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Hennepin Marsh Amphibian and Reptile Inventory Report

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Executive Summary

In 2019, Herpetological Resource and Management, LLC (HRM) was contracted by Environmental Consulting and Technology (ECT) to conduct a baseline evaluation and make recommendations for habitat rehabilitation targeting amphibians and reptiles in Hennepin Marsh. Work was funded through the National Oceanic and Atmospheric Administration (NOAA). An analysis of historic herpetofauna records, with a preliminary survey and habitat assessment was conducted in 2019 and 2020 to identify habitat restoration targets. Several opportunities were identified for improving amphibian and reptile habitat and later incorporated into the overall restoration of Hennepin Marsh. Pre-restoration monitoring was conducted in 2020 to establish baseline data of species richness, abundance and distribution. The results of these surveys will be used to help evaluate restoration success and wildlife response. Significant findings from these assessments included:

- A total of 7 species of herpetofauna including 3 amphibians and 4 reptiles were documented within the project area.
- All of these species were officially documented for the first time in Hennepin Marsh.
- Based on current conditions and historic records, an additional 14 species may occur in Hennepin Marsh including the State protected Eastern Fox Snake, Mudpuppy, and Butler's Garter Snake.

The restoration of Hennepin Marsh will likely increase the number of wildlife species present and increase the abundance of its already present species. This project will also contribute to restoring lost habitats and degraded fish and wildlife populations within the Detroit

River. These actions will help address measures needed for the removal of Beneficial Use Impairments and ultimately delisting this region as an Area of Concern (AOC).

Introduction

The Detroit River is an important international channel that links Lake St. Clair and the Upper Great Lakes to Lake Erie. Over 100 years of development have degraded the river by eliminating areas of suitable fish and wildlife habitat and introducing various sources of pollution which have contributed to high levels of bacteria, PCBs, and other contaminants in the system. As a result, the Detroit River is one of 43 contaminated sites designated as an Area of Concern (AOC) under the 1987 Great Lakes Water Quality Agreement. Listed among the multiple Beneficial Use Impairments (BUIs) is the loss of fish and wildlife habitat. The river historically supported extensive areas of coastal marsh with shorelines covered by beds of emergent and submergent aquatic vegetation. Urbanization in the watershed resulted in the loss of more than 90% of the river's coastal wetlands (United States Environmental Protection Agency 1996). A majority of the remaining wetland habitat is found on the river's islands, which support a considerable amount of suitable habitat for resident and migratory fish and wildlife. Recently, several groups and agencies from both United States and Canada have spearheaded efforts to conduct restoration that will contribute to the removal of BUIs on the Detroit River and aid in the overall delisting as an AOC.

Hennepin Marsh, located on Grosse Ile Island in the Trenton Channel of the Detroit River, was selected for restoration and enhancement with work beginning in 2019. The natural habitat on the island has become degraded over the last twenty years due to erosion as well as invasive vegetation and restoring this unique Great Lakes ecosystem was identified as a high priority. In 2019, Herpetological Resource and Management (HRM) was contracted by Environmental Consulting and Technology (ECT) as part of a grant from the Friends of the

Detroit River with funding provided by the National Oceanic and Atmospheric Administration (NOAA) to evaluate Hennepin Marsh for restoration opportunities targeting amphibians and reptiles (herpetofauna). Field work began in late spring and summer of 2020 with HRM conducting site visits and rapid habitat assessments to assist in guiding restoration actions targeting amphibians and reptiles. Surveys focused on recording overall amphibian and reptile presence, represented age classes, spatial distribution, and relative abundance, which will be important tools in evaluating the restoration success.

Site Description

Hennepin Marsh is a 154-acre wetland complex located in the Trenton Channel of the Detroit River along the western shore of Grosse Ile. Grosse Ile was historically dominated by Maple forest and hardwood swamp with abundant native emergent vegetation along the shoreline. Trenton Channel experiences heavy watercraft traffic resulting in significant wave action. This, coupled with high water levels, has led to a loss of natural vegetation and hardening of the shoreline causing substantial erosion and providing disturbance conditions suitable for invasive plants to colonize. The marsh complex is separated into two portions by the Grosse Ile Toll Bridge.

North Hennepin Marsh consists of 106 acres of shallow wetland area. Currently, this area is mainly submerged aquatic macrophyte with water levels ranging from 2 – 8 feet. South Hennepin Marsh is composed of 48 acres of coastal wetlands and multiple barrier islands. The vegetation composition of this site is similar to the habitat to the north. The three barrier islands along the southern tip of Grosse Ile have assisted in protecting the respective emergent shoreline from surge driven erosion. Unfortunately, the barrier islands are quickly eroding and will not

provide protection to the coastal wetlands of Grosse Ile for much longer if restoration does not occur. For this project, HRM's efforts were focused on the northern part of the marsh complex.

Herpetofaunal Regulations

Michigan Threatened and Endangered species are afforded protection against collection or take through the Natural Resources and Environmental Protection Act, Part 365, Endangered Species Protection, administered by the Michigan Department of Natural Resources (MDNR) Wildlife Division. The law requires permits when listed species might be harmed, handled, or disturbed, even if proposed work includes conservation activities that are likely to benefit the species long-term (Michigan Department of Natural Resources 1994). Most Special Concern species in Michigan are not afforded protection under this legislation; however, Special Concern reptiles and amphibians are protected from take in accordance with MDNR Fisheries Division Order (224.16). The order states that take from the wild or possession of any such species is prohibited except as authorized under a scientific collectors permit. The Eastern Massasauga Rattlesnake is also listed as Federally Threatened. The Federal Endangered Species Act of 1973 protects threatened and endangered species by prohibiting take including harassing, harming, hunting, shooting, wounding, killing, trapping, capturing, or collecting individuals (U.S. Fish and Wildlife Service and National Marine Fisheries Service 1973).

Methods

Prior to initiating surveys in Hennepin Marsh, a historical review was conducted in 2019 to determine herpetofauna species that may currently occur on the islands. Several data sources were utilized including museum collection records, Michigan Department of Natural Resources Wildlife, Fisheries, and Parks and Recreation Divisions (MDNR), United States Fish and Wildlife Service USFWS), Michigan Natural Features Inventory (MNFI) administered natural heritage database records, and the Michigan Herp Atlas Project. Sampling was delayed due to Covid-19 and restrictions on travel limiting early season species surveys and detection. Surveys were conducted in late spring and summer of 2020. HRM conducted rapid site assessments targeting herpetofauna habitat in Hennepin Marsh within the proposed restoration areas. Objectives were to assess herpetofauna community composition, relative abundance, represented age classes, and spatial distribution of amphibians and reptiles in proposed restoration areas for later comparison to post restoration findings. Transect surveys conducted on foot were limited to public access shoreline. Aquatic surveys were conducted by a team of two using watercraft (Photo 1). Both strategies were utilized to assess both aquatic and terrestrial habitat and identify potential restoration opportunities targeting amphibians and reptiles. Emphasis for potential restoration opportunities was placed on possible nesting, foraging, and basking locations as well as refugia. Methods to detect herpetofauna included visual encounter surveys which included the investigation of potential basking and nesting areas, as well as turning over natural and artificial cover (logs, boards, debris, etc.).

Site conditions were recorded for each survey event using a Kestrel 3000 pocket weather meter. During all of HRM's surveys in Hennepin Marsh, no voucher specimens were collected but photographs were taken when possible. All survey activities were in accordance with HRM's

Scientific Collector's and Threatened and Endangered Species permits issued by the State of Michigan.

Each positively identified amphibian and reptile was recorded in the database. The following data were collected for each record: (1) species, (2) sex of each individual (when possible), (3) behavior of each individual, and (4) reproductive condition of each individual (if it can be determined). Observation locations were recorded using Trimble® Juno SB GPS Units, which record the location to U.S. Environmental Protection Agency (EPA) Tier II National Geospatial Data Spatial Standards, and were mapped using ArcMap® software. Control points were obtained during every survey to confirm spatial accuracy and equipment functionality.

Results

Based on the desktop review of aerial imagery and historical records, HRM identified five (5) rare amphibian and reptile species that may occur within the project area including: Blanding's Turtle (*Emydoidea blandingii*), Mudpuppy (*Necturus maculosus*), Butler's Garter Snake (*Thamnophis butleri*), Black (Grey) Rat Snake (*Pantherophis obsoletus*), and Eastern Fox Snake (*Pantherophis gloydi*). All of these identified potential species are listed as Special Concern or Threatened in Michigan.

Ongoing research into the genetics, physiology, behavior, and fossil history of amphibians and reptiles has led to debates about their proper classification. Some biologists have proposed the splitting of established genera like *Rana* ("typical frogs") and *Bufo* ("true toads") into the newer genera *Lithobates* and *Anaxyrus*, respectively (Harding and Holman 1999). Some suggestions have included using the newly proposed groupings as subgenera, allowing

recognition of the new divisions while maintaining name stability. For the purposes of this report this system will be followed for the genus of toad *Bufo* (*Anaxyrus*). The genus of “typical frogs” will not include subgenera based on a recent publication which supports the placement of all North American ranid frogs in the genus *Rana* (Yuan, Zhou et al. 2016). These classifications are also recognized by Harding and Mifsud (2017).

HRM documented one (1) of the target species, Blanding’s Turtle, within the survey area on June 18. In addition to this target species, six (6) other species of herpetofauna were documented over the survey period. These species include Bullfrog (*Rana [Lithobates] catesbeiana*), Green Frog (*Rana [Lithobates] clamitans melanota*), Eastern American Toad (*Bufo[Anaxyrus] americanus americanus*) (Photo 2), Northern Water Snake (*Nerodia sipedon sipedon*), Midland Painted Turtle (*Chrysemys picta marginata*), and Northern Map Turtle (*Graptemys geographica*) (Table 1).

Based on available habitat, microhabitat features, and previous surveys of the surrounding area, eleven (11) additional species of herpetofauna are known to occur or may occur in the project area but were not detected during the survey period. These species include Gray Treefrog (*Hyla versicolor/chrysoscelis*), Northern Leopard Frog (*Rana [Lithobates] pipiens*), Wood Frog (*Rana [Lithobates] sylvatica*), Western Chorus Frog (*Pseudacris triseriata*), Northern Spring Peeper (*Pseudacris crucifer*), Eastern Snapping Turtle (*Chelydra serpentina serpentina*), Eastern Spiny Softshell Turtle (*Apalone spinifera*), Eastern Musk Turtle (*Sternotherus odoratus*), Red-eared Slider (*Trachemys scripta elegans*), Eastern Garter Snake (*Thamnophis sirtalis sirtalis*), and Northern Brown Snake (*Storeria dekayi*).

Discussion

Amphibians and reptiles are recognized as key bioindicators (gauges of environmental health), due in part to their high sensitivity to environmental pollutants and habitat disturbance. Their presence, richness, and distribution are important metrics for determining the health of natural communities (Cooperrider et al. 1986; Welsh and Droege 2001; Guilfoyle 2010). Documenting the herpetofaunal diversity and habitat usage in Hennepin Marsh is an effective way to assess the overall ecosystem health of the site and will likely serve as a valuable tool for evaluating the success of proposed restoration efforts.

Initial pre-restoration field work conducted by HRM in Hennepin Marsh in 2020 focused on assessing habitat conditions and restoration opportunities targeting reptiles and amphibians. Findings of these surveys resulted in seven (7) species of herpetofauna observed. Objectives were placed on determining amphibian and reptile relative abundance and spatial distribution in order to advise ECT and FODR on restoration strategies to enhance and improve habitat conditions for these organisms. During this period, detection rate may have been affected by the atypically high water levels that have been observed in the Detroit River in recent years as well as overall low precipitation during HRM's survey period. Results were also likely impacted by delayed sampling due to Covid-19 and travel restrictions. Surveys were limited to late spring and summer months which likely affected detection rates of some amphibians and reptiles. Ideally, comprehensive amphibian and reptile assessments should occur at different times of the active season to capture seasonal trends in activity, habitat use, and presence of multiple age classes. For example, Mudpuppies have been identified as potentially present offshore of Grosse Ile based on historical records and available habitat; however due to the timing of surveys, targeted trapping was not conducted as it is outside of the active season. Capture efforts for this species

should be conducted in early spring when the species is still active in nearshore habitats and submerged traps do not pose the risk of capturing turtles that may drown. Due to their largely cryptic nature and seasonal activity, conducting surveys over multiple seasons would provide greater opportunity for detection and a more accurate depiction of the species community compositions and spatial distribution in Hennepin Marsh.

Based on HRM's surveys of Hennepin Marsh in 2020, the available herpetofauna habitat can be considered low. Given the relatively small size of Hennepin Marsh and Grosse Ile's isolated location, it is expected to have an overall lower diversity compared to communities on mainland habitats. Hennepin Marsh does support some features that are beneficial for local herpetofauna. The central project area contains pockets of woody vegetation in open water (Photo 3), which provide critical basking opportunities and refugia for many species. Numerous individuals of some species including Northern Map Turtle (Photo 4) and Midland Painted Turtle were observed utilizing the basking logs (Photo 5). Juvenile and metamorph Eastern American Toads were observed throughout the 2020 assessments, indicating that amphibians are currently using the available habitat to successfully reproduce (Photo 6). During and following restoration activities, these habitats should be protected to ensure that amphibians and reptiles in Hennepin Marsh can fulfill their seasonal life history needs.

Several rare and sensitive amphibians and reptiles known to historically occur in or near Hennepin Marsh were not observed during HRM's 2020 assessments. The Eastern Fox Snake is a State Threatened species whose range lies entirely within the Great Lakes basin where it is found in coastal marshes and other near shore habitats. While no observations of this species have been recorded directly in Hennepin Marsh, Fox Snakes are well documented on Grosse Ile

and in the surrounding area in recent years. Their strong swimming ability, adaptation to urban and suburban landscapes, and tendency to travel long distances indicate the species is capable of colonizing Hennepin Marsh, if suitable habitat is present. Implementing proposed restoration activities including the installation of rock basking structures in protected areas will provide resources required by Eastern Fox Snakes to help support this rare species.

As previously discussed, Mudpuppies were not observed during HRM's 2020 assessments; however, they are known to occur throughout the Detroit River. This fully aquatic salamander, which has been elevated to Special Concern in Michigan due to significant declines, should remain a major target for herpetofauna restoration and monitoring. Mudpuppies are also the obligate host to the state Endangered Salamander Mussel (*Simposonais ambigua*), making it an integral component of this aquatic ecosystem. Additionally, Mudpuppies are one of few native Michigan species to have adapted to include invasive species in their diet. Round Gobies (*Neogobius melanostomus*) and Zebra Mussels (*Dreissena polymorpha*) are invasive in the Great Lakes and cause extensive damage to ships, water management systems, and native fish populations. Mudpuppies prey on both of these invasive species and act as a natural management of the Round Goby and Zebra Mussel which benefits the Great Lakes ecosystem as a whole and the communities that benefit from this resource (Stapleton et al. 2018). Mudpuppies were last documented by HRM in Hennepin Marsh in 2012, but were last observed in the Detroit River in 2020. Mudpuppy trapping was not conducted during this project due to timing constraints and the lower probability of capture and increased risk of bycatch mortalities, particularly turtles. Currently, little habitat within the near-shore areas of the island is available for this species. Aquatic habitat features designed for use by Mudpuppies for nesting, breeding, and refugia purposes should be implemented and will likely increase the use of the area in and around

Hennepin Marsh by this species following construction. This project and post restoration monitoring will also contribute to larger scale research and restoration work targeting Mudpuppies that has been recently initiated within the Detroit River and surrounding Great Lakes region (Craig et al. 2015; Herpetological Resource and Management 2016).

The Butler's Garter Snake is also known to historically occur on Grosse Ile and has a high probability of currently inhabiting the Hennepin Marsh complex. This species is listed as Special Concern in Michigan and faces population declines due to habitat loss and fragmentation. Butler's Garter Snakes are a burrowing species, so much of their time is spent underground (Harding and Mifsud 2017). The compacted shoreline of Hennepin Marsh makes burrowing activities much more difficult. Restoring the offshore islands south of Grosse Ile would help to combat compaction and erosion in the area benefiting Butler's Garter Snakes. Butler's Garter Snakes are known to utilize a variety of habitat compositions and therefore travel between habitat types often seeking open grass fields to bask, marshy wetlands to forage, or hibernacula in the fall. Urban development fragments the habitat mosaic that this species requires which strains and segments the population. Improving habitat connectivity and heterogeneity by implementing hibernacula and shelter logs/structure would help the Butler's Garter Snake population in and around Hennepin Marsh recover.

Severe erosion has significantly degraded shoreline habitat in Hennepin Marsh. Shorelines along the western and southern portion of the island where wave action appears to be more severe have become incredibly degraded in some areas. The erosion has created conditions that make it difficult for some herpetofauna to move between the river and the island which discourages animals from inhabiting the marsh. The wave action and high water levels in recent

years have also begun to wear the protective islands that once protected the southern end of Hennepin Marsh.

Between the hardened shorelines and loss of sandy beach habitat, turtle nesting opportunities appear to be very limited in and around Hennepin Marsh. The largest areas suitable for nesting are currently restricted to the sandy shoreline comprised of private beaches. During HRM's 2020 assessments, limited evidence of turtle nesting activity was observed.

A major contributing factor of the degradation of habitat in Hennepin Marsh is the excessive presence of invasive vegetation. Problematic invasives observed during HRM's assessments included European frog's-bit (*Hydrocharis morsus-ranae*), Eurasian honeysuckle (*Lonicera* spp.), European Buckthorn (*Rhamnus cathartica*), Eurasian common reed (*Phragmites australis* ssp. *australis*), multiflora rose (*Rosa multiflora*), and White mulberry (*Morus alba*). Several of these species can negatively impact herpetofauna populations through habitat alteration, competition, and added predation pressure. Additionally, the shade from densely established plants can eliminate sunny basking areas for reptiles reducing critical thermoregulatory opportunities. Of these invasives observed in Hennepin, *Phragmites* likely poses one of the largest threats. Large expanses dominate several plant communities and its presence threatens coastal marsh habitat throughout the Detroit River. Besides eliminating suitable habitat directly, this and other invasive species severely fragment amphibian and reptile habitat by creating physical barriers and preventing their dispersal through the landscape (Westbrooks 1998; Tulbure et al. 2007). Dense, mature stands of *Phragmites* were observed along a significant portion of the shoreline (Photo 7). The barrier presented by *Phragmites* currently prevents herpetofauna from moving between sunny and shaded areas needed for

optimal thermoregulation and between land and open water. Additionally, the plant has been shown to shade out nesting habitat with the lower temperatures leading to reduced turtle hatching success (Bolton and Brooks 2010). Efforts to restore connectivity throughout the Grosse Ile's segmented habitats and the Detroit River will provide immense value for herpetofauna as well as other wildlife species.

Recommendations

Several basking structures should be added to the shoreline and open water areas of Hennepin Marsh to aid in thermoregulation of reptiles and provide cover and resting sites for other wildlife. Amphibians and reptiles can warm themselves on or under sun-exposed rocks and logs or in gaps in the vegetation canopy where the sun shines. It is equally important that structurally diverse areas of vegetation and substrates that provide shade or cooler temperatures are adjacent to basking areas. Woody debris with submerged branches along the shoreline can have dual use and also provide adherence points for amphibian eggs and cover for snakes, turtles, fish, amphibian larvae, and aquatic macroinvertebrates. Terrestrial nesting areas should also be constructed to accommodate turtles and snakes. Mudpuppy refugia as well as breeding, nesting, and nursery sites should be incorporated too (Photo 8). Developing a management plan to maintain Hennepin Marsh, especially turtle nesting areas is critical. This plan should have an emphasis on removal of invasive plant species focusing on *Phragmites*.

Optimizing the protective islands to provide flat basking and nesting structures for reptiles would greatly benefit the community present and encourage new species to colonize. By creating offshore nesting sites, the risk of predation by Raccoons is drastically reduced which would encourage turtle populations in particular to improve. Using small gravel and cobble in

these locations can help prevent turtles from being trapped between large rocks. Adding smaller cobbles to the rocks surrounding the toll bridge that divides North Hennepin Marsh from South Hennepin Marsh would work towards the same goal of preventing herpetofauna from getting stuck when attempting to utilize the slope for basking (Photo 9).

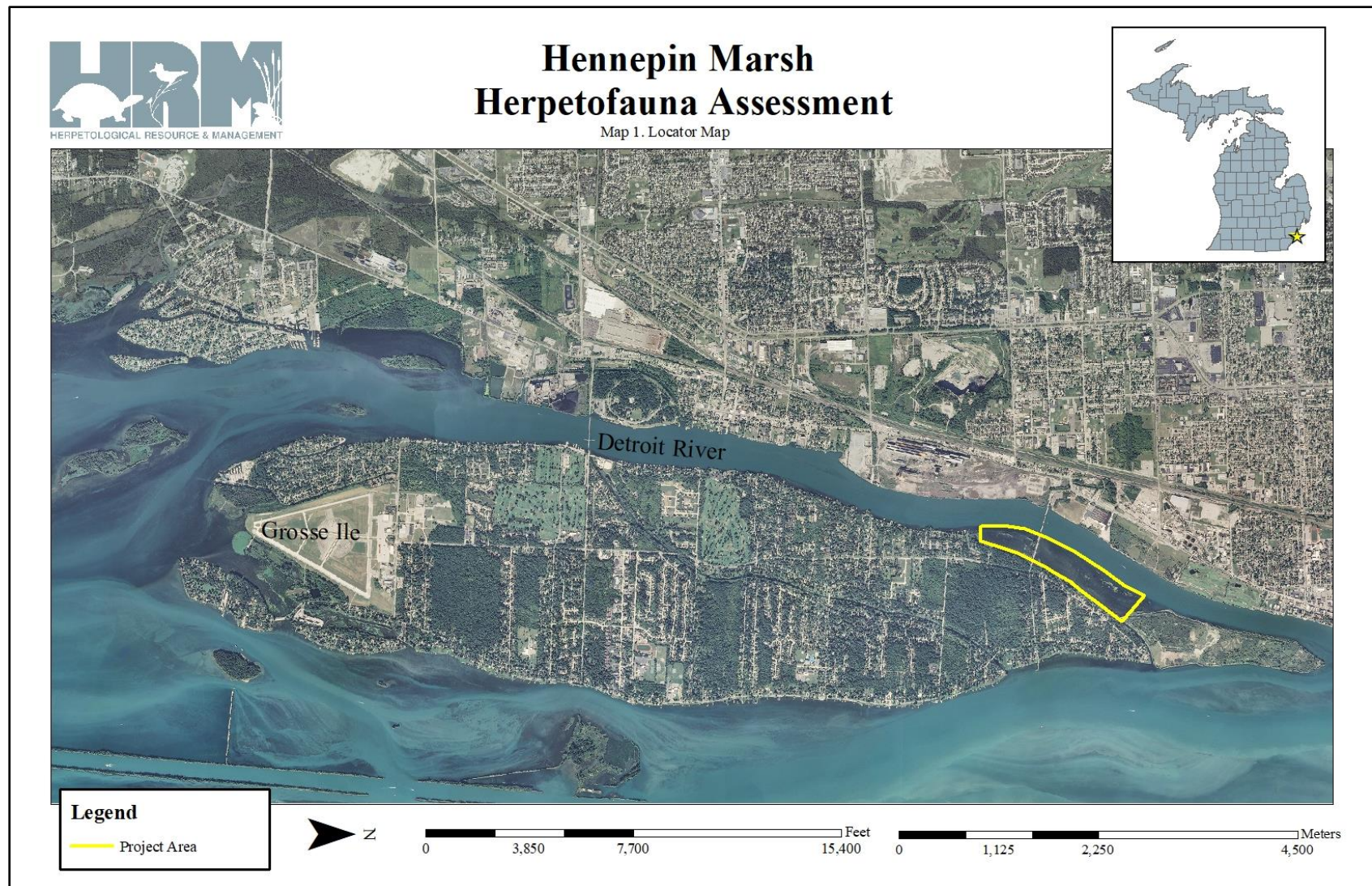
Post construction restoration strategies are just as significant in protecting wildlife as the habitat features that are created. Synthetic soil erosion control mesh can fatally entangle herpetofauna and other wildlife. Photodegradable varieties do not degrade well when shaded by newly sprouted vegetation and should also be avoided. There are several natural products available that should be used instead that will have minimal to no impact on herpetofauna (Mifsud 2014). When grading wetlands and coastal areas post construction, creating wetlands with several depths, even if only varying by a few inches, can provide nursery habitat for a variety of aquatic, semiaquatic, and biphasic animals.

Conclusion

The Detroit River Watershed supports a number of rare and sensitive species and restoration in the area is essential to the long-term viability of the region's ecological function. The natural communities of Hennepin Marsh are currently degraded and available herpetofauna habitat is considered limited. The area historically supported diverse communities of amphibians and reptiles and though several species are currently present, overall richness has decreased from historic levels and population size and spatial distribution is limited. Proposed restoration measures targeting amphibians and reptiles will likely aid in increasing the overall ecosystem function of Hennepin Marsh. This work will also be a valuable step toward the removal of the

loss of fish and wildlife habitat beneficial use impairment.

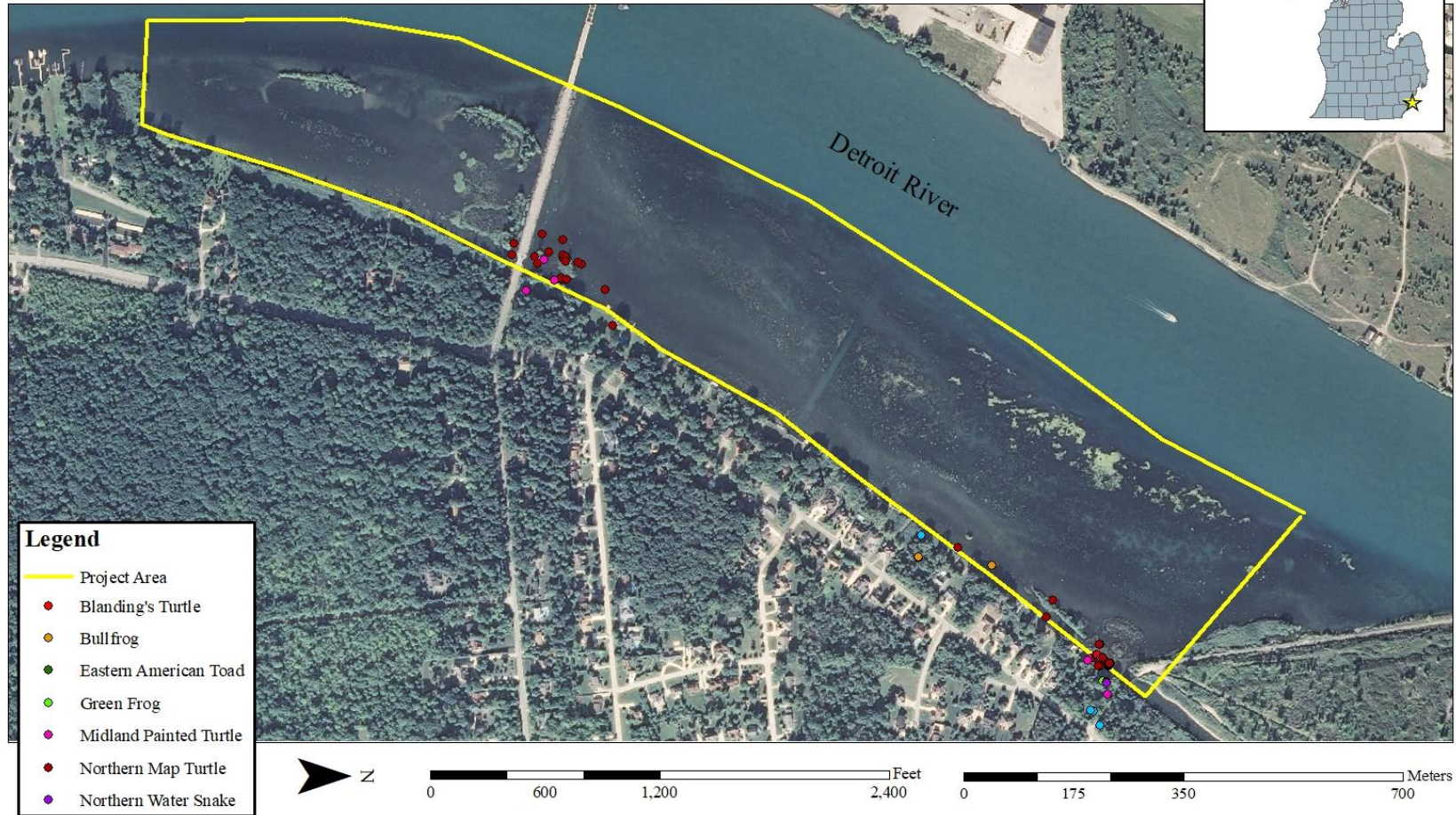
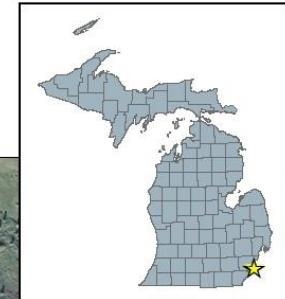
Maps



Map 1. Location of Hennepin Marsh restoration project.

Hennepin Marsh Herpetofauna Assessment

Map 2. Herpetofauna Locations



Map 2. 2020 Hennepin Marsh Herpetofauna observations

Tables

Table 1: Hennepin Marsh herpetofauna species historically recorded, species observed during HRM's most recent survey, and herpetofauna that were not observed recently but may potentially occur on the island.

Common Name	Species Name	Historically Observed	Observed 2020	Potential
Bullfrog	<i>Rana [Lithobates] catesbeiana*</i>	X	X	
Green Frog	<i>Rana [Lithobates] clamitans*</i>	X	X	
Wood Frog	<i>Rana sylvatica*</i>			X
Northern Leopard Frog	<i>Rana [Lithobates] pipiens</i>	X		X
Eastern American Toad	<i>Bufo [Anaxyrus] americanus americanus**</i>	X	X	
Northern Spring Peeper	<i>Pseudacris crucifer crucifer</i>	X		X
Western Chorus Frog	<i>Pseudacris triseriata</i>	X		X
Gray Treefrog	<i>Hyla versicolor/chrysoscelis</i>			X
Mudpuppy	<i>Necturus maculosus maculosus</i>	X		X
Butler's Garter Snake	<i>Thamnophis butleri</i>			X
Eastern Garter Snake	<i>Thamnophis sirtalis sirtalis</i>	X		X
Eastern Fox Snake	<i>Pantherophis gloydi</i>	X		X
Northern Brown Snake	<i>Storeria dekayi dekayi</i>	X		X
Northern Water Snake	<i>Nerodia sipedon sipedon</i>	X	X	
Eastern Spiny Softshell Turtle	<i>Apalone spinifera spinifera</i>			X
Eastern Snapping Turtle	<i>Chelydra serpentina serpentina</i>	X		X
Midland Painted Turtle	<i>Chrysemys picta marginata</i>	X	X	
Northern Map Turtle	<i>Graptemys geographica</i>	X	X	
Blanding's Turtle	<i>Emydoidea blandingii</i>	X	X	
Red-eared Slider	<i>Trachemys scripta elegans</i>	X		X
Eastern Musk Turtle	<i>Sternotherus odoratus</i>			X

Table 2. Habitat restoration recommendations generated based on the preliminary 2020 site assessment.

Hennepin Marsh Initial Habitat Improvement Recommendations	
Action	Target
Remove invasive species with emphasis on <i>Phragmites</i>	Increase ecological integrity of the site and provide opportunities for increased spatial distribution and Reduce habitat fragmentation
Provide basking logs	Aid in thermoregulation of reptiles
Place small multi-branched limbs in open water marsh along coast	Provide adherence points for amphibian eggs and cover for a variety of wildlife
Create terrestrial nesting areas	Increase recruitment and population viability of turtle populations
Place flat basking structures	Aid in thermoregulation of reptiles
Provide small gravel and cobble in potential turtle basking locations	Prevent turtles from becoming trapped in large riprap
Install Mudpuppy habitat structures	Provide critical breeding, nesting, and nursery sites.
Remediate protective southern islands	Combat erosion and degradation of coastal habitat
Use wildlife friendly erosion control post construction	Reduce herpetofauna fatalities from getting caught in erosion netting
Create multi-step coastal wetlands	Provide different depths of water for herpetofauna to utilize for breeding sites, nurseries, and seasonal habitat

Photos



Photo 1. HRM staff conducting surveys of herpetofauna via watercraft.



Photo 2. Juvenile Eastern American Toad observed in North Hennepin Marsh.



Photo 3. Islands of woody vegetation provide basking opportunities and refuge for herpetofauna.

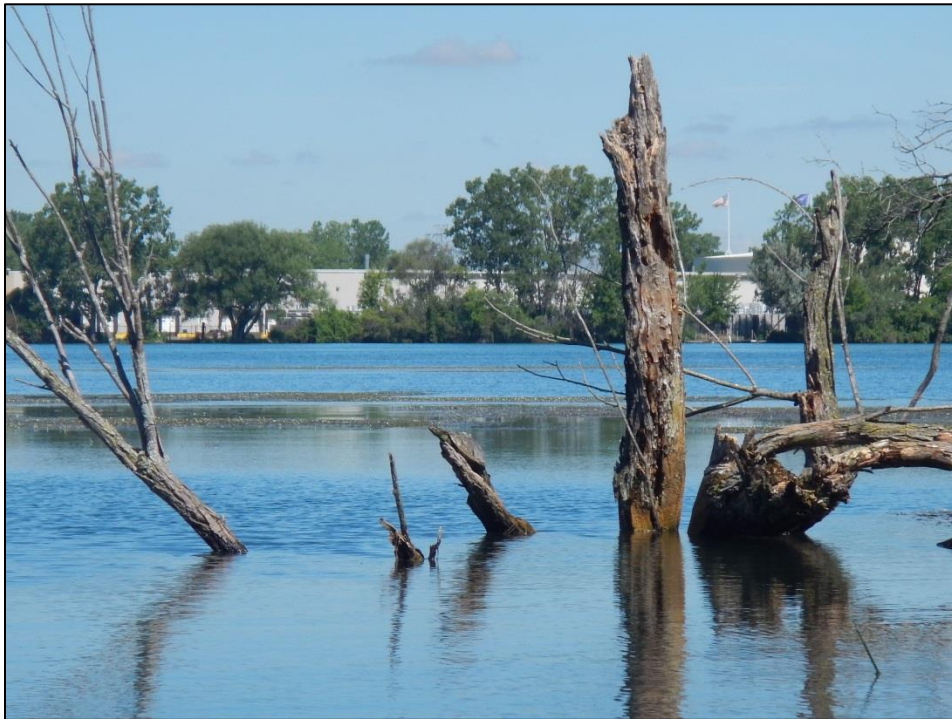


Photo 4. Northern Map Turtle utilizing available basking logs in North Hennepin Marsh.



Photo 5. Midland Painted Turtle observed basking in North Hennepin Marsh.



Photo 6. Metamorph toad observed in North Hennepin Marsh.



Photo 7. *Phragmites* dominates the shoreline of North Hennepin Marsh.



Photo 8. Rocky shoreline of South Hennepin Marsh suitable for Mudpuppies.



Photo 9. Small interstitial rocks should be incorporated between larger rocks to prevent turtles from getting stuck in gaps.



Photo 10. Northern Map Turtle observed swimming in open water habitat of South Hennepin Marsh.

Species Summaries

Northern Leopard Frog (*Rana pipiens*)



The Northern Leopard Frog is listed as a Species of Greatest Conservation Need in Michigan. Once fairly common, populations of this frog suffered serious declines in the 60's and 70's and now can be uncommon in much of its range. The Northern Leopard Frog prefers habitats that are open and may consist of marshes, bogs, edges of water bodies, fields, meadows and even lawns. Northern Leopard Frogs feed primarily on invertebrates but full grown adults are known to eat small frogs such as Spring Peepers. A large variety of predators including humans feed upon all life stages of Leopard Frogs. During the spring, these frogs transition to shallow water for breeding but then disperse to dry land for the remainder of the summer. As with other amphibians, pollutants in the water have a negative effect on this species but the leopard frog tends to be particularly sensitive. The leopard frog is also sensitive to changes in the pH of water and generally does not do well in acidified waters. This frog also faces pressure from human collection for science and bait. Overall, it is believed though that the Northern Leopard Frog has the potential to recover from its reduced populations if the proper habitat is available (Harding and Mifsud 2017).

Western Chorus Frog (*Pseudocris triseriata*)



The Western Chorus Frog or sometimes the Striped Chorus Frog is a small frog with a tan to brown body with dark stripes on the back and a distinctive light stripe along the upper lip. Listed in Michigan as a Species of Greatest Conservation Need the Western Chorus Frog has faced recent declines in its population. There are two subspecies of Chorus frogs within the mid-west including the Western Chorus Frog and the Boreal Chorus Frog both species being extremely similar to each other only being distinguished by Boreal Chorus Frogs have slightly shorter legs and more likely to have spots instead of stripes on their back. The Western Chorus Frog prefers a variety of habitats including swamps, marshes, old fields and damp woodlands. Breeding occurs early in the spring, calling can be heard as short scratchy sounds similar to a nail running along the bristles of a pocket comb. Adult Western Chorus Frogs feed upon a verity of small invertebrates such as insects and spiders. Snakes are a common predator of this species with their small size and coloration as their primary defense from being discovered. This frog while tolerant of many human activities being found near developed and agricultural lands are still vulnerable to pollution and destruction of their critical sources of water (Harding 1997; Holman 2012).

Mudpuppy (*Necturus maculosus maculosus*)



Mudpuppies are large entirely aquatic salamanders that are a Species of Special Concern in Michigan. They are easily recognized by their large size (up to 1.5 feet long) and large external gills just behind the head (Harding and Mifsud 2017). Small Mudpuppies might resemble the larvae of other salamanders, but have only four toes on each foot instead of five. In Michigan, this species is the only amphibian that normally inhabits the open water of large lakes and rivers, spending most of its time hiding under flat rocks. They are highly carnivorous and are often caught by fishermen, even in winter. Because of their unique appearance and unjustified reputation as predators of game fish, they are often killed when captured, even though they are harmless. Mudpuppies breed in fall, entering shallow water as the temperatures cool, but do not nest until the following spring. Females require moderately shallow water with plenty of large, flat rocks on the bottom beneath which they can deposit their eggs. Mudpuppies are the obligate host species for the larvae of the Salamander Mussel (*Simpsonaias ambigua*), a state Endangered species (Eagle et al. 2005). This species is also potentially important in helping control invasive species. They have been recorded eating invasive round gobies (*Apollonia melanostomus*) and invasive mussels making them an important species in maintaining healthy aquatic habitats.

Eastern Fox Snake (*Pantherophis gloydi*)



Eastern Fox Snakes have a small range restricted to areas along and adjacent to the shores of Lake Huron and Lake Erie. They are a State Threatened species in Michigan, and are listed as Endangered in Canada. Fox Snakes require grassland habitat that is rarely mowed or burned, and often prefer to take shelter and overwinter in adjacent riprap or similar habitat. Although they spend much of their time in uplands feeding on small mammals, they are very strong swimmers, and it is not uncommon for them to use waterways to travel significant distances. Despite their size, these snakes are often preyed upon by large raptors and medium sized mammals. In the fall, Fox Snakes enter hibernacula, which sometimes include communal sites, and do not emerge until mid-April or May. Breeding occurs in spring, and eggs are laid in June or July, hatching about two months later. Fox Snakes are often senselessly killed because they are mistaken for Copperheads (*Agkistrodon contortrix*, a U.S. species not present in Michigan), because of the orange head, or rattlesnakes because they will vibrate their tail against dry vegetation when threatened, producing a loud buzz (Harding and Mifsud 2017). This species is also uniquely vulnerable to habitat loss because of its restriction to a thin strip of shoreline where it must compete with intense road development (COSEWIC 2008).

Butler's Garter Snake (*Thamnophis butleri*)



In Michigan, the Butler's Garter Snake is listed as a Species of Special Concern, which affords it protection under MDNR Fisheries Order 224.13 (Herpetological Resource and Management 2014). In Canada, the species is listed as Endangered. Ranging from 15 to 29 inches these yellow/orange striped snakes are restricted to the eastern half of the state. The Butler's Garter Snake requires wet grassy habitat including meadows prairies, water body shores, old fields etc. and is commonly found under debris in these locations outside of their mating season, which occurs in early spring. Movements of this species tend to be restricted to the vicinity of water and patterns of movement parallel the margins of marsh habitat. Butler's Garter Snakes are rarely observed in woods and wooded areas likely act as a barrier. The primary prey source for these snakes are earthworms, which they typically hunt for in fairly small ranges of less than 1 ha. Being a relatively small snake the Butler's Garter Snake faces predation from an array of wildlife. The largest growing threat for this snake is the development of urban and suburban lands which can devastate communities of this snake that rely on the open fields in which buildings are being built and are often found basking on gravel roads and walking/bicycle trails (Harding and Mifsud 2017; COSEWIC 2010).

Blanding's Turtle (*Emydoidea blandingii*)



In Michigan, the Blanding's Turtle is listed as a Species of Special Concern and protected under the MDNR Fisheries Order 224.13. While still locally common in some parts of Michigan, this species is listed as Threatened and Endangered in other portions of their range, and it is currently being considered for federal protection. This species requires a mosaic of wetland habitats for their survival. For much of the year, they prefer open water areas with structures such as logs or stumps to bask. Females require well drained soils, usually with southern exposure, for nesting and will travel long distances to locate a suitable nesting location. Hibernation occurs within ponds where the animals burrow into the mud below the frost line. The Blanding's Turtle has a life span of approximately 80 years, and does not reach sexual maturity until around 20 years of age. Adults have no natural predators, but hatchling and juvenile turtles suffer very high mortality rates. Annual nest predation by predators, especially raccoons, is often 100%. For this reason, it may take one adult female decades to produce enough turtles to replace herself and her mate and thus maintain a stable population. Due to their very low reproductive rate, it is extremely important to maintain ample nesting areas as well as shrub swamp wetland habitat that young Blanding's Turtles rely on for shelter (Harding and Mifsud 2017; Carl H. Ernst 2009).

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