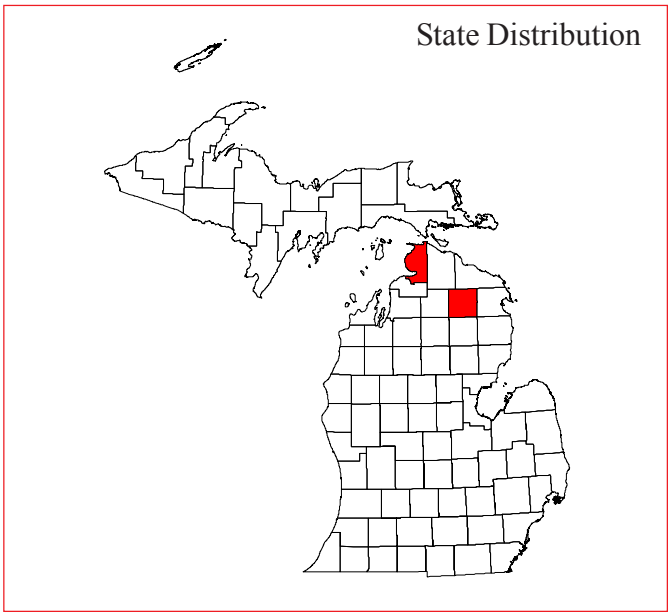
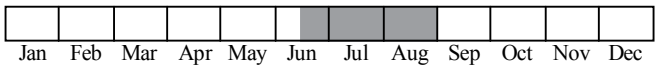
Brychius hungerfordi (Spangler) Hungerford's crawling water beetle

Photo by R. M. Strand





Status: Federal and state endangered

Global and state rank: S1/G1

Family: Haliplidae (crawling water beetle family)

Range: The Hungerford's crawling water beetle is currently known from five locations in Michigan's northern Lower Peninsula and Ontario's Bruce Peninsula. It has the easternmost range of the four North American species of the genus *Brychius*, which is Holarctic in distribution. The three other species in western North America generally occur at more northerly latitudes than *B. hungerfodi*, with scattered, localized populations extending farther south in mountainous regions. The western species' preference for cool, glacial streams, and the fragmented and highly localized distribution of Hungerford's crawling water beetle in northern Michigan and southern Ontario, have led some researchers to assert that it is a post-glacial relict that was more widespread in eastern North America during glacial intervals (Wilsmann and Strand, 1990). Extensive surveys have failed to locate *B. hungerfordi* in Wisconsin and Minnesota, as well as in additional locations in Michigan and southern Canada.

State distribution: The Hungerford's crawling water beetle is currently known from four sites in the northern tip of the Lower Peninsula, all in Emmet and Montmorency counties. It was first collected in 1952 from the East Branch of the Maple River in Emmet County (Spangler 1954). Additional populations were discovered in the East Branch of the Black River in Montmorency County in 1989 (Wilsmann and Strand 1990), the Carp River in Emmet County in 1997 (Keller et. al 1997), and in Van Hetton Creek in Montmorency County in 1999 (Vande Kopple pers. comm.).

Recognition: Adult *B. hungerfordi* are **small, yellowish brown beetles with irregular dark markings and narrow longitudinal stripes on the wing covers**, or elytra. **Each stripe consists of a series of fine, closely spaced, and darkly pigmented perforations**. Adults have a body length of 0.15-0.17 inches (3.70-4.35 mm) and a width of 0.07-0.09 inches (1.90-2.25 mm). Females tend to be larger than males (Wilsmann and Strand 1990). Hungerford's crawling water beetle adults may be distinguished from all other haliplids in Michigan, as well as from members of the similar aquatic beetle family, Elmidae, by the shape of the pronotum, that is, the dorsal plate between the head and the base of the wings. In *B. hungerfordi*, **the sides of the pronotum are nearly parallel for the basal 2/3 and widened midlaterally** (Hilsenhoff and Brigham 1978). The larva of *Brychius* can be readily distinguished from larvae of all other described haliplids by having the third antennal segment shorter than the second segment (Strand and Spangler 1994). *Brychius hungerfordi* larvae are light yellowish brown and have cylindrical bodies that taper to a hooked tail. They are rather stiff, and possess short legs with single tarsal hooks Wilsmann and Strand 1990).

Best survey time: The best time to survey for the beetles is from mid June through the end of August.

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Adult numbers are high in early summer, then decline in late summer as the number of larvae increase. Adults and larvae can be dislodged from the substrate with a kick and caught downstream in a standard D-shaped aquatic sampling net. Larvae can also be caught by scooping up algae and underlying substrate with a small spade. The samples can then be washed through a 1.4 mm brass sieve and emptied into a white plastic dish pan filled with stream water for identification.

Habitat: All of the sites where the beetles have been found are characterized by open to partially open canopy, moderate to fast stream flow, good stream aeration, inorganic substrate and alkaline water conditions (USFWS 1994). Adults are often found in riffles and other well-aerated stream segments with clean cobble or gravel with an underlying sand substrate and attached aquatic plants. The water is typically cool (15° to 25°) and is from a few inches to a few feet deep. Adults are usually encountered crawling on bare gravel and rocks in portions of the stream with stronger currents, while larvae seem to prefer areas of slower current with dense growths of macroalgae, notably *Chara* (Wilsmann and Strand, 1990). White (1986) observed adults in water that was greater than 0.5 m deep where the current velocity was greater than 50 cm per second. The substrate at these locations consisted of larger rocks (>25 cm in some direction) covered with green alga *Cladophora glomerata.*

Some researchers have speculated that beaver activity influences the local distribution of *B. hungerfordi* populations within a watershed. The impoundments formed behind beaver dams minimize fluctuations in downstream flow, reducing the frequency and magnitude of flooding and drying episodes that might prove detrimental to the beetles. Additionally, the riffles created on the downstream side of beaver dams are preferred environments for the adult beetles; the highest density *B. hungerfordi* populations are below beaver dams or immediately downstream of human-made structures that create similar conditions, such as wing dams and culverts (Wilsmann and Strand, 1990). Larvae and adults apparently require the clean gravel substrata with high algal growth that beaver dams and human-made impoundments set up and maintain (Strand and Spangler 1984).

Biology: The life history of the Hungerford's crawling water beetle is not completely documented, though it is believed to be similar to that of other haliplids (Hickman 1929, 1930, and 1931). Both adults and larvae are thought to be herbivorous, feeding on algae and periphyton. Like all haliplids, adult *B. hungerfordi* respire air from a bubble held beneath their elytra (wing covers) and the fused metacoxal plates of their hind legs, which they must periodically replenish at the surface. This air bubble also serves a hydrostatic function and allows the beetle to float to the surface (Hickman 1930). Larvae do not take in air at the surface, but rather absorb oxygen directly from the water through tracheal gills (Holmen 1987). White (1986) concluded from his observations of adult *B. hungerfordi* that they were strong swimmers (unlike other haliplids) and that their torpedo body shape may be an important aid in maintaining their position within the riffle. He further observed that their trip through the water column to the surface and back was quite rapid and that there was minimal downstream displacement. Fish, tadpoles and other aquatic insects prey upon haliplids (Hickman 1931). The crawling water beetle's habit of crawling among plants and filamentous algae may serve to hide them from many predators (Wilsmann and Strand 1990). White (1986) suggests that the adults microhabitat preference among rocks in shallow swiftly flowing water, place them out of the range of midwater and benthic predators. The larva, with its stiff body and hooked tail is adapted for crawling through vegetation where it too could avoid predation. There is no evidence that *B. hungerfordi* has a dispersal flight as no adults have ever been found at blacklight stations and the adults seem unusually reluctant to fly. Thus the primary mode of dispersal appears to be movement within the stream system (Wilsmann and Strand 1990).


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Reproduction in haliplids occurs in the spring and early summer though there may be another generation in the fall (Hickman 1931). Members of this family lay their adhesive eggs on filamentous algae and aquatic plants from early May through early July. The larvae go through three instars before pupating in moist soil a few inches above the water line. The time elapsing between oviposition and emergence of the adult is temperature dependent, but may be as little as seven weeks. While other haliplids may overwinter as either adults or larvae, numbers of adult *B. hungerfordi* decline as the summer progresses, while larval numbers increase. Strand (1989) concluded from his studies that the larvae he observed in the fall were in a state of diapause that may represent the overwintering stage of *B. hungerfordi*. Consequently, some researchers have concluded that the species overwinters in the larval stage (Wilsmann and Strand, 1990).

Conservation/management: The Hungerford's crawling water beetle was listed as state endangered in 1987 by the Michigan Department of Natural Resources (Michigan Dept. Nat. Res., 1989). The U.S. Fish and Wildlife Service later listed it as federally endangered in 1994 since at that at that time it was only known from three isolated locations in the world and because of the rarity and threats associated with its habitat (USFWS 1994).

In the recent past, stream modification has been the primary threat to this species. This includes dredging, stream pollution, logging, channelization, beaver control, bank stabilization, and impoundment. Fish management in the form of introductions, removals and chemical treatments also poses a threat to *B. hungerfordi*. In particular, the introduction of brown trout can increase the likelihood of predation and may explain why the beetle is absent from streams where the trout was introduced in the early part of the century (Strand 1989, Wilsmann and Strand 1990, USFWS 1994). Removal of existing beaver dams upstream from *B. hungerfordi* populations could endanger the population downstream. At the same time, new beaver activity should be carefully monitored to ensure that new floodings do not eliminate known beetle populations. The cleaning out of ditches and culverts near occupied streams should be approached cautiously and only after careful discussion as it could pose a serious threat to the beetle if not done properly.

Until more is known about the biology of this species, wise management will simply be the protection of both the physical and chemical components of its habitat and protection against unnatural levels of predation (Wilsmann and Strand 1990). Given the rapid increase in recreational development and demands for fish, wildlife and forest management in northern Michigan, unknown populations could easily be extirpated before they are discovered. In addition, with so few known populations, the chance of local extinction is quite high. Thus protection of existing populations and the establishment of additional populations in suitable habitat may be the best hedge against extinction (Wilsmann and Strand 1990, USFWS 1994).

Research needs: Locating additional populations through field surveys is of critical importance to insure that these populations are adequately protected. In addition, non-destructive field studies are needed to understand the ecology of this species. More specifically very little is known about this beetle's population dynamics, life history, resource requirements, dispersal capabilities, environmental tolerance limits and the effects of predation and environmental variability on the persistence of populations. Establishing new populations of *B. hungerfordi* will not be possible until additional surveys and ecological studies have been conducted (Wilsmann and Strand 1990). The association of this species with beaver activity should also be investigated.

Related abstracts: Red-shouldered hawk, wood turtle.

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