Species Status Assessment

Common Name: Mudpuppy **Date Updated:** April 2025

Scientific Name: *Necturus maculosus* **Updated By:** C. Macklem & L. Pipino

Class: Amphibia

Family: Proteidae

Species Synopsis:

The mudpuppy (*Necturus maculosus*, Rafinesque 1818) is a fully aquatic salamander belonging to the Proteidae family, which currently includes two extant genera: *Necturus,* traditionally comprising five North American species, and *Proteus*, with one European species (Larson et al. 2003, Petranka 2010). Recent phenotypic, morphological, and genetic evidence suggests that additional species designations within *Necturus* may be warranted (Chabarria et al. 2018, Guyer et al. 2020), including for *N. maculosus* (Chabarria et al. 2018, Greenwald et al. 2020). *Necturus maculosus* was previously divided into two subspecies, the common mudpuppy (*N. m. maculosus)* and the red river mudpuppy or "waterdog" (*N. m. louisianensis*), the latter of which was recently treated as a full species (*N. louisianensis*) (Nicholson 2025, Chabarria et al 2018, Fouquette and Dubois 2014). More recent research has identified two genetically distinct lineages of *N. maculosus*; one within the Upper and/or Lower Mississippi River basins and the other in the Great Lakes basin (Chabarria et al. 2018, Greenwald et al. 2020). Mudpuppies in New York appear to belong to the Great Lakes basin genetic cluster, which is thought to range from the eastern Canadian provinces of Manitoba, Ontario, and Quebec, south to Missouri and Illinois, northern Indiana, Michigan, and east to New York (Chabarria et al. 2018). However, additional studies are needed to elucidate these genetic relationships and potential intergradation zones; therefore, reference to *N. maculosus* in this document incorporates data from mudpuppies within the current species designation and range, which spans from the eastern Canadian provinces of Manitoba, Ontario, and Quebec, south to Alabama, Mississippi, and Georgia (NatureServe 2023). The mudpuppy has also been introduced in several states including Massachusetts, Rhode Island, New Hampshire, and Maine (Greenwald et al. 2020, NatureServe 2023), likely due to its use as fish bait (Petranka 1998).

In New York, the mudpuppy is found in rivers and lakes across the state, except for in central and eastern southern-tier counties, Long Island, and the Adirondacks (Gibbs et al. 2007). Mudpuppies can be found in a variety of aquatic environments from clear, fast-flowing streams and warm, slow-moving rivers to deep, cold lakes and shallow, weedy ponds (Gibbs et al. 2007). While *N. maculosus* is thought to be stable on a range-wide scale (IUCN 2023, NatureServe 2023), these assessments have been based on the range of the species prior to the recently proposed additional species designations (Chabarria et al. 2018, Greenwald et al. 2020). On a more regional scale, mudpuppies are thought to be declining across the Great Lakes region due in part to factors such as the use of TFM (3-trifluoromethyl-4-nitrophenol) lampricides, habitat loss, overexploitation, invasive species, extreme weather events, and pollution and siltation of streams (Harding 1997, Pfingsten and White 1989, Mifsud 2014, Andrews et al. 2018, Stapleton et al. 2018, COSEWIC 2023).

I. Status

a. Current legal protected Status

i. **Federal:** Not Listed **Candidate:** No

ii. **New York:** Not Listed, Proposed Special Concern; SGCN

b. Natural Heritage Program

i. **Global:** G5

ii. **New York:** S3S4 **Tracked by NYNHP?:** No (*Watch List*)

Other Ranks:

-IUCN Red List: Least Concern
-COSEWIC (2023): Threatened in Manitoba, Special Concern in Ontario and Quebec
-Northeast Regional SGCN (2023): Watchlist (Assessment Priority)
-NEPARC Regional List (2010): High Concern

Status Discussion:

The IUCN (2023) justifies a listing of Least Concern because of the species having a "wide distribution, tolerance of a degree of habitat modification, and presumed large and stable population." NEPARC (2010) lists common mudpuppy as a Species of High Concern because more than 50% of northeastern states listed it in their Wildlife Action Plans. Similarly, the Northeast Fish and Wildlife Diversity Technical Committee listed the common mudpuppy as having low regional responsibility and high regional concern in 2013, because the region harbors less than 50% of the species distribution but >50% of occupied states met the criteria for conservation concern (TC and NFWDTC 2013). In 2023, the mudpuppy was listed as a Northeast Regional Watchlist (Assessment Priority) species, a category that is used for species that are data deficient, have uncertain taxonomy, or are showing varying trends in different parts of the region, highlighting a need for additional survey or research efforts (TC and NFWDTC 2023). Mass mortality events combined with ongoing threats from pollution, urban development, impoundment, fishing, diseases, and aquatic invasive species led Canada to infer declines in abundance and distribution for mudpuppies in Manitoba, Ontario, and Quebec (COSEWIC 2023). Mudpuppy populations in several Lake Champlain tributaries have also declined or been lost due to TFM use, and multiple recommendations have been made to list the species as threatened in Vermont, though they have not been accepted by the Agency of Natural Resources (Vermont Fish & Wildlife Department 2015).

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Stable	Stable		G5	
Northeastern US	Yes	Unknown	Unknown		S2S4	No
New York	Yes	Unknown	Unknown	1985-present	S3S4, Proposed Special Concern	Yes
Connecticut	Yes	Unknown	Unknown	2005-2015 (SWAP)	S3S4, Special Concern	Yes
Massachusetts	Yes	Unknown	Unknown		Not Listed (likely introduced)	No

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
New Jersey	No	N/A	N/A			
Pennsylvania	Yes	Unknown	Unknown		S3, Not Listed	Yes
Vermont	Yes	Declining	Declining	2005-2015 (SWAP)	S2, Special Concern	Yes
Ontario	Yes	Declining	Declining	Through 2023	S4, Special Concern	Yes
Quebec	Yes	Declining	Declining	Through 2023	S4, Special Concern	Yes

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York:

There are currently no regular monitoring activities for *N. maculosus* in New York. The New York Amphibian and Reptile Atlas Project (Herp Atlas), conducted from 1990-1999, documented the geographic distribution of all species of amphibians and reptiles in the state. The Herp Atlas database also includes pre-1990 records from various sources, such as museum records, researchers' field notes, and published literature. In addition to the Atlas, a study conducted between 2016 and 2017 documented the presence and absence of mudpuppies in western New York waterbodies (Haines 2021).

Trends Discussion:

The mudpuppy (*N. maculosus*) is generally considered stable on a range-wide scale (IUCN 2023, NatureServe 2023). However, on a more regional scale, mudpuppies have experienced declines in recent years in the Great Lakes region and in Vermont (Mifsud 2014, Andrews et al. 2018, Stapleton et al. 2018). In Vermont, for instance, lampricide applications to the Lamoille River are believed to be linked to the death of 528 mudpuppies in 2009, and fewer than 10 mortalities following a repeat application in 2013, strongly suggests a significant population decline at this location (Vermont Fish & Wildlife Department 2015, Chellman et al. 2017). Additionally, a population in Lewis Creek has declined to the point of non-detection, with no mudpuppies observed for over two decades (Vermont Fish & Wildlife Department 2015). In Canada, the absence of incidental observations in some areas raises concerns about potential declines or extirpations, and several populations have experienced mass mortality events, with an estimated 13,368 to 32,586 mudpuppies dying between 2000 and 2019 from botulism, extreme weather, and/or lampricide applications (COSEWIC 2023). These events are likely to have had a significant impact on the abundance of mudpuppies in affected populations. Canadian mudpuppy populations are projected to decline 10-70% over the next three generations (COSEWIC 2023). Additionally, mudpuppies are subject to persecution and collection and may be killed by anglers due to the mistaken belief that they are poisonous or excessively consuming game fish (Gibbs et al. 2007).

The decline in mudpuppy populations has broader ecological implications, particularly for the salamander mussel (*Simpsonaias ambigua*), which was proposed for listing as endangered under the Endangered Species Act in 2023 (US Fish and Wildlife Service 2023). The salamander

mussel relies on *N. maculosus* as its obligate host for successful reproduction, with its larvae (glochidia) developing on the gills of the mudpuppy (US Fish and Wildlife Service 2023). Although the salamander mussel was once believed to be extirpated in New York, a recent observation of a fresh shell was made in 2018 (US Fish and Wildlife Service 2023). A substantial decline in mudpuppy populations could help explain the observed reduction in salamander mussel numbers, suggesting that mudpuppies may have suffered a significant reduction from once stable populations.

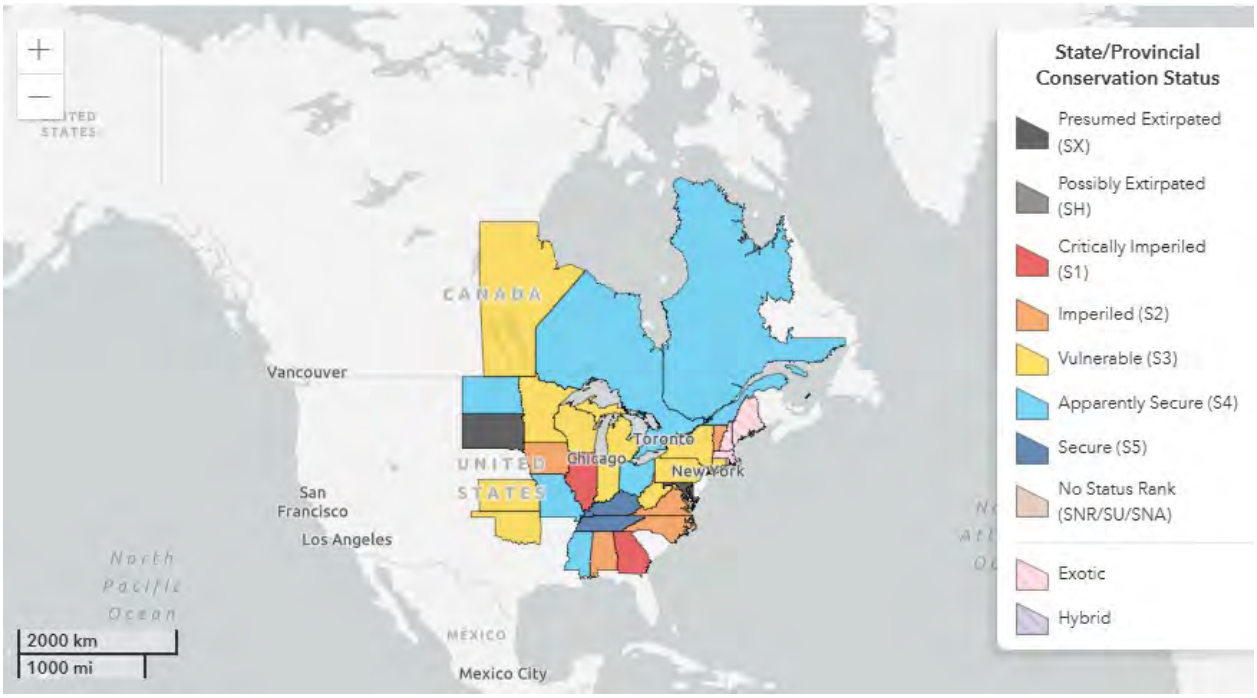

Figure 1. Conservation status of the mudpuppy (*Necturus maculosus)* in North America (NatureServe 2023)

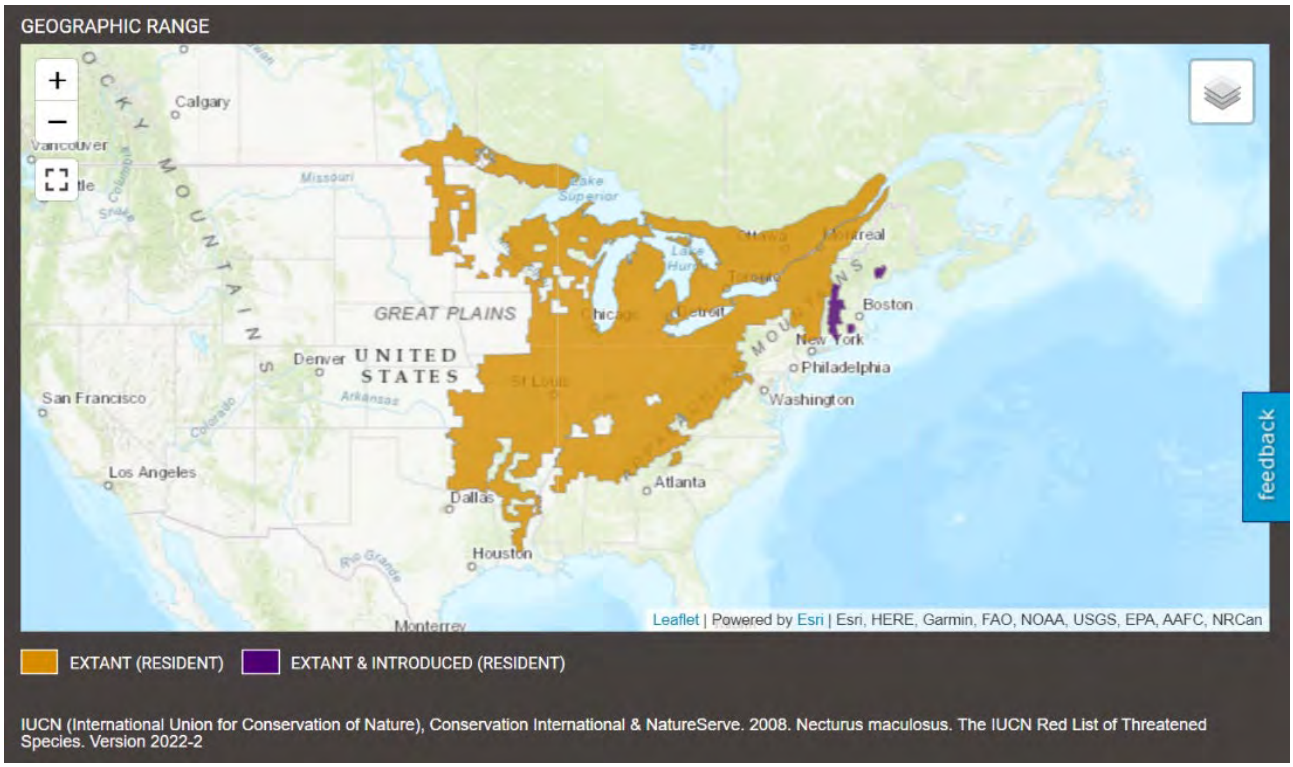

Figure 2. Mudpuppy (*Necturus maculosus*) range map (IUCN 2023)

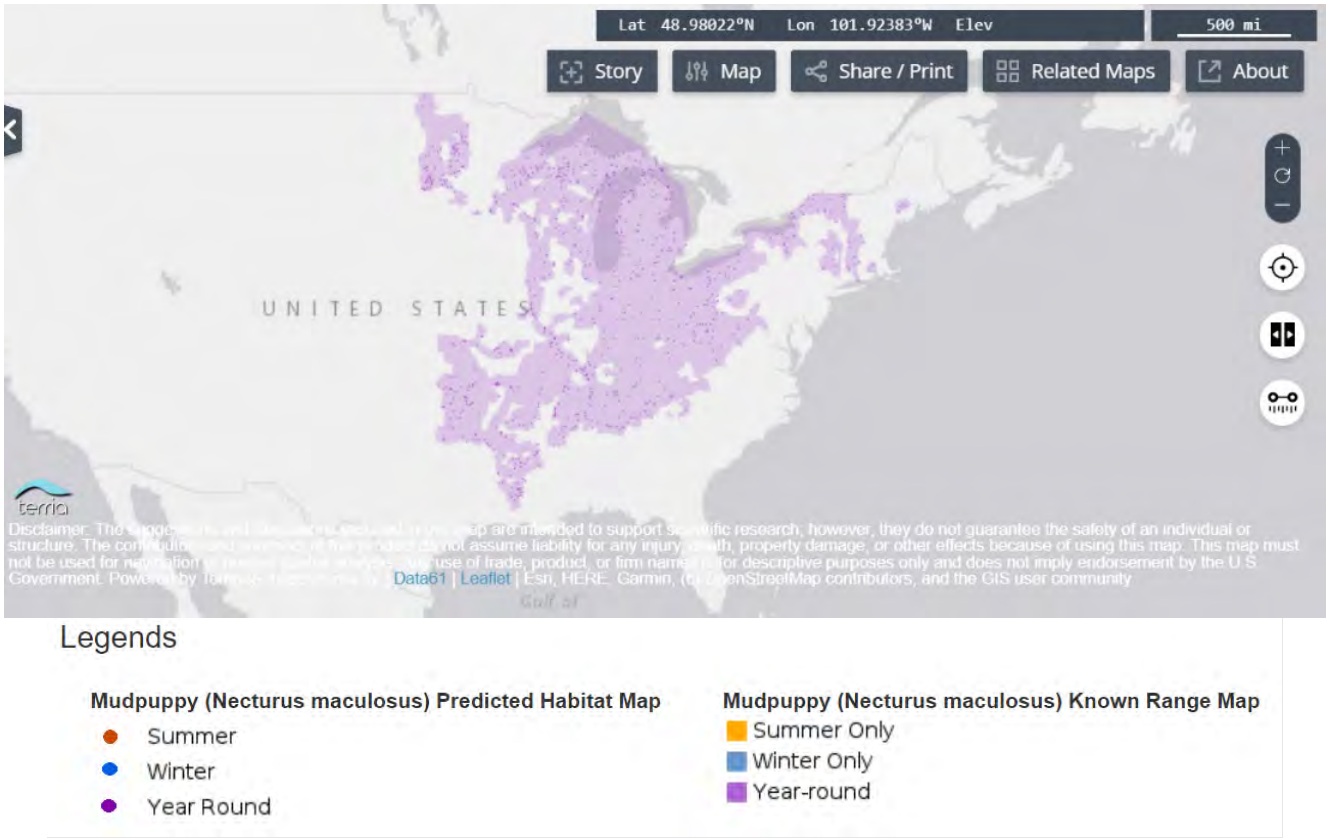

Figure 3. Mudpuppy predicted habitat map and known range map (USGS 2019)

III. New York Rarity:

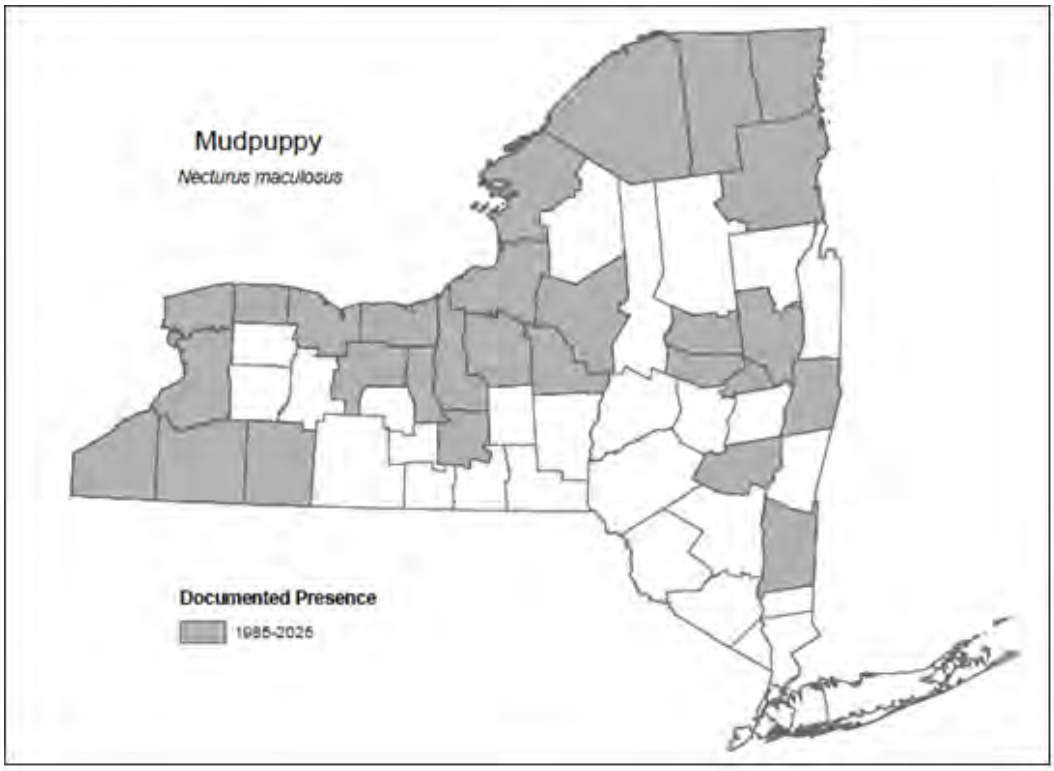

Figure 4: Distribution of the mudpuppy (*Necturus maculosus*) in New York,1985-2025 (NYSDEC)

Details of historic and current occurrence:

The NY Amphibian and Reptile Atlas (1990-99) documented mudpuppies in 66 survey quads (USGS 7.5 minute topographic quadrangle) across the state. Since 2000, additional records were added to the NY Herpetology database from 16 more quads. Post-1990, mudpuppies have also been documented in waterways in Dutchess and Orleans Counties (NYSDEC unpublished, Haines 2021).

A recent survey effort (2016-2017) in western New York documented mudpuppies in 5 of 20 Lake Erie tributaries and 1 of 11 Lake Ontario tributaries (Haines 2021). However, during these surveys, mudpuppies were not documented in at least one stream where they had been previously reported. Mudpuppies were also documented in the lentic habitats within the Alleghany watershed, and within the Genesee River (although there are no lentic habitats within this drainage).

New York's Contribution to Species North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
1-25%	Core	

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

1. Large/Great River
2. Medium River
3. Small River
4. Summer-stratified Monomictic Lake
5. Headwater/Creek

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
No	No	Declining	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

Mudpuppies can be found in a variety of permanent aquatic habitats, both standing and flowing, including large rivers, deep cold lakes, shallow weedy ponds, and fast-moving streams (Gibbs et al. 2007). They are fully aquatic bottom dwellers and are commonly associated with submerged cover such as flat rocks, bank overhangs, debris, weeds, or logs (Gibbs et al. 2007). Mudpuppies are frequently found beneath cover during daylight hours, but in weed-filled waters or those with high turbidity, they may be active throughout the day (Hulse et al. 2001). In broad streams that become warm early in the season, adults seem to prefer well-aerated areas near rifts and riffles, which may be used as nesting sites (Bishop 1941). Larvae and juveniles in the same areas may be found in greater numbers in deeper pools with more accumulated organic debris (Bishop 1941, Green et al. 2014). Eggs are attached to the undersides of cover objects, such as flat-bottomed rocks, in shallow water (Smith 1911, Bishop 1941).

V. Species Demographic, and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Yes	-	-	Yes	Yes	-

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion:

In northern populations, mudpuppies primarily mate in the fall, though some may mate sporadically through April (Bishop 1941). In New York, adults have been observed in mating aggregations, where males deposit spermatophores that are collected by females (Bishop 1941, Gibbs et al. 2007). Females can store sperm for six months or more, and generally oviposit in late spring (Bishop 1941, Petranka 1998). Females construct nests by excavating depressions beneath rocks, logs, boards or other structures, and eggs are laid singly, attached to the underside of submerged cover, usually in clusters of 70-120 per nest (Gibbs et al. 2007). The female will remain in the

excavated area with the eggs until they hatch into larvae about two months later (Gibbs et al. 2007). Sexual maturity is reached in approximately five years, when individuals reach a size of about 6 to 8 inches in total length, though mudpuppies are paedomorphic, with adults retaining their larval form (Gibbs et al. 2007). Mudpuppies have been reported to live for more than 20 years (Petranka 1998).

Mudpuppies do not appear to disperse often or over great distances. For example, mudpuppies introduced in Maine in 1939 have not been found more than 17 miles away from their original release site (Schmidt et al. 2004). Additionally, a study on movements of *N. maculosus* in Louisiana found that the maximum distance moved was 840 ft up to 2089 days after initial capture, with a mean distance between capture events of 261 ft (Shoop and Gunning 1967). Genetics work in Kentucky also revealed genetic differentiation between mudpuppy river populations, suggesting that movement of *N. maculosus* is constrained by the lotic network architecture, as well as within river populations, with barriers such as dams likely restricting movements (Murphy et al. 2018).

VI. Threats*:*

Canada has identified pollutants (including pesticides, lampricides, nutrients, industrial chemicals, road salt, and pharmaceuticals), habitat modification (including hydrology alterations from dams and extreme weather, erosion and land use change from development, and fragmentation from roads), exploitation (directly through the pet trade and for personal harvest and indirectly as bycatch by anglers), and introduced species (including botulism, *Ranavirus*, *Bd*, *Bsal*, zebra mussel, quagga mussel, and Eurasian watermilfoil) as the primary threats to mudpuppies, all of which are exacerbated by the life history of the species as an aquatic habitat obligate, with late maturation, and susceptibility to bioaccumulation of toxins (COSEWIC 2023).

The most pressing threats to mudpuppies appear to be direct mortality caused by botulism, lampricides, and extreme weather events. A recent Canadian report estimates that between 2000 and 2019, 13,368 to 32,586 mudpuppies from the Great Lakes region died from these causes (COSEWIC 2023). Well-documented instances of direct mortality include the loss of hundreds of mudpuppies, resulting from lampricide treatments in the tributaries of Lake Champlain in both New York and Vermont (Vermont Fish & Wildlife Department 2015, Chellman et al. 2017). Young individuals are particularly susceptible, and repeated or chronic exposure appears to negatively impact reproduction, which can potentially lead to population declines or even extirpation (Boogaard et al. 2003, Matson 2022, Wagner and Peterman 2024). In New York State, the continued use of lampricides in New York waters remains a potential threat to populations (NYSDEC n.d., USFWS n.d.). Mortality from type E botulism has also been documented in Lake Erie (COSEWIC 2023). Extreme weather events, such as hurricanes, have been linked to direct mortality events as well (COSEWIC 2023), and climate change may exacerbate these threats in the future.

Industrial, agricultural, and municipal pollutants are also a concern for mudpuppies (COSEWIC 2023). For example, mudpuppies in the St. Lawrence River have high levels of PCBs (Bonin et al. 1995), and despite being banned decades ago, PCB levels continue to exceed the threshold effect level (i.e., the minimum level at which a toxic response is observed in benthic organisms) at more than 10% of St. Lawrence River sites just across the New York border in Canada (Working Group on the State of the St. Lawrence Monitoring 2020, COSEWIC 2023). Elevated PCB levels have been implicated in deformities of mudpuppies as well as hormonal disturbances (COSEWIC 2023).

Habitat alteration from erosion, land use development, and dams can destroy or degrade mudpuppy habitat, reduce connectivity within and between populations, and alter the hydrology of habitats, potentially reducing the availability of suitable habitat for both mudpuppies and their prey, reducing dispersal opportunities, and leading to mortality (Murphy et al. 2018, COSEWIC 2023).

Direct and indirect exploitation of mudpuppies continues to be a pervasive threat to the species as well. Protections for the species varies across its range and personal harvest of mudpuppies can still occur in some areas, though it is not often tracked when it occurs (COSEWIC 2023). Additionally, mudpuppies have been found in both local and global markets being sold as food, and in the pet trade, which could result in substantial take of the species depending on market demand (COSEWIC 2023). Indirect exploitation also occurs as mudpuppies are regularly caught as bycatch by anglers who may kill rather than release them (potentially due to once pervasive misinformation about their toxicity or negative impact on fish populations), or who may release them only for the mudpuppies to die later due to injuries and/or fishing hooks not being removed (COSEWIC 2023).

Several emerging diseases also pose a threat to mudpuppies including *Batrachochytrium dendrobatidis (Bd), B. salamandrivorans (Bsal),* and *Ranavirus*. The chytrid fungus, *B. dendrobatidis* (*Bd*), first described in 1998 (Longcore et al. 1999), has become a disease of global concern, with a recent study finding *Bd*-infection in 72% of sampled countries and in 1062 of 1966 (54%) amphibian species tested (Monzon et al. 2020). Fully aquatic salamanders, including other *Necturus* species, are susceptible to *Bd* (Chatfield et al. 2012). *Necturus maculosus* salamanders have been found to be infected with *Bd* in Virginia (Eskew et al. 2014) and in Wisconsin (Standish et al. 2018). While *Bsal* hasn't been introduced in North America yet, a recent study identified areas that have conditions suitable for *Bsal* in Ontario, Canada, as well as areas with the highest suitability for *Bd* (Crawshaw et al. 2022). Many of these locations overlap with the range of the mudpuppy (Crawshaw et al. 2022). However, research that directly exposed *N. maculosus* to *Bsal*, did not produce infected individuals (Gray et al. 2023).

Threat Level 1	Threat Level 2	Threat Level 3	Spatial Extent*	Severity*	Immediacy*	Trend	Certainty
5. Biological Resource Use	5.4 Fishing & Harvesting Aquatic Resources	5.4.1 Recreational or subsistence fishing	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
7. Natural System Modifications	7.2 Dams & Water Management/Use	7.2.1 Water level management using dams (change in water flow)	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
8. Invasive & Other Problematic Species	8.1 Invasive Non-Native Plants & Animals	Choose an item.(lampricide treatments)	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
8. Invasive & Other Problematic Species	8.4 Pathogens	8.4.1 Bacterial pathogens (botulism e)	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
8. Invasive & Other Problematic Species	8.4 Pathogens	8.4.2 Viral pathogens	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
8. Invasive & Other Problematic Species	8.4 Pathogens	8.4.3 Fungal pathogens	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.

Table 1. Threats to the mudpuppy.

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ✓ **No:** _____ **Unknown:** _____

If yes, describe mechanism and whether adequate to protect species/habitat:

In 2006, the State of New York adopted legislation (ECL section 11-0107 sub 2) that gave all native frogs, turtles, snakes, lizards, and salamanders legal protection as game species, with no salamander species open to harvest. The legislation also outlaws the sale of any native species of herpetofauna regardless of its origin.

Under Article 24 of the New York State Environmental Conservation Law, the Freshwater Wetlands Act provides protection to wetlands greater than 12.4 acres in size as well as smaller wetlands of 'Unusual Importance'. Beginning on January 1, 2028, the default size threshold of regulated wetlands will decrease to 7.4 acres. The Freshwater Wetlands Act also allows the Adirondack Park Agency to protect wetlands over one acre in size or any size wetland adjacent to open water within the Adirondack Park. The U.S. Army Corps of Engineers also protects wetlands, irrespective of size, under Section 404 of the Clean Water Act.

Under Article 15 Title 5 of the New York State Environmental Conservation Law, the Protection of Waters program provides protection for the state's water resources, including rivers, streams, lakes, and ponds. Environmental Conservation Law (section 15-0501 sub 1) prohibits the modification or disturbance of the course, channel, or bed of any stream without permit from the department.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

Research is needed to better determine habitat use and seasonal movement patterns in New York, which could help us understand potential impacts of TFM treatments. More research is also needed on the direct effects of TFM use on this species and whether increasing the lampricide treatment interval to every six years instead of every four because that may allow for greater recruitment since mudpuppies reach sexual maturity after 4-5 years and/or may be less susceptible to the effects of lampricide than earlier age classes

Distribution and population trends are poorly known, and the development and implementation of standardized survey techniques will help determine the quality and extent of occupied habitat in the state. Additionally, range-wide genetic work should be completed to help determine whether additional species designations are warranted.

The Comprehensive Wildlife Conservation Strategy (NYSDEC 2005) includes recommendations for the following actions for mudpuppy. These actions continue to be essential for the conservation of this species. Actions that have been accomplished, or where progress has been made, are denoted with a check.

Habitat research:

____ Develop standardized habitat survey protocols, and implement survey protocols at all known and potentially suitable sites, to document the character, quality and extent of occupied habitat.

Life history research:

____ Document life history parameters specific to New York populations of the species, including age and sex ratios, longevity, age at sexual maturity, survivorship of young, predator-prey relationships, and habitat requirements.

Modify regulation:

✓ Adopt into New York's Environmental Conservation Law provisions which designate mudpuppy as a protected small game species.

Other action:

____ Investigate the effects of lampricide applications upon mudpuppy populations which are resident in Lake Champlain and its tributary streams.

____ Investigate the significance of botulism-induced mortality in mudpuppy populations resident in Lake Erie.

Population monitoring:

____ Conduct periodic re-survey of known sites of species occurrence, in order to detect population trends.

Statewide baseline survey:

____ Develop standardized population survey protocols, and implement survey protocols at all known and potentially suitable sites, to document the extent of occupied habitat.

Complete Conservation Actions table using IUCN conservation actions taxonomy at link below. Use headings 1-6 for Action Category (e.g., Land/Water Protection) and associated subcategories for Action (e.g., Site/Area Protection) - https://www.iucnredlist.org/resources/conservation-actions-classification-scheme

Action Category	Action	Description
A.2 Direct Species Management	A.2.0.0.0 Direct Species Management	Invasive/Problematic Species Control
B.3 Outreach	B.3.1.0.0 Outreach, communication, and distribution	Awareness and Communications
B.4 Law Enforcement and Prosecution	B.4.0.0.0 Law Enforcement and Prosecution	Compliance & Enforcement
C.6 Design and Plan Conservation	C.6.5.1.3 Develop a conservation, management, or restoration plan for protected private lands	Habitat and natural process restoration

Table 2. Recommended conservation actions for the mudpuppy.

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