STATUS REVIEW
Hungerford's crawling water beetle (*Brychius hungerfordi*)

GENERAL INFORMATION

Species: Hungerford's crawling water beetle (HCWB)

Reviewers:

Lead Field Office: Carrie Tansy, 517-351-8375, Michigan ESFO

Lead Regional Office: Laura Ragan, 612-713-5157, Region 3

Listing Status:

Date of listing publication: March 7, 1994

FR citation(s): 59 FR 10580

Classification: Endangered

Methodology used to complete the review:
In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a status review is to assess each threatened species or 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 HCWB to inform this status review.

Carrie Tansy, Fish and Wildlife Biologist with the Service's Michigan Ecological Services Field Office prepared this 5-year review in coordination with the Great Lakes Regional Office. We collected new information on the species' status, biology, distribution, and threats since the last 5-year status review in order to determine whether new information indicates that the species' listing status remains "endangered".

FR Notice citation announcing the species is under active review:
August 21, 2020, 85 FR 53842.

Review History:
Two previous 5-year reviews for HCWB have been conducted and were finalized on August 28, 2009 and July 5, 2012. Both of the previous 5-year reviews for HCWB summarized new information regarding the species' status, distribution, and threats and recommended no change to the species' classification as endangered.

REVIEW ANALYSIS

Recovery Criteria:
Hungerford's Crawling Water Beetle (*Brychius hungerfordi*) Recovery Plan (9/28/2006)

Down-listing criteria (from endangered to threatened status) call for a minimum of five U.S. populations, in at least three different watersheds, that have had stable or increasing populations for at least 10 years, and at least one population considered viable (USFWS 2006). Delisting criteria require that these five populations are sufficiently secure and adequately managed to assure long-term viability. In addition, recovery criteria require that habitat necessary for long-term survival and recovery has been identified and conserved. In 2006, these criteria were

considered "interim" because further research was necessary to make them fully measurable. Since the recovery plan was written, research has clarified important aspects of Hungerford's crawling water beetle's life history, ecology, population biology, and habitat requirements. The recovery criteria are appropriate given our current understanding of the species. At this time, we have the requisite number of populations, but do not have information on population viability for any populations to allow us to fully evaluate recovery progress.

New information since the last 5-year review is summarized below, along with a brief introductory summary of the overall biology and distribution to provide context for the reader. For additional discussion on HCWB, refer to the previous 5-year reviews and Recovery Plan.

Biology and Habitat Summary

HCWB is a member of the Haliplidae family or crawling water beetles, so named as the adults typically crawl, but can also swim using alternating leg strokes (as opposed to other aquatic beetles that used paired strokes). All members of the Haliplidae (collectively known as haliplids) are aquatic, with all active life history stages spent in water (Pennak 1953, Roughley and Larson 1991). Haliplidae larvae are unique among aquatic beetles as they feed strictly on algae using specially adapted mouth parts. Species of *Brychius* tend to be highly localized and difficult to collect. Even when present, it is possible to sample an area and collect no specimens (Mousseau 2004; Grant *et al.* 2011).

Populations of HCWB are found downstream from culverts, beaver and natural debris dams, and human-made impoundments. They are found in plunge pools created below these structures, as well as in riffles and other well-aerated sections of the stream. In general, HCWB is found 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 generally found at depths of a few inches to a few feet in streams that are relatively cool (15º C to 25º C) (Wilsmann and Strand 1990). The streamflow variability of a site appears to be important for this species. HCWB seems to prefer seasonal streams that have some groundwater input. These streams do not dry up completely, but the water level can drop considerably (*e.g.*, several feet in the East Branch of the Maple River) (Vande Kopple and Grant 2004). As the water levels drop, damp river edge sand becomes exposed in the summer and fall (Vande Kopple and Grant 2004). This microhabitat may be important for the pupation stage of the life cycle.

Presence of algae appears to be important in determining suitable habitat for the species. Both adults and larvae are commonly found in association with several species of algae. Adults appear to be generalists in their food choice, feeding on algae including *Chara*, *Cladophora*, and *Dichotomosiphon*, and as well as the epiphytic diatom *Cocconeis* (Grant and Vande Kopple 2009). The diet of adults may also change seasonally (Grant and Vande Kopple 2003). Larvae appear to prefer the alga *Dichotomosiphon tuberosus* (Grant and Vande Kopple 2009). *Dichotomosiphon*, although widespread, is not common. Its presence may be an important factor in determining the distribution of HCWB (Grant and Vande Kopple 2009). Not only is it a possible source of food, but algae may also be important for other reasons (*e.g.*, cover, oxygen source, etc.).

Additional surveys are necessary to determine the extent of HCWB's distribution. There is reason to believe HCWB may be more widely distributed than the streams where it has been previously documented. The types of streams inhabited by this species do not appear to be rare. In fact, streams similar to those in which the species is found appear to be common in northern

Michigan and other surrounding states. The two most recently discovered sites -- Middle Branch of Big Creek in Oscoda County, and Portage Creek in Kalkaska County -- are farther south in Michigan than other HCWB populations (Grant *et al.* 2011; Dingledine 2019). For the first time, these new discoveries put the species outside of the Port Huron Moraine (moraines are landforms created by ridges of glacial till that formed at the edge of retreating glaciers), which may have implications for its historical biogeography. Previous survey efforts (prior to 2011) had been primarily limited to northern Michigan within the Port Huron Moraine (B. VandeKopple, pers. comm., 2018).

The distribution of the species prior to its discovery in 1952 is not known. To determine the historical distribution, collections were examined for HCWB specimens (Mousseau 2004), leading to discovery of HCWB specimens collected in St. Clair County, MI. The St. Clair County record is that of two HCWB larvae, which were collected in the St. Clair River in 1983 by Pat Hudson (Hudson *et al.* 1986) and were confirmed as HCWB (R. Roughley, pers. comm., 2004). This record is curious because the St. Clair River is dissimilar to known sites and would not be classified as suitable habitat based on our current understanding of the species. Survey attempts in 2002 were unsuccessful in locating HCWB larvae in the St. Clair River (P. Hudson, pers. comm., 2002), and very few Haliplids (of any species) have been documented in the St. Clair River in published reports or literature. Haliplids have been reported in tributaries to the St. Clair River, so it is possible that HCWB occurred higher in the watershed and the individuals collected in 1983 washed downstream (and thus do not represent a resident population of HCWB in the St. Clair River proper).

Most areas of the state have not been surveyed for HCWB. While we generally recommend HCWB surveys in more typical HCWB habitat in proximity to known occurrences, macroinvertebrate surveys throughout the state that key Haliplidae to genus (instead of to family, which is the standard protocol for most macroinvertebrate surveys) could help further clarify the species' distribution and habitat requirements.

Updated Information and Current Species Status

Range and distribution

Hungerford's crawling water beetle occurs in northern Michigan and the Bruce Peninsula of Ontario. The known distribution of the species has increased from 3 known populations at the time of listing to 13 populations at the time of this 5-year review (Figure 1). The current U.S. populations are distributed across seven watersheds (at the HUC 10 level) (Figure 2). Since the last 5-year review, two new populations have been discovered in northern Michigan in Portage Creek in Kalkaska/Crawford Counties and Mullet Creek in Cheboygan County. The Mullet Creek record is from a specimen collected in 2009 but was not identified as HCWB until 2020.

New information on each river obtained since the previous 5-year review is discussed below.

Carp Lake River

HCWB has been found in this stream in association with Oliver and Gill Roads. The undersized culverts at Oliver Road were replaced in 2006, and HCWB adults were relocated upstream to another extant site at Gill Road. Oliver Road was recolonized by HCWB following culvert replacement (Grant *et al.* 2011). Gill Road has supported larger number of HCWB (with 29 adults found in 2009). In August 2017, 20 adult HCWB were found below Gill Road, including the cobble riffle area below the plunge pool (Vande Kopple 2017a).

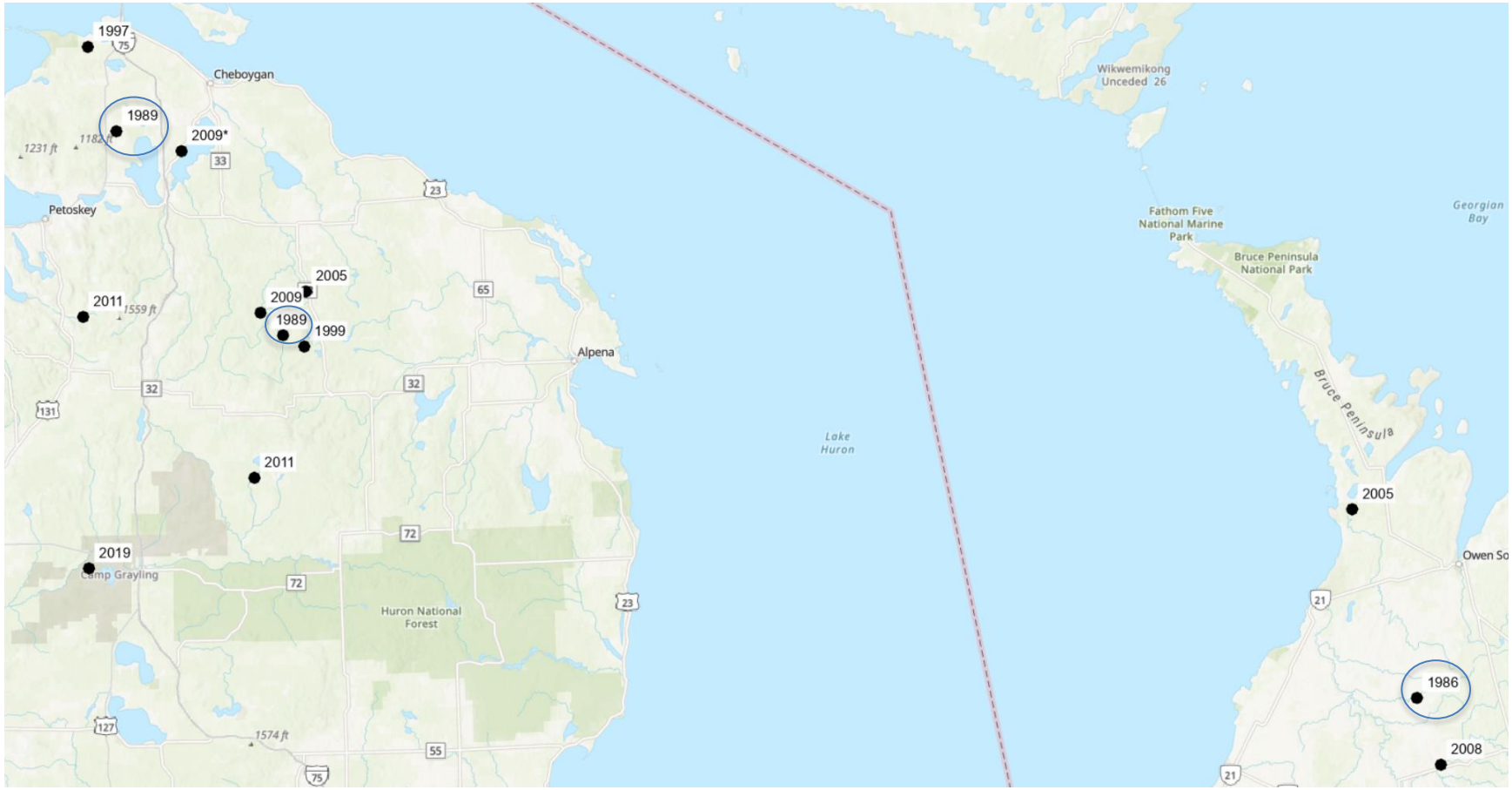

Figure 1. Known rangewide distribution of HCWB in northern Michigan and Ontario labeled with the year of discovery. The locations known at the time of listing are circled.

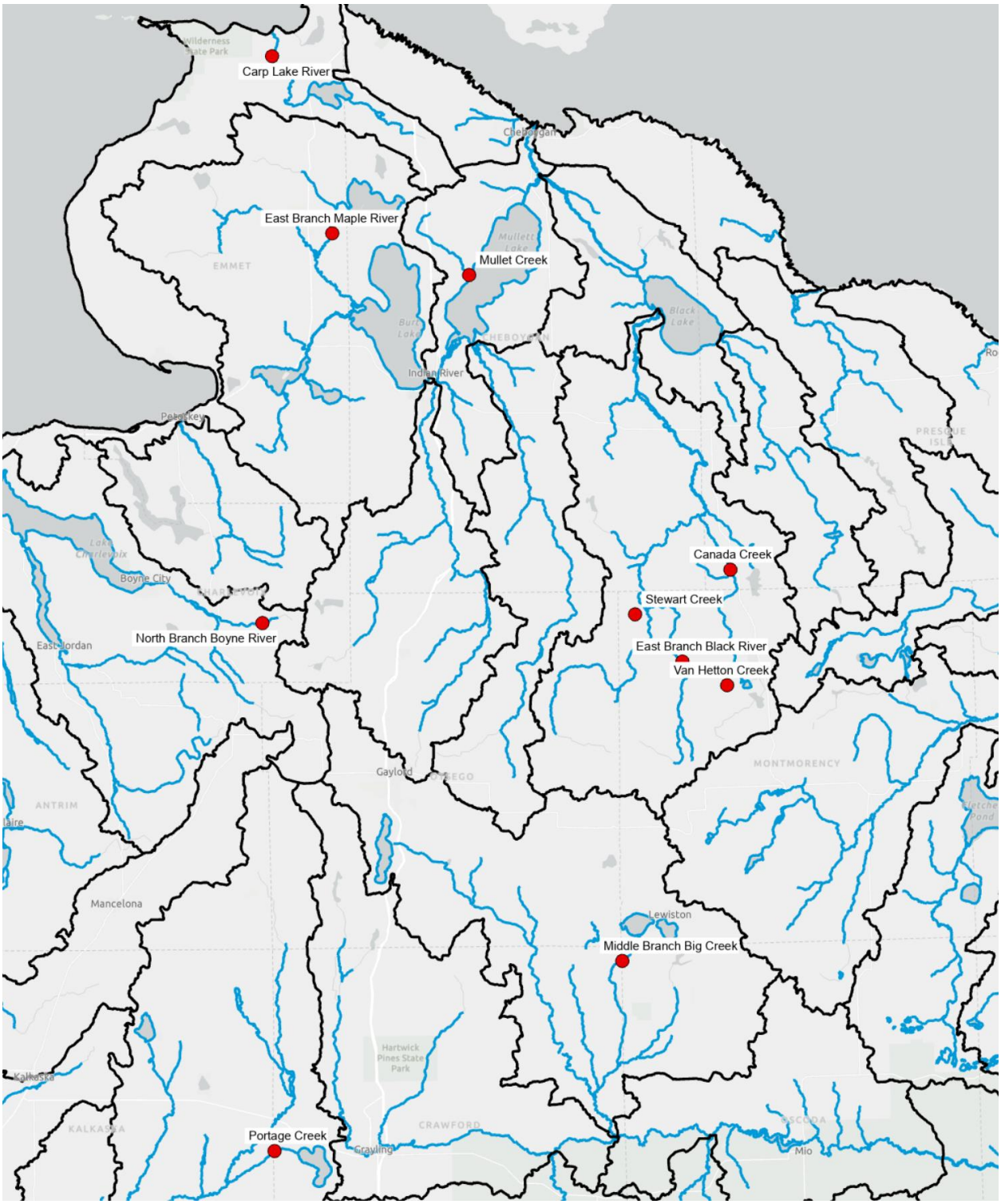

Figure 2. Michigan HCWB locations (labeled with river name) and watershed boundaries (HUC 10).

The perched culverts at Gill Road were replaced with a timber bridge in 2019. Efforts to find and relocate HCWB at this site prior to construction were unsuccessful; high water levels and relatively fast flow, as well as no *Dichotomosiphon* and limited algae in general were noted at the site (B. Ebbers, Great Lakes Ecosystems, pers. comm., 2019). In 2020, post-construction surveys at Gill Road noted that the pool and riffle system was similar visually to pre-bridge installation, but *Dichotomosiphon* was still absent, and no HCWB were found (B. Ebbers, Great Lakes Ecosystems, pers. comm, 2020). Upstream of Gill Road, habitat was unsuitable in 2017 due to recent beaver activity (Vande Kopple 2017a), but in 2020 the upstream habitat looked promising, including a *Dichotomosiphon* colony a few hundred feet upstream of the road crossing (B. Ebbers, Great Lakes Ecosystems, pers. comm., 2020). Since *Dichotomosiphon* occurs upstream of the Gill Road crossing, it is likely that it will eventually recolonize downstream areas including the pool and riffle system at Gill Road (B. Ebbers, Great Lakes Ecosystems, pers. comm., 2020). Other areas upstream of Gill Road in the Carp Lake River were surveyed in 2020, specifically the road/stream crossings at Munger and Reed Roads, and no HCWB were found (Dey 2021).

East Branch of Maple River

HCWB has been documented throughout several miles of this river from the Douglas Lake Road crossing downstream for approximately 2.5 miles until the two-track crossing just above Woodland Road/Lake Kathleen. Due to its proximity to the University of Michigan Biological Station, the East Branch of Maple River is the best studied population of HCWB and has the largest known population of this species. The results of a mark-recapture study in 2001 in one pool indicated population numbers near 1,000 (Grant *et al.* 2002). Because HCWB occurs in several locations along 2.5 miles of the stream, we expect that the population in the East Branch of Maple River is much greater than 1,000 individuals, although we do not have population estimates in recent years.

In July 2012, ten adult HCWB were found in three locations just upstream of Lake Kathleen. One year later, one adult was collected from the pool below the Lake Kathleen dam, but a follow up survey just below the dam during the anticipated peak of adult abundance (August 2013) did not find any HCWB (Vande Kopple *et al.* 2013). The one adult may have washed down from an upstream site (*i.e.*, the population immediately above Lake Kathleen), or HCWB may occur in the main stem in low densities.

In 2018, the dam at Lake Kathleen was removed as well as undersized culverts at the two-track stream crossing just upstream of the dam. Pre-construction HCWB surveys attempted to find any HCWB in the area of disturbance and relocate them upstream. A total of 16 adults and 14 larvae were moved in July and August 2018 in preparation for construction at Lake Kathleen and the two-track (Vande Kopple 2018). Surveys were conducted in 2019 and 2020 to assess habitat conditions and HCWB presence, post-construction. At the two-track crossing, the river has changed significantly since the culverts were removed; the river current is faster now, and *Dichotomosiphon* no longer occurs at the two-track crossing (B. Ebbers, pers. comm., 2019). In 2019, it looked like there was significantly more potential HCWB habitat located farther downstream, although it had not yet been colonized by either *Dichotomosiphon* or HCWB. One adult HCWB was found about 200 feet downstream of the new two-track stream crossing. In 2020, no HCWB were found. The suitable habitat observed downstream in 2019 was no longer present in 2020, evidence of the continuing dynamic nature of this stream. Habitat upstream of

the two-track crossing has not changed following the dam removal project (B. Ebbers, pers. comm., 2021).

East Branch of Black River
Only a few individuals have been found in this river from 1989 to 1996 (Strand 1989, Legge 1996). In October 2019, one adult was accidentally collected at Barber Bridge during macroinvertebrate surveys (C. Keason, Tipp of the Mitt Watershed Council, pers. comm., 2019) indicating HCWB still occurs in this river.

Van Hellon Creek (also known as Van Hetton and Van Helen Creek)
HCWB was first discovered in Van Hellon Creek in July 1999 (Grant *et al.* 2000). In 2010, the culvert at the Roth Road crossing was replaced with a larger culvert (USFWS 2010). Three adult beetles were removed from the site before construction and relocated 0.5 mile downstream where a population of HCWB had been confirmed (USFWS 2011). Post-construction surveys in 2011 found five adult beetles immediately below the new culvert (Grant *et al.* 2011). In July 2012, the site was revisited to assess recolonization following the culvert replacement. Grant *et al.* (2012) found that the culvert replacement project, although well engineered, resulted in re-distributed detritus that had accumulated for many years on the upstream side of the culvert. A low water year in 2012 and increased stream flow through the new culvert resulted in a significant down-cutting of the stream channel through the rich accumulated organic layer present immediately upstream of the road crossing, exposing a large area of mud flats on that side, and sending some organic material downstream. The 2012 low water level, a result of sustained dry conditions, apparently increased the proportion of groundwater to base flow, resulting in colder temperatures than HCWB is typically found in (Grant *et al.* 2012). No beetles were found below the culvert in 2012 despite relatively intensive survey effort (Grant *et al.* 2012).

HCWB may still be extant at the relocation site, farther downstream of the road crossing. The water temperatures were generally warmer than at the road crossing, with patches of *Dichotomosiphon* easily visible (Grant *et al.* 2011). This location is downstream from a beaver dam that was active at the time of the survey.

Stewart Creek
The culvert at this site was replaced in the summer of 2012 (USFWS 2012). Prior to the construction, Stewart Creek was surveyed, in late June of 2012 (Grant *et al.* 2012). In June, two people searched the first 40 feet of the creek downstream of the old culvert, for 30 minutes each, and found no beetles. In July, following construction, two adult beetles were found with only ten minutes effort. *Dichotomosiphon* beds were still present after culvert installation, and the water temperature was near ideal for HCWB (Grant *et al.* 2012). In 2013, only one beetle was found. Although the culvert replacement did not appear to result in negative effects to HCWB habitat at this site, a large cedar tree had fallen directly on the best *Dichotomosiphon* beds downstream of the culverts (Vande Kopple *et al.* 2013). The current status of this site is not known.

Canada Creek
No new information on Canada Creek since the last status review.

Mullet Creek
In February 2020, a HCWB larva was found in a collection. The specimen had been collected in May 2009 from Mullet Creek/Straits Highway (C. Keason, Tipp of the Mitt Watershed Council, pers. comm., 2020). According to the 2009 data sheet, it was originally mistaken for an Elmidae. The specimen was confirmed as HCWB in March 2020 (B. Vande Kopple, Retired Resident

Biologist University of Michigan Biological Station, pers. comm., 2020). This record represents a new county record and a new watershed. The current status of this site is not known.

North Branch of the Boyne River
No new information on North Branch Boyne River since the last status review.

Middle Branch of Big Creek
This site was discovered in 2011 when ten adult HCWBs were located at the Pickerel Road crossing (Grant *et al.* 2011). Surveys in 2019 found 7 adults in the same general location (Leisen 2019a). In 2020, the Oscoda County Road Commission removed the undersized culvert and replaced it with an appropriately-sized structure (USFWS 2020a). During a pre-construction survey, one adult was found and relocated downstream of the area of disturbance (Leisen 2020).

Portage Creek – In August and September 2019, surveys of Portage Creek in Kalkaska County located several HCWB at two locations of Portage Creek within the Camp Grayling Michigan National Guard installation (Dingledine 2020). The habitat surveyed was predominantly sandy substrates with large woody debris, to small cobble and pebble substrate. The HCWBs were found in association with *Chara*. A few individuals were found in two additional locations within Portage Creek in 2020, and additional surveys at Camp Graying are planned in 2021 (Dingledine 2020).

No new information on the Ontario populations was received since the previous status review.

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

Conservation Measures (since last 5-yr review)

In 2018, Bob Vande Kopple (species expert and recently retired resident biologist at the University of Michigan Biological Station (UMBS)), Service, UMBS, and Huron Pines co-hosted a workshop for interested parties to increase awareness and experience working with HCWB. Participants learned how to identify HCWB and closely related species, identify suitable habitat, important life history information, and hands-on survey techniques. One of the goals of the workshop was to increase the number of people qualified to conduct surveys for this species. Since the workshop, four new 10(a)(1)(A) permits were issued (to supplement the one existing permit held by Bob Vande Kopple).

The Michigan Department of Natural Resources Fisheries Division developed a draft model to identify streams that are highly suitable for HCWB across Michigan (A. Cooper and K. Wehrly, MDNR, unpubl. data., 2018). The model results can help us target future survey effort across the state. Based on variables determined to be most important to predicting HCWB presence, and considering future anticipated changes to these variables due to changing climate, they predicted an increase in suitable habitat availability when comparing current conditions to mid-century (2046-2065) (A. Cooper and K. Wehrly, MDNR, unpubl. data., 2018). Many stream reaches in northern Michigan have the geology, groundwater input, and flow regimes that typify good HCWB habitat, but they are currently too cold. A predicted increase in the mean water temperature in July resulted in an increase in availability of suitable HCWB habitat (A. Cooper and K. Wehrly, MDNR, unpubl. data., 2018). These data are preliminary and will be finalized in the coming year.

Threats

The listing rule cites the research results of Wilsmann and Strand (1990), which indicated the rarity of the species and its geographic isolation. The Service analyzed the status survey, as well as other information, and determined that the beetle is facing serious threats and should be protected as an endangered species (USFWS 1994). The listing rule speculated that human activities, such as fish management, logging, beaver control, dredging, stream pollution, and general stream degradation, have likely contributed to the reduction of HCWB habitat. Other threats identified include amateur collections, disease, or predation. In general, threats to the species include any activities that degrade water quality or remove or disrupt the pools and riffle environment of streams in which this species lives.

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

It has been speculated that beaver are important for creating and maintaining habitat for HCWB, but beaver activity can also eliminate HCWB habitat. Although a beaver dam typically creates good habitat immediately below the structure, it often eliminates suitable habitat for many miles upstream and can result in considerable siltation downstream. In relatively warmer river systems where HCWB is abundant, beaver activity may be of little value or consequence to the beetle, or even detrimental to otherwise good HCWB habitat. For example in the Van Helen Creek system, beaver dams appear to alter, reduce, or temporarily eliminate HCWB habitat in flooded areas. Conversely, in colder waters, like the North Branch of the Boyne River, beaver activity may be important to HCWB survival (Grant *et al.* 2011). In these rivers, beaver activity may favor HCWB, by warming the water, to a temperature range suitable for *Dichotomosiphon* growth (Grant *et al.* 2011). Beaver activity can also affect flow rates to create or eliminate suitable HCWB habitat. For example, in the East Branch of the Maple River, recent efforts to restore the river to more free-flowing, natural conditions has increased flow rates and resulted in elimination of *Dichotomosiphon* in portions of the stream (B. Ebbers pers. comm, 2020). Beaver activity in this area may slow the river's flow to the extent that suitable habitat including sandbars and *Dichotomosiphon* colonies can re-form (B. Ebbers, pers. comm, 2020). In other streams, such as upstream of Gill Road in the Carp Lake River (VandeKopple 2017b), beaver activity has resulted in loss of suitable habitat where the impounded areas become stagnant and silty. Thus, beaver activity and/or management can have benefits at some sites and eliminate habitat at others.

Similarly, culvert replacement projects where HCWB is known to occur have benefits and potential risks that must be carefully weighed. Removing undersized culverts can improve water quality by restoring natural substrate, reducing erosion and loading of road-associated sediments into the river, remove barriers to dispersal, and stabilize hydrology of the stream. Overall, we expect long-term benefits to HCWB if culvert replacement projects occur, as long as HCWB are relocated to nearby suitable habitat immediately prior to construction. Generally, once the habitat stabilizes and *Dichotomosiphon* subsequently recolonizes the area, we expect HCWB to recolonize suitable habitat following culvert replacement projects. However, if the road crossing project subsequently removes suitable habitat features (*e.g.,* if high levels of sand deposition occur, or if we lose *Dichotomosiphon* colonies*)*, it can take years for suitable habitat to return following construction. Adult beetles presumably shift around in the system, within or among years, to wherever *Dichotomosiphon* is established in sufficient quantities and other suitable habitat features allow for successful HCWB reproduction (Grant *et al.* 2011).

Overutilization for commercial, recreational, scientific, or educational purposes:

Macroinvertebrates are indicators of water quality and are regularly monitored throughout the

region where HCWB occurs. Many protocols include collection (specimens are placed in a vial in isopropyl alcohol). Specimens are identified only to family (*e.g.*, Haliplidae), often by volunteers with limited training, and some HCWB may be inadvertently collected. In fact, this has happened at least a couple of times since HCWB was listed (discussed above). Outreach is planned in 2021 to increase awareness of the endangered status of HCWB, how to easily identify HCWB, and encourage survey crews to identify all Haliplids to species before collecting (and instead photo document, if unsure); this could greatly reduce this threat and potentially increase our knowledge of the species' distribution.

Disease or predation:
One person surveying for HCWB mentioned concerns about fish predation at the Pickerel Road crossing of the Middle Branch Big Creek, specifically the presence of many Creek Chub (*Semotilus atromaculatus*) during release of beetles back into the water. In an effort to reduce predation, they successfully used the collecting tray to shield the HCWB from potential predation and released them into dense cover. The HCWB survey protocol was updated to add minimization measures when releasing HCWB when fish are present.

Introduction of new non-native aquatic species could cause significant threat to HCWB (through increased predation, competition for resources, loss of habitat), but no new invasive species are known to occur within occupied HCWB streams at this time. Conservation organizations and anglers are monitoring the spread of invasive species in northern Michigan to manage this threat to aquatic resources.

Inadequacy of existing regulatory mechanisms:
No new information since last 5-year review.

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 harm to HCWB (USFWS 2004). No new TFM treatments have been proposed within known occupied HCWB streams since the last 5-year review, and none are planned currently, but future treatments could be necessary if sea lamprey populations increase in HCWB streams.

The existence of relatively few 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. Numbers in a particular location appear to fluctuate widely (*i.e.*, one survey might find 20 adults but later only one or two beetles are found); this may be related to normal fluctuations in seasonal abundance due to HCWB's life history, with fewer adults being present during certain months, in addition to beetles being more widely dispersed, unlike when females are ovipositing in the *Dichotomosiphon* mats where they are highly concentrated (M. Grant, University of Michigan Biological Station, pers. comm., 2010). Adults also shift around in the river as habitat availability shifts. Additional survey effort

(both within known occupied streams and suitable habitat elsewhere in the region) would be helpful to clarify the status of HCWB populations and the species as a whole.

Synthesis

In many occupied streams, undersized culverts at stream/road crossings have been replaced to improve water quality and reduce sedimentation into the stream. These projects generally improve conditions for HCWB over the long-term by reducing sedimentation and erosion, especially when excessive sand deposition is avoided and *Dichotomosiphon* is maintained to the extent possible. Beaver activity can both create and eliminate suitable habitat. Adult beetles presumably shift around in the system, within or among years, to wherever *Dichotomosiphon* is established in sufficient quantities and other suitable habitat features allow for successful HCWB reproduction (Grant *et al.* 2011).

Outreach efforts are planned to increase identification of HCWB during general macroinvertebrate surveys, and training has been offered recently to increase the number of people qualified to conduct targeted HCWB surveys. Our hope is that these efforts will help improve our understanding of the species' distribution.

The distribution of the species is wider than what was known at listing, but there are still only a relatively few known populations, most represented by small numbers of individuals. New information about the species' habitat requirements and life history has been discovered since the time of listing, but much is still unknown about resource requirements, population dynamics, and the extent to which certain stressors act on populations. At this time, the new information on distribution, biology, and threats is not sufficient to warrant a change in status. For the next 5-year review, as staffing and resources allow, a status assessment using the Species Status Assessment (SSA) Framework would be valuable.

Recommended Recovery Actions

Highest priority recovery actions identified in the Recovery Plan for the next 5 years:

- 1.5.2. Conduct restoration activities that result in overall benefits to the watershed after ensuring benefits to HCWB outweigh risks
- 2.1. Conduct studies to examine life history and ecology
- 2.2. Examine habitat requirements
- 2.4. Conduct studies to examine population dynamics and demography
- 2.5. Investigate genetic heterogeneity and population viability
- 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
- 4. Develop and implement public education and outreach

RESULTS

U.S. FISH AND WILDLIFE SERVICE
STATUS REVIEW of *Brychius hungerfordi*

Current Classification: Endangered

Status Recommendation resulting from Status Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (Indicate reasons for delisting per 50 CFR 424.11):
____ The species is extinct
____ The species does not meet the definition of an endangered or threatened species
____ The listed entity does not meet the statutory definition of a species.
__x__ No change needed

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service, Michigan Field Office

Approve SCOTT HICKS Digitally signed by SCOTT HICKS Date: 2021.03.30 10:08:18 -04'00'

REFERENCES

Dey, L. 2020. Pre-Construction Survey for Hungerford's Crawling Water Beetle on Carp River at Reed Road and Munger Road. Report to the U.S. Fish and Wildlife Service, submitted by the Little Traverse Bay Band Odawa Indians. 3 pp.

Dey, L. 2021. Endangered species permit annual report for Hungerford's crawling water beetle (2020 field season). Report to the U.S. Fish and Wildlife Service, submitted by the Little Traverse Bay Band Odawa Indians. 5pp.

Dingledine, N. 2020. Annual report of activities of permit #TE90426-C-0. Report to the Michigan Field Office. 17 pp.

Dingledine, N. 2019. Annual report of activities of permit #TE90426-C-0. Report to the Michigan Field Office. 66 pp.

Grant, M. and R. Vande Kopple. 2009. A stable isotope investigation into the feeding behavior of *Brychius hungerfordi* Spangler (Coleoptera: Haliplidae), a federally endangered crawling water beetle. The Coleopterist Bulletin 63(1): 71-83.

Grant, M. and R. Vande Kopple. 2003. Preliminary report of the feeding habits of Hungerford's crawling water beetle. Report to the U.S. Fish and Wildlife Service. 4 pp.

Grant, M., B. Scholtens, R. Vande Kopple, and B. Ebbers. 2002. Size estimate of a local population of *Brychius hungerfordi* (Coleoptera: Haliplidae). The Great Lakes Entomologist 35(1): 23-26.

Grant, M., R. Vande Kopple, and B. Ebbers. 2011. Hungerford's crawling water beetle survey, Northern Lower Michigan, 2011 Field Season. Report to the U.S. Fish and Wildlife Service. 10 pp.

Grant, M., R. Vande Kopple, and B. Ebbers. 2012. Hungerford's crawling water beetle survey, Northern Lower Michigan, 2012 Field Season. Report to the U.S. Fish and Wildlife Service. 11 pp.

Grant, M., R. Vande Kopple, and B. Ebbers. 2000. New distribution record for the endangered crawling water beetle *Brychius hungerfordi* (Coleoptera: Haliplidae) and notes on seasonal abundance and food preferences. The Great Lakes Entomologist 33(3-4): 165-168.

Great Lakes Environmental Center, Inc. (GLEC). 2018. Biological Assessment of the Gill Road over Carp Lake River Timber Bridge Project. Submitted to Little Traverse Bay Bands of Odawa Indians. 22 pp.

Hoving, C. Lee, Y., Badra, P., and B. Klatt. 2013. Changing climate, changing wildlife. A vulnerability assessment of 400 species of greatest conservation need and game species in Michigan. Michigan Department of Natural Resources, Wildlife Division Report No. 3564. 82pp.

Hudson, P. L., B. M. Davis, S. J. Nichols, and C. M. Tomcko. 1986. Environmental studies of macrozoobenthos, aquatic macrophytes, and juvenile fishes in the St. Clair-Detroit River system, 1983-1984. Administrative Report. National Fisheries Center-Great Lakes, U.S. Fish and Wildlife Service, No.86-7.

Leisen, J. 2019a. Hungerford's Crawling Water Beetle Survey Report – August 7, 2019. Report submitted to the U.S. Fish and Wildlife Service, submitted by Huron Pines, Gaylord, Michigan. 6pp.

Leisen, J. 2019b. 2019 Annual Permit Report, TE 33366D-0. Report submitted to the U.S. Fish and Wildlife Service, submitted by Huron Pines, Gaylord, Michigan. 5 pp.

Leisen, J. 2020. 2020 Annual Permit Report, TE 33366D-0. Report submitted to the U.S. Fish and Wildlife Service, submitted by Huron Pines, Gaylord, Michigan. 3 pp.

Meffe, G. K. and Carroll, C. R. 1997. Principles of Conservation Biology. Second edition. Sinauer Associates, Inc., Sunderland, Massachusetts.

Merritt, R., Cummins, K., and M. B. Berg (Eds.). 2019. An introduction to the aquatic insects of North America. 5th edition. Kendal Hunt Publishing. 1498 pp.

Mousseau, T. 2004. Taxonomy, classification, reconstructed phylogeny, biogeography, and natural history of nearctic species of' *Brychius* Thomson (Coleoptera: Haliplidae). Master's Thesis, University of Manitoba, Winnipeg. 155 pp+ appendices.

Mousseau, T. and R. E. Roughley. 2007. Taxonomy, Classification, Reconstructed Phylogeny and Biogeography of Nearctic Species of *Brychius* Thomson (Coleoptera: Haliplidae). The Coleopterists Bulletin 61(3): 351-397.

Pennak, R. W. 1953. Fresh-water invertebrates of the United States. The Ronald Press Company, New York. 769 pp.

Roughley, R. E. and D. E. Larson. 1991. Aquatic Coleoptera of springs in Canada. Memoirs of the Entomological Society of Canada 155: 125-140.

Shaffer, M. L. 1981. Minimum population size for species conservation. BioScience 31(2): 131-134.

U.S. Fish and Wildlife Service (USFWS). 1994. Determination of endangered status for Hungerford's crawling water beetle. Final Rule. Federal Register 59(44): 10580-10584.

U.S. Fish and Wildlife Service (USFWS). 2006. Hungerford's Crawling Water Beetle (*Brychius hungerfordi*) Recovery Plan. U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. vii + 82 pp.

U.S. Fish and Wildlife Service (USFWS). 2012. Biological Opinion for Blue Lakes Road Culvert Replacement Project in Stewart Creek. Submitted to the USFWS Alpena FWCO. Biological Opinion No. 12-R3-ELFO-02. 22pp.

U.S. Fish and Wildlife Service (USFWS). 2017. Biological Assessment of the Woodland Road, Lake Kathleen Dam, and Two-Track Crossing Project on the Maple River. Prepared by the Alpena Fish and Wildlife Conservation Office for the Michigan Field Office. 22pp.

U.S. Fish and Wildlife Service (USFWS). 2018a. Biological Opinion, Effects to the Hungerford's Crawling Water Beetle *(Brychius hungerford*i) from the Culvert Replacement along Pickerel Lake Road over the Middle Branch of Big Creek, Oscoda County. 26pp.

U.S. Fish and Wildlife Service (USFWS). 2018b. Biological Opinion for the Woodland Road, Lake Kathleen Dam, and Two-Track Crossing Project on the Maple River, Emmet County, Michigan. 42 pp.

U.S. Fish and Wildlife Service (USFWS). 2019. Biological Opinion for the Gill Road Timber Bridge Project, Carp Lake River, Emmet County, Michigan. 33pp.

U.S. Fish and Wildlife Service (USFWS). 2020a. Biological Opinion, Effects to the Hungerford's Crawling Water Beetle *(Brychius hungerford*i) from the Culvert Replacement along Pickerel Lake Road over the Middle Branch of Big Creek, Oscoda County. 26pp.

U.S. Fish and Wildlife Service (USFWS). 2020b. Biological Assessment Munger and Reed Road Timber Bridge Project, Carp Lake River, Emmet County, Michigan. 15pp.

U.S. Fish and Wildlife Service (USFWS). 2020c. Biological Opinion, Effects to the Hungerford's Crawling Water Beetle (*Brychius hungerfordi*), from Culvert Replacements at Reed and Munger Roads over the Carp Lake River, Emmet County, Michigan. 31 pp.

U.S. Fish and Wildlife Service (USFWS). 2020d. Biological Opinion. U.S. Army Corps of Engineers' permit issuance for Michigan Electric Transmission Company's Riggsville to Port Calcite and Port Calcite to Rockport Rebuild, Presque Isle and Cheboygan Counties, Michigan. 119pp.

U.S. Fish and Wildlife Service (USFWS). 2020e. Draft Hungerford's crawling water beetle survey and relocation protocol. 16pp.

United States Fish and Wildlife Service (USFWS). 2004. Biological opinion for sea lamprey control in the Carp Lake River. USFWS, East Lansing Field Office, East Lansing, MI. Log No.05-R3-ELFO-01. 25 pp.

Van Vondel, B.J. Description of the third instar larva of *Haliplus variomaculatus* Brigham & Sanderson with notes on larvae of Nearctic Haliplidae (Coleoptera). Tijdschrift voor Entomologie 154: 127–133

Vande Kopple, R. 2017a. A survey of the Gill Road pool of the Carp Lake River for *Brychius hungerfordi.* Report to the U.S. Fish and Wildlife Service. 5pp.

Vande Kopple, R. 2017b. Report for Permit TE11035A-2. Report to the U.S. Fish and Wildlife Service. 3pp.

Vande Kopple, R. 2018. Report for Permit TE11035A-2. Report to the U.S. Fish and Wildlife Service. 5pp.

Vande Kopple, R. 2019. Report for Permit TE11035A-2. Report to the U.S. Fish and Wildlife Service. 4pp.

Vande Kopple, R. and M. Grant. 2004. Carp Lake River Section 7 Consultation: *Brychius hungerfordi* and the proposed sea lamprey barrier project. Biological Assessment. Available From: U.S. Army Corps of Engineers. 11 pp.

Vande Kopple, R., M. Grant and B. Ebbers. 2013. Hungerford's crawling water beetle survey, Northern Lower Michigan, 2013 Field Season. Report to the U.S. Fish and Wildlife Service. 18 pp.

Wilsmann, L. A. and R. M. Strand. 1990. A status survey of *Brychius hungerfordi* (Coleoptera: Haliplidae) in Michigan. Report to the U.S. Fish and Wildlife Service. 51 pp.