record of flight in HCWB despite many hours of observation. No new information has become available.

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

Road work and culvert removal or bridge construction projects continue to be evaluated on a case-by-case basis to determine the potential risks and benefits to HCWB. For example, in Van Hellon Creek, the project to replace the undersized culvert and compact the approach road surface with Afton stone was estimated to reduce erosion and sedimentation into the creek by 9 tons/year (USFWS 2011). Based upon the initial post-construction survey, the habitat at the road crossing still supports adult beetles, while improving the habitat by enhancing stream flow through the culvert and reducing the threats associated with sedimentation (Grant *et al.* 2011b).

In addition, surveys in 2011 found adult beetles at the Oliver Road crossing of Carp Lake River for the first time since the construction of a new bridge in 2006 (Grant *et al.* 2011b). Beetles were removed from the site and relocated approximately three miles upstream to suitable habitat, just prior to the start of construction. This provides some evidence that culvert replacement projects may have short-term impacts to HCWB populations but may improve stream conditions, allowing eventual recolonization by HCWB.

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes: The listing rule indicates that scientific collections have been few and are housed in appropriate museums, but there is the possibility that amateur scientific collections could occur because of the species' rarity (USFWS 1994). There is no new information about the impacts of overutilization of HCWB for commercial, recreational, scientific, or educational purposes.

2.3.2.3 Disease or predation: The listing rule states that although little is known about disease and predation, there are no indications that they may be contributing to the decline of HCWB (USFWS 1994). There is no new information about the impacts of disease and predation on HCWB.

2.3.2.4 Inadequacy of existing regulatory mechanisms: HCWB receives protection as an endangered species in Michigan under Part 365 of the Natural Resources and Environmental Protection Act of 1994 (NREPA). This law makes it illegal to take, possess, transport, import,

export, process, sell or offer for sale, or buy or offer to buy any species listed as endangered (M.C.L.A. 324.36505).

The streams occupied by this species are also regulated by Federal and state law. The Michigan Department of Environmental Quality implements section 404 of the Federal Clean Water Act. This section allows Michigan to regulate placement of fill material and discharge of pollutants in waters of the United States. Streams in Michigan are also protected by Part 301, Inland Lakes and Streams, of the NREPA (M.C.L.A. 324.30101 – 13).

2.3.2.5 Other natural or manmade factors affecting its continued existence:

The use of lampricides for the control of sea lamprey has been identified as a potential concern for HCWB, and the Service has concluded that the lampricide, 3-trifluoromethyl-4-nitrophenol (TFM), is likely to cause harassment and possibly harm to HCWB (USFWS 2004). Treatment of Carp Lake River in 2004 avoided use of TFM at the Gill Road population of HCWB. But in 2008, the Service's Sea Lamprey Management Program determined that treatment of the entire Carp Lake River was necessary (USFWS 2008). Conservation measures to minimize the exposure of Hungerford's to TFM included collection and removal of as many beetles as possible from the stream at Gill Road both prior to and during treatment. Beetles would have been held in an aquarium and released back at the Gill Road site after the TFM block had passed; however, no HCWB were detected in the stream before or during TFM application (USFWS 2009b). It is not known whether beetles were present prior to the treatment, but post-treatment surveys found HCWB immediately downstream from Gill Road and the population appeared healthy (Grant *et al.* 2009b).

The existence of only eleven small, geographically isolated populations of HCWB increases the potential for extinction from stochastic events, such as human caused or natural environmental disturbances. Small isolated populations are more likely to be destroyed by chance environmental and demographic events than larger widespread populations (Shaffer 1981). For this species, stochastic events could destroy an entire population and, in some cases, a significant percentage of the known individuals. Small population size and restricted range also makes HCWB vulnerable to genetic isolation (Meffe and Carroll 1997). The limited gene pool may lead to decreased fitness (Meffe and Carroll 1997). There have been no studies examining population viability or genetic diversity of this species.

Our analyses under the Endangered Species Act also include consideration of ongoing and projected changes in climate. The terms "climate" and

“climate change” are defined by the Intergovernmental Panel on Climate Change (IPCC). “Climate” refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term “climate change” thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

In the Great Lakes region, the climate will likely grow warmer and probably drier overall during the 21st century (Kling *et al.* 2003). Although average annual precipitation may increase slightly by the end of the century, seasonal precipitation cycles are predicted to become more extreme. Winter and spring rains are likely to increase, amplifying the magnitude of spring floods, especially if the floods coincide with snowmelt when soils are still frozen. Summer rains are also expected to decrease by up to 50 percent, causing a general drying of watersheds, especially during summer and autumn, due to less rainfall, warmer temperatures, and higher rates of evaporation. Stream responses to these changes will vary, but alteration of aquatic habitats, disruption of the timing of fish and insect life cycles, and a reduction in primary and secondary productivity are possible (Kling *et al.* 2003).

2.4 Synthesis

At the time of the last 5-year review for HCWB (USFWS 2009a), only six occupied streams were known, with the number of beetles at those sites typically very low (only one or a few beetles found periodically). It was uncertain at that time what characteristics were important to determine suitable habitat for this species. Threats identified in the last 5-year review included stream modification, logging in riparian areas, and certain types of fish management activities, but the greatest threat to recovery remained the lack of information on ecology and natural history. The risk of extinction due to stochastic events was also identified as a major threat.

Since that time, presence of this species has been documented in a few additional locations, including a new watershed, AuSable River, not previously considered within the known range (see 2.3.1.5). Survey work since listing has not been

extensive, but further efforts may continue to result in new occurrences. Nevertheless, the existence of only eleven small, geographically isolated occurrences seems to be a major threat to this species by increasing the risk of extinction due to stochastic events.

Although all the characteristics of suitable habitat are still uncertain, the presence of *Dichotomosiphon* algae appears to be an important element. This alga taxon has been identified as the primary larval food source, and adult beetles seek out these algal mats for egg-laying. Thus, the presence of this alga may influence the population and distribution of HCWB.

As discussed in 2.3.1.2, numbers of beetles at the known sites vary throughout the year, with high numbers of adults found in summer and low numbers over the winter. This likely relates to emergence of adults in the spring, and concentrations in algal mats for egg-laying, but the overall population dynamics of this species are not well understood.

Threats to this species include stream modification, road work, and certain types of fish management activities. Recent road culvert projects and sea lamprey control actions appear to indicate that conservation measures can be implemented to reduce adverse effects to HCWB, with little impact to HCWB populations. Monitoring at some of these project sites is on-going and may provide additional insight on the magnitude and management of these threats. No information is available at this time to assess the threat of logging to HCWB.

Climate change represents an unknown threat to HCWB. Due to its apparent dependence on various stream characteristics, such as water temperature and flow rate, substrate composition of gravel and cobble, and the presence of *Dichotomosiphon* algae, alteration of stream habitat from climate change may significantly change the distribution and persistence of HCWB in certain streams. Climate change may cause some streams to become unsuitable for HCWB while others develop suitable habitat; however, the geographic isolation of HCWB populations and its uncertain dispersal capabilities (as discussed in 2.3.1.7) may affect its ability to find and colonize new streams.

At this time, the greatest challenge to ensuring recovery of this species remains the lack of information on ecology and natural history. Additional information is needed on resource requirements and microhabitat preferences, life history, and population dynamics. This information will allow us to better assess threats, including the unknown threat of climate change, identify additional recovery actions, and determine the long-term recovery objectives and measurable threat-based recovery criteria.

Although HCWB has been found in new locations and a new watershed, some previously known sites have become extirpated, and the species' distribution is still restricted to a relatively few number of streams. Information about this

species' population dynamics remains limited, and the loss of two sites may represent an overall population decline in spite of discoveries of new locations. Preliminary information suggests that some of the identified threats, such as road work and culvert replacement, may be managed to reduce impacts to this species; however, climate change represents a new, unknown threat for HCWB. Because the beetle maintains small numbers and limited distribution and threats to the species have not been ameliorated, HCWB continues to be in danger of extinction throughout all or a significant portion of its range, meeting the definition of an endangered species under the Endangered Species Act.

3.0 RESULTS

3.1 Recommended Classification:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

3.2 New Recovery Priority Number: No change.

Brief Rationale: The recovery priority number for the Hungerford's crawling water beetle is 5, based on a high degree of threat and a low recovery potential. Although conservation measures may be able to reduce some threats, uncertainty remains high, and the species' limited, geographically isolated distribution represents a significant, on-going threat. The lack of understanding about the species' life history requirements hampers its recovery potential.

3.3 Listing and Reclassification Priority Number: Not applicable.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- Implement recovery actions identified in the recovery plan:
 - 2.1. Conduct studies to examine life history and ecology
 - 2.2. Examine habitat requirements
 - 2.3. Confirm threats to the species
 - 2.4. Conduct studies to examine population dynamics and demography
 - 2.5. Investigate genetic heterogeneity and population viability
 - 2.7. Investigate the hydrological needs of the species
 - 3.2. Continue to survey new locations to identify new populations or areas of suitable habitat
 - 3.3. Develop and implement a monitoring plan for all known sites
- Determine long-term recovery objectives and objective and measurable threat-based criteria.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Brychius hungerfordi*

Current Classification: Endangered

Recommendation resulting from the 5-Year Review

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

Appropriate Recovery Priority Number: 5

Review Conducted By: Barbara Hosler

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve Scott Hicks Date 7-5-2012
Scott Hicks

REGIONAL OFFICE APPROVAL:

Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service, Midwest Region

Approve [Signature] Date 7/5/2012