



Appendix 3 - **SGCN SUMMARIES**

Michigan's Wildlife Action Plan 2015-2025

Cover Photos Credits

Habitat – MNFI, Dave Cuthrell

Eastern Massasauga – Jennifer Moore

TABLE OF CONTENTS

INTRODUCTION TO SGCN SUMMARIES.....	2
SGCN SUMMARIES.....	3
MUSSELS	6
SNAILS	26
CRAYFISH.....	57
INSECTS.....	59
<i>MAYFLIES</i>	60
<i>DRAGONFLIES & DAMSELFLIES</i>	62
<i>STONEFLIES</i>	67
<i>GRASSHOPPERS & CRICKETS</i>	69
<i>CICADAS & HOPPERS</i>	76
<i>BEETLES</i>	80
<i>BEES</i>	83
<i>CADDISFLIES</i>	85
<i>BUTTERFLIES & MOTHS</i>	86
<i>FISHFLIES</i>	111
FISH	112
AMPHIBIANS	126
REPTILES.....	132
BIRDS.....	141
MAMMALS	164
LITERATURE REFERENCED FOR SGCN SUMMARIES	170

INTRODUCTION TO SGCN SUMMARIES

One of the premises behind the development of Michigan's Wildlife Action Plan is the need to preserve the full breadth of Michigan's wildlife diversity. One of the initial steps taken to address this need was to identify species of greatest conservation need (SGCN), which are those species of wildlife (by definition, both aquatic and terrestrial) with small or declining populations or other characteristics that make them vulnerable.

This appendix provides baseline information on SGCN. The information provided in the following summaries represents the current state of knowledge of the full set of SGCN. The summaries describe general abundance, distribution, landscape feature associations, and known threats, as well as issues of importance to the individual species (see descriptions below).

Distribution Maps

A distribution map is provided for each species for which data are available. Distribution of terrestrial species is presented by county, whereas distribution of aquatic species is presented with point data. Distribution maps for crossover species (those that use both aquatic and terrestrial landscape features during their life cycles) were created in the manner that best represents the available data. Available data were of a variety of types and from a variety of sources. When location data for a species were limited, historical and recent locations were combined to more accurately represent the potential distribution of the species. When the distribution represented on the map differs significantly from the known current locations, this difference is recognized in the accompanying text.

Distribution & Abundance

Each SGCN summary includes a description of the distribution and abundance of the species in Michigan, if known. Each summary also notes whether the species is currently Federally or State listed as endangered or threatened, or whether the species has been recognized as a Special Concern species.

Associated Landscape Features / Habitat

The associations with landscape features identified within the SGCN summaries include all landscape features used by the species, regardless of frequency of use or preferences, based on review of scientific literature and comments from species experts.

Associated Threats

Each SGCN summary lists all identified threats to the species, not just those to which the species is most susceptible; threats to which species are believed to be less susceptible should also be monitored to ensure they do not become more significant problems in the future.

Comments

The comments in the SGCN summaries provide species-specific information that is not available elsewhere in the action plan, and describe recommended conservation actions, research, survey and monitoring, and other information pertinent to conservation of the species.

SGCN SUMMARIES

Table of Contents

MUSSELS..... 6	ACORN RAMSHORN 30	TAPERED VERTIGO 54
A FINGERNAIL CLAM 6	AN AQUATIC SNAIL 30	TRUMPET VALLONIA..... 54
BLACK SANDSHELL 7	BANDED GLOBE 31	VELVET WEDGE 55
CLUBSHELL..... 7	BOREAL FOSSARIA 31	WATERCRESS SNAIL..... 55
CREEK HEELSPLITTER 8	BROADSHOULDER PHYSA 32	WIDESPREAD COLUMN 56
DEERTOEO 8	BROWN WALKER..... 32	YELLOW GLOBELET 56
EASTERN ELLIPTIO..... 9	BUGLE FOSSARIA..... 33	CRAYFISH.....57
EASTERN PONDMUSSEL 9	CAMPELOMA SPIRE SNAIL 33	BIG WATER CRAYFISH 57
ELKTOE 10	CANADIAN DUSKYSNAIL 34	CALICO CRAYFISH..... 58
ELLIPSE..... 10	CARINATE PILLSNAIL 34	INSECTS59
EUROPEAN PEA CLAM 11	CAROLINA MANTLESLUG 35	A MAYFLY 60
FAWNSFOOT 11	CHERRYSTONE DROP..... 35	A MAYFLY 61
FLUTEDSHELL..... 12	COLDWATER PONDSNAIL 36	WALKER'S TUSKED SPRAWLER..... 61
GIANT NORTHERN PEA CLAM 12	COPPER BUTTON..... 36	ELUSIVE SNAKETAIL 62
GREATER EUROPEAN PEA CLAM 13	CRESTED VERTIGO 37	EXTRA-STRIPED SNAKETAIL 63
HICKORYNUT 13	CRESTED VERTIGO 37	GREY PETALTAIL 63
KIDNEYSHELL 14	DEEP-THROAT VERTIGO..... 38	HINE'S EMERALD DRAGONFLY 64
LAKE FLOATER 14	DEEPWATER PONDSNAIL..... 38	INCURVATE EMERALD..... 64
LILLIPUT 15	DELICATE VERTIGO 39	LAURA'S SNAKETAIL 65
NORTHERN RIFFLESHELL..... 15	DEPRESSED AMBERSNAIL 39	PYGMY SNAKETAIL 65
ORNAMENTED PEACLAM..... 16	DOMED DISC..... 40	RIVERINE CLUBTAIL 66
PAPER PONDSHELL..... 16	EASTERN FLAT-WHORL 40	RUSSET-TIPPED CLUBTAIL 66
PINK HEELSPLITTER 17	FILE THORN 41	A STONEFLY..... 67
PINK PAPERSHELL 17	FLANGED VALVATA..... 41	ARCTIC SPRINTFLY..... 68
PURPLE LILLIPUT..... 18	FLAT DOME..... 42	ATLANTIC-COAST LOCUST 69
PURPLE WARTYBACK..... 18	FOSTER MANTLESLUG 42	BLUE-LEGGED LOCUST 70
RAINBOW 19	GLOBE SILTSNAIL..... 43	BOG CONEHEAD 70
RAYED BEAN..... 19	GRAVEL PYRG..... 43	DAVIS'S SHIELD-BEARER..... 71
RIVER FINGERNAIL CLAM..... 20	GREAT LAKES PHYSA..... 44	DELICATE MEADOW KATYDID 71
ROUND HICKORYNUT 20	HONEY VERTIGO 44	GREEN DESERT GRASSHOPPER 72
ROUND LAKE FLOATER 21	HUBRICH'T'S VERTIGO 45	HOOSIER LOCUST 72
ROUND PEACLAM 21	LAKE SUPERIOR RAMSHORN..... 45	LAKE HURON LOCUST..... 73
ROUND PIGTOE 22	LAMBDA SNAGGLETOOTH 46	PINE KATYDID 73
SALAMANDER MUSSEL..... 22	MEDIAN STRIATE..... 46	RED-FACED MEADOW KATYDID..... 74
SLIPPERSHELL 23	MYSTERY VERTIGO 47	SECRETIVE LOCUST..... 74
SNUFFBOX 23	PETOSKEY PONDSNAIL 47	TAMARACK TREE CRICKET 75
THREEHORN WARTYBACK..... 24	PLEISTOCENE CATINELLA..... 48	ANGULAR SPITTLEBUG 76
WAVYRAYED LAMPMUSSEL..... 24	PROUD GLOBE..... 48	GREAT PLAINS SPITTLEBUG 77
WHITE CATSPA W 25	PROUD GLOBELET 49	HURON RIVER LEAFHOPPER..... 77
SNAILS 26	PURPLECAP VALVATA 49	A LEAFHOPPER..... 78
A LAND SNAIL 26	PYRAMID DOME..... 50	A LEAFHOPPER..... 78
A LAND SNAIL 27	SEALED GLOBELET 50	ROBERTSON'S FLIGHTLESS
A LAND SNAIL 27	SIX-WHORL VERTIGO 51	PLANTHOPPER 79
A LAND SNAIL 28	SMOOTH COIL 51	BLACK LORDITHON ROVE BEETLE 80
A LAND SNAIL 28	SOUTHEASTERN GEM 52	CANTRALL'S BOG BEETLE..... 81
A LAND SNAIL..... 29	SPIKE-LIP CRATER..... 52	DOUGLAS STENELMIS RIFFLE BEETLE 81
A LAND SNAIL 29	SPINDLE LYMNAEA 53	
	STERKI'S GRANULE 53	

MICHIGAN'S WILDLIFE ACTION PLAN 2015-2025
SGCN DISTRIBUTION, STATUS, HABITATS & THREATS

HUNGERFORD'S CRAWLING WATER BEETLE.....	82	YELLOW-BANDED DAY-SPHINX.....	110	NORTHERN RIBBON SNAKE	137
SIX-BANDED LONGHORN BEETLE.....	82	A FISHFLY.....	111	NORTHERN RINGNECK SNAKE	138
RUSTY-PATCHED BUMBLE BEE	83	FISH	112	QUEEN SNAKE.....	138
YELLOW BANDED BUMBLE BEE	84	BIGMOUTH SHINER.....	112	SIX-LINED RACERUNNER.....	139
A CADDISFLY.....	85	BLACK REDHORSE.....	113	SMOOTH GREEN SNAKE.....	139
3-STRIPED ONCOCNEMIS	86	BRINDLED MADTOM	113	SPOTTED TURTLE	140
AWEME BORER	87	CHANNEL DARTER	114	WOOD TURTLE	140
BLAZING STAR BORER	87	CREEK CHUBSUCKER	114	BIRDS	141
BOREAL BRACHIONYNCHA	88	EASTERN SAND DARTER	115	AMERICAN BITTERN.....	141
CORYLUS DAGGER MOTH	88	IVES LAKE CISCO	115	BALD EAGLE.....	142
CULVERS ROOT BORER	89	KIWI.....	116	BARN OWL	142
DOLL'S MEROLONCHE	89	CISCO OR LAKE HERRING.....	116	BLACK TERN.....	143
DUKES' SKIPPER.....	90	LAKE STURGEON	117	BLACK-BACKED WOODPECKER.....	143
DUNE CUTWORM	90	MOONEYE	117	BLACK-CROWNED NIGHT-HERON .	144
DUSTED SKIPPER.....	91	NORTHERN MADTOM	118	CASPIAN TERN.....	144
EARLY HAIRSTREAK	91	ORANGETHROAT DARTER.....	118	CERULEAN WARBLER.....	145
FREIJA FRITILLARY	92	PUGNOSE MINNOW.....	119	COMMON LOON	145
FRIGGA FRITILLARY.....	92	PUGNOSE SHINER.....	119	COMMON MOORHEN	146
FROSTED ELFIN	93	REDSIDE DACE	120	COMMON NIGHTHAWK.....	146
GIANT EUCOSMA MOTH.....	93	RIVER DARTER	120	COMMON TERN.....	147
GOLD MOTH.....	94	RIVER REDHORSE	121	DICKCISSEL	147
GOLDEN BORER.....	94	SAUGER	121	EASTERN RED KNOT.....	148
GRIZZLED SKIPPER.....	95	SHORTJAW CISCO.....	122	FORSTER'S TERN	148
KARNER BLUE	95	SILVER CHUB	122	GOLDEN-WINGED WARBLER	149
LARGE MARBLE	96	SILVER SHINER.....	123	GRASSHOPPER SPARROW	149
LEADPLANT MOTH	96	SISKIWIT LAKE CISCO.....	123	HENSLOW'S SPARROW	150
MACOUN'S ARCTIC.....	97	SOUTHERN REDBELLY DACE	124	HOODED WARBLER	150
MAGDALEN UNDERWING	97	SPOONHEAD SCULPIN	124	KING RAIL.....	151
MARITIME SUNFLOWER BORER.....	98	STARHEAD TOPMINNOW	125	KIRTLAND'S WARBLER.....	151
MICHIGAN DUNE DART.....	98	AMPHIBIANS	126	LEAST BITTERN	152
MITCHELL'S SATYR	99	BLANCHARD'S CRICKET FROG	126	LONG-EARED OWL	152
MONARCH BUTTERFLY	99	BOREAL CHORUS FROG.....	127	LOUISIANA WATERTHRUSH	153
MOTTLED DUSKYWING.....	100	MARbled SALAMANDER	127	MERLIN	153
NEWMAN'S BROCADE	100	MINK FROG.....	128	MIGRANT LOGGERHEAD SHRIKE...	154
NORTHERN BLUE	101	MUDPUPPY.....	128	NORTHERN GOSHAWK	154
NORTHERN HAIRSTREAK.....	101	NORTHERN DUSKY SALAMANDER..	129	NORTHERN HARRIER.....	155
OTTOE SKIPPER	102	PICKEREL FROG	129	OSPREY.....	155
PERSIUS DUSKY WING.....	102	SMALLMOUTH SALAMANDER.....	130	PEREGRINE FALCON.....	156
PHLOX MOTH	103	SOUTHERN TWO-LINED SALAMANDER	130	PIPING PLOVER.....	156
PINE IMPERIAL MOTH	103	130	PRAIRIE WARBLER.....	157
PIPEVINE SWALLOWTAIL	104	WESTERN LESSER SIREN	131	PROTHONOTARY WARBLER.....	157
POWESHIEK SKIPPERLING	104	WOODHOUSE'S TOAD	131	RED-HEADED WOODPECKER	158
QUIET UNDERWING	105	BLANDING'S TURTLE.....	132	RED-SHOULDERED HAWK	158
RED-DISKED ALPINE	105	BLUE RACER.....	133	SHARP-TAILED GROUSE	159
REGAL FERN BORER.....	106	BUTLER'S GARTER SNAKE	133	SHORT-EARED OWL.....	159
SILPHIUM BORER MOTH.....	106	COPPERBELLY WATER SNAKE	134	SPRUCE GROUSE.....	160
SPARTINA MOTH	107	EASTERN BOX TURTLE	134	TRUMPETER SWAN.....	160
SPRAGUE'S PYGARCTIA	107	EASTERN FOX SNAKE	135	WESTERN MEADOWLARK	161
SULFUR ROSINWEED STEM BORER .	108	EASTERN MASSASAUGA.....	135	WHIP-POOR-WILL	161
SWAMP METALMARK	108	EASTERN MUSK TURTLE	136	WILSON'S PHALAROPE	162
THE RELIC	109	GRAY RAT SNAKE.....	136	YELLOW RAIL	162
THREE-HORNED MOTH	109	KIRTLAND'S SNAKE.....	137	YELLOW-HEADED BLACKBIRD.....	163
THREE-STAFF UNDERWING	110			YELLOW-THROATED WARBLER.....	163

MICHIGAN'S WILDLIFE ACTION PLAN 2015-2025
SGCN DISTRIBUTION, STATUS, HABITATS & THREATS

MAMMALS	164	MOOSE	166	SMOKY SHREW.....	168
EVENING BAT.....	164	NORTHERN BAT OR NORTHERN MYOTIS		TRICOLORED BAT	169
INDIANA BAT OR INDIANA MYOTIS	165	167	WOODLAND VOLE.....	169
LEAST SHREW	165	NORTHERN FLYING SQUIRREL.....	167		
LITTLE BROWN BAT	166	PRAIRIE VOLE	168		

MUSSELS



A fingernail clam (*Pisidium simplex*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Three occurrences in MNFI database. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: headwaters & small tributaries; medium rivers; lakes

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS: Distribution and population status needs to be determined.



black sandshell

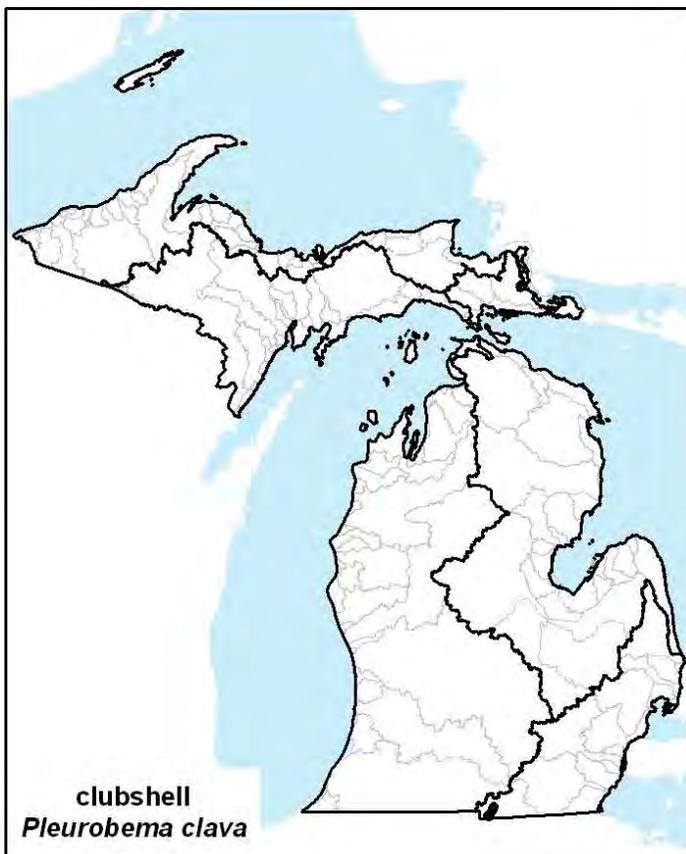
(*Ligumia recta*)

DISTRIBUTION & ABUNDANCE: Currently state listed as endangered but recommended downlisting to threatened. This species is rare in the Erie, Huron, and Michigan basins. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: shoreline; large lakes; medium rivers; large rivers; gradient: moderate; rock substrates; soft substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS: Population status needs to be determined and refugia needs to be preserved. Experts suggest this species is declining due to zebra mussels.



clubshell

(*Pleurobema clava*)

DISTRIBUTION & ABUNDANCE: State and federally listed as endangered. Only found in one watershed.

ASSOCIATED LANDSCAPE FEATURES: headwaters & small tributaries; medium rivers; large rivers; rock substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: extremely vulnerable with very high confidence

COMMENTS: Host species have only been determined in the laboratory, field verification is needed. Species can be difficult to sample because they burrow below surface. Protection of this species will require partnerships and cooperation with landowners in the watershed. Population should be monitored to ensure that successful reproduction is occurring. Opportunities for restoration and reintroduction should be sought.



creek heelsplitter

(*Lasmigona compressa*)

DISTRIBUTION & ABUNDANCE: Currently not listed, but recommended to be state listed as special concern. This species is widespread although not common over its entire range. In Michigan it is somewhat rare and there have been recent large declines. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: small lakes; medium lakes; large lakes; headwaters & small tributaries; medium rivers; large rivers; gradient: moderate; rock substrates; soft substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: highly vulnerable with moderate confidence

COMMENTS: Surveys are needed for this species to determine population status. There is evidence to suggest that there has been a loss of year classes for this species in Michigan.



deertoe

(*Truncilla truncata*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Found in eight watersheds post-1989.

ASSOCIATED LANDSCAPE FEATURES: medium lakes; large lakes; headwaters & small tributaries; medium rivers; large rivers; gradient: moderate; rock substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS: Distribution and population status needs to be determined.



eastern elliptio

(*Elliptio complanata*)

DISTRIBUTION & ABUNDANCE: Currently not listed, but recommended to be state listed as special concern. Species is very regional, and shows recent population declines.

ASSOCIATED LANDSCAPE FEATURES: ponds; small lakes; medium lakes; medium rivers; rock substrates; soft substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS: Distribution and population status needs to be determined.



eastern pondmussel

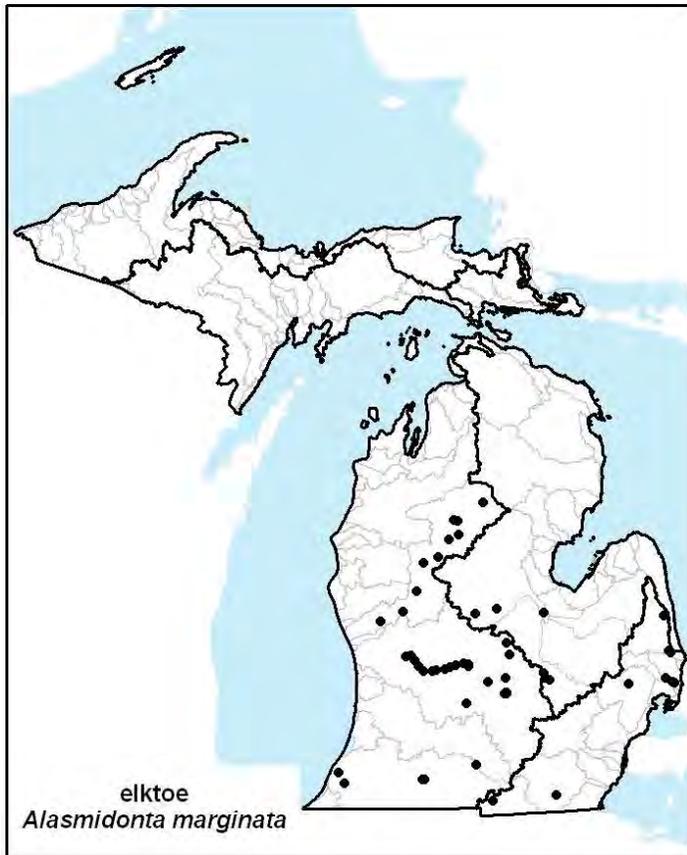
(*Ligumia nasuta*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Found alive at five sites that are all extremely infested with dreissenids. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: shoreline; ponds; small lakes; medium lakes; large lakes; headwaters & small tributaries; medium rivers; gradient: slow; soft substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: moderately vulnerable with low confidence

COMMENTS: Distribution and population status need to be determined. Experts suggest this species is in decline due to zebra mussels. Host species need to be determined.



elktoe

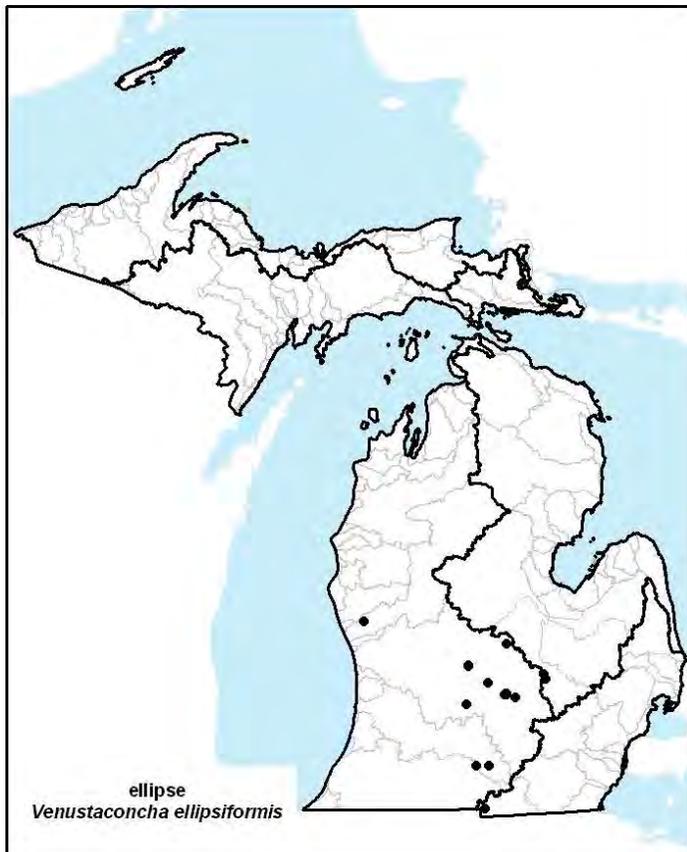
(*Alasmidonta marginata*)

DISTRIBUTION & ABUNDANCE: State-listed as special concern. This species is found throughout the Lower Peninsula. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: medium rivers; large rivers; rock substrates; soft substrates; turbid water; clear water

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; pesticides & herbicides; Climate vulnerability: highly vulnerable with low confidence

COMMENTS: This species can be difficult to sample for because of its burying habits. Sampling may be most efficient at the beginning of the dry season. Population status needs to be determined.



ellipse

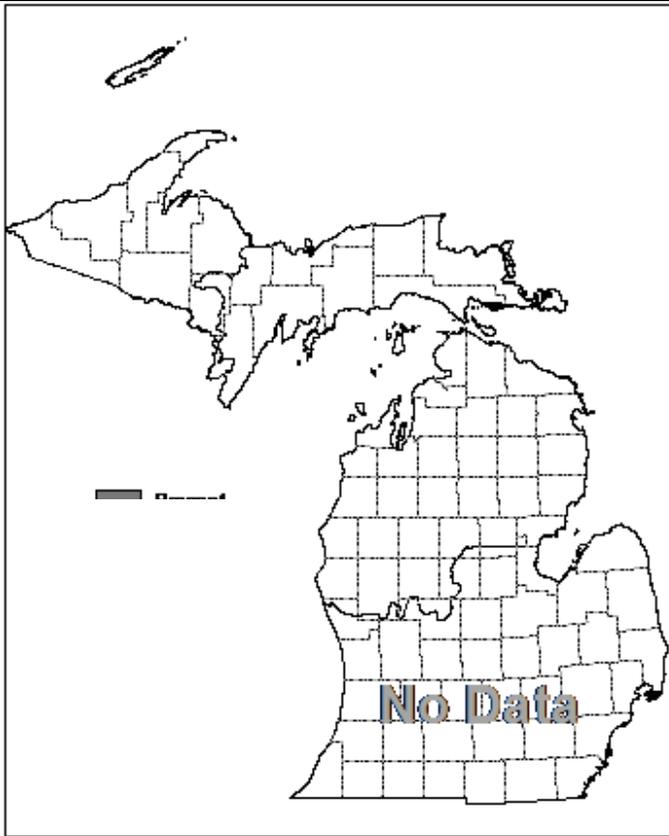
(*Venustaconcha ellipsiformis*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Species is rare in Michigan with a low number of locations although a recent increase in watersheds. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: headwaters & small tributaries; medium rivers; gradient: moderate; rock substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: extremely vulnerable with moderate confidence

COMMENTS: Hosts have been determined in laboratory and need to be verified in the field. Population status needs to be determined.



European pea clam

(Sphaerium corneum)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Unknown distribution and abundance.

ASSOCIATED LANDSCAPE FEATURES:

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS:



fawnsfoot

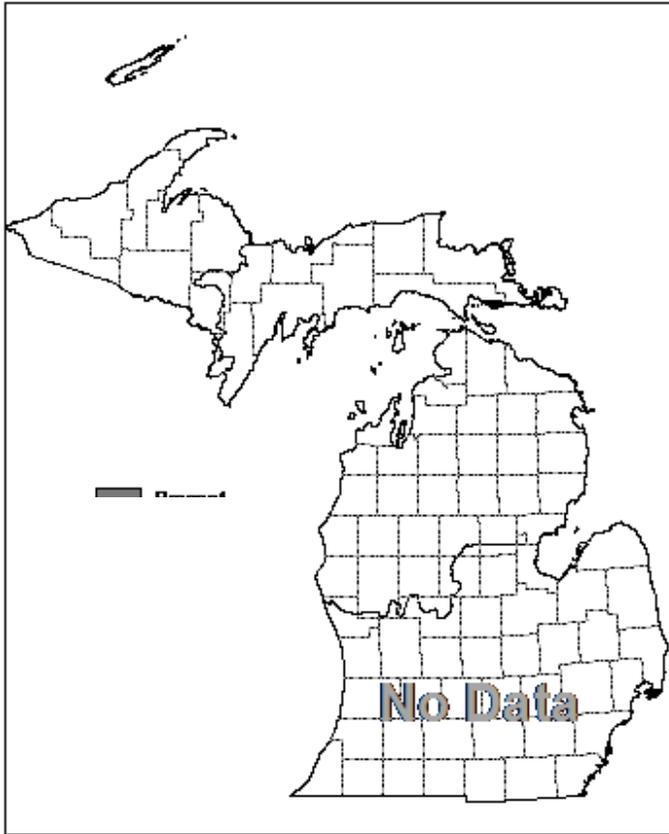
(Truncilla donaciformis)

DISTRIBUTION & ABUNDANCE: Currently state listed as threatened but recommended to be listed as endangered. Known in less than five watersheds in Michigan. Population declines from historic data.

ASSOCIATED LANDSCAPE FEATURES: medium lakes; large lakes; medium rivers; large rivers; gradient: slow; rock substrates; soft substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS: Distribution and population status need to be determined. Little known about this species in Michigan.



flutedshell

(*Lasmigona costata*)

DISTRIBUTION & ABUNDANCE: Currently not state listed but recommended to be listed as special concern. Recent population declines noted.

ASSOCIATED LANDSCAPE FEATURES: medium rivers; large rivers; gradient: moderate; rock substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS: Distribution and population status need to be determined.



giant northern pea clam

(*Pisidium idahoense*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES:

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS:



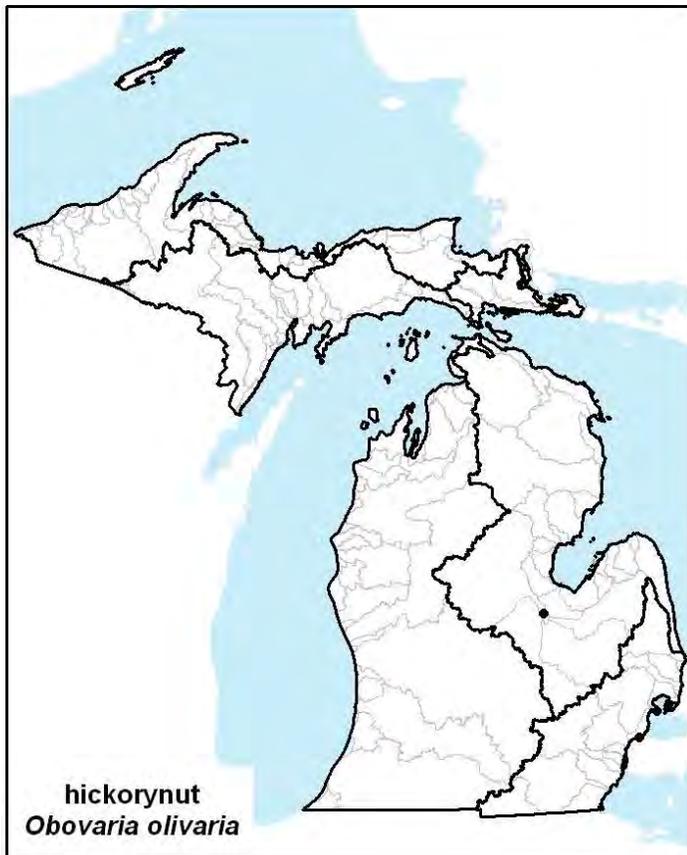
Greater European pea clam
(Pisidium amnicum)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES:

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS:



hickorynut

(Obovaria olivaria)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Very rare in Michigan; recently found in only two watersheds indicating a decline. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: headwaters & small tributaries; medium rivers; large rivers; gradient: moderate; rock substrates; soft substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: highly vulnerable with low confidence

COMMENTS: Population status and distribution needs to be determined. Maintenance or establishment of vegetated riparian buffers can help protect mussel habitats from many of their threats (MNFI 2007).



kidneyshell

(*Ptychobranthus fasciolaris*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Rare in Michigan. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: medium lakes; large lakes; medium rivers; large rivers; gradient: moderate; rock substrates; soft substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS: Host species need to be determined for this species. Population status needs to be determined. The kidney shell experiences an especially high mortality rate in low dissolved oxygen conditions (Tezloff 2001). The species is also negatively affected by zebra mussels (MNFI 2015).



Lake floater

(*Pyganodon lacustris*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Possibly underestimated through current survey methods. Distribution and abundance unknown.

ASSOCIATED LANDSCAPE FEATURES:

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS:



lilliput

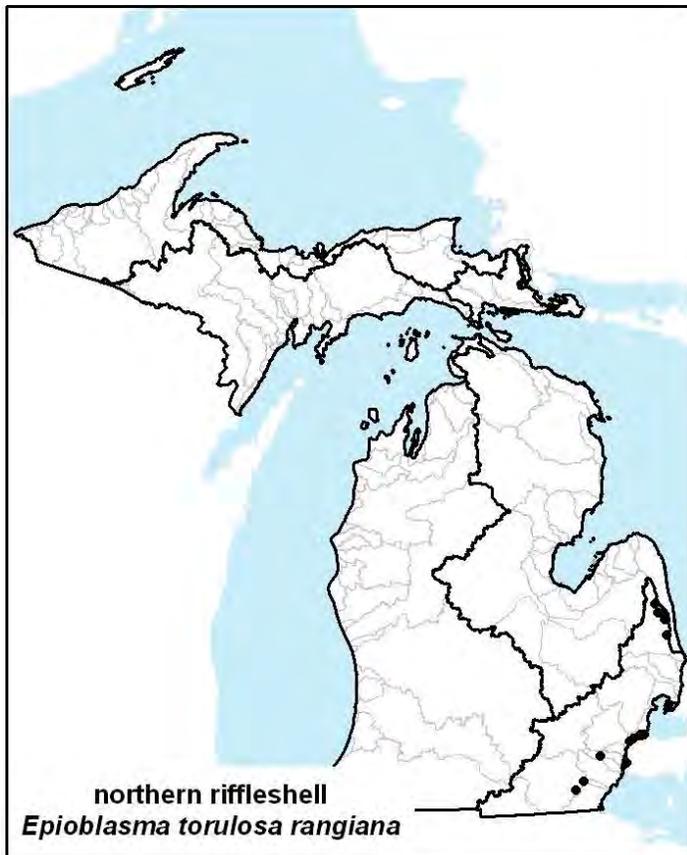
(*Toxolasma parvus*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Abundance and distribution are unknown.

ASSOCIATED LANDSCAPE FEATURES: ponds; small lakes; headwaters & small tributaries; medium rivers; soft substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS: Species is small and may be overlooked during surveys. Declines may be due to fragmentation and zebra mussels. Distribution and population status need to be determined.



northern riffleshell

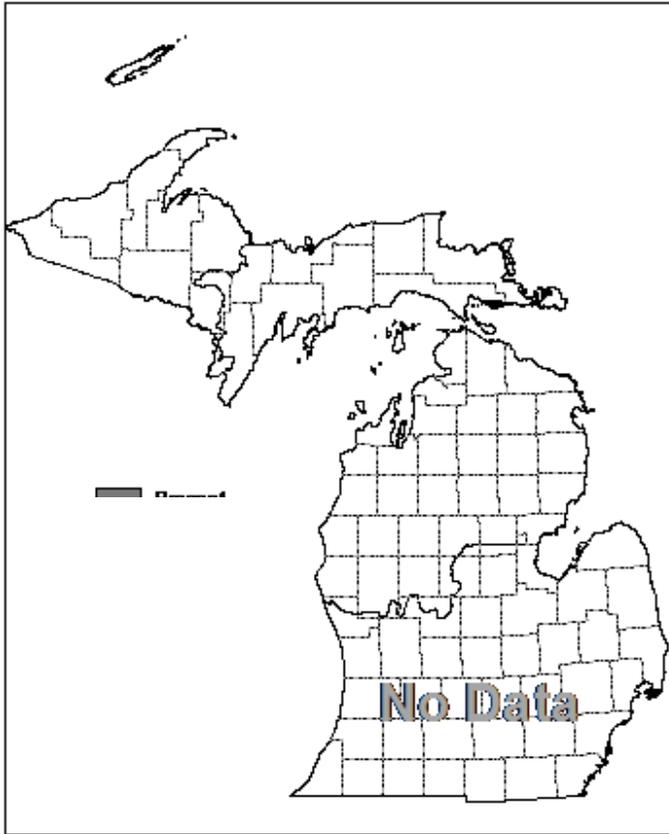
(*Epioblasma torulosa rangiana*)

DISTRIBUTION & ABUNDANCE: State and federally listed as endangered. Historically occurred in only three watersheds in Michigan. Populations in the State have been devastated by stream dredging and the introduction of zebra mussels. Abundance is very low and species is imperiled.

ASSOCIATED LANDSCAPE FEATURES: shoreline; medium rivers; large rivers; rock substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: extremely vulnerable with high confidence

COMMENTS: Host species determined in laboratory, field verification needed. Population status needs to be determined, one recently dead individual was found in the Detroit River in 2005. Opportunities for restoration and reintroduction should be sought. The continued spread of zebra mussels into inland stream systems will make eventual recovery extremely difficult.



ornated peacocks

(Pisidium cruciatum)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Unknown distribution and abundance.

ASSOCIATED LANDSCAPE FEATURES:

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS:



paper pondshell

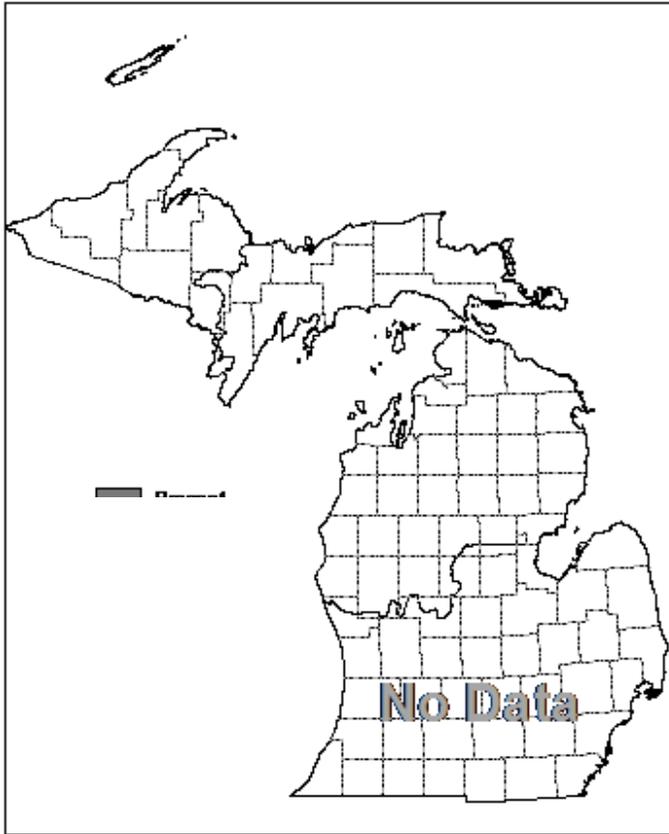
(Utterbackia imbecillis)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Found in low numbers among many watersheds but populations are declining. Unknown abundance.

ASSOCIATED LANDSCAPE FEATURES:

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS:



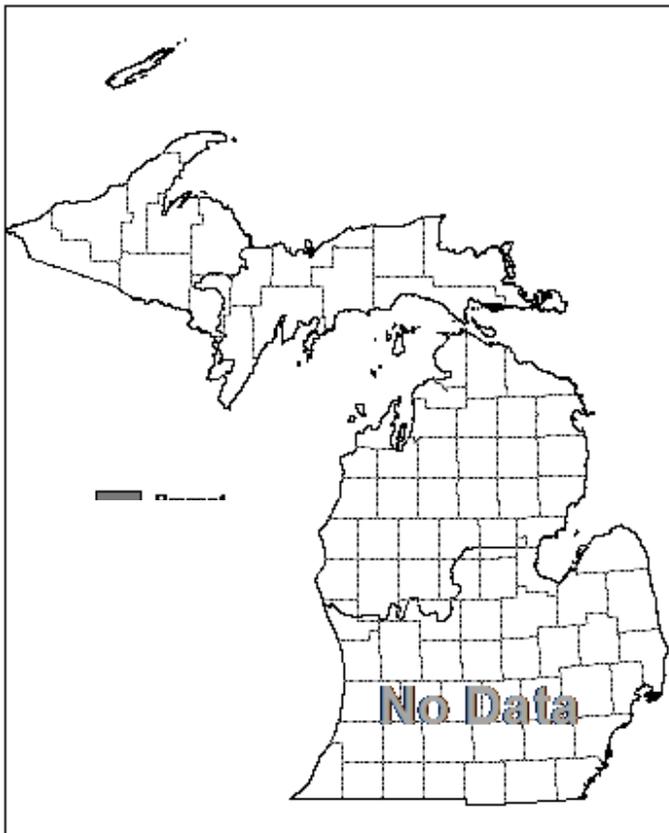
pink heelsplitter
(*Potamilus alatus*)

DISTRIBUTION & ABUNDANCE: Currently not state listed, but recommended to be listed as special concern. Declines in recent surveys. Unknown distribution and abundance.

ASSOCIATED LANDSCAPE FEATURES:

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS:



pink papershell
(*Potamilus ohioensis*)

DISTRIBUTION & ABUNDANCE: Currently state listed as threatened, but recommended to be listed as endangered. Unknown abundance.

ASSOCIATED LANDSCAPE FEATURES:

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS: Only four records in MNFI database.



purple lilliput

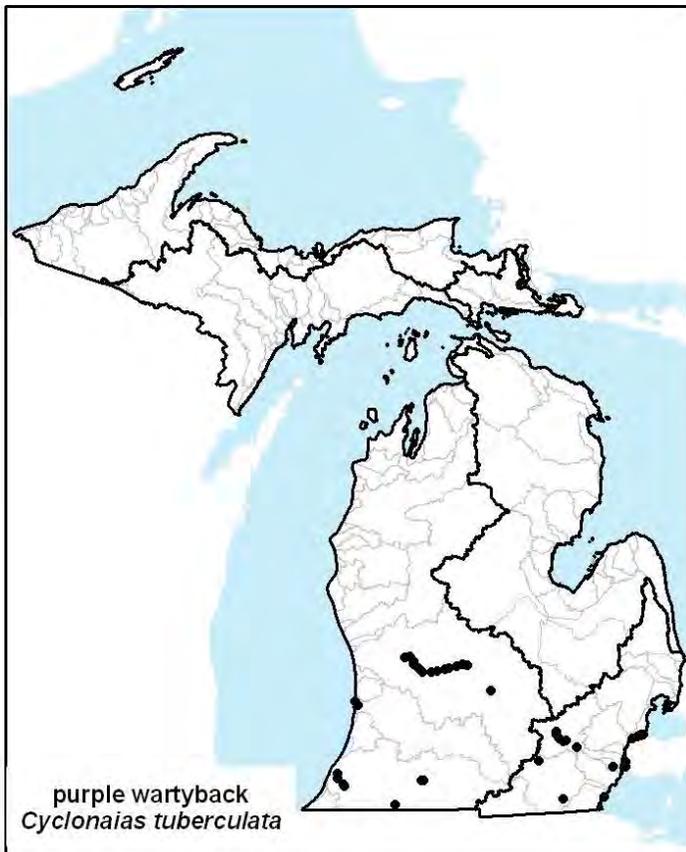
(*Toxolasma lividus*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Critically imperiled in Michigan and imperiled globally. There are eight occurrences documented. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: small lakes; small lakes; medium lakes; headwaters & small tributaries; medium rivers; gradient: moderate; rock substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: extremely vulnerable with moderate confidence

COMMENTS: Host species needs to be determined and confirmed. Control of zebra mussels is critical to preserving the species (MNFI 2015). Population status needs to be determined.



Purple wartyback

(*Cyclonaias tuberculata*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Occurs occasionally in the Southern Lower Peninsula. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: medium rivers; large rivers; gradient: moderate; rock substrates; soft substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: moderately vulnerable with low confidence

COMMENTS: Northern Michigan is the northern edge of range for this species. There is concern about dreissenids and size class changes. Population status needs to be determined.



rainbow

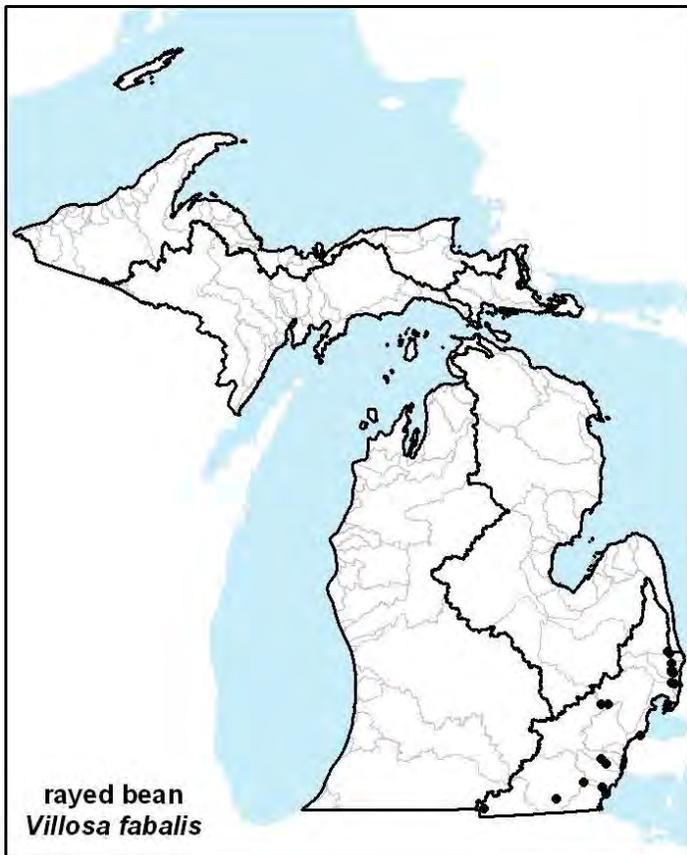
(*Villosa iris*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. There have been recent declines from historic levels.

ASSOCIATED LANDSCAPE FEATURES: shoreline; nearshore; small lakes; medium lakes; large lakes; cool headwaters & small tributaries; cool medium rivers; cool large rivers; gradient: moderate; rock substrates; soft substrates; clear water

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS: Host species determined in laboratory, field verification needed. Population status needs to be determined.



rayed bean

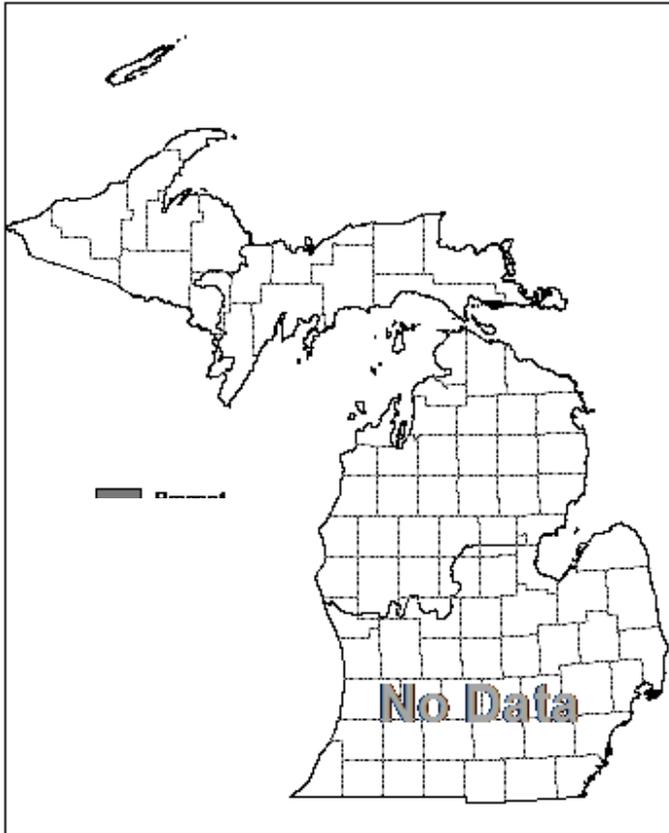
(*Villosa fabalis*)

DISTRIBUTION & ABUNDANCE: State and federally listed as endangered. Found in extremely low numbers in only four watersheds. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: small lakes; medium lakes; headwaters & small tributaries; medium rivers; rock substrates; soft substrates; vegetation

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerable: highly vulnerable with low confidence

COMMENTS: Host species and breeding season in Michigan needs to be determined. Population status and distribution needs to be determined.



river fingernail clam

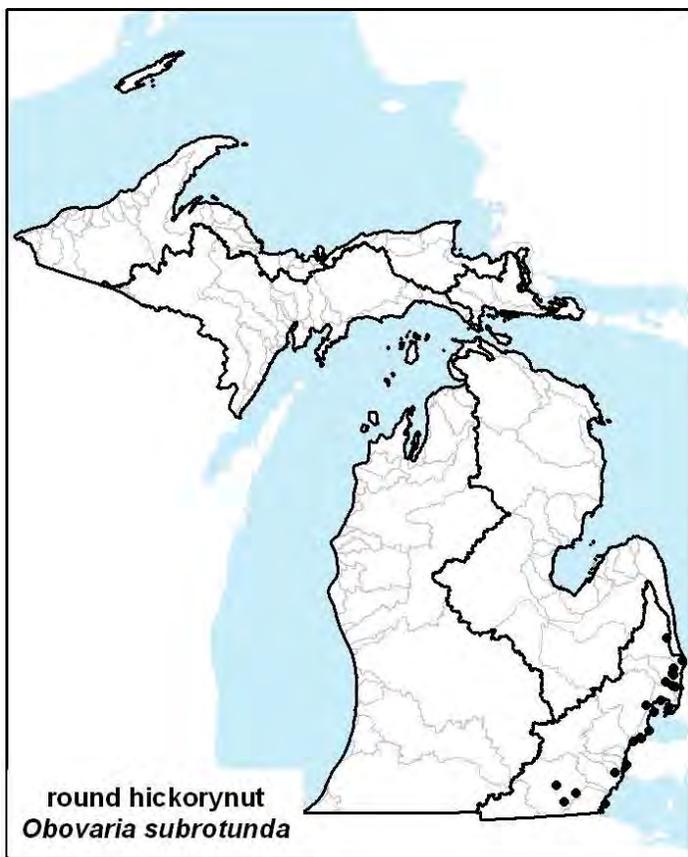
(Sphaerium fabale)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Unknown abundance.

ASSOCIATED LANDSCAPE FEATURES:

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS: MNFI contains records for more than 20 Michigan counties.



round hickorynut

(Obovaria subrotunda)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Recently found in only two watersheds which indicated a decline. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: shoreline; nearshore; large lakes; medium rivers; large rivers; gradient: slow; gradient: moderate; rock substrates; soft substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: insufficient evidence because host fish are not known

COMMENTS: Host species needs to be determined. Population status needs to be determined.



round lake floater

(*Pyganodon subgibbosa*)

DISTRIBUTION & ABUNDANCE: Currently state listed as threatened, but recommended downlisting to special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: small lakes; medium lakes; large lakes; large rivers; gradient: slow; soft substrates; unknown

ASSOCIATED THREATS: lack of scientific knowledge; unknown; climate vulnerability: unknown

COMMENTS: It is debated whether this species is a junior synonym of the giant floater (*Pyganodon grandis*). Genetic work needs to be done. This species may also be known by the name *Anodonta subgibbosa*. A threat assessment is needed for this species.



round peaclam

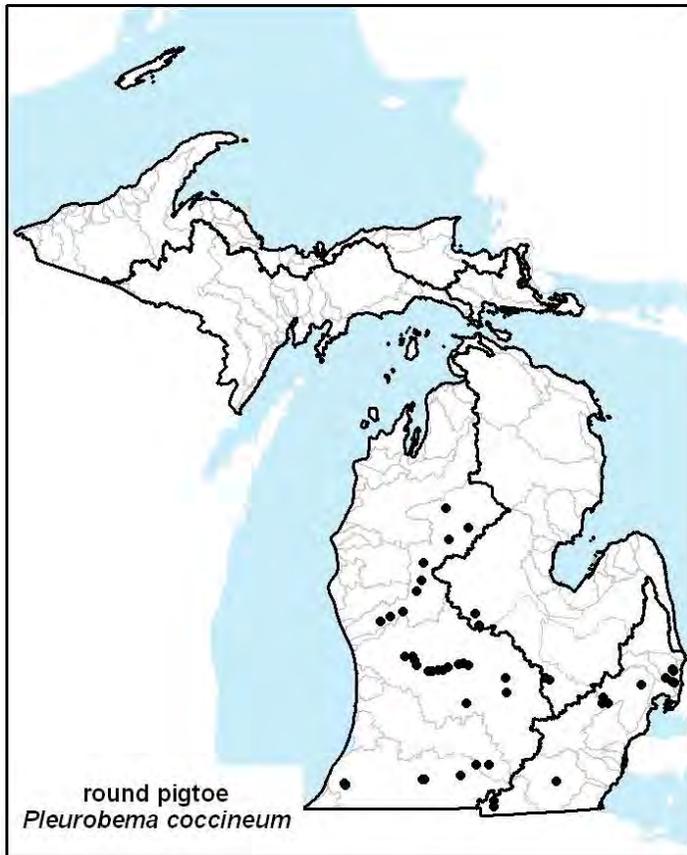
(*Pisidium equilaterale*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Unknown distribution and abundance.

ASSOCIATED LANDSCAPE FEATURES:

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS: No records in MNFI database.



round pigtoe

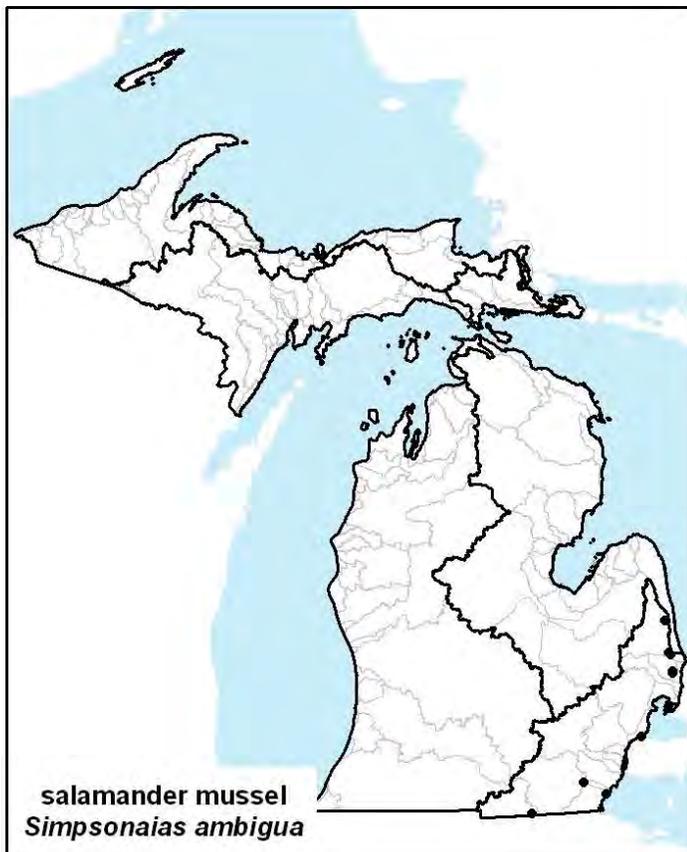
(*Pleurobema sintoxia*)

DISTRIBUTION & ABUNDANCE: Federally and State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: medium rivers; large rivers; gradient: moderate; rock substrates; soft substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; removal of wildlife; urban, municipal, and industrial pollution; climate vulnerability: highly vulnerable with low confidence

COMMENTS: Michigan is northern extent of range for this species. Host species have only been determined in the laboratory, field verification is needed. This species is highly variable and plastic in its appearance and morphology within a watershed. Population status needs to be determined.



salamander mussel

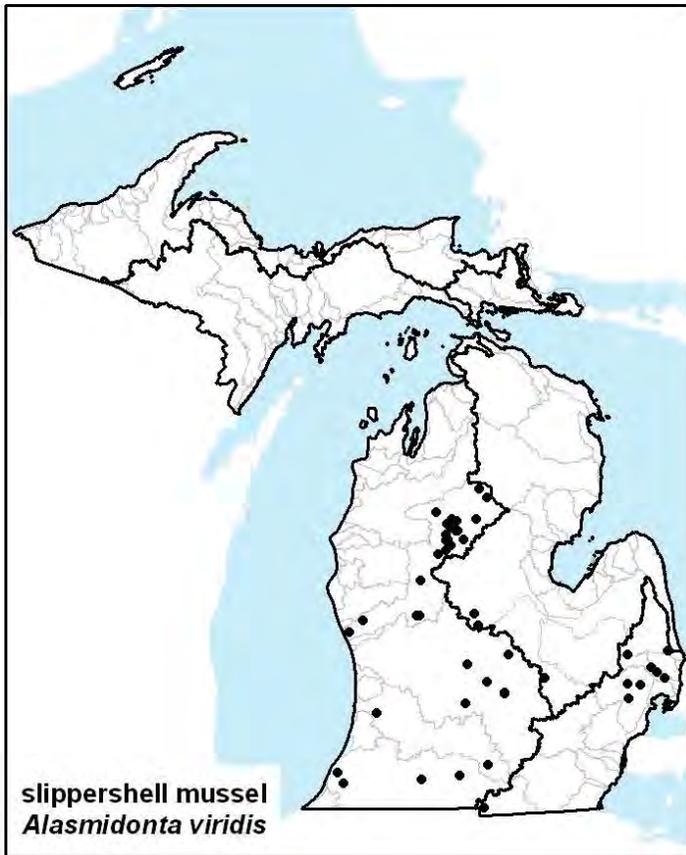
(*Simpsonaias ambigua*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Since 1980, this species has only been found in 2 watersheds. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: medium rivers; large rivers; rock substrates; soft substrates

ASSOCIATED THREATS: other biological interactions (host species, mudpuppy, also species of greatest conservation need); climate vulnerability: extremely vulnerable with high confidence

COMMENTS: The mudpuppy is the salamander mussel's only known host, and hence its populations are tied to the mudpuppy. This species may be overlooked in surveys because they are small and reside under flat rocks and similar objects, as does their host. Targeted surveys are needed to determine distribution and population status of this species.



slippershell

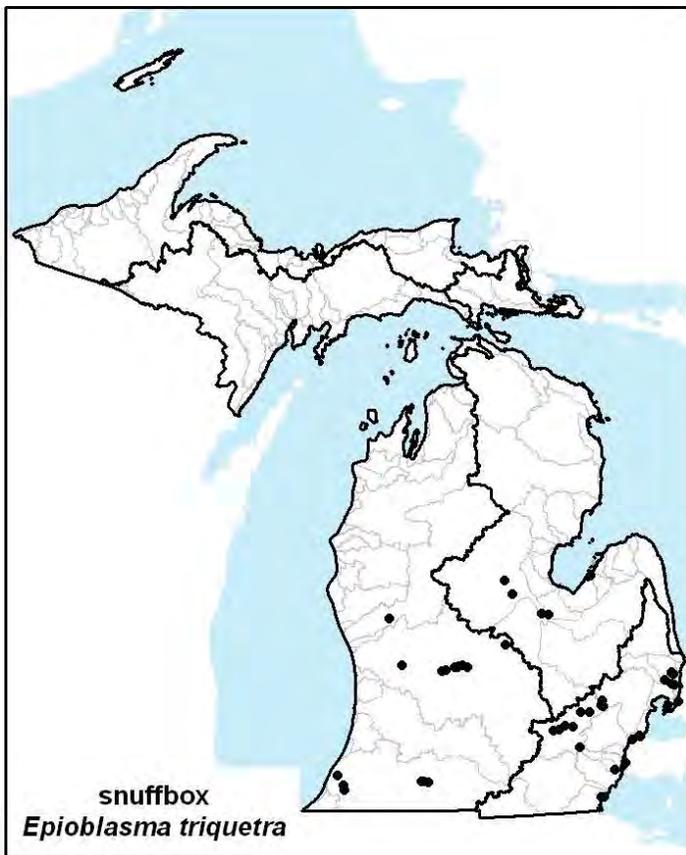
(*Alasmidonta viridis*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Abundance unknown.

ASSOCIATED LANDSCAPE FEATURES: small lakes; medium lakes; headwaters & small tributaries; medium rivers; large rivers; rock substrates; soft substrates; clear water

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; pesticides & herbicides; urban, municipal, and industrial pollution; Climate vulnerability: extremely vulnerable with very high confidence

COMMENTS: This species can be overlooked during sampling because of its small size and burrowing habit. Population status needs to be determined.



snuffbox

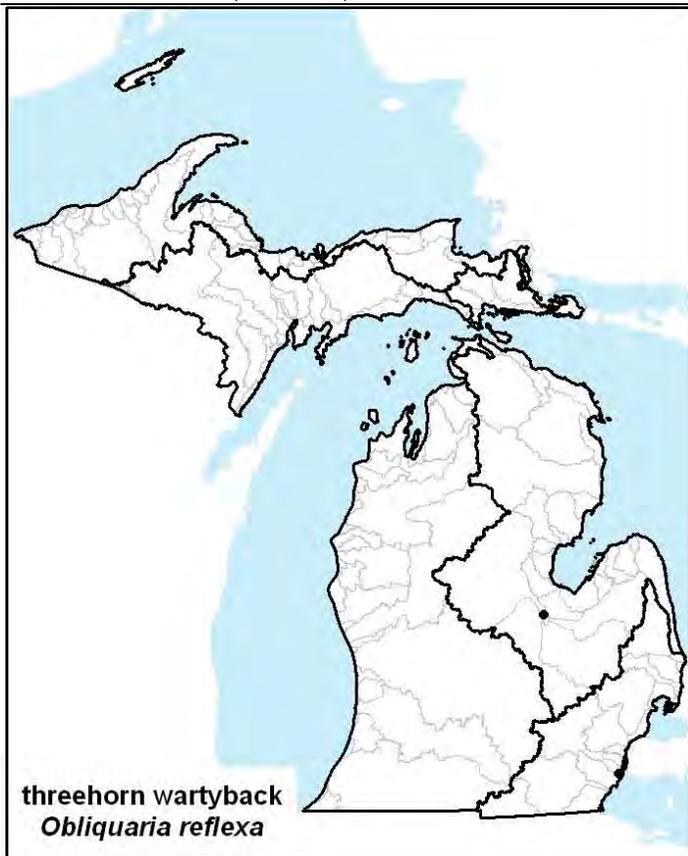
(*Epioblasma triquetra*)

DISTRIBUTION & ABUNDANCE: State and federally listed as endangered. Occurs occasionally throughout the Southern Lower Peninsula. The Grand River population status may be described as a stronghold. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: medium rivers; large rivers; gradient: moderate; gradient: fast; rock substrates; clear water

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: highly vulnerable with low confidence

COMMENTS: Michigan is the northern edge of range for this species. Population status needs to be determined.



threehorn wartyback

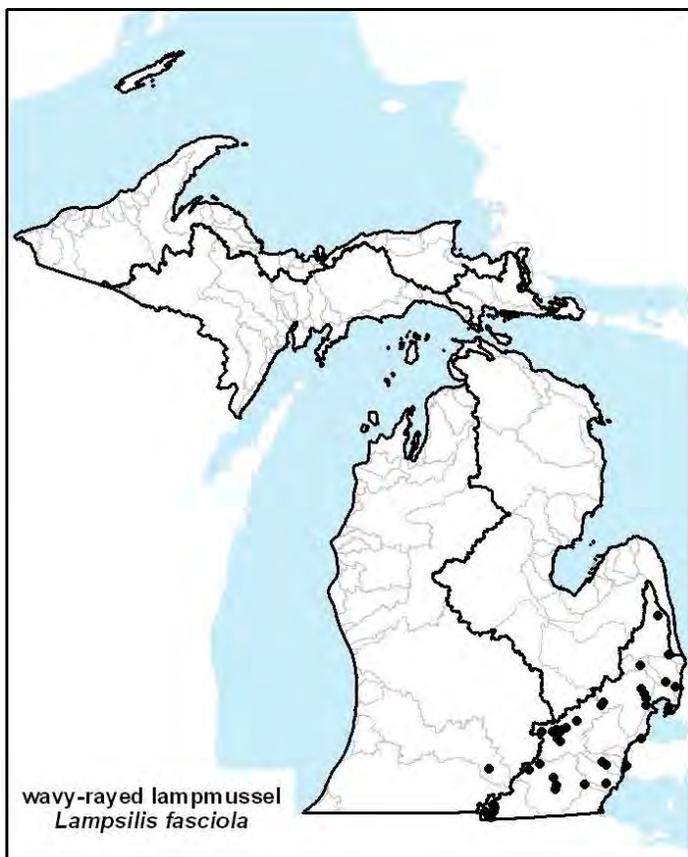
(*Obliquaria reflexa*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Very rare in Michigan. Populations in Lake Erie and St. Clair appear to have declined due to zebra mussels. There has been a recent decline in the number of watersheds occupied (MNFI 2014). Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: medium lakes; large lakes; medium rivers; large rivers; gradient: moderate; rock substrates; soft substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate change: extremely vulnerable with high confidence

COMMENTS: Host species has only been determined in the laboratory, field verification is needed. The Black River (Lake Erie basin) may be a refugia. Surveys are needed to assess this population. It has been suggested that metamorphosis of this species may happen without parasitizing other species (Oesch 1984).



wavy-rayed lampmussel

(*Lampsilis fasciola*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Occurs occasionally in the south-eastern part of the State. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: medium rivers; rock substrates; soft substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: highly vulnerable with low confidence

COMMENTS: Smallmouth bass is the only known host species. Status of population needs to be determined. Need to be concerned about dreissenids and size class changes.



white catspaw

(*Epioblasma obliquata perobliqua*)

DISTRIBUTION & ABUNDANCE: State and federally listed as endangered. Only occurs in the Lake Erie basin in three locations although is possibly extirpated as two historical areas have no recent evidence of occurrence. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: headwaters & small tributaries; medium rivers; large rivers; rock substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dams; dredging & channelization; fragmentation; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: unknown

COMMENTS: Host species unknown. This species has been declining over its entire range. Population status needs to be determined. This species may also be known by the name *Dysnomia sulcata delicata*.

SNAILS



a land snail

(Catinella gelida)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Abundance is unknown and is possibly extirpated. Globally listed as critically imperiled.

ASSOCIATED LANDSCAPE FEATURES: inland rock/cliff/ledge

ASSOCIATED THREATS: incompatible natural resource mgmt; lack of scientific knowledge; non-consumptive recreation; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information

County Occurrences of
Catinella protracta



a land snail

(*Catinella protracta*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: fen; inland emergent wetland; river/stream/riparian/floodplain corridor; prairie; swamp; alvar/rock; dry hardwood; mesic hardwood; inland rock/cliff/ledge; coastal dune/beach; down woody debris

ASSOCIATED THREATS: incompatible natural resource mgmt; urban, municipal & industrial pollution; pesticides & herbicides; industrial/residential/recreational development; forestry practices; lack of scientific knowledge; non-consumptive recreation; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information

County Occurrences of
Euconulus alderi



a land snail

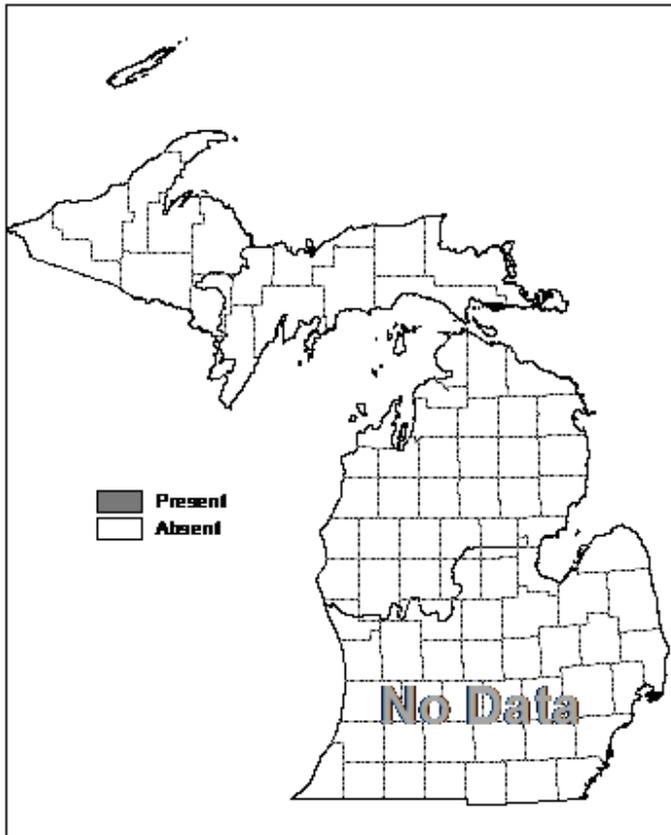
(*Euconulus alderi*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. This species is known from 10 locations in the Upper Peninsula. It is imperiled in Michigan.

ASSOCIATED LANDSCAPE FEATURES: lowland conifer; bog; fen; swamp; coastal dune/beach

ASSOCIATED THREATS: conversion to agriculture lands; incompatible natural resource mgmt; industrial/residential/ recreational development; forestry practices; urban, municipal, and industrial pollution; climate vulnerability: extremely vulnerable with moderate confidence

COMMENTS: Need surveys to further assess abundance and distribution; need basic life history information; need to identify threats. Require cool, moist conditions; canopy removal heats and dries the soil making conditions unsuitable for this species. Acid rain may pose a problem for this species.



a land snail

(Glyphyalinia solida)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: mesic hardwood; dry hardwood; down woody debris

ASSOCIATED THREATS: incompatible natural resource mgmt; industrial/residential/recreational development; forestry practices; pesticides & herbicides; lack of scientific knowledge; non-consumptive recreation; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information

County Occurrences of
Vallonia gracilicosta albula



a land snail

(Vallonia gracilicosta albula)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Known from only 8 locations in the upper peninsula. This species is considered critically imperiled in Michigan due to extreme rarity.

ASSOCIATED LANDSCAPE FEATURES: rock/cliff/ledge

ASSOCIATED THREATS: lack of scientific knowledge; forestry practices; climate vulnerability: highly vulnerable with moderate confidence

COMMENTS: Need additional surveys to assess abundance and distribution; need basic life history information; need to identify threats. Require cool, moist conditions; canopy removal will result in dryer microhabitat conditions unsuitable for this species. At least one Michigan occurrence is at risk of being clearcut. This species may also be known by the name *Vallonia albula*.

County Occurrences of
Vertigo modesta modesta



A land snail

(Vertigo modesta modesta)

DISTRIBUTION & ABUNDANCE: State listed as endangered. This species is known from only two locations in the Upper Peninsula. These represent the only known populations for the species in the eastern U.S. It is considered critically imperiled in Michigan.

ASSOCIATED LANDSCAPE FEATURES: rock/cliff/ledge

ASSOCIATED THREATS: lack of scientific knowledge; non-consumptive recreation; climate vulnerability: unknown; unknown

COMMENTS: Need additional surveys to assess abundance and distribution; need basic life history information; need to identify threats.

County Occurrences of
Vertigo modesta parietalis



a land snail

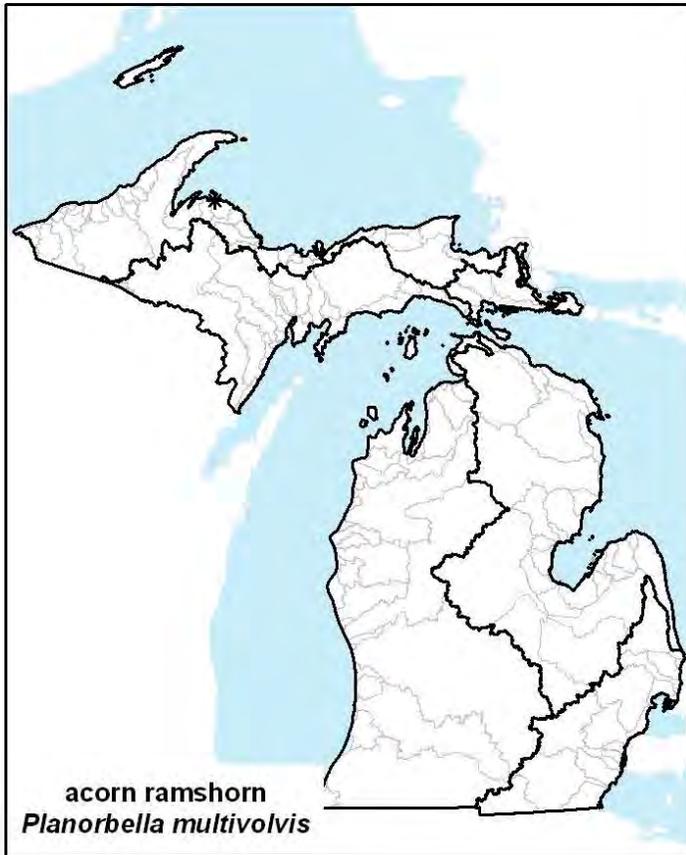
(Vertigo modesta parietalis)

DISTRIBUTION & ABUNDANCE: State listed as endangered. This subspecies is known from only one location in Michigan. It is considered critically imperiled in the State.

ASSOCIATED LANDSCAPE FEATURES: rock/cliff/ledge

ASSOCIATED THREATS: lack of scientific knowledge; industrial/residential/recreational development; non-consumptive recreation; incompatible natural resource management; climate vulnerability: extremely vulnerable with high confidence

COMMENTS: Need additional surveys to assess abundance and distribution; need basic life history information; need to identify threats.



acorn ramshorn

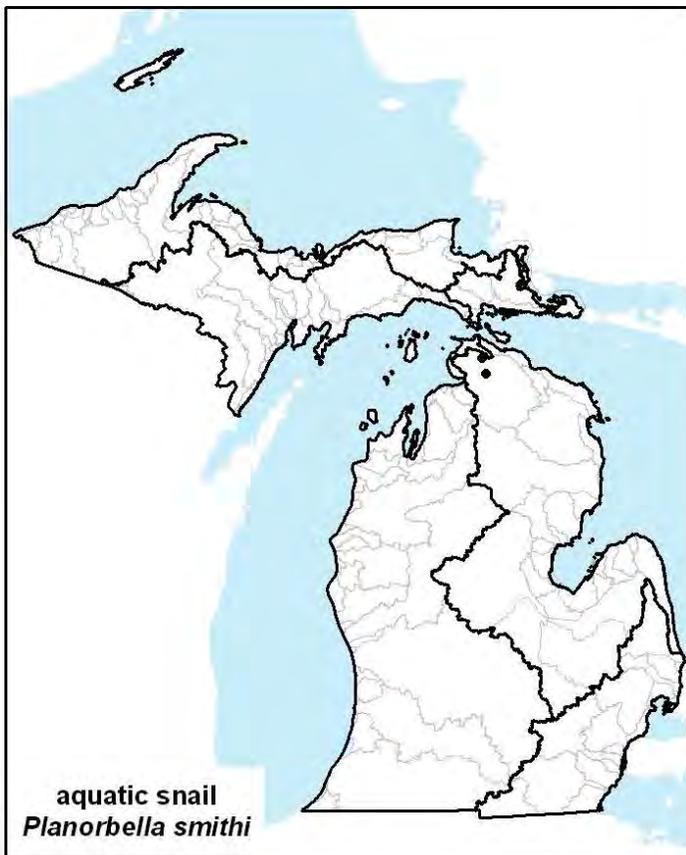
(*Planorbella multivolvis*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. This species is believed to be endemic to Howe Lake. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: large lakes

ASSOCIATED THREATS: lack of scientific knowledge; unknown; climate vulnerability: unknown

COMMENTS: Distribution, population status, habitat usage, threats, and general life history information need to be determined. Species presumed extinct (MNFI 2015).



an aquatic snail

(*Planorbella smithi*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. This species has only been found in Douglas and Burt lakes (no point data available), abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: large lakes; trophic status: oligotrophic; soft substrates

ASSOCIATED THREATS: shore-line development; chemical molluscicides; lack of scientific knowledge; unknown; climate vulnerable: highly vulnerable with low confidence

COMMENTS: Distribution, population status, habitat usage, threats, and general life history information need to be determined.

County Occurrences of
Anguispira kochi



banded globe

(Anguispira kochi)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: mesic hardwood; floodplain

ASSOCIATED THREATS: industrial/residential/recreational development; non-consumptive recreation; forestry practices; lack of scientific knowledge; climate vulnerability: extremely vulnerable with moderate confidence; unknown

COMMENTS: Need additional surveys to assess abundance and distribution; need basic life history information; need to identify threats.

County Occurrences of
Fossaria galbana



boreal fossaria

(Fossaria galbana)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: large rivers; medium lakes; large lakes; vegetation

ASSOCIATED THREATS: altered nutrient inflows; altered sediment loads; pesticides & herbicides; urban, municipal & industrial pollution; dredging & channelization

COMMENTS: Requires highly oxygenated aquatic habitats; Need surveys to assess abundance and distribution; need basic life history information

County Occurrences of
Physella parkeri



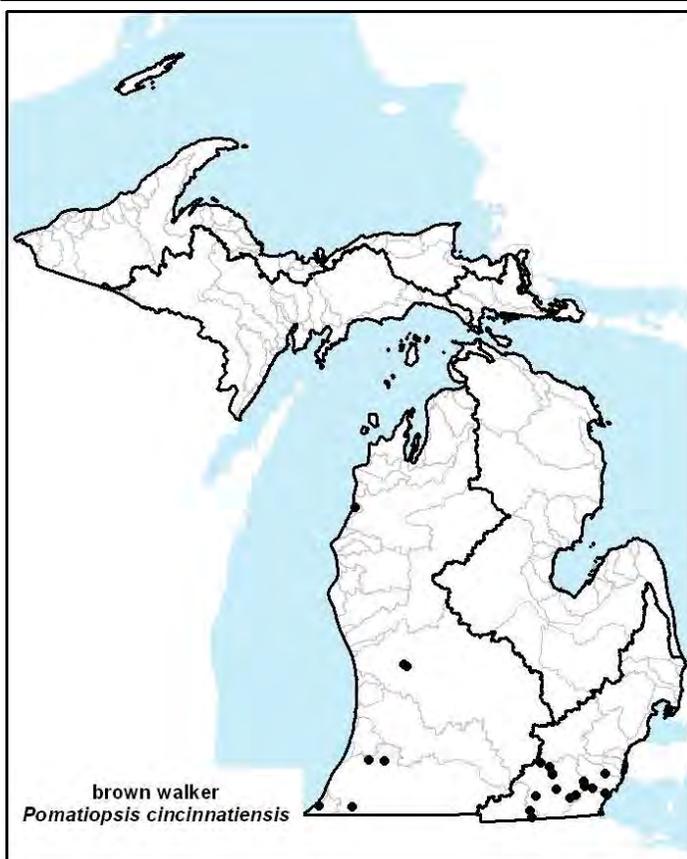
broadshoulder physa
(Physella parkeri)

DISTRIBUTION & ABUNDANCE: State listed as threatened and globally imperiled. Abundance is not known.

ASSOCIATED LANDSCAPE FEATURES: medium lakes; large lakes; cold

ASSOCIATED THREATS: fragmentation; dredging & channelization; altered nutrient inflows; altered sediment loads; altered hydrologic regimes; urban, municipal & industrial pollution; wetland modifications

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information



brown walker

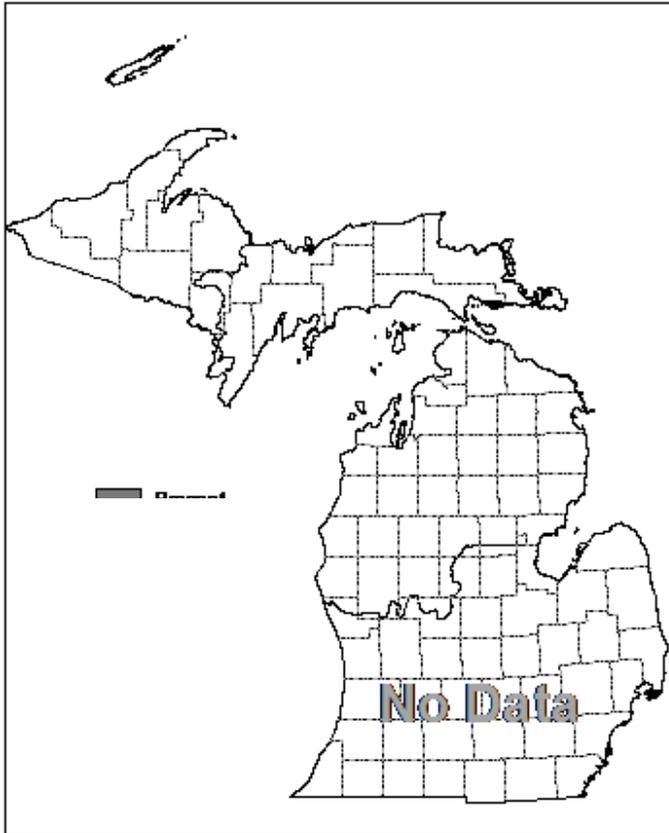
(Pomatiopsis cincinnatiensis)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Occurs occasionally in southern lower Michigan. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: headwaters & small tributaries; banks: clay; vegetation; other (hibernates under leaf litter, needs moist banks)

ASSOCIATED THREATS: altered hydrologic regimes, altered sediment loads, lack of scientific knowledge, pesticides & herbicides, urban, municipal, and industrial pollution; climate vulnerability: highly vulnerable with low confidence

COMMENTS: Depends on maintaining natural vegetative canopy cover along stream banks. Population status needs to be determined. Work on dispersal is needed.



bugle fossaria

(*Fossaria cyclostoma*)

DISTRIBUTION & ABUNDANCE: State listed as threatened.

ASSOCIATED LANDSCAPE FEATURES: fen, inland emergent wetland, coastal emergent wetland; submergent wetland; shoreline

ASSOCIATED THREATS: incompatible natural resources management; non-consumptive recreation; urban, municipal & industrial pollution; dredging & channelization; altered nutrient inflows; altered sediment loads

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information

County Occurrences of
Cincinnatia cincinnatiensis



campeloma spire snail

(*Cincinnatia cincinnatiensis*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: headwaters/small tributaries; large lakes; medium lakes; small lakes

ASSOCIATED THREATS: urban, municipal & industrial pollution; altered nutrient inflows; altered sediment loads; pesticides & herbicides; dredging & channelization; dams; fragmentation; wetland modifications

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information

County Occurrences of
Lyogyrus walkeri



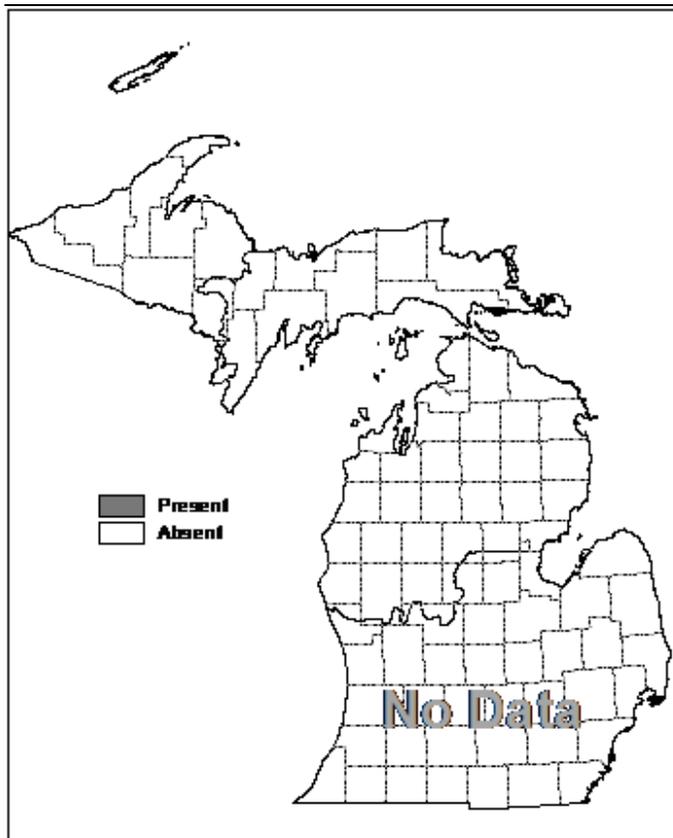
Canadian duskysnail
(Lyogyrus walkeri)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: headwaters/small tributaries; soft substrates; gradient: slow; vegetation

ASSOCIATED THREATS: urban, municipal & industrial pollution; altered nutrient inflows; pesticides & herbicides; dredging & channelization; dams

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information



carinate pillsnail
(Euchemotrema hubrichti)

DISTRIBUTION & ABUNDANCE: State listed as threatened.

ASSOCIATED LANDSCAPE FEATURES: inland rock/cliff/edge

ASSOCIATED THREATS: incompatible natural resource mgmt; lack of scientific knowledge; non-consumptive recreation; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information

County Occurrences of
Philomycus carolinianus



Carolina mantleslug

(Philomycus carolinianus)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: right-of-way; lowland hardwood; lowland conifer; ephemeral wetland; inland lake

ASSOCIATED THREATS: forestry practices; non-consumptive recreation; incompatible natural resource management; lack of scientific knowledge; climate vulnerability: presumed stable with moderate confidence; unknown

COMMENTS: Need additional surveys to assess abundance and distribution; need basic life history information; need to identify threats.

County Occurrences of
Hendersonia occulta



cherrystone drop

(Hendersonia occulta)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Known from only two sites in Michigan. Considered critically imperiled in Michigan.

ASSOCIATED LANDSCAPE FEATURES: lowland hardwood; lowland conifer; river/stream/riparian/floodplain corridor; alvar/rock; inland rock/cliff/ledge; unknown

ASSOCIATED THREATS: incompatible natural resource mgmt; industrial/residential/recreational development; forestry practices; lack of scientific knowledge; climate vulnerability: extremely vulnerable with low confidence

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats.



coldwater pondsnail
(Stagnicola woodruffi)

DISTRIBUTION & ABUNDANCE: State listed as special concern.

ASSOCIATED LANDSCAPE FEATURES: shoreline

ASSOCIATED THREATS: dams; dredging & channelization; altered sediment loads; fragmentation; urban, municipal & industrial pollution

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information



copper button
(Mesomphix cupreus)

DISTRIBUTION & ABUNDANCE: State listed as special concern.

ASSOCIATED LANDSCAPE FEATURES: floodplain; mesic hardwood; unknown

ASSOCIATED THREATS: incompatible natural resource mgmt; industrial/residential/recreational development; forestry practices; lack of scientific knowledge; climate vulnerability: highly vulnerable with moderate confidence

COMMENTS: Need additional surveys to assess abundance and distribution; need to identify habitat; need basic life history information; need to identify threats.

County Occurrences of
Vertigo cristata



crested vertigo
(*Vertigo cristata*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Known from 19 sites in the Upper Peninsula. Surveys resulted in fewer than 10 individuals at these locations, except in the Keweenaw Peninsula where it was more abundant. It is currently considered vulnerable in Michigan.

ASSOCIATED LANDSCAPE FEATURES: alvar/rock; inland rock/cliff/ledge

ASSOCIATED THREATS: lack of scientific knowledge; climate vulnerability: extremely vulnerable with high confidence; unknown

COMMENTS: Need additional surveys to assess abundance and distribution, particularly in the Lower Peninsula; need basic life history information; need to identify threats.

County Occurrences of
Vertigo pygmaea



crested vertigo
(*Vertigo pygmaea*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Its status in the State is currently undetermined, but it is clearly extremely rare.

ASSOCIATED LANDSCAPE FEATURES: fen

ASSOCIATED THREATS: lack of scientific knowledge; altered fire regime; forestry practices; non-consumptive recreation; climate vulnerability: moderately vulnerable with low confidence

COMMENTS: Need additional surveys to assess abundance and distribution; including the Detroit area since this species is known from other Great Lakes metropolitan areas. Need basic life history information; need to identify threats.

County Occurrences of
Vertigo nylanderi



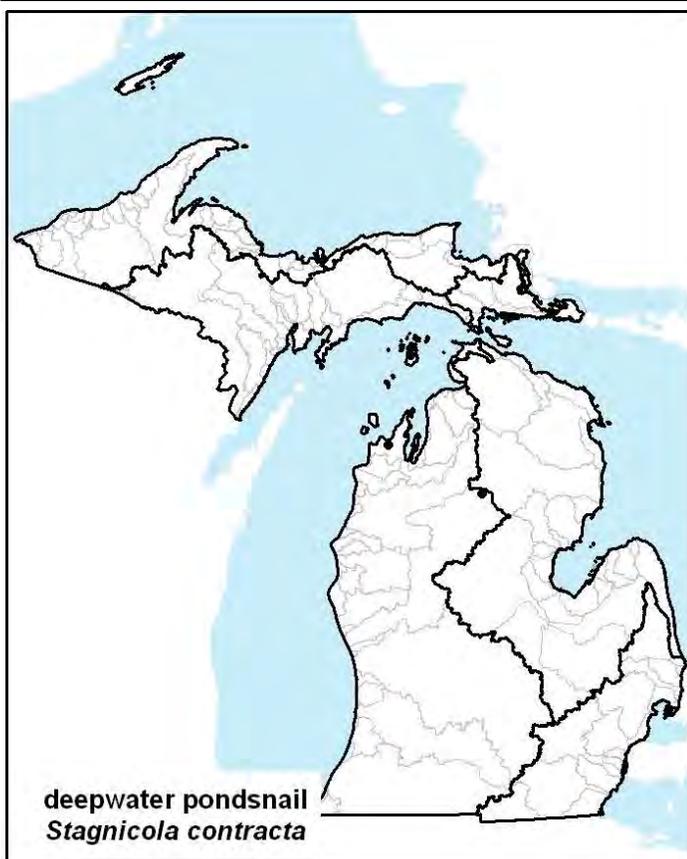
deep-throat vertigo
(Vertigo nylanderi)

DISTRIBUTION & ABUNDANCE: State listed as endangered. There are four populations in the Upper Peninsula and each population is extremely small and restricted. This species is considered critically imperiled in Michigan.

ASSOCIATED LANDSCAPE FEATURES: lowland conifer; bog; swamp; alvar/rock; coastal dune/beach

ASSOCIATED THREATS: altered fire regime; lack of scientific knowledge; industrial/residential/recreational development; forestry practices; non-consumptive recreation; climate vulnerability: extremely vulnerable with moderate confidence; unknown

COMMENTS: Need additional surveys to assess abundance and distribution; need basic life history information; need to identify threats. This is the rarest *Vertigo* species in North America. The extremely small population sizes at each site makes occurrences of this species extremely susceptible to catastrophic disturbance, like fire. Nekola (1998) noted that this species (tamarack wetlands) is limited to the same habitat that mammoth populations were limited to at the end of the last ice age.



deepwater pondsnail
(Stagnicola contracta)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Known from only four locations with no recent occurrences, abundance unknown.

ASSOCIATED LANDSCAPE FEATURES: large lakes

ASSOCIATED THREATS: lack of scientific knowledge; unknown; climate vulnerability: highly vulnerable with very high confidence

COMMENTS: Distribution, population status, habitat usage, threats, and general life history information need to be determined.

County Occurrences of
Vertigo bollesiana



delicate vertigo

(*Vertigo bollesiana*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Historically known from a few locations in southeastern Michigan and 13 locations in the Upper Peninsula, but only recorded in one Michigan county since 1998. Surveys resulted in fewer than 10 individuals at most locations. This species is considered imperiled in Michigan.

ASSOCIATED LANDSCAPE FEATURES: lowland hardwood; mesic hardwood; lowland conifer; mesic conifer; inland emergent wetland; alvar/rock; inland rock/cliff/ledge

ASSOCIATED THREATS: grazing & mowing patterns; non-consumptive recreation; pesticides & herbicides; removal of non-timber flora; wetland modifications; climate vulnerability: highly vulnerable with moderate confidence

COMMENTS: Need additional surveys to assess abundance and distribution; need basic life history information; need to identify threats. Rock climbing has caused at least one extirpation; rock climbing should be directed away from imperiled snail populations. The filling of upland sinks with trash or soil can alter microhabitat conditions. Grazing may pose a serious threat at some locations. Only documented at sites that have been stable for approximately 100 years or more.

County Occurrences of
Oxyloma peoriense



depressed ambersnail

(*Oxyloma peoriense*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: inland emergent wetland; coastal emergent wetland; submergent wetland

ASSOCIATED THREATS: incompatible natural resource mgmt; industrial/residential/recreational development; forestry practices; pesticides & herbicides lack of scientific knowledge; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information

County Occurrences of
Discus patulus



domed disc

(Discus patulus)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: mesic hardwood; down woody debris, floodplain

ASSOCIATED THREATS: industrial/residential/recreational development; non-consumptive recreation; forestry practices; lack of scientific knowledge; lack of scientific knowledge; climate vulnerability: extremely vulnerable with moderate confidence

COMMENTS: Need additional surveys to assess abundance and distribution; need basic life history information; need to identify threats.

County Occurrences of
Planogyra asteriscus



eastern flat-whorl

(Planogyra asteriscus)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Known from only 9 sites in the Upper Peninsula of Michigan, historically found in eight sites in the Lower Peninsula. It is considered very rare in the State.

ASSOCIATED LANDSCAPE FEATURES: lowland shrub; lowland conifer; bog; fen; swamp; coastal dune/beach; inland rock/cliff/ledge; other (deep leaf litter)

ASSOCIATED THREATS: lack of scientific knowledge; climate vulnerability: extremely vulnerable with low confidence; unknown

COMMENTS: Need surveys to assess abundance and distribution, particularly in cedar swamps; need basic life history information; need to identify threats.

County Occurrences of
Carychium nannodes



file thorn

(*Carychium nannodes*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: inland rock/cliff/ledge; mesic hardwood

ASSOCIATED THREATS: industrial/residential/recreational development; lack of scientific knowledge; non-consumptive recreation; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to determine specific site preferences

flanged valvata

(*Valvata winnebagoensis*)

DISTRIBUTION & ABUNDANCE: State listed as special concern and globally imperiled.

ASSOCIATED LANDSCAPE FEATURES: cold; medium lakes; large lakes; ponds

ASSOCIATED THREATS: dams; dredging & channelization; fragmentation; altered sediment loads; urban, municipal & industrial pollution; pesticides & herbicides

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information



County Occurrences of
Ventridens suppressus



flat dome

(Ventridens suppressus)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: mesic hardwood

ASSOCIATED THREATS: incompatible natural resource mgmt; industrial/residential/recreational development; forestry practices; lack of scientific knowledge; non-consumptive recreation; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need specific habitat needs

County Occurrences of
Pallifera fosteri



Foster mantleslug

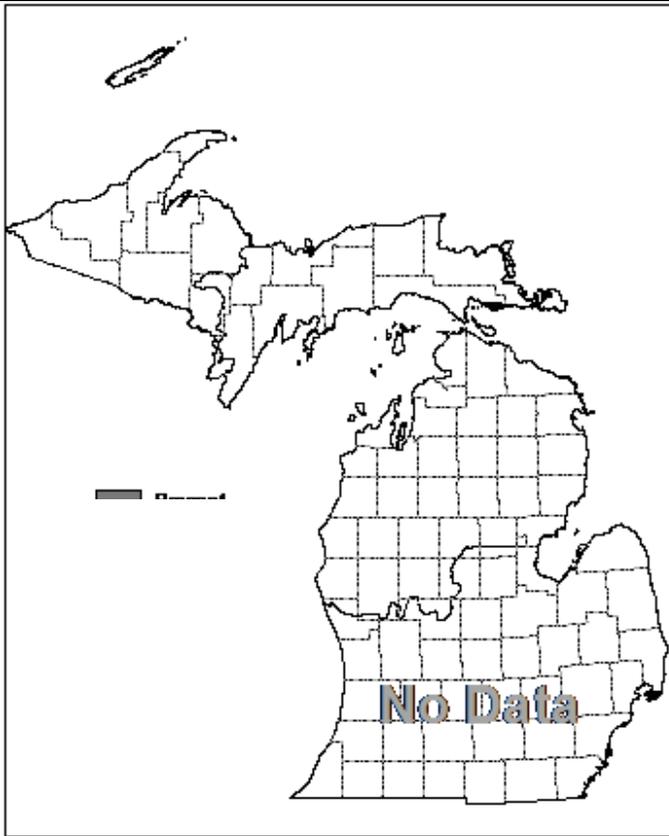
(Pallifera fosteri)

DISTRIBUTION & ABUNDANCE: State listed as threatened. The abundance of this species is currently unknown. Recent efforts to locate this species have been unsuccessful.

ASSOCIATED LANDSCAPE FEATURES: right-of-way; lowland hardwood; lowland conifer; ephemeral wetland; inland lake

ASSOCIATED THREATS: fragmentation; conversion to agriculture lands; forestry practices; non-consumptive recreation; lack of scientific knowledge; climate vulnerability: unknown

COMMENTS: Need additional surveys to assess abundance and distribution; need basic life history information; need to identify threats.



globe siltsnail

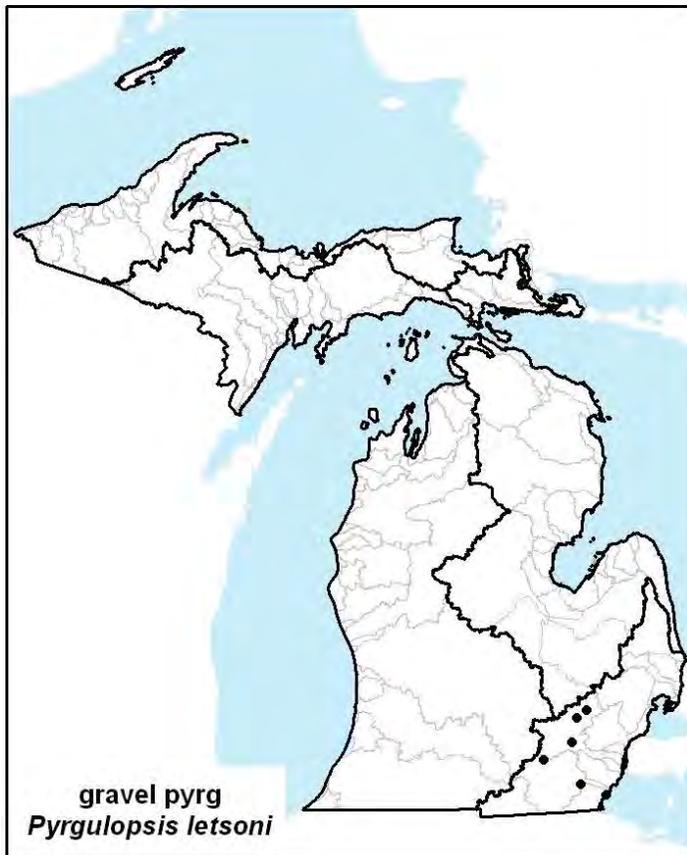
(Birgella subglobosus)

DISTRIBUTION & ABUNDANCE: State listed as special concern.

ASSOCIATED LANDSCAPE FEATURES: medium rivers; large rivers; medium lakes; large lakes

ASSOCIATED THREATS: urban, municipal & industrial pollution; pesticides & herbicides; dams; dredging & channelization; fragmentation; altered sediment loads

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information



gravel pyrg

(Pyrgulopsis letsoni)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Species found only in Lake Erie basin at a few locations. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: unknown

ASSOCIATED THREATS: lack of scientific knowledge; climate vulnerability: highly vulnerable with low confidence; unknown

COMMENTS: Distribution, population status, habitat usage, threats, and general life history information need to be determined.



Great Lakes physa

(*Physella magnalacustris*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Distribution and abundance are unknown.

ASSOCIATED LANDSCAPE FEATURES: nearshore; rocky substrates; large lakes

ASSOCIATED THREATS: non-consumptive use; incompatible natural resources management; urban, municipal & industrial pollution

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information



honey vertigo

(*Vertigo tridentata*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is not known.

ASSOCIATED LANDSCAPE FEATURES: alvar/rock; mesic hardwood; mesic conifer; down woody debris

ASSOCIATED THREATS: fragmentation; incompatible natural resource mgmt; fragmentation; industrial/residential/recreational development; pesticides & herbicides; urban, municipal & industrial pollution; forestry practices; lack of scientific knowledge; non-consumptive recreation; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information

County Occurrences of
Vertigo hubrichti



Hubricht's vertigo

(*Vertigo hubrichti*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. This species is known from 14 locations in the Upper Peninsula. It is considered imperiled in Michigan and vulnerable globally.

ASSOCIATED LANDSCAPE FEATURES: rock/cliff/ledge

ASSOCIATED THREATS: lack of scientific knowledge; climate vulnerability: extremely vulnerable with moderate confidence; unknown

COMMENTS: Need additional surveys to assess abundance and distribution; need basic life history information; need to identify threats

Lake Superior ramshorn

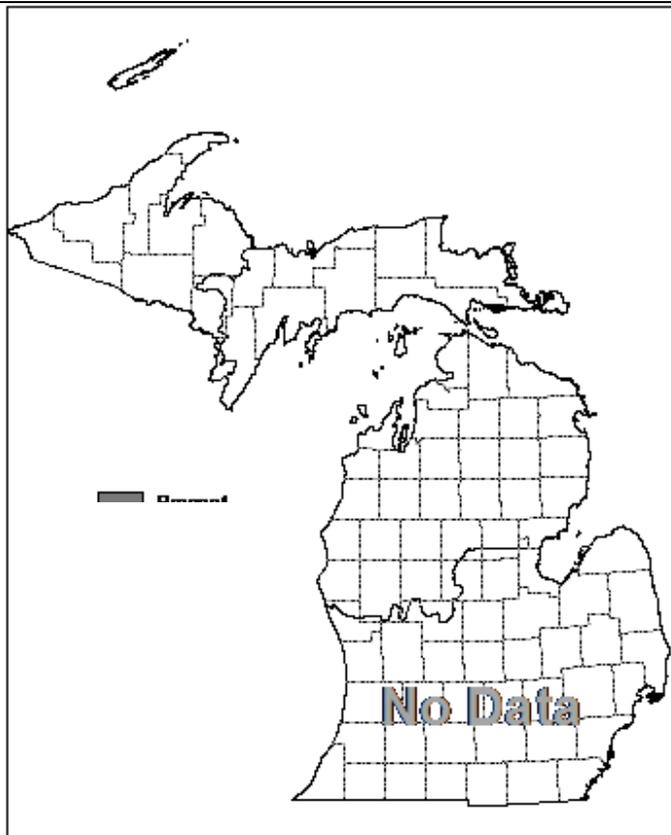
(*Helisoma anceps royalense*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Distribution and abundance unknown.

ASSOCIATED LANDSCAPE FEATURES: vegetation; large lakes; large rivers; soft substrates

ASSOCIATED THREATS: altered sediment loads; fragmentation; dredging & channelization; dams; altered nutrient inflows; pesticides & herbicides; urban, municipal & industrial pollution

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information



County Occurrences of
Gastrocopta holzingeri



lambda snaggletooth

(*Gastrocopta holzingeri*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Known from only 3 sites in the Upper Peninsula and from St. Clair County in the Lower Peninsula. It is considered critically imperiled in the State.

ASSOCIATED LANDSCAPE FEATURES: rock/cliff/ledge

ASSOCIATED THREATS: industrial/residential/recreational development; lack of scientific knowledge; climate vulnerability: extremely vulnerable with very high confidence

COMMENTS: Need additional surveys to assess abundance and distribution; need basic life history information; need to identify threats.

County Occurrences of
Striatura meridionalis



median striate

(*Striatura meridionalis*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Unknown abundance.

ASSOCIATED LANDSCAPE FEATURES: river/ stream/ riparian/floodplain corridor; dry conifer; mesic conifer

ASSOCIATED THREATS: incompatible natural resource mgmt; industrial/residential/recreational development; forestry practices; pesticides & herbicides; lack of scientific knowledge; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information



mystery vertigo
(Vertigo paradoxa)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Known from 21 sites in the Upper Peninsula. Most of the U.S. populations of this species are in the Upper Peninsula. This species is considered very rare in Michigan and is probably very rare globally.

ASSOCIATED LANDSCAPE FEATURES: lowland hardwood; mesic hardwood; lowland conifer; mesic conifer; inland rock/cliff/ledge

ASSOCIATED THREATS: dredging & channelization; altered fire regime; grazing & mowing patterns; industrial/residential/recreational development; forestry practices; non-consumptive recreation; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: highly vulnerable with low confidence

COMMENTS: Need additional surveys to assess abundance and distribution; need basic life history information; need to identify threats. Require cool, moist conditions; canopy removal will result in dryer microhabitat conditions unsuitable for this species. Locations of this species in Michigan are susceptible to residential or recreational development and road construction. ORV and foot traffic should be redirected around occupied areas. Rock climbing should be directed away from imperiled snail populations. Acid rain may also pose a threat to this species.



Petoskey pondsnail
(Stagnicola petoskeyensis)

DISTRIBUTION & ABUNDANCE: State listed as endangered. This species is only found in one stream draining into Little Traverse Bay near Petoskey in Michigan (no point data available). Possibly extirpated. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: headwaters & small tributaries

ASSOCIATED THREATS: lack of scientific knowledge; unknown; climate vulnerability: unknown

COMMENTS: Need to determine if this species is still extant in Michigan. Distribution, population status, habitat usage, threats, and general life history information need to be determined.

County Occurrences of
Catinella exile



pleistocene catinella
(Catinella exile)

DISTRIBUTION & ABUNDANCE: State listed as threatened. It is currently known from only three sites in the Upper Peninsula. This species is globally imperiled.

ASSOCIATED LANDSCAPE FEATURES: fen; coastal dune/beach; alvar/rock

ASSOCIATED THREATS: conversion to agriculture lands; altered hydrologic regimes; incompatible natural resource mgmt; industrial/residential/recreational development; forestry practices; urban, municipal, and industrial pollution; climate vulnerability: extremely vulnerable with moderate confidence

COMMENTS: Need surveys to assess abundance and distribution—particularly at rich fen sites in the Lower Peninsula; need basic life history information; need to identify threats. In occupied sites, forest clearing, road construction and other development should be avoided. Acid rain may be a threat to this species.

County Occurrences of
Mesodon elevatus



proud globe
(Mesodon elevatus)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: floodplain; mesic hardwood; unknown

ASSOCIATED THREATS: incompatible natural resource mgmt; industrial/residential/recreational development; lack of scientific knowledge; forestry practices; climate vulnerability: highly vulnerable with moderate confidence; unknown

COMMENTS: Need additional surveys to assess abundance and distribution; need to identify habitat; need basic life history information; need to identify threats.

County Occurrences of
Mesodon pennsylvanicus



proud globelet

(*Mesodon pennsylvanicus*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: mesic hardwood; dry hardwood; down woody debris

ASSOCIATED THREATS: conversion to agriculture lands; fragmentation; altered fire regime; incompatible natural resource mgmt; industrial/residential/recreational development; forestry practices; lack of scientific knowledge; pesticides & herbicides; non-consumptive recreation; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information

County Occurrences of
Valvata perdepressa



purplecap valvata

(*Valvata perdepressa*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Globally ranked as vulnerable. Distribution and abundance unknown.

ASSOCIATED LANDSCAPE FEATURES: cold; large lakes; large rivers; medium rivers

ASSOCIATED THREATS: altered nutrient inflows; urban, municipal & industrial pollution; dredging & channelization; dams; pesticides & herbicides

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information

County Occurrences of
Ventridens intertextus



pyramid dome

(Ventridens intertextus)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: mesic hardwood

ASSOCIATED THREATS: incompatible natural resource mgmt; forestry practices; lack of scientific knowledge; pesticides & herbicides; altered fire regime; non-consumptive recreation; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information

County Occurrences of
Mesodon mitchellianus



sealed globelet

(Mesodon mitchellianus)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: mesic hardwood; dry hardwood; river/stream/riparian/floodplain corridor

ASSOCIATED THREATS: incompatible natural resource mgmt; industrial/residential/recreational development; forestry practices; pesticides & herbicides; lack of scientific knowledge; urban, municipal & industrial pollution; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to determine habitat requirements

County Occurrences of
Vertigo morsei



six-whorl vertigo
(Vertigo morsei)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Two populations in Mackinac County are currently known in the Upper Peninsula. The status of an old recorded population in Chippewa County is unknown. The status of the species at several sites in the Lower Peninsula is also unknown, but these populations may not be extant, due to changes in land use and development. Their status needs to be determined through additional surveys. This species is currently considered imperiled in Michigan.

ASSOCIATED LANDSCAPE FEATURES: inland emergent wetland; fen; pond; river/stream/riparian/floodplain corridor

ASSOCIATED THREATS: conversion to agriculture lands; altered hydrologic regimes; incompatible natural resource mgmt; industrial/residential/recreational development; forestry practices; non-consumptive recreation; climate vulnerability: extremely vulnerable with low confidence

COMMENTS: Need additional surveys to assess abundance and distribution; need basic life history information; need to identify threats. Require cool, moist conditions; canopy removal will result in dryer microhabitat conditions unsuitable for this species.

NOTE: Distribution only includes recently confirmed sites. Historic locations in Chippewa County and at several locations in the Lower Peninsula are not shown. See text for more information.



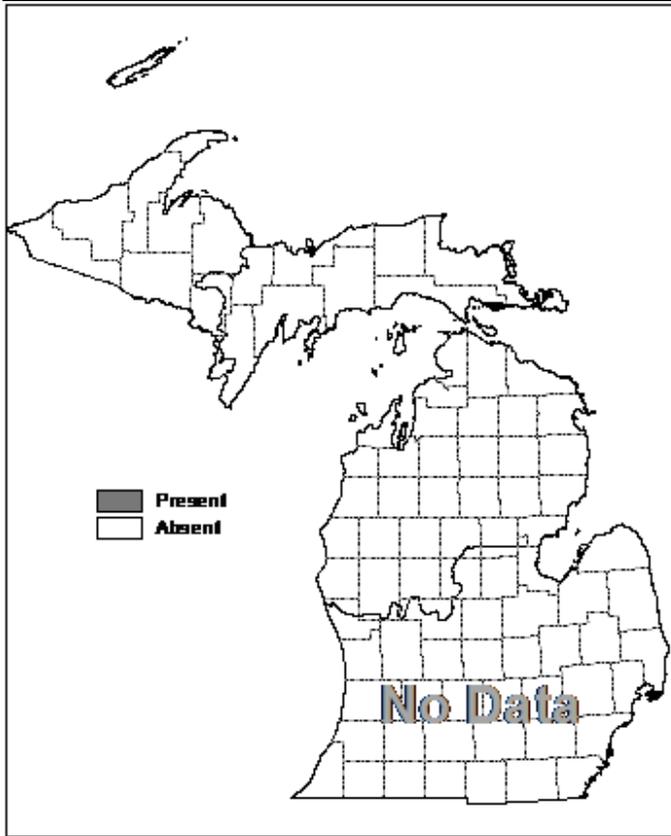
smooth coil
(Helicodiscus singleyanus)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Unknown distribution and abundance.

ASSOCIATED LANDSCAPE FEATURES: prairie; right-of-way

ASSOCIATED THREATS: pesticides & herbicides; urban, municipal & industrial pollution; lack of scientific knowledge; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information



southeastern gem

(*Hawaiiia alachuana*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Unknown distribution and abundance.

ASSOCIATED LANDSCAPE FEATURES: mesic hardwood; dry hardwood

ASSOCIATED THREATS: incompatible natural resource mgmt; industrial/residential/recreational development; forestry practices; lack of scientific knowledge; non-consumptive recreation; pesticides & herbicides; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information

County Occurrences of
Appalachina sayanus



spike-lip crater

(*Appalachina sayanus*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. The status and abundance of this species is undetermined. It is currently known to be extant at 2 sites in Michigan. It was much more broadly distributed in the early 20th century, so this species appears to have experienced considerable decline.

ASSOCIATED LANDSCAPE FEATURES: lowland hardwood; mesic hardwood; lowland conifer; bog; swamp; river/stream/riparian/floodplain corridor; inland rock/cliff/ ledge; down woody debris

ASSOCIATED THREATS: incompatible natural resource mgmt; industrial/residential/recreational development; lack of scientific knowledge; forestry practices; climate vulnerability: highly vulnerable with low confidence

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats. Where this species occurs, a forest canopy should be maintained; canopy reduction results in the warming and drying of soil conditions unfavorable to this species. This species may also be known by the names *Appalachina sayana* and *Mesodon sayanus*.



spindle lymnaea

(*Acella haldemani*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. This species is rare and seems to have localized populations and is found only sporadically throughout its range. In Michigan it is very rare. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: ponds; small lakes; medium lakes; trophic status: eutrophic; swamp; soft substrates; vegetation

ASSOCIATED THREATS: lack of scientific knowledge; unknown; climate vulnerability: extremely vulnerable with moderate confidence

COMMENTS: Distribution, population status, life history requirements, and threats need to be determined.

County Occurrences of
Guppya sterkii



Sterki's granule

(*Guppya sterkii*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. This species is known from only one location on the Delta-Schoolcraft county line in the Upper Peninsula. It is considered critically imperiled in the State.

ASSOCIATED LANDSCAPE FEATURES: mesic hardwood; mesic conifer; inland rock/cliff/ledge

ASSOCIATED THREATS: industrial/residential/recreational development; forestry practices; social attitudes; climate vulnerability: highly vulnerable with low confidence

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats. Require cool, moist conditions; canopy removal heats and dries the soil making conditions unsuitable for this species. At the only known occurrence in Michigan, landowners are throwing yard debris over the slope where the population occurs.

County Occurrences of
Vertigo elatior



tapered vertigo
(Vertigo elatior)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Known from numerous sites in the upper Peninsula. Records also exist for the Lower Peninsula, but many of these are from old records, so a status determination for the Lower Peninsula is dependent upon additional surveys. It was identified from 14 sites in recent surveys in the Upper Peninsula in 1998. This species is currently considered vulnerable in Michigan.

ASSOCIATED LANDSCAPE FEATURES: lowland conifer; bog; ephemeral wetland; fen; swamp; alvar/rock; coastal dune/beach

ASSOCIATED THREATS: lack of scientific knowledge; climate vulnerability: highly vulnerable with moderate confidence; unknown

COMMENTS: Need additional surveys to assess abundance and distribution, particularly in the Lower Peninsula; need basic life history information; need to identify threats.

County Occurrences of
Vallonia parvula



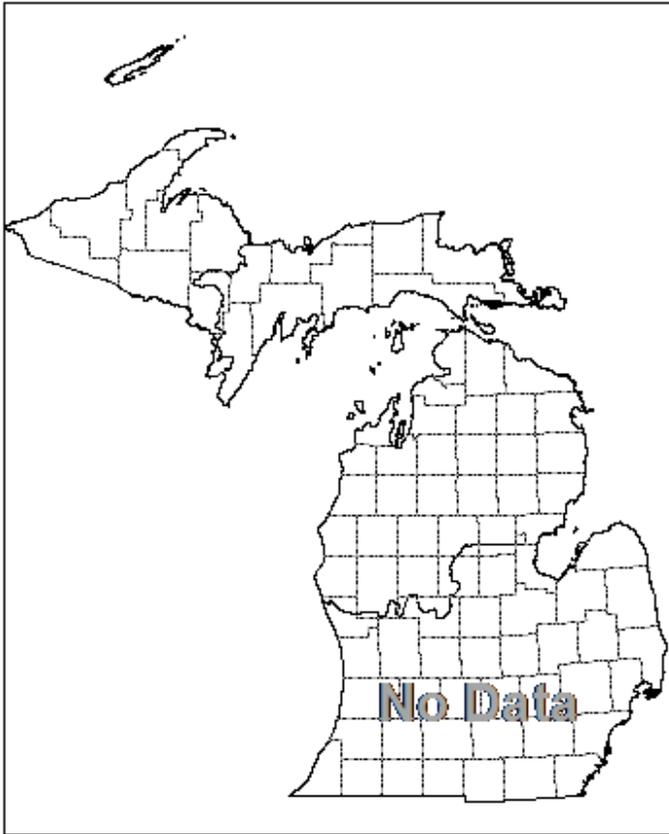
trumpet vallonia
(Vallonia parvula)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: prairie, dry hardwood, mesic hardwood; inland rock/cliff/ledge

ASSOCIATED THREATS: incompatible natural resource mgmt; industrial/residential/recreational development; forestry practices; non-consumptive recreation; pesticides & herbicides; lack of scientific knowledge; non-consumptive recreation; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information



velvet wedge

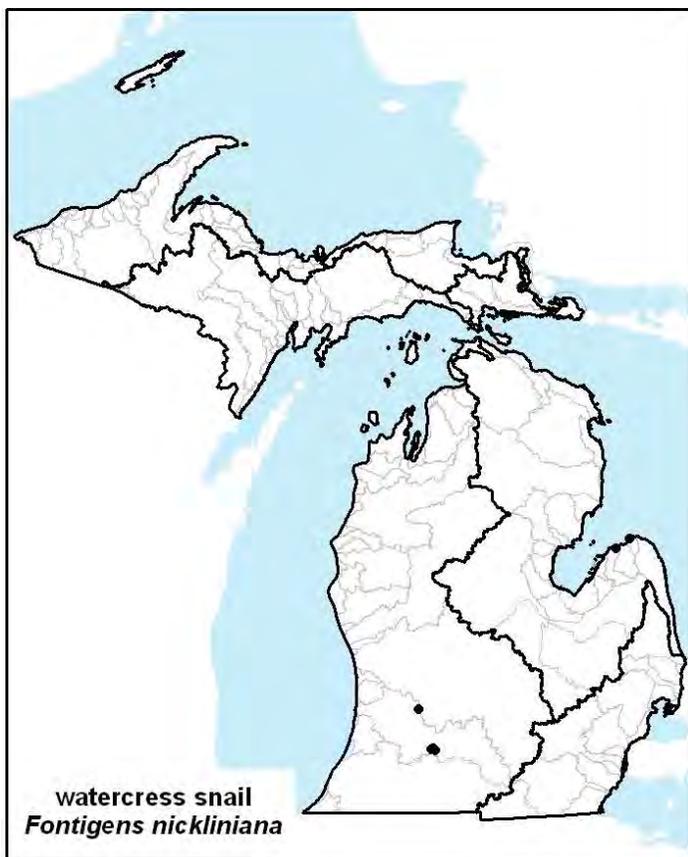
(Xolotrema denotata)

DISTRIBUTION & ABUNDANCE: State listed as special concern.

ASSOCIATED LANDSCAPE FEATURES: floodplain; mesic hardwood; unknown

ASSOCIATED THREATS: incompatible natural resource mgmt; industrial/residential/recreational development; lack of scientific knowledge; forestry practices; climate vulnerability: unknown

COMMENTS: Need additional surveys to assess abundance and distribution; need to identify habitat; need basic life history information; need to identify threats. This species may also be known by the name *Xolotrema denotatum* and *Triodopsis denotata*.



watercress snail

(Fontigens nickliniana)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: ponds; small lakes; cool headwaters & small tributaries; vegetation

ASSOCIATED THREATS: lack of scientific knowledge; climate vulnerability: extremely vulnerable with very high confidence; unknown

COMMENTS: Population status, distribution and threats information is needed. Usually found on watercress, an exotic invasive species that gets crowded out by other invasive plants.

County Occurrences of
Pupilla muscorum



widespread column
(Pupilla muscorum)

DISTRIBUTION & ABUNDANCE: State listed as special concern. It was historically known from four counties but only recently found in one Michigan county in the Upper Peninsula.

ASSOCIATED LANDSCAPE FEATURES: right-of-way; lowland hardwood; mesic hardwood; lowland conifer; mesic conifer; ephemeral wetland; swamp; inland rock/cliff/ledge

ASSOCIATED THREATS: conversion to agriculture lands; lack of scientific knowledge; forestry practices; other biological interactions (habitat alterations due to excessive deer browsing); wetland modifications; climate vulnerability: moderately vulnerable with low confidence

COMMENTS: Need additional surveys to assess abundance and distribution; need basic life history information; need to identify threats.

County Occurrences of
Mesodon clausus



yellow globelet
(Mesodon clausus)

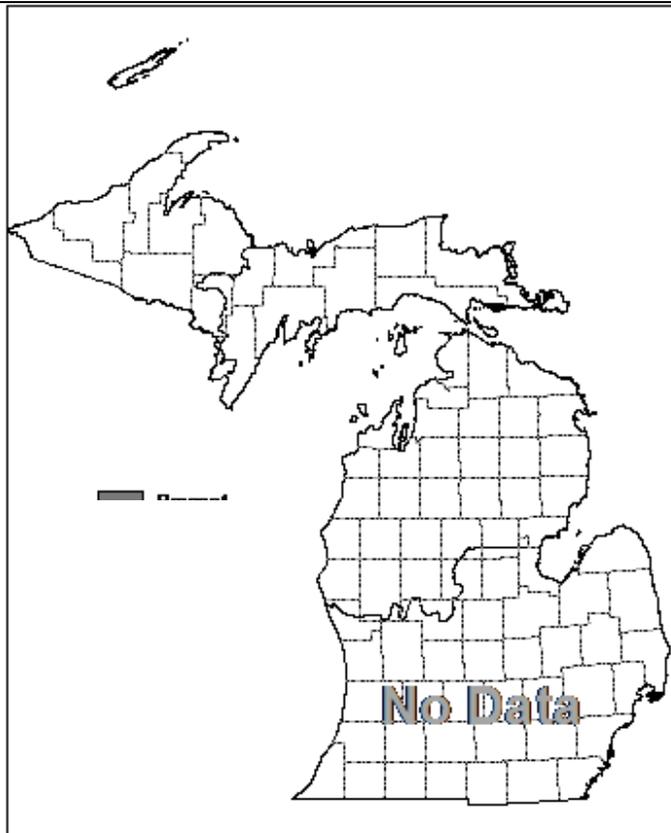
DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: prairie; mesic hardwood, down woody debris; snag/cavity

ASSOCIATED THREATS: incompatible natural resource mgmt; industrial/residential/recreational development; forestry practices; lack of scientific knowledge; non-consumptive recreation; grazing & mowing patterns; pesticides & herbicides; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats.

CRAYFISH



big water crayfish

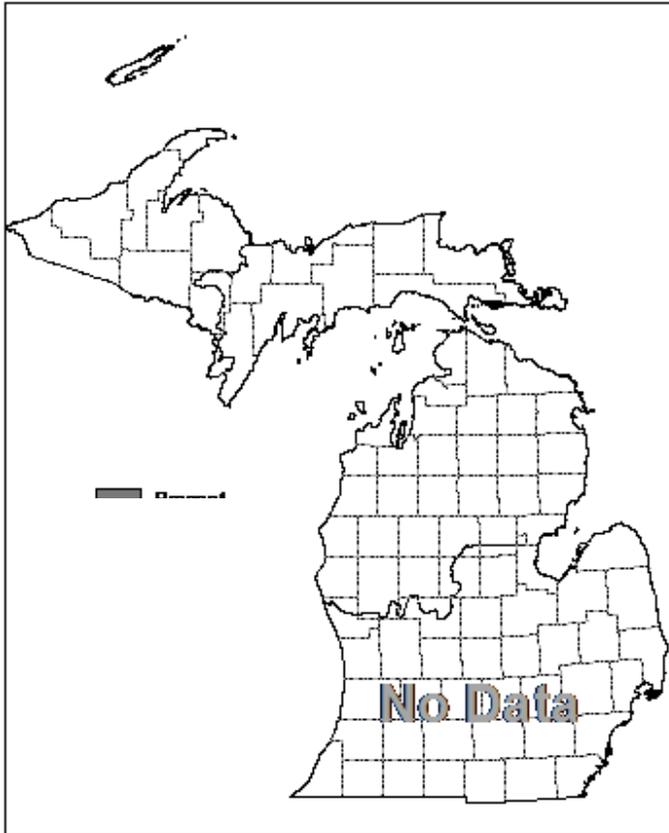
(Cambarus robustus)

DISTRIBUTION & ABUNDANCE: Currently not listed but recommended to be listed as special concern (2015). Could be 20 or fewer populations.

ASSOCIATED LANDSCAPE FEATURES: large rivers; large lakes; gradient: fast

ASSOCIATED THREATS: fragmentation; wetland modifications

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information



calico crayfish

(Orconectes immunis)

DISTRIBUTION & ABUNDANCE: Currently not listed but recommended to be listed as threatened (2015). Only nine individuals found in 2014 surveys.

ASSOCIATED LANDSCAPE FEATURES: ponds; floodplains; soft substrates; small lakes; headwaters/small tributaries

ASSOCIATED THREATS: other; non-consumptive use; unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; also called papershell crayfish

INSECTS

MAYFLIES



a mayfly

(Epeorus suffusus)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Known from only one location in the Upper Peninsula (but with no known occurrences in MNFI database), status unknown. This species is only known from four other locations globally, hence NatureServe tentatively ranks this species as critically imperiled globally. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: unknown

ASSOCIATED THREATS: unknown; lack of scientific knowledge; climate vulnerability: unknown; pesticides & herbicides; urban, municipal & industrial pollution; altered sediment loads

COMMENTS: Distribution, population status, habitat usage, threats, and general life history information need to be determined. Larvae have not been identified, only the adults.



a mayfly

(Habrophelebiodes americana)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance unknown. Only one known record from the Upper Peninsula.

ASSOCIATED LANDSCAPE FEATURES: unknown

ASSOCIATED THREATS: unknown; lack of scientific knowledge; climate vulnerability: unknown; pesticides & herbicides; urban, municipal & industrial pollution; altered sediment loads

COMMENTS: Distribution, population status, habitat usage, threats, and general life history information need to be determined.



Walker's tusked sprawler

(Anthopotamus verticis)

DISTRIBUTION & ABUNDANCE: Not currently state listed but recommended to be listed as special concern. Rare and local rangewide.

ASSOCIATED LANDSCAPE FEATURES: medium rivers; large rivers; rock substrates

ASSOCIATED THREATS: altered sediment loads; riparian modifications; urban, municipal & industrial pollution; altered nutrient inflows; pesticides & herbicides; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats.

DRAGONFLIES & DAMSELFLIES



elusive snaketail

(*Stylurus notatus*)

DISTRIBUTION & ABUNDANCE: State listed as special concern and recommended to be elevated to threatened. Population abundance is unknown. Found in six Michigan counties since 1998.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* large lakes; large rivers; gradient: moderate; soft substrates; vegetation; *terrestrial:* river/stream/riparian/floodplain corridor

ASSOCIATED THREATS: dams, dredging & channelization, forestry practices, invasive plants & animals, pesticides & herbicides, urban, municipal, and industrial pollution; climate vulnerability: presumed stable with very high confidence

COMMENTS: Distribution and population status need to be determined.



extra-striped snaketail

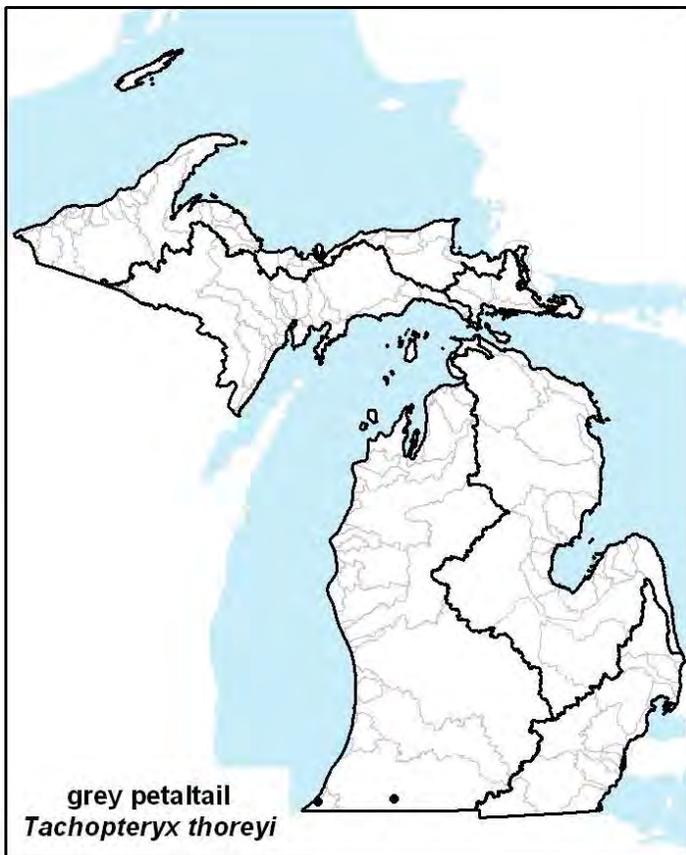
(*Ophiogomphus anomalus*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Known from only 10 locations, abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* cold medium rivers; cold large rivers; *terrestrial:* river/stream/riparian/floodplain corridor

ASSOCIATED THREATS: altered sediment loads, dams, dredging & channelization, pesticides & herbicides, urban, municipal, and industrial pollution; climate vulnerability: presumed stable with very high confidence

COMMENTS: Distribution, population status, habitat usage, and general life history information need to be determined.



grey petaltail

(*Tachopteryx thoreyi*)

DISTRIBUTION & ABUNDANCE: Currently state listed as threatened, but recommended to be listed as endangered. Only two known locations, abundance unknown.

ASSOCIATED LANDSCAPE FEATURES: *terrestrial:* forest opening; lowland conifer; lowland hardwood; *aquatic:* fen; swamp; other (specific habitat: hillside seeps) headwaters & small tributaries; bog; vegetation; woody structure

ASSOCIATED THREATS: dredging & channelization; altered hydrologic regimes; industrial/residential/recreational development; forestry practices; pesticides & herbicides; riparian modifications; unknown; wetland modifications; climate vulnerability: presumed stable with moderate confidence

COMMENTS: Edge of range species. Distribution and population status need to be determined. Relative severity of listed threats is not well known and other currently unknown threats may exist for this species; a threats assessment is needed for this species.



Hine's emerald dragonfly

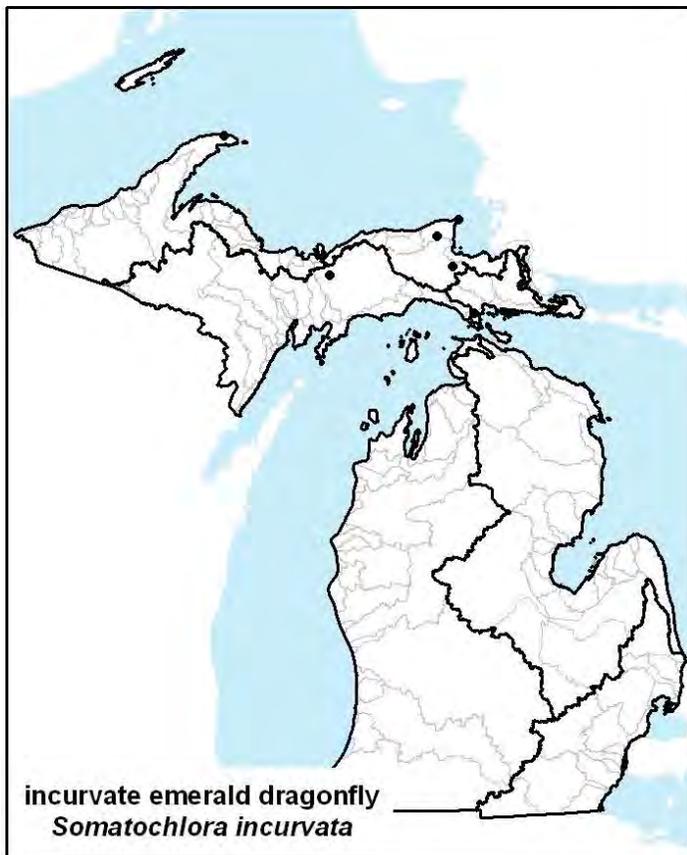
(*Somatochlora hineana*)

DISTRIBUTION & ABUNDANCE: State and federally listed as endangered. Very rare. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* headwaters & small tributaries; fen; ephemeral wetland; soft substrates; vegetation; other (marl habitats with seeps); *terrestrial:* right-of-way; lowland shrub; forest opening; lowland conifer; inland emergent wetland; river/stream/ riparian/floodplain corridor; coastal emergent wetland; edge

ASSOCIATED THREATS: fragmentation; altered hydrologic regimes; industrial/residential/recreational development; invasive plants & animals; non-consumptive recreation; pesticides & herbicides; scientific research; urban, municipal, and industrial pollution; wetland modifications; climate vulnerability: extremely vulnerable with very high confidence

COMMENTS: Population monitoring and protection efforts are needed. Larval stage of at least some populations are dependent upon crayfish burrows for persistence during dry periods. Protection of hydrologic patterns is essential at occupied sites.



incurvate emerald

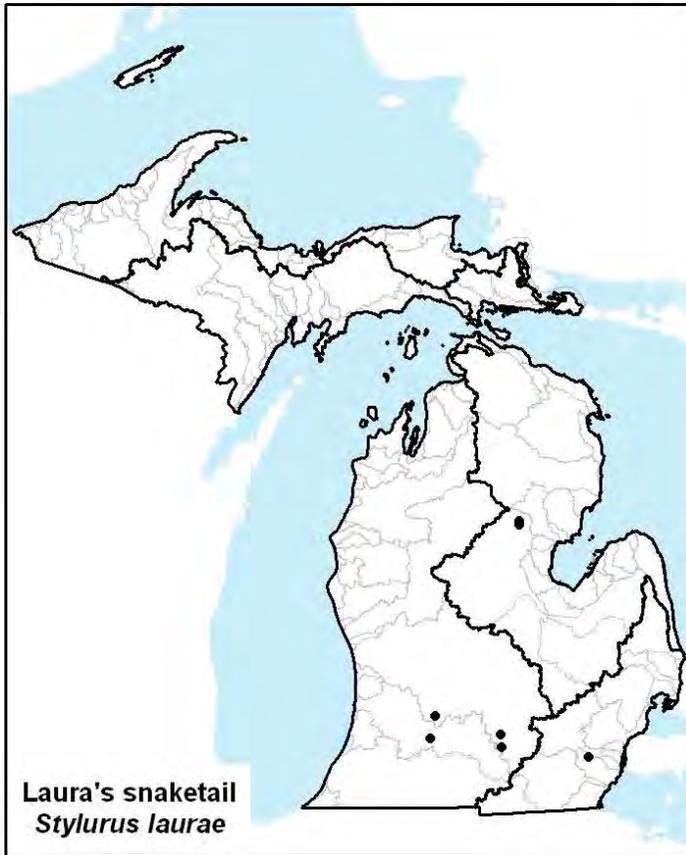
(*Somatochlora incurvata*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Known from only five locations, abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* shoreline; ponds; headwaters & small tributaries; bog; fen; vegetation; *terrestrial:* lowland shrub; forest opening; lowland conifer; inland emergent wetland; coastal emergent wetland

ASSOCIATED THREATS: altered hydrologic regimes; mining practices; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: moderately vulnerable with very high confidence

COMMENTS: Distribution and population status needs to be determined.



Laura's snaketail

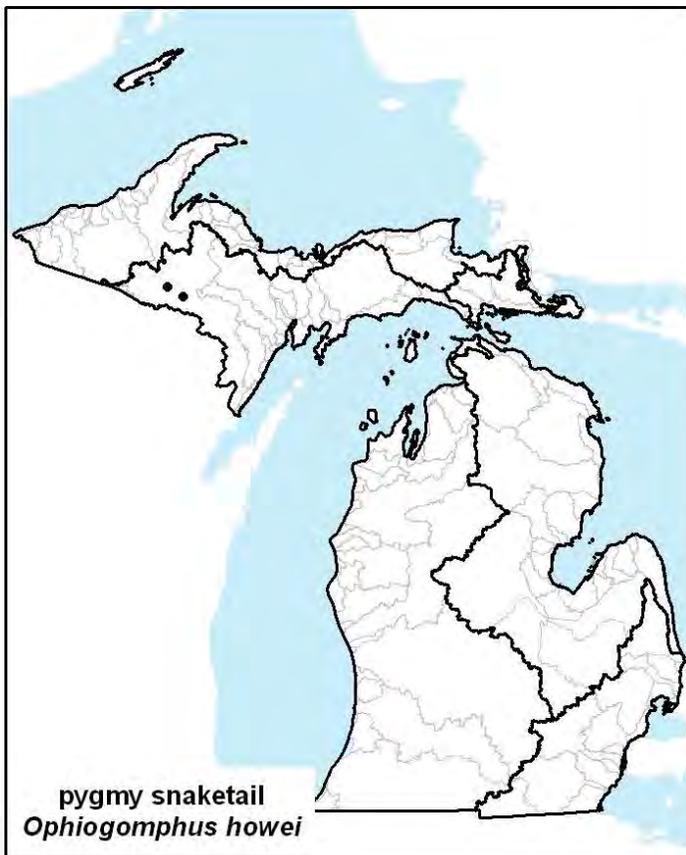
(*Stylurus laurae*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Known from nine counties, abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* headwaters & small tributaries; medium rivers; large rivers; gradient: slow; gradient: moderate; soft substrates; *terrestrial:* river/stream/riparian/ floodplain corridor

ASSOCIATED THREATS: altered sediment loads, dams, dredging & channelization, forestry practices, pesticides & herbicides, urban municipal, and industrial pollution; climate vulnerability: presumed stable with very high confidence

COMMENTS: Distribution, population status, habitat usage, and general life history information need to be determined.



pygmy snaketail

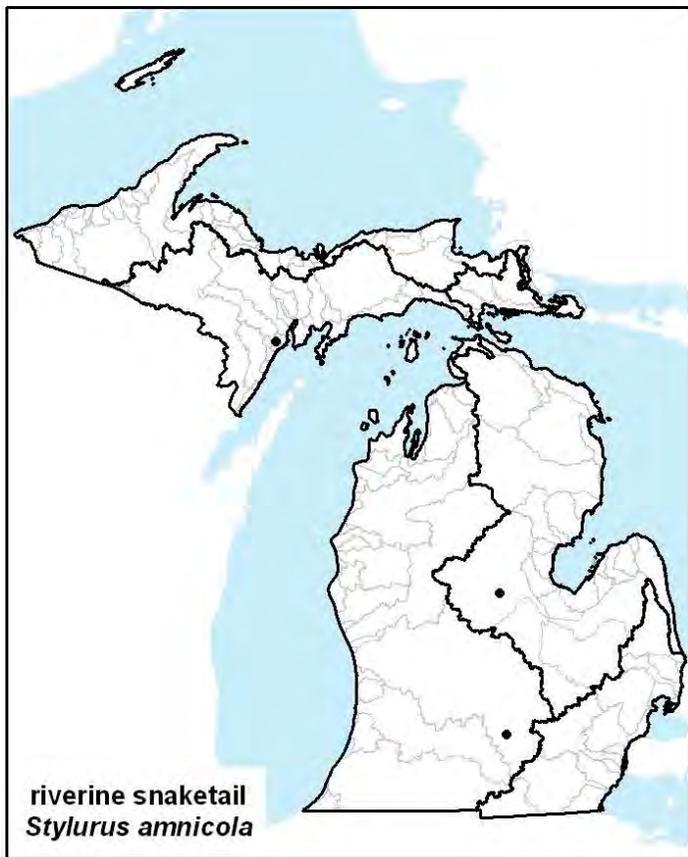
(*Ophiogomphus howei*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Known from only two locations, abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* cold medium rivers; cold large rivers; gradient: moderate; gradient: fast; rock substrates; vegetation; clear water; *terrestrial:* river/stream/ riparian/floodplain corridor

ASSOCIATED THREATS: dams, dredging & channelization, invasive plants & animals, urban, municipal, and industrial pollution; climate vulnerability: presumed stable with very high confidence

COMMENTS: Distribution, population status, habitat usage, and general life history information need to be determined.



riverine clubtail

(*Stylurus amnicola*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Known from only 3 locations, abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* medium rivers; large rivers; gradient: moderate; gradient: fast; rock substrates; soft substrates; *terrestrial:* river/stream/riparian/ floodplain corridor

ASSOCIATED THREATS: dams, dredging & channelization, forestry practices, invasive plants & animals, pesticides & herbicides, urban, municipal, and industrial pollution; climate vulnerability: presumed stable with very high confidence

COMMENTS: Distribution, population status, habitat usage, threats, and general life history information need to be determined.

russet-tipped clubtail

(*Stylurus plagiatus*)

DISTRIBUTION & ABUNDANCE: State listed as special concern but recommended elevation to endangered. Population abundance in unknown. Three known occurrences in MNFI database. Largest population likely extirpated, many surveys unsuccessful.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* large lakes; large rivers; soft substrates; turbid water; *terrestrial:* river/stream/riparian/ floodplain corridor

ASSOCIATED THREATS: riparian modifications; lack of scientific knowledge; climate vulnerability: presumed stable with very high confidence; unknown

COMMENTS: Distribution, population status, and threats need to be determined. Relative severity of listed threats is not well known and other currently unknown threats may exist for this species; a threats assessment is needed for this species.



STONEFLIES



a stonefly

(Isogenoides doratus)

DISTRIBUTION & ABUNDANCE: Unknown. Historically occurred in Lake county (no point data available).

ASSOCIATED LANDSCAPE FEATURES: cool headwaters & small tributaries; cool medium rivers; unknown

ASSOCIATED THREATS: lack of scientific knowledge; climate vulnerability: unknown; unknown

COMMENTS: Distribution, population status, habitat usage, threats, and general life history information need to be determined.



arctic sprintfly

(*Arcynopteryx compacta*)

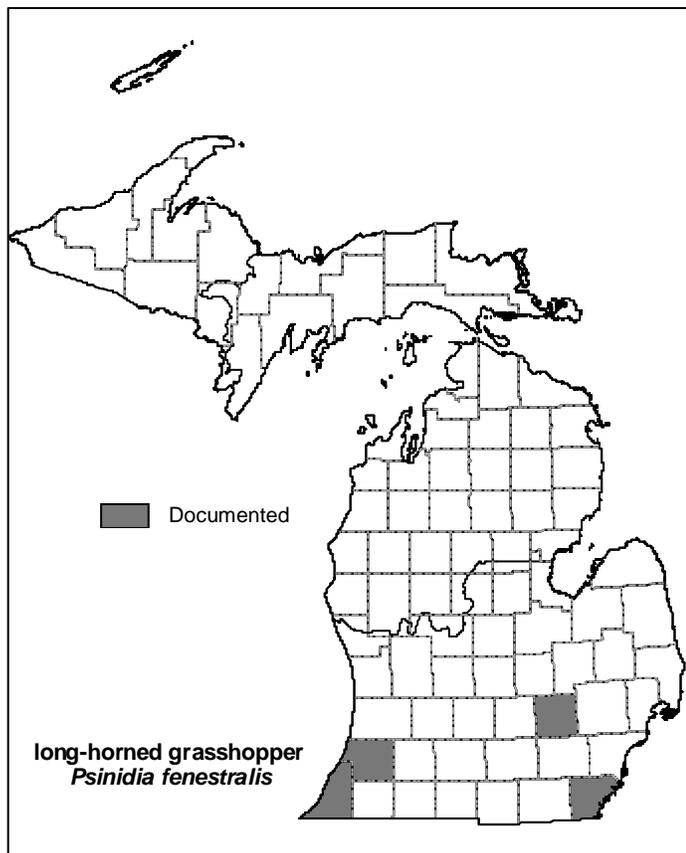
DISTRIBUTION & ABUNDANCE: Rare with only one known record. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: small lakes; medium lakes; headwaters & small tributaries; medium rivers; rock substrates

ASSOCIATED THREATS: lack of scientific knowledge; climate vulnerability: unknown; unknown

COMMENTS: Distribution, population status, habitat usage, threats, and general life history information need to be determined.

GRASSHOPPERS & CRICKETS



Atlantic-coast locust

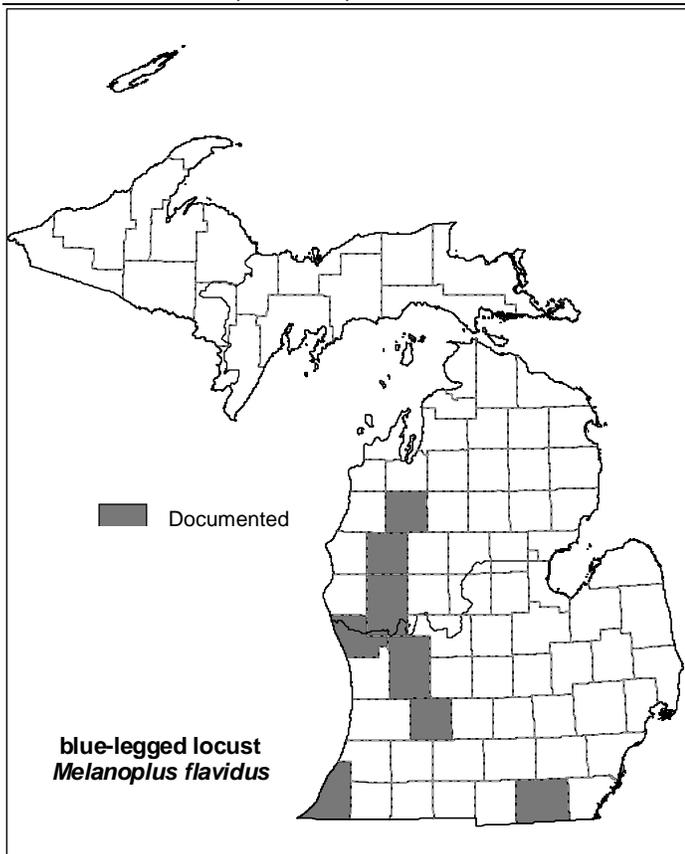
(Psinidia fenestralis)

DISTRIBUTION & ABUNDANCE: State listed as special concern. The specific status of this species in Michigan is currently undetermined, but it is clearly very rare in the State and may be critically imperiled. The status throughout most of its range is in question, but it appears to be rare or imperiled across its range.

ASSOCIATED LANDSCAPE FEATURES: savanna; inland lake; river/stream/riparian/floodplain corridor; coastal dune/beach; edge

ASSOCIATED THREATS: lack of scientific knowledge; pesticides & herbicides; climate vulnerability: unknown; unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information. Relative severity of listed threats is not well known and other currently unknown threats may exist for this species; a threats assessment is needed for this species.



blue-legged locust

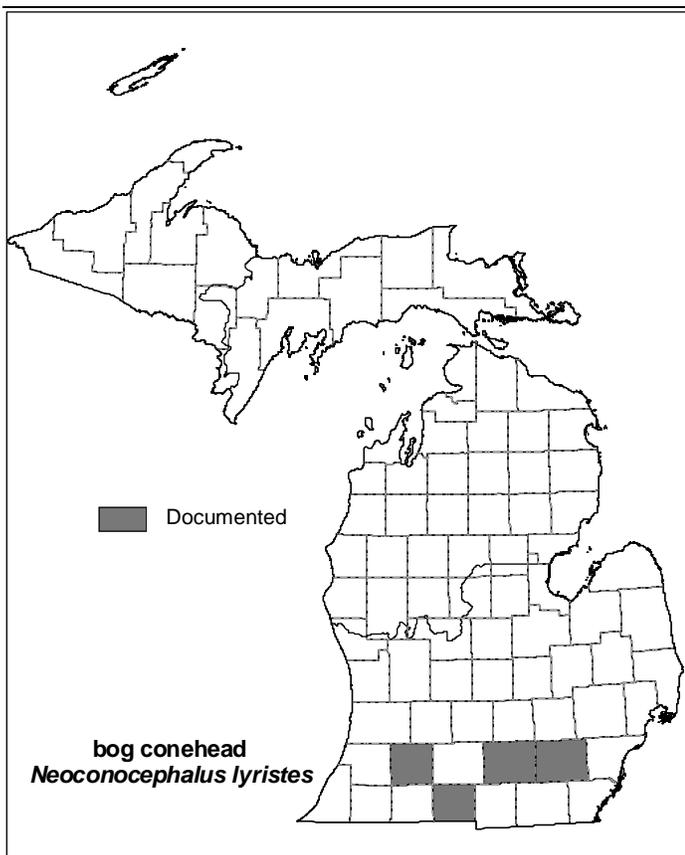
(*Melanoplus flavidus*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Occurs sporadically in the western Lower Peninsula. The specific status of this species in Michigan is currently undetermined, but it is clearly rare in the State and may be critically imperiled.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; savanna; coastal dune/beach

ASSOCIATED THREATS: altered fire regime; incompatible natural resource mgmt; lack of scientific knowledge; pesticides & herbicides; climate vulnerability; unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats. Prescribed fire is an important management tool, but care should be taken to ensure that occupied areas are only partially burned.



bog conehead

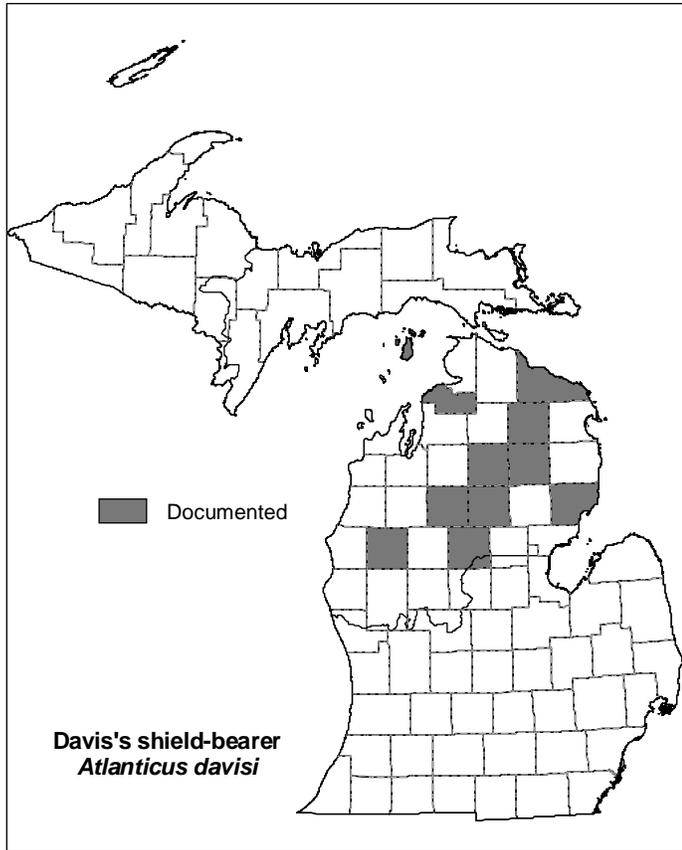
(*Neoconocephalus lyristes*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Has been found at scattered locations across the Southern Lower Peninsula. It is considered rare and may be critically imperiled in the State. Its rangewide status is currently undetermined; its status is unknown in Wisconsin and Ontario and it is uncommon in Missouri.

ASSOCIATED LANDSCAPE FEATURES: bog; inland emergent wetland; fen; ephemeral wetland

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; industrial/residential/recreational development; invasive plants & animals; lack of scientific knowledge; wetland modifications; climate vulnerability; unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats.



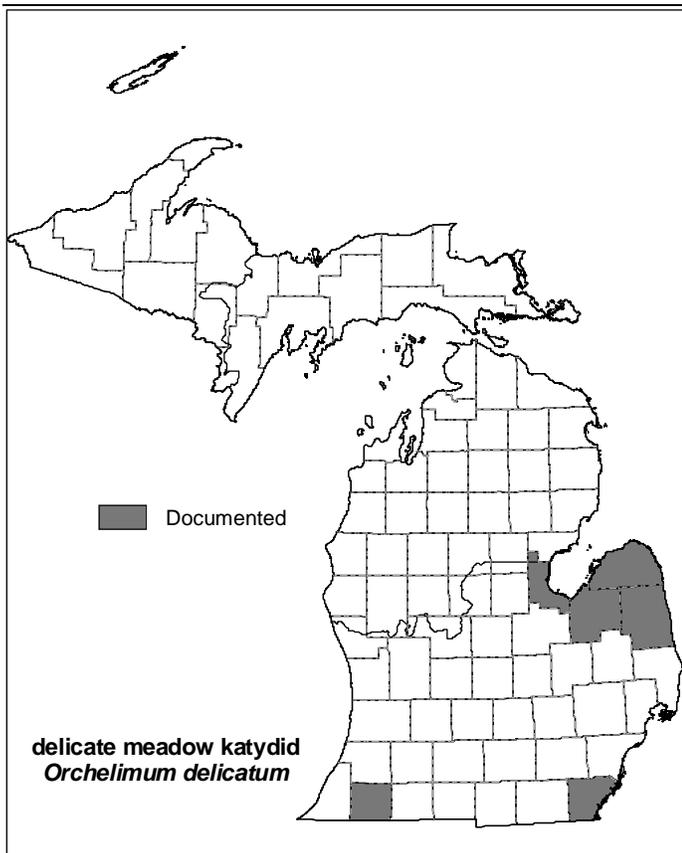
Davis's shield-bearer
(Atlantiscus davisii)

DISTRIBUTION & ABUNDANCE: State listed as special concern. This Northern Lower Peninsula species is rare in Michigan and may be imperiled. Michigan represents the western edge of its range. Its global conservation status has not been determined.

ASSOCIATED LANDSCAPE FEATURES: savanna; lowland hardwood; mesic hardwood; dry hardwood; bog; other (dead leaves)

ASSOCIATED THREATS: lack of scientific knowledge; climate vulnerability: unknown; unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats.



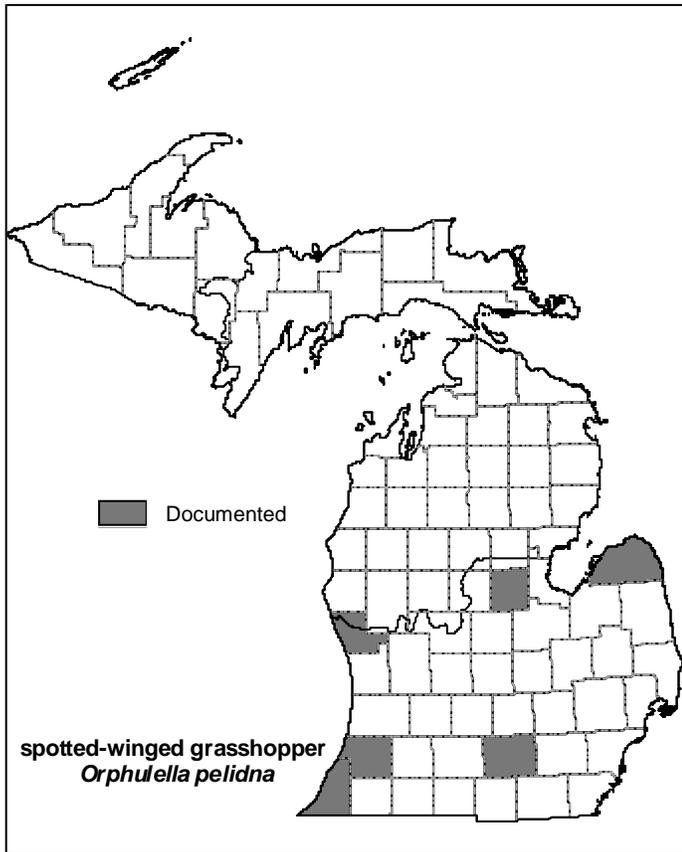
delicate meadow katydid
(Orchelimum delicatum)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Occurs scattered sporadically across much of the southeast Lower Peninsula. It is rare in the State and may actually be extremely rare. A more solid status determination is dependent upon surveys.

ASSOCIATED LANDSCAPE FEATURES: prairie; lowland shrub; inland emergent wetland; ephemeral wetland; coastal emergent wetland; coastal dune/beach

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; altered hydrologic regimes; industrial/residential/recreational development; lack of scientific knowledge; pesticides & herbicides; wetland modifications; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats.



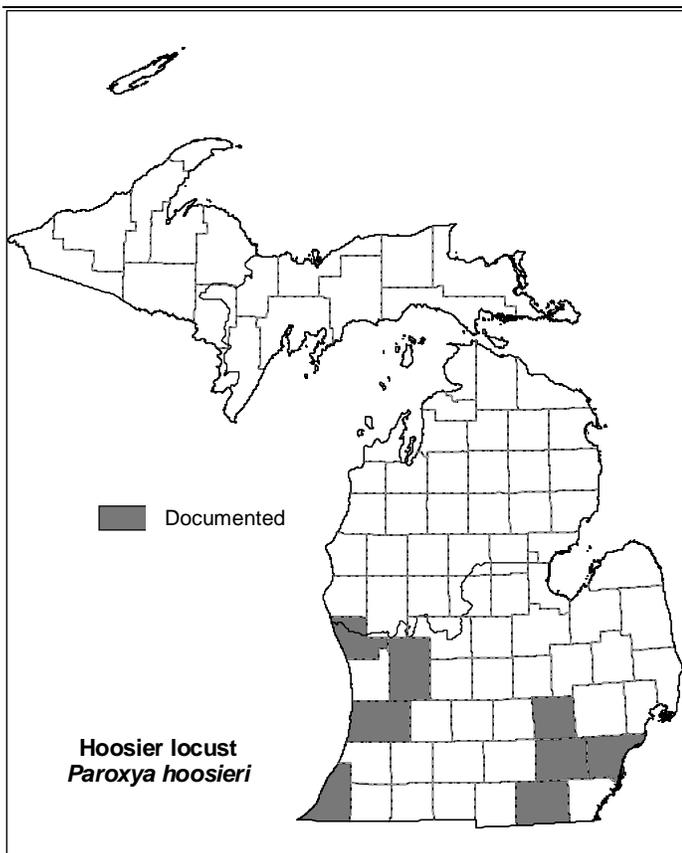
green desert grasshopper
(Orphulella pelidna)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Occurs sporadically in the Southern Lower Peninsula in oak savanna and associated prairie communities. The abundance of this species is currently not determined in the State.

ASSOCIATED LANDSCAPE FEATURES: prairie; pasture; right-of-way; savanna; dry hardwood; inland emergent wetland; coastal dune/beach

ASSOCIATED THREATS: lack of scientific knowledge; pesticides & herbicides; climate vulnerability: unknown; unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information. Relative severity of listed threats is not well known and other currently unknown threats may exist for this species; a threats assessment is needed for this species.



Hoosier locust
(Paroxya hoosieri)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Occurs at scattered locations throughout the Lower Peninsula. It is rare in Michigan and may be imperiled. It is rare across its range. Michigan probably maintains the strongest populations for this species.

ASSOCIATED LANDSCAPE FEATURES: idle/old field; bog; inland emergent wetland; fen; ephemeral wetland; pond; inland lake; river/stream/riparian/floodplain corridor; down woody debris

ASSOCIATED THREATS: altered fire regime; altered hydrologic regimes; lack of scientific knowledge; non-consumptive recreation; pesticides & herbicides; wetland modifications; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats.

County Occurrences of
Trimerotropis huroniana



Lake Huron locust

(*Trimerotropis huroniana*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Occurs in dune areas along the Great Lakes shoreline in the Northern Lower Peninsula and Eastern Upper Peninsula. It is locally abundant where its habitat is suitable. Overall it is considered rare in Michigan. This species has a distribution limited to the upper Great Lakes and Michigan represents the core of the species distribution.

ASSOCIATED LANDSCAPE FEATURES: coastal dune/beach; Great Lakes island

ASSOCIATED THREATS: fragmentation; industrial/residential/recreational development; invasive plants & animals; non-consumptive recreation; climate vulnerability: moderately vulnerable with very high confidence

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to further identify threats. ORV traffic should be redirected around occupied areas. Due to dispersal limitations, the large-scale development of Great Lakes shoreline areas is likely to result in fragmentation of populations.

County Occurrences of
Scudderia fasciata



pine katydid

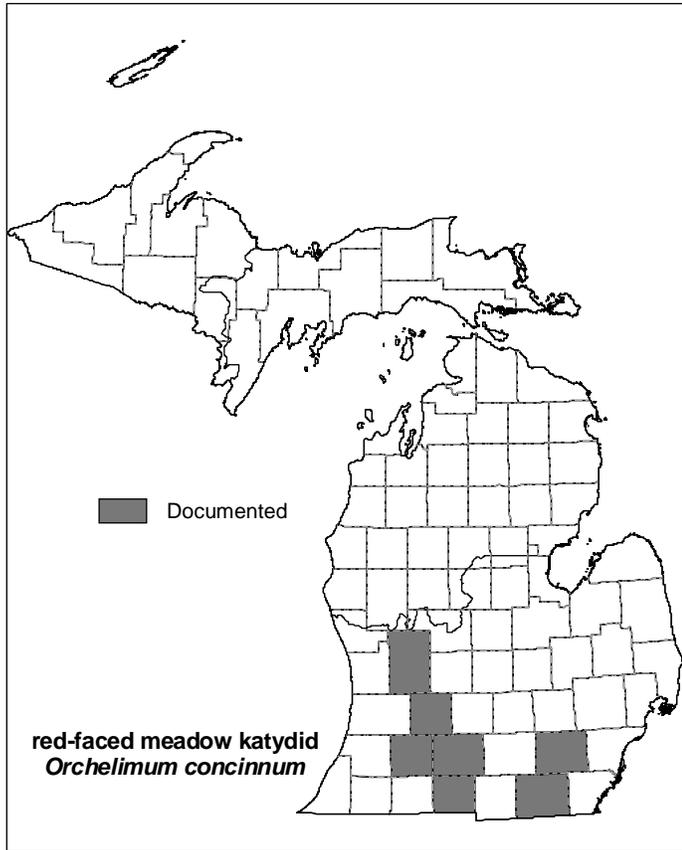
(*Scudderia fasciata*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Occurs sporadically in the Southern Lower Peninsula. It is rare in the State and may be extremely rare. A more solid status determination is dependent upon surveys. It is sporadically distributed throughout the northeastern U.S., so Michigan appears to represent the edge of its range. Its rangewide status is undetermined.

ASSOCIATED LANDSCAPE FEATURES: mesic conifer; dry conifer

ASSOCIATED THREATS: incompatible natural resource mgmt; lack of scientific knowledge; pesticides & herbicides; climate vulnerability: highly vulnerable with low confidence; unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information. Relative severity of listed threats is not well known and other currently unknown threats may exist for this species; a threats assessment is needed for this species.



red-faced meadow katydid
(Orchelimum concinnum)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Occurs sporadically throughout much of the Lower Peninsula. It is considered rare and may be imperiled in the State. The range-wide status of this species is undetermined, but Michigan appears to represent the core of its range.

ASSOCIATED LANDSCAPE FEATURES: inland emergent wetland; fen; ephemeral wetland

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; industrial/residential/recreational development; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; wetland modifications; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats.

County Occurrences of
Appalachia arcana



secretive locust
(Appalachia arcana)

DISTRIBUTION & ABUNDANCE: State listed as special concern. It is endemic to Michigan and occurs across nine counties in the Northern Lower Peninsula, but it may no longer occur in two of these counties. It is considered rare in Michigan.

ASSOCIATED LANDSCAPE FEATURES: prairie; savanna; lowland shrub; upland shrub; mesic hardwood; dry hardwood; dry conifer; forest opening; bog; fen; ephemeral wetland

ASSOCIATED THREATS: altered fire regime; fragmentation; incompatible natural resource mgmt; industrial/residential/ recreational development; lack of scientific knowledge; forestry practices; pesticides & herbicides; climate vulnerability: moderately vulnerable with very high confidence

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats.



tamarack tree cricket
(*Oecanthus laricis*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. This species is extremely rare in the State, occurring only in isolated patches of appropriate habitat in the Southern Lower Peninsula. It has a very limited distribution; known only from Ohio and Michigan.

ASSOCIATED LANDSCAPE FEATURES: prairie; lowland conifer; bog; fen; swamp

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; fragmentation; altered hydrologic regimes; incompatible natural resource mgmt; industrial/residential/ recreational development; invasive plants & animals; pesticides & herbicides; wetland modifications; climate vulnerability: extremely vulnerable with high confidence

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats.

CICADAS & HOPPERS



angular spittlebug
(Lepyronia angulifera)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Sparsely distributed across parts of the Southern Lower Peninsula. It is restricted to very specific habitat and vegetation and therefore occurs in isolated patches. It is considered uncommon to rare across its range.

ASSOCIATED LANDSCAPE FEATURES: prairie; lowland conifer; fen

ASSOCIATED THREATS: altered fire regime; incompatible natural resource mgmt; industrial/residential/recreational development; invasive plants & animals; lack of scientific knowledge; other biological interactions (decline in host plants, especially *Eleocharis*); pesticides & herbicides; climate vulnerability: extremely vulnerable with very high confidence

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats. Prescribed fire is an important management tool, but care should be taken to ensure that occupied areas are only partially burned. Protection and recovery efforts need to address declines in host plants, especially *Eleocharis* sp.



great plains spittlebug
(Lepyronia gibbosa)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Occurs at numerous sites across 6 counties in the west central Lower Peninsula and sparsely in the southwest Lower Peninsula. It is locally abundant where found, but its host plants may be in decline in these areas. It is a Forest Service sensitive species. This species may be rare across its range.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; right-of-way; savanna; dry hardwood; dry conifer; forest opening; ephemeral wetland

ASSOCIATED THREATS: climate change; conversion to agriculture lands; altered fire regime; fragmentation; incompatible natural resource mgmt; industrial/residential/ recreational development; invasive plants & animals; lack of scientific knowledge; non-consumptive recreation; climate vulnerability: highly vulnerable with moderate confidence

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats. Prescribed fire is an important management tool, but care should be taken to ensure that occupied areas are only partially burned. ORV traffic should be redirected around occupied areas.



Huron River leafhopper
(Flexamia huroni)

DISTRIBUTION & ABUNDANCE: Currently state listed as threatened, but recommended elevation to endangered. This extremely rare species is dependent upon a State-threatened plant, mat muhly (*Muhlenbergia richardsonis*), that occurs in a globally imperiled natural community, prairie fen. This species is known only from five sites in northwestern Oakland County. The range-wide status of this species is currently undetermined.

ASSOCIATED LANDSCAPE FEATURES: prairie; fen

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; altered hydrologic regimes; industrial/residential/recreational development; invasive plants & animals; lack of scientific knowledge; non-consumptive recreation; other biological interactions (loss of host plant (*Muhlenbergia richardsonis*)); pesticides & herbicides; wetland modifications; climate vulnerability: extremely vulnerable with very high confidence

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats. The protection and restoration of host plant populations, the State threatened mat muhly (*Muhlenbergia richardsonis*), is critical in the conservation of this species.



a leafhopper
(Dorydiella kansana)

DISTRIBUTION & ABUNDANCE: State listed as special concern. There are seven known locations in the last 20 years. Data is currently unavailable on its distribution and abundance.

ASSOCIATED LANDSCAPE FEATURES: prairie; coastal emergent wetland; coastal dune/beac

ASSOCIATED THREATS: conversion to agriculture lands; incompatible natural resource mgmt; lack of scientific knowledge; pesticides & herbicides; climate vulnerability: highly vulnerable with very high confidence

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information. Relative severity of listed threats is not well known and other currently unknown threats may exist for this species; a threats assessment is needed for this species.



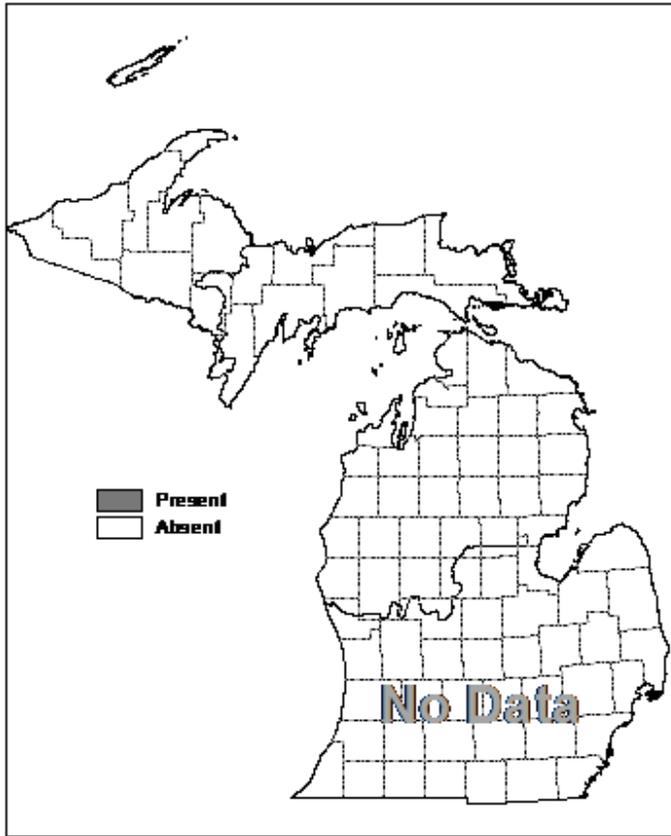
a leafhopper
(Flexamia reflexus)

DISTRIBUTION & ABUNDANCE: Currently state listed as special concern but recommended elevation to threatened. This species is extremely rare and critically imperiled in Michigan. The range-wide status of this species is currently undetermined.

ASSOCIATED LANDSCAPE FEATURES: hayland; pasture; right-of-way; savanna; fen; other

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; altered hydrologic regimes; incompatible natural resource mgmt; industrial/residential/recreational development; invasive plants & animals; lack of scientific knowledge; wetland modifications; climate vulnerability: presumed stable with very high confidence

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats.



Robertson's flightless planthopper

(*Fitchiella robertsoni*)

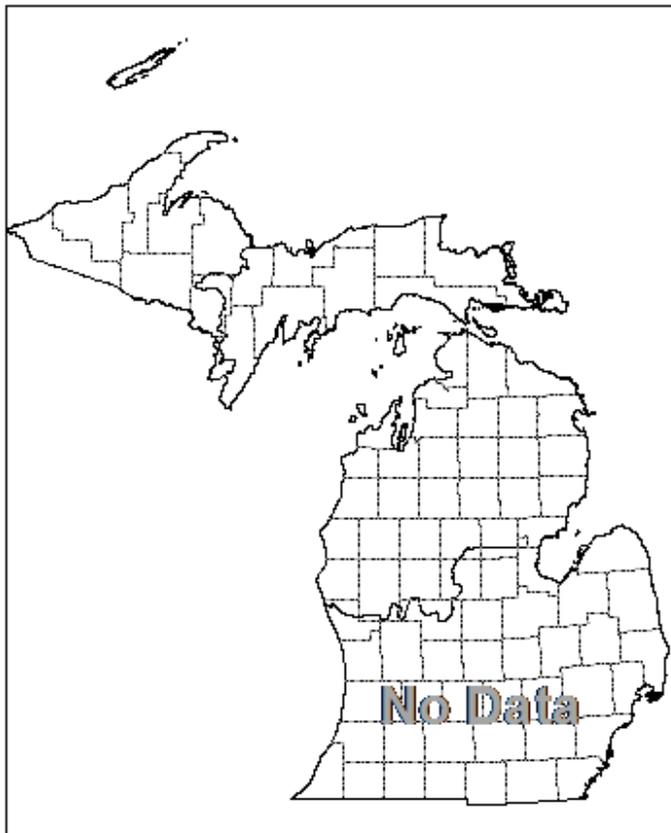
DISTRIBUTION & ABUNDANCE: Currently state listed as special concern with the recommendation to elevate to endangered. Globally rare and known only from two sites in the state. Maps unavailable.

ASSOCIATED LANDSCAPE FEATURES: unknown

ASSOCIATED THREATS: climate vulnerability: unknown; lack of scientific knowledge; unknown

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats.

BEETLES



black lordithon rove beetle

(Lordithon niger)

DISTRIBUTION & ABUNDANCE: State listed as special concern. This species is probably extirpated from Michigan. It was once thought to be globally extinct, but was discovered in Rhode Island in 1994. It is considered critically imperiled globally.

ASSOCIATED LANDSCAPE FEATURES: lowland hardwood; mesic hardwood; dry hardwood; other (species in this genus occur on fleshy fungi); late successional forest

ASSOCIATED THREATS: incompatible natural resource mgmt; lack of scientific knowledge; forestry practices; removal of non-timber flora; climate vulnerability: unknown

COMMENTS: Need surveys to determine presence in the State and, if present, assess abundance and distribution. Late successional forest hardwood or mixed conifer/hardwood forests with very old trees appears to be critical to this species.

Cantrall's bog beetle

(Liodesus cantralli)



DISTRIBUTION & ABUNDANCE: State listed as special concern. The status of this species is uncertain in Michigan. It is uncommon at best and is probably critically imperiled.

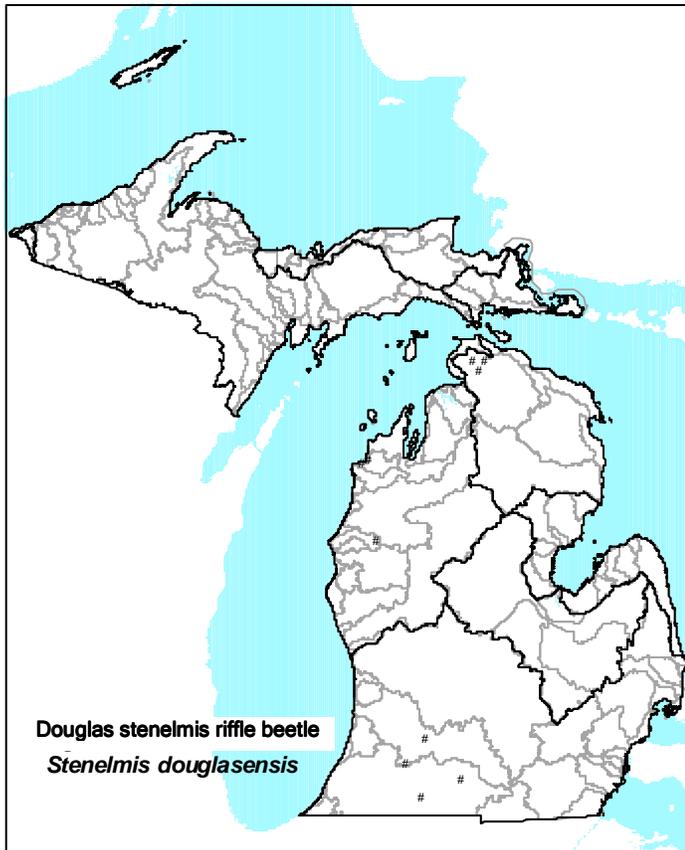
ASSOCIATED LANDSCAPE FEATURES: ponds; banks: clay; bog; fen; inland emergent wetland

ASSOCIATED THREATS: Lack of life history knowledge; unknown

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats.

Douglas stenelmis riffle beetle

(Stenelmis douglasensis)



DISTRIBUTION & ABUNDANCE: State listed as special concern. The Douglas stenelmis riffle beetle is rare or extremely rare in Michigan and is considered imperiled or critically imperiled. It has been known to occur, in low abundance, at only a handful of locations in the lower peninsula.

ASSOCIATED LANDSCAPE FEATURES: large lakes; wave-washed shore; headwaters/small tributaries; medium rivers; large rivers; soft substrates; woody structure; clear water

ASSOCIATED THREATS: altered nutrient inflows; dams; climate vulnerability: extremely vulnerable with low confidence

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats.

Hungerford's crawling water beetle
(Brychius hungerfordi)



DISTRIBUTION & ABUNDANCE: State and federally listed as endangered. Known from eight occurrences in the State. It is abundant at only one of these locations. It is considered critically imperiled in Michigan and globally.

ASSOCIATED LANDSCAPE FEATURES: cool headwaters/small tributaries; headwaters/small tributaries; cool medium rivers; medium rivers; gradient: moderate; gradient: fast; rock substrates; vegetation; woody structure; clear water

ASSOCIATED THREATS: altered nutrient inflows; incompatible natural resources management; other biological interactions (decline in beavers; increase in predators); removal of wildlife

COMMENTS: Need surveys to assess abundance and distribution; need basic life history information; need to identify threats.

six-banded longhorn beetle
(Dryobius sexnotatus)



DISTRIBUTION & ABUNDANCE: Currently state listed as special concern with a recommendation to elevate to threatened. The distribution and status of this species in the State is currently undetermined. It is known historically from only one location and it may be extirpated from the State. Its status globally is also undetermined.

ASSOCIATED LANDSCAPE FEATURES: lowland hardwood; mesic conifer; river/stream/riparian/floodplain corridor; snag/cavity; late successional forest

ASSOCIATED THREATS: disease, pathogens, & parasites; incompatible natural resource mgmt; forestry practices; pesticides & herbicides; climate vulnerability: unknown

COMMENTS: Need surveys to determine presence in the State and, if present, assess abundance and distribution. Its requirement for very old sugar maple trees results in this species' association with late successional forests. Spraying for gypsy moths may pose a significant threat to this species.

BEES



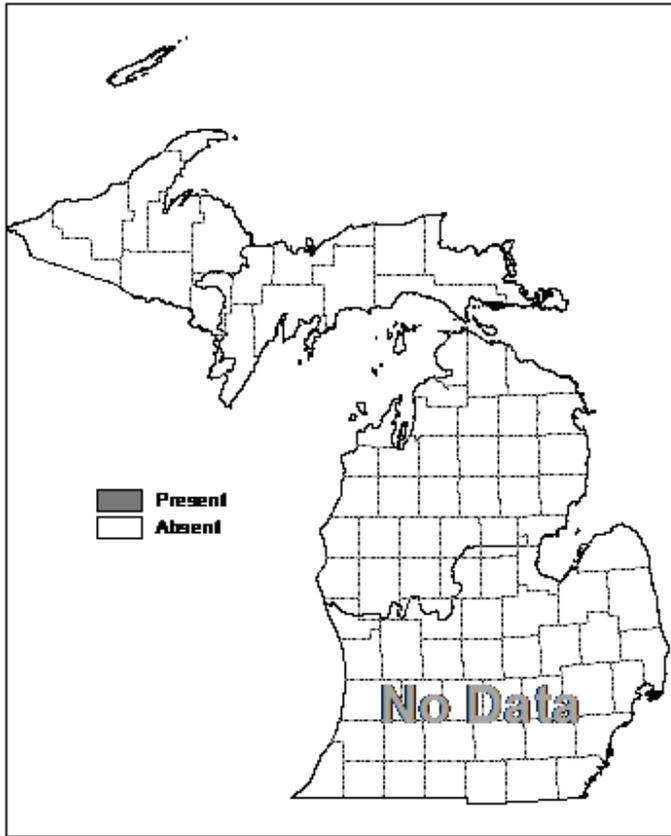
rusty-patched bumble bee
(Bombus affinis)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Unknown distribution and abundance.

ASSOCIATED LANDSCAPE FEATURES: forest opening; prairie

ASSOCIATED THREATS: pesticides & herbicides; invasive plants & animals; other biological interactions (spread of pests and diseases by commercial bumble bee industry); climate vulnerability: presumed stable with very high confidence

COMMENTS: Causes of decline are unlikely reversible. Surveys are needed to determine abundance and distribution.



yellow banded bumble bee
(*Bombus terricola*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Distribution and abundance are unknown.

ASSOCIATED LANDSCAPE FEATURES: forest opening; prairie

ASSOCIATED THREATS: pesticides & herbicides; invasive plants & animals; other biological interactions (spread of pests and diseases by commercial bumble bee industry); climate vulnerability: presumed stable with very high confidence

COMMENTS: Causes of decline are unlikely reversible. Surveys are needed to determine abundance and distribution.

CADDISFLIES



a caddisfly

(Limnephilus pallens)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Only known at one site, distribution and abundance are unknown.

ASSOCIATED LANDSCAPE FEATURES: unknown

ASSOCIATED THREATS: lack of scientific knowledge; unknown

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats. Also known as *Limnephilus samoedus*.

BUTTERFLIES & MOTHS

County Occurrences of
Oncocnemis piffardi



3-striped oncocnemis
(*Oncocnemis piffardi*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. It is considered extremely rare in Michigan and may be critically imperiled in the State.

ASSOCIATED LANDSCAPE FEATURES: inland emergent wetland; ephemeral wetland; river/stream/riparian/ floodplain corridor; coastal dune/beach

ASSOCIATED THREATS: lack of scientific knowledge; unknown; climate vulnerability: highly vulnerable with moderate confidence

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats.

County Occurrences of
Papaipema aweme



aweme borer
(Papaipema aweme)

DISTRIBUTION & ABUNDANCE: State listed as special concern. One recent record exists in Michigan, but Minnesota found a recent record in different habitats than once thought.

ASSOCIATED LANDSCAPE FEATURES: coastal dune/beach; Great Lakes island; other (sandy inland former lakeshores); unknown

ASSOCIATED THREATS: industrial/residential/recreational development; invasive plants & animals; lack of scientific knowledge; other biological interactions (alterations to habitat due to excessive deer browsing); climate vulnerability: moderately vulnerable with moderate confidence

COMMENTS: Need expanded targeted surveys to determine presence or absence and, if present, assess abundance and distribution. If it is still present, high deer densities on Beaver Island or elsewhere may pose a significant threat.

County Occurrences of
Papaipema beeriana



blazing star borer
(Papaipema beeriana)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Known from less than 12 sites scattered across southern Michigan and one site in the Northern Lower Peninsula. This species is considered very rare and it may be very imperiled in Michigan. This species is considered rare or uncommon globally.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; savanna; lowland hardwood; inland emergent wetland; fen; large contiguous natural landscape

ASSOCIATED THREATS: conversion to agriculture lands; dams; altered fire regime; fragmentation; altered hydrologic regimes; incompatible natural resource mgmt; industrial/residential/recreational development; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology including habitat requirements; need to assess threats; need info on response to controlled burns. Prescribed fire is an important management tool, but care should be taken to ensure occupied areas are only partially burned. Impoundment is a threat at least one site in Michigan.

County Occurrences of
Brachionycha borealis



boreal brachionyncha
(Brachionycha borealis)

DISTRIBUTION & ABUNDANCE: State listed as special concern. It is considered extremely rare in Michigan and may be critically imperiled.

ASSOCIATED LANDSCAPE FEATURES: savanna; dry hardwood; mesic conifer; dry conifer; forest opening

ASSOCIATED THREATS: incompatible natural resource mgmt; lack of scientific knowledge; pesticides & herbicides; unknown; climate vulnerability: presumed stable with high confidence

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats. Gypsy moth spraying is likely a threat.

County Occurrences of
Acrionicta falcata



corylus dagger moth
(Acrionicta falcata)

DISTRIBUTION & ABUNDANCE: State listed as special concern. It is considered rare in the State and may be imperiled. Current distribution and abundance is unknown. Its global status is unknown at this time. Rare range-wide.

ASSOCIATED LANDSCAPE FEATURES: lowland hardwood; mesic hardwood; unknown

ASSOCIATED THREATS: lack of scientific knowledge; unknown; climate vulnerability: moderately vulnerable with low confidence.

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats.

County Occurrences of
Papaipema sciata



Culvers root borer
(Papaipema sciata)

DISTRIBUTION & ABUNDANCE: Currently state listed as special concern with a recommended elevation to threatened. Known from 9 sites that are scattered across the Southern Lower Peninsula. It is considered rare and may be imperiled in Michigan.

ASSOCIATED LANDSCAPE FEATURES: prairie; fen

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; fragmentation; altered hydrologic regimes; incompatible natural resource mgmt; industrial/residential/ recreational development; invasive plants & animals; lack of scientific knowledge; other biological interactions (deer browse of host plant); pesticides & herbicides; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats. Prescribed fire is an important management tool, but care should be taken to ensure that occupied areas are only partially burned.

County Occurrences of
Merolonche doli



Doll's merolonche
(Merolonche doli)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Known from only a few sites in the Northern Lower Peninsula however all records are historic. It is considered imperiled or critically imperiled in the State due to extreme rarity.

ASSOCIATED LANDSCAPE FEATURES: savanna; lowland hardwood; mesic hardwood; dry hardwood; lowland conifer; mesic conifer; dry conifer; bog; fen

ASSOCIATED THREATS: altered fire regime; altered hydrologic regimes; incompatible natural resource mgmt; industrial/ residential/recreational development; lack of scientific knowledge; forestry practices; pesticides & herbicides; wetland modifications; climate vulnerability: moderately vulnerable with moderate confidence

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats. Gypsy moth spraying may impact this species. Easier to find as larvae vs. adult.

County Occurrences of
Euphyes dukesi



Dukes' skipper

(Euphyes dukesi)

DISTRIBUTION & ABUNDANCE: State listed as threatened. This skipper is extremely rare in the State and is considered critically imperiled. This species is globally vulnerable.

ASSOCIATED LANDSCAPE FEATURES: right-of-way; lowland shrub; forest opening; inland emergent wetland; ephemeral wetland; swamp; river/stream/riparian/floodplain corridor

ASSOCIATED THREATS: conversion to agriculture lands; fragmentation; grazing & mowing patterns; altered hydrologic regimes; industrial/residential/recreational development; invasive plants & animals; other biological interactions (decline of host plants - sedges); pesticides & herbicides; wetland modifications; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need to assess threats. Protection and restoration efforts should consider the status of host plant populations, sedges (*Carex* sp.). Mosquito spraying may pose a significant threat.

County Occurrences of
Euxoa aurulenta



dune cutworm

(Euxoa aurulenta)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Collected from nine locations scattered along Great Lakes shoreline areas all prior to 1994. It is considered rare in Michigan and may be critically imperiled in the State.

ASSOCIATED LANDSCAPE FEATURES: coastal dune/beach

ASSOCIATED THREATS: industrial/residential/recreational development; invasive plants & animals; lack of scientific knowledge; non-consumptive recreation; pesticides & herbicides; climate vulnerability: presumed stable with very high confidence

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats.

County Occurrences of
Atrytonopsis hianna



dusted skipper

(*Atrytonopsis hianna*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Recent surveys have continued to find this species but abundance is unknown and distribution is restricted.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; right-of-way; right-of-way; savanna; dry conifer; forest opening

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; fragmentation; incompatible natural resource mgmt; industrial/residential/recreational development; military maneuvers; non-consumptive recreation; pesticides & herbicides; climate vulnerability: moderately vulnerable with low confidence

COMMENTS: Need surveys to assess abundance and distribution; need to assess threats.

County Occurrences of
Erora laeta



early hairstreak

(*Erora laeta*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. This species is rare in Michigan and may be imperiled in the State. This species may be globally rare as well.

ASSOCIATED LANDSCAPE FEATURES: right-of-way; lowland hardwood; mesic hardwood; dry hardwood; forest opening; edge

ASSOCIATED THREATS: disease, pathogens, & parasites; industrial/residential/recreational development; lack of scientific knowledge; forestry practices; other biological interactions (decline of nectar sources); pesticides & herbicides; climate vulnerability: moderately vulnerable with low confidence

COMMENTS: Need surveys to assess abundance and distribution; need to assess threats. Decline in nectar sources (e.g. fleabane (*Erigeron* sp.) and ox-eyed daisy (*Chrysanthemum leucanthemum*)) may be a problem in some areas. Gypsy moth spraying may pose a significant threat. Negatively affected by beech scale.

County Occurrences of
Boloria freija



freija fritillary
(Boloria freija)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Scattered throughout much of the Upper Peninsula. They are locally uncommon and may be rare overall across the State.

ASSOCIATED LANDSCAPE FEATURES: lowland shrub; lowland conifer; mesic conifer; dry conifer; bog; submergent wetland

ASSOCIATED THREATS: climate change; mining practices; lack of scientific knowledge; other biological interactions (decline in host plant populations (dwarf birch)); unknown; climate vulnerability: highly vulnerability with low confidence

COMMENTS: Need surveys to assess abundance and distribution; need to assess threats. Identification of host plant(s) in Michigan is needed and subsequent protection or restoration efforts should consider the status of the host plant. Peat mining also poses a threat to this species.

County Occurrences of
Boloria frigga



frigga fritillary
(Boloria frigga)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Scattered throughout much of the Upper Peninsula. It is locally uncommon and may be rare overall in the State.

ASSOCIATED LANDSCAPE FEATURES: lowland shrub; lowland conifer; mesic conifer; dry conifer; bog; pond; fen

ASSOCIATED THREATS: climate change; fragmentation; mining practices; lack of scientific knowledge; other biological interactions (decline in larval host plant and nectar sources); unknown; climate vulnerability: highly vulnerable with low confidence

COMMENTS: Need surveys to assess abundance and distribution; need to assess threats. As a boreal species, this species may be susceptible to climate change in Michigan. Protection or restoration efforts must consider the status of the host plant, dwarf birch (*Betula nana*). Peat mining also poses a threat to this species.

County Occurrences of
Incisalia irus



frosted elfin
(Incisalia irus)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Scattered throughout the Lower Peninsula and locally uncommon where found. Overall this species is rare to imperiled in Michigan. This species is considered rare globally.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; right-of-way; savanna; upland shrub; dry hardwood; forest opening; edge

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; fragmentation; incompatible natural resource mgmt; industrial/residential/recreational development; invasive plants & animals; forestry practices; non-consumptive recreation; other biological interactions (loss of host plant; deer browse of host plant); pesticides & herbicides; climate vulnerability: highly vulnerable with moderate confidence.

COMMENTS: Need surveys to assess abundance and distribution; need to assess threats; need more information on adult nectaring sources. Gypsy moth spraying may be a problem to this species. Protection and restoration efforts must consider the status of its host plant, lupine (*Lupinus perennis*). Excessive ORV traffic can disturb frosted elfin habitat and result in significant mortality of larvae. This species is also known by the name *Incisalia irus*.



giant eucosma moth
(eucosma giganteana)

DISTRIBUTION & ABUNDANCE: Recommended to be listed as special concern. Only 2 specimens are known from Michigan. Southern Michigan is on the NE edge of species distribution

ASSOCIATED LANDSCAPE FEATURES: prairie

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; fragmentation; incompatible natural resource mgmt; industrial/residential/recreational development; invasive plants & animals; forestry practices; other biological interactions (loss of host plant; deer browse of host plant); pesticides & herbicides

COMMENTS: Need surveys to assess abundance and distribution; need to assess threats. Larvae feed only in stems of *Silphium* spp., all of which are rare and intensely local in State. Species flies from July to mid August.

County Occurrences of
Basilodes pepita



gold moth

(Basilodes pepita)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Extremely rare in Michigan and considered imperiled or critically imperiled.

ASSOCIATED LANDSCAPE FEATURES: lowland hardwood; swamp; river/stream/riparian/floodplain corridor

ASSOCIATED THREATS: lack of scientific knowledge; unknown; climate vulnerability: highly vulnerable with low confidence

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats.

County Occurrences of
Papaipema cerina



golden borer

(Papaipema cerina)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Occurs in three southwest Michigan counties. It prefers a complex mosaic of wetland and upland habitats, so it is rare and populations tend to occur patchily. It is considered imperiled or critically imperiled in the State.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; right-of-way; mesic hardwood; dry hardwood; lowland conifer; inland emergent wetland; fen; swamp; large contiguous natural landscape

ASSOCIATED THREATS: conversion to agriculture lands; fragmentation; grazing & mowing patterns; industrial/residential/recreational development; invasive plants & animals; lack of scientific knowledge; forestry practices; pesticides & herbicides; wetland modifications; climate vulnerability: moderately vulnerable with moderate confidence

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats. Golden borers are poor fliers and are therefore highly susceptible to fragmentation. Protection or restoration of complex habitat mosaics, particularly those containing fens or other wetlands, forest, and prairie, is critical to the conservation of this species. More information on the use of these mosaics and comprehensive planning efforts will benefit this species.

County Occurrences of
Pyrgus wyandot



grizzled skipper
(Pyrgus wyandot)

DISTRIBUTION & ABUNDANCE: Currently state listed as special concern with a recommendation to elevate to threatened. This skipper is rare in the Northern Lower Peninsula and is considered imperiled or critically imperiled in the State. Its global status is currently in question, but recent declines indicate that it may be critically imperiled globally as well.

ASSOCIATED LANDSCAPE FEATURES: idle/old field; right-of-way; savanna; lowland shrub; upland shrub; lowland conifer; forest opening; bog; fen; alvar/rock; edge

ASSOCIATED THREATS: altered fire regime; grazing & mowing patterns; incompatible natural resource mgmt; industrial/residential/recreational development; lack of scientific knowledge; pesticides & herbicides; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need to assess threats. Prescribed fire is an important management tool, but care should be taken to ensure occupied areas are only partially burned. A rangewide decline in this species is correlated with gypsy moth spraying. This species may also be known by the name *Pyrgus cantaureae wyandot*.

County Occurrences of
Lycaeides melissa samuelis



Karner blue
(Lycaeides melissa samuelis)

DISTRIBUTION & ABUNDANCE: State listed as threatened and federally listed as endangered. Restricted to lupine rich savanna areas in southwest Michigan, but it is locally abundant where habitat is available. A historic population in Monroe County is presumed to be extirpated. Overall it is considered rare and imperiled in the State.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; hayland; right-of-way; savanna; dry hardwood; dry conifer; forest opening; edge

ASSOCIATED THREATS: climate change; conversion to agriculture lands; disease, pathogens, & parasites; altered fire regime; fragmentation; grazing & mowing patterns; incompatible natural resource mgmt; industrial/residential/ recreational development; invasive plants & animals; non-consumptive recreation; other biological interactions (habitat alterations due to excessive deer browsing); pesticides & herbicides; removal of wildlife; climate vulnerability: highly vulnerable with very high confidence

COMMENTS: Need to determine population responses to various management regimes. Prescribed fire is an important management tool, but care should be taken to ensure that occupied areas are only partially burned. Protection and recovery efforts must consider the status of its host plant, lupine (*Lupinus perennis*). Recovery efforts must deal with connectivity between habitat

County Occurrences of
Euchloe ausonides



large marble

(*Euchloe ausonides*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Currently known only from Isle Royale in Michigan. It is considered imperiled or critically imperiled in the State.

ASSOCIATED LANDSCAPE FEATURES: lowland conifer; mesic conifer; dry conifer; forest opening; Great Lakes island; edge; inland rock/cliff/ledge

ASSOCIATED THREATS: lack of scientific knowledge; climate vulnerability: extremely vulnerable with very high confidence; unknown

COMMENTS: Need surveys to assess abundance and distribution—especially in the Porcupine Mountains and the Keweenaw Peninsula; need to assess threats; need to identify adult food source in Michigan; need information on life history and ecology

County Occurrences of
Schinia lucens



leadplant moth

(*Schinia lucens*)

DISTRIBUTION & ABUNDANCE: State listed as endangered in Michigan. It is considered critically imperiled in the State.

ASSOCIATED LANDSCAPE FEATURES: right-of-way, prairie

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; fragmentation; incompatible natural resource mgmt; industrial/residential/recreational development; invasive plants & animals; other biological interactions (decline in host plant (leadplant) populations); pesticides & herbicides; removal of wildlife; climate vulnerability: highly vulnerable with very high confidence

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats. Protection or recovery efforts must consider the status of its host plant, the special concern leadplant (*Amorpha canescens*). Mechanical disturbance may be an important management tool in preventing succession to woody vegetation in rights-of-ways, but care should be taken to avoid impacts to the species by considering the timing, extent, and location of these disturbances. Prescribed fire may be an important management tool, but care should be taken to ensure that occupied areas are only partially burned. Collection may pose a threat to this species.

County Occurrences of
Oeneis macounii



Macoun's arctic

(*Oeneis macounii*)

DISTRIBUTION & ABUNDANC: State listed as special concern. Generally widespread and abundant on Isle Royale. It is considered uncommon or rare in Michigan and may be imperiled.

ASSOCIATED LANDSCAPE FEATURES: upland shrub; lowland conifer; mesic conifer; dry conifer; Great Lakes island; edge; inland rock/cliff/ledge

ASSOCIATED THREATS: altered fire regime; lack of scientific knowledge; forestry practices; unknown; climate vulnerability: extremely vulnerable with moderate confidence

COMMENTS: Need surveys to assess abundance and distribution—particularly in Keweenaw, Houghton, and Ontonagon Counties; need to assess threats; need to identify host plant; need to assess life history and ecology

County Occurrences of
Catocala illecta



magdalen underwing

(*Catocala illecta*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. It is considered uncommon or rare in Michigan and it may be imperiled. There are only three known occurrences in Michigan.

ASSOCIATED LANDSCAPE FEATURES: lowland shrub; lowland hardwood; river/stream/riparian/floodplain corridor

ASSOCIATED THREATS: incompatible natural resource mgmt; lack of scientific knowledge; pesticides & herbicides; unknown; climate vulnerability: moderately vulnerable with moderate confidence.

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats.

County Occurrences of
Papaipema maritima



maritime sunflower borer
(Papaipema maritima)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Occurs scattered across far southern Michigan. It is considered very rare and may be critically imperiled in the State and is globally vulnerable.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; right-of-way; inland emergent wetland; fen

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; altered hydrologic regimes; incompatible natural resource mgmt; industrial/residential/recreational development; invasive plants & animals; fragmentation; lack of scientific knowledge; pesticides & herbicides; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats.



Michigan dune dart
(Copablepharon michiganensis)

DISTRIBUTION & ABUNDANCE: Recommended as special concern. Endemic to Michigan and Wisconsin dunes. Known only from the dunes along Lake Michigan in Oceana County.

ASSOCIATED LANDSCAPE FEATURES: coastal dune/beach

ASSOCIATED THREATS: Lack of knowledge; industrial/residential/recreational development; non-consumptive recreation

COMMENTS: More surveys needed. All Great Lakes specimens of *C. longipenne* now belong to *C. michiganensis* so existing material in collections should be examined for this recently described species. Early stages and host are unknown (Lafontaine 2004). Lots of potential habitat but survey badly needed; need to survey small sites as well as extensive dune complexes.

County Occurrences of
Neonympha mitchellii mitchellii



Mitchell's satyr

(*Neonympha mitchellii mitchellii*)

DISTRIBUTION & ABUNDANCE: State and federally listed as endangered. This species is scattered throughout parts of the Southern Lower Peninsula. It is very rare, occurring in isolated fens and similar habitat. It is considered critically imperiled in Michigan and imperiled or critically imperiled globally.

ASSOCIATED LANDSCAPE FEATURES: prairie; lowland shrub; lowland conifer; inland emergent wetland; fen; pond; river/stream/riparian/floodplain corridor; edge

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; fragmentation; grazing & mowing patterns; altered hydrologic regimes; incompatible natural resource mgmt; industrial/residential/recreational development; invasive plants & animals; lack of scientific knowledge; non-consumptive recreation; pesticides & herbicides; removal of wildlife; wetland modifications; climate vulnerability: extremely vulnerable with very high confidence

COMMENTS: Need to determine population responses to restoration techniques. Prescribed fire is an important management tool. During protection and recovery efforts, consider the status of its host plant, *Carex stricta* And redirect ORV and foot traffic around occupied areas. Beaver may create suitable habitat. Over collecting has been believed to impact populations and mosquito spraying may also result in impacts. Groundwater patterns must be protected.



monarch butterfly

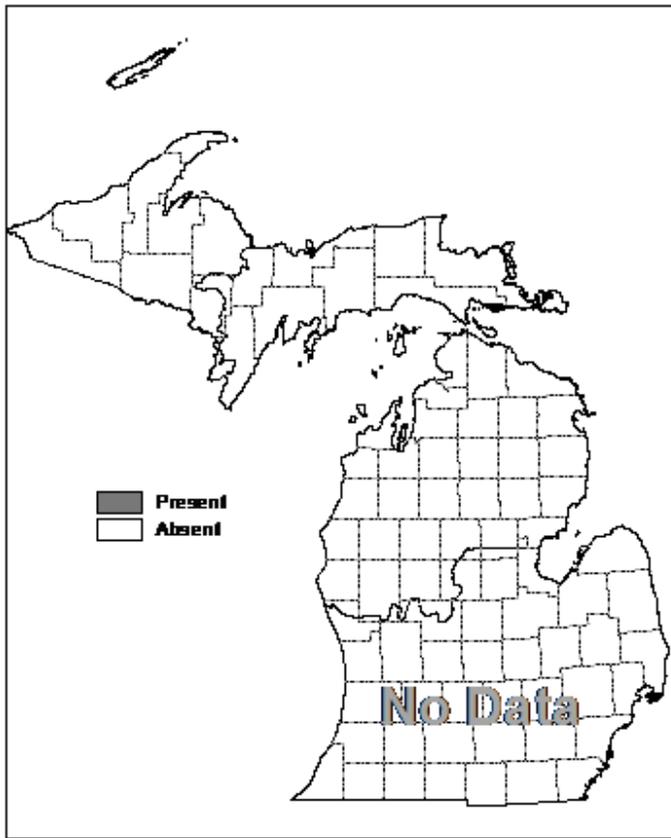
(*Danaus plexippus*)

DISTRIBUTION & ABUNDANCE: The species is undergoing major declines throughout its range.

ASSOCIATED LANDSCAPE FEATURES: prairie; savanna; orchard; dry conifer; dry hardwood; upland shrub; suburban/small town

ASSOCIATED THREATS: fragmentation; pesticides & herbicides

COMMENTS: Monarch butterflies have declined more than 90% over the past 20 years. This decline has prompted a recent petition to the U.S. Fish and Wildlife Service (USFWS) to list the monarch as a federally threatened species. In response to these declines the White House issued a Presidential Memorandum directing federal actions to address pollinator conservation. For example, the USFWS's Director issued a USFWS-wide charge to develop a strategy for monarch conservation that addresses habitat restoration and enhancement, education and outreach, and monitoring and research needs. To promote these efforts the Association of Fish and Wildlife Agencies (AFWA) passed a resolution that supports the "voluntary and incentive-based efforts to address threats of loss, fragmentation, and modification of monarch breeding habitat." Lastly, AFWA has asked the States to consider adding pollinators as SGCN in their state wildlife action plan. [Joint Memorandum Regarding Collaborative Efforts to Conserve the Monarch Butterfly and Other Native Pollinators" signed by USFWS



Mottled duskywing

(*Erynnis martialis*)

DISTRIBUTION & ABUNDANCE: Recommended as special concern. Less than 20 EO's known in Michigan. Likely decreasing in abundance and distribution.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; right-of-way; savanna; upland shrub; dry hardwood; forest opening

ASSOCIATED THREATS: Lack of knowledge.

COMMENTS: Many MI records are old and site viabilities are in question.

County Occurrences of
Meropleon ambifusca



Newman's brocade

(*Meropleon ambifusca*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. It is considered extremely rare in Michigan and may be critically imperiled in the State.

ASSOCIATED LANDSCAPE FEATURES: prairie; forest opening; inland emergent wetland; fen; ephemeral wetland

ASSOCIATED THREATS: lack of scientific knowledge; unknown; climate vulnerability: highly vulnerable with moderate confidence

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats.

County Occurrences of
Lycaeides idas nabokovi



northern blue

(*Lycaeides idas nabokovi*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. It is uncommon in the central and western Upper Peninsula. Overall it is considered rare and imperiled in the State with only nine occurrences in Michigan.

ASSOCIATED LANDSCAPE FEATURES: right-of-way; savanna; lowland shrub; upland shrub; lowland conifer; dry conifer; forest opening; bog; fen; ephemeral wetland; inland rock/cliff/ledge

ASSOCIATED THREATS: altered fire regime; fragmentation; incompatible natural resource mgmt; lack of scientific knowledge; forestry practices; pesticides & herbicides; climate vulnerability: highly vulnerable with very high confidence

COMMENTS: Need surveys to assess abundance and distribution; need to assess threats; need more information on adult food sources. Prescribed fire is an important management tool, but care should be taken to ensure that occupied areas are only partially burned.

County Occurrences of
Fixsenia favonius ontario



northern hairstreak

(*Fixsenia favonius ontario*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Only two records in MNFI database, one recent and one historic. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: idle/old field; right-of-way; savanna; upland shrub; lowland hardwood; dry hardwood; edge

ASSOCIATED THREATS: conversion to agriculture lands; incompatible natural resource mgmt; industrial/residential/ recreational development; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; unknown; climate vulnerability: moderately vulnerable with low confidence

COMMENTS: Need surveys to assess presence in the State and, if present, abundance and distribution. Relative severity of listed threats is not well known and other currently unknown threats may exist for this species; a threats assessment is needed for this species.

County Occurrences of
Hesperia ottoe



ottee skipper
(Hesperia ottoe)

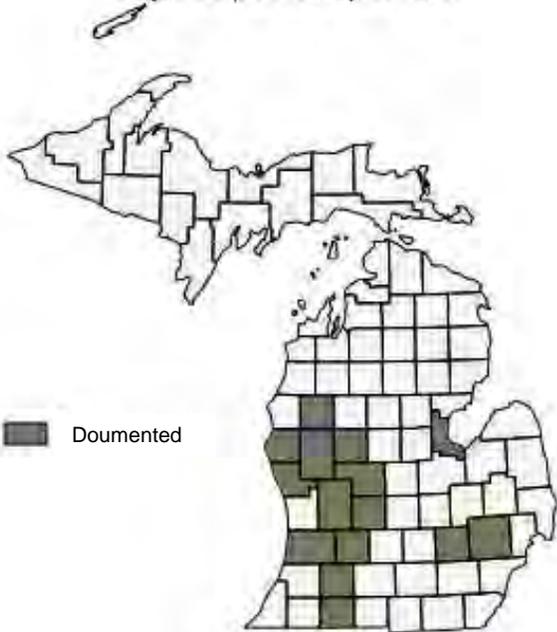
DISTRIBUTION & ABUNDANCE: Currently state listed as threatened with the recommendation to elevate to endangered. Considered very rare in southwest Michigan and is considered imperiled or critically imperiled in the State. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; right-of-way; savanna; upland shrub; coastal dune/beach; large contiguous natural landscape

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; fragmentation; grazing & mowing patterns; incompatible natural resource mgmt; industrial/residential/recreational development; invasive plants & animals; forestry practices; non-consumptive recreation; pesticides & herbicides; climate vulnerability; moderately vulnerable with moderate confidence.

COMMENTS: Need surveys to assess abundance and distribution; need to assess threats. Prescribed fire is an important management tool, but care should be taken to ensure that occupied areas are only partially burned.

County Occurrences of
Erynnis persius persius



persius dusky wing
(Erynnis persius persius)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Locally uncommon throughout much of the Southern Lower Peninsula. It is considered vulnerable in Michigan.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; right-of-way; savanna; upland shrub; dry hardwood; forest opening; fen

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; fragmentation; grazing & mowing patterns; incompatible natural resource mgmt; industrial/residential/recreational development; invasive plants & animals; lack of scientific knowledge; other biological interactions (deer browse of host plant); pesticides & herbicides; climate vulnerability; moderately vulnerable with moderate confidence

COMMENTS: Need surveys to assess abundance and distribution; need to assess threats. Need to reverse vegetative succession patterns in occupied areas. This species is also known by the name *Erynnis persius*.

County Occurrences of
Schinia indiana



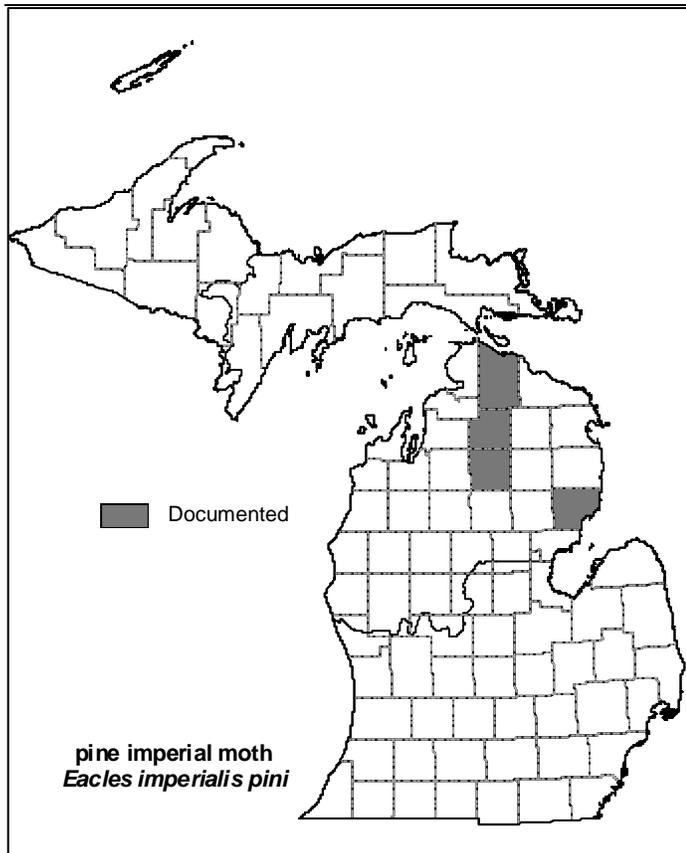
phlox moth
(Schinia indiana)

DISTRIBUTION & ABUNDANCE: State listed as endangered in Michigan. The phlox moth is known from only two locations in the west-central Lower Peninsula. It is considered imperiled or critically imperiled in Michigan and it may be imperiled across its range.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; right-of-way; savanna

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; fragmentation; grazing & mowing patterns; incompatible natural resource mgmt; lack of scientific knowledge; forestry practices; pesticides & herbicides; climate vulnerability: extremely vulnerable with very high confidence

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats. Any efforts to protect or restore this species should consider its host plant, downy phlox (*Phlox pilosa*). Mowing or prescribed burns can delay flowering and result in the absence of blossoms and seeds following adult emergence. Phlox moths are poor dispersers, so they are highly susceptible to habitat fragmentation.



pine imperial moth
(Eacles imperialis pini)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Occurs scattered across the Northern Lower Peninsula. It is considered rare in the State and may be imperiled.

ASSOCIATED LANDSCAPE FEATURES: lowland conifer; mesic conifer; dry conifer

ASSOCIATED THREATS: lack of scientific knowledge; forestry practices; pesticides & herbicides; unknown; climate vulnerability: moderately vulnerable with low confidence

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats.

County Occurrences of
Battus philenor



pipevine swallowtail
(Battus philenor)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Infrequently found throughout much of the Southern Lower Peninsula. It is considered imperiled or critically imperiled in Michigan.

ASSOCIATED LANDSCAPE FEATURES: idle/old field; right-of-way; savanna; orchard; mesic hardwood; dry hardwood; ephemeral wetland; river/stream/riparian/floodplain corridor; edge

ASSOCIATED THREATS: invasive plants & animals; lack of scientific knowledge; non-consumptive recreation; other biological interactions (loss of host plant - *Aristolochia* spp.); pesticides & herbicides; removal of non-timber flora; climate vulnerability: presumed stable with low confidence

COMMENTS: Need surveys to assess status, abundance, and distribution in the state as well as research to obtain life history and ecological information as well as to assess threats. Protection or restoration efforts must consider the host plant, *Aristolochia* spp.

County Occurrences of
Oarisma poweshiek



poweshiek skipperling
(Oarisma poweshiek)

DISTRIBUTION & ABUNDANCE: Currently state listed as threatened with the recommendation to elevate to endangered and federally listed as endangered. This species is very rare and is considered critically imperiled both in the state and globally.

ASSOCIATED LANDSCAPE FEATURES: prairie; lowland shrub; mesic conifer; forest opening; bog; fen; ephemeral wetland; inland lake

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; fragmentation; altered hydrologic regimes; industrial/residential/recreational development; lack of scientific knowledge; invasive plants and animals; other biological interactions (loss of host plant - *Eleocharis* spp.); pesticides & herbicides; wetland modifications; climate vulnerability: extremely vulnerable with very high confidence

COMMENTS: Need surveys to assess abundance and distribution; need to assess threats. Protection and restoration efforts should consider the status of host plant populations, *Eleocharis* spp.

County Occurrences of
Catocala dulciola



quiet underwing
(Catocala dulciola)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Very rare and intensely local in Michigan. It is considered imperiled or critically imperiled in the State. This species is considered vulnerable globally.

ASSOCIATED LANDSCAPE FEATURES: idle/old field; right-of-way; savanna; lowland hardwood; mesic hardwood; dry hardwood; river/stream/riparian/floodplain corridor; edge

ASSOCIATED THREATS: altered fire regime; lack of scientific knowledge; pesticides & herbicides; unknown; climate vulnerability: moderately vulnerable with moderate confidence.

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats. The larval host plant is hawthorn (*Crataegus sp.*)

County Occurrences of
Erebia discoidalis



red-disked alpine
(Erebia discoidalis)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Occurs across four counties in the Western Upper Peninsula where it is uncommon.

ASSOCIATED LANDSCAPE FEATURES: idle/old field; mesic conifer; forest opening; bog; ephemeral wetland; large contiguous natural landscape

ASSOCIATED THREATS: climate change; lack of scientific knowledge; pesticides & herbicides; unknown; climate vulnerability: moderately vulnerable with low confidence

COMMENTS: Need surveys to assess abundance and distribution; need to assess threats, life history, and ecology.

County Occurrences of
Papaipema speciosissima



regal fern borer

(*Papaipema speciosissima*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Considered rare in Michigan and may be imperiled.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; lowland shrub; lowland hardwood; fen; swamp; river/stream/riparian/floodplain corridor

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; altered hydrologic regimes; industrial/residential/recreational development; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; climate vulnerability: highly vulnerable with low confidence

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats.

County Occurrences of
Papaipema silphii



silphium borer moth

(*Papaipema silphii*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Documented form less than 10 sites in the Southern Lower Peninsula with only 3 non-historical occurrences in MNFI database. The populations are isolated due to fragmentation and loss of habitat. This species is considered imperiled or critically imperiled in Michigan.

ASSOCIATED LANDSCAPE FEATURES: prairie; right-of-way; lowland conifer; fen; ephemeral wetland

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; fragmentation; incompatible natural resource mgmt; industrial/residential/recreational development; invasive plants & animals; lack of scientific knowledge; other biological interactions (decline in host plant); pesticides & herbicides; wetland modifications; climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats. Prescribed fire is an important management tool, but care should be taken to ensure that occupied areas are only partially burned. Protection and recovery efforts must consider the status of its host plant, prairie dock (*Silphium terebinthinaceum*). ORV traffic should be redirected around occupied areas.

County Occurrences of
Spartiniphaga inops



spartina moth
(Spartiniphaga inops)

DISTRIBUTION & ABUNDANCE: State listed as special concern. This species is extremely rare and is considered imperiled or critically imperiled in the State. This species may be imperiled across its range.

ASSOCIATED LANDSCAPE FEATURES: prairie; inland emergent wetland

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; altered hydrologic regimes; fragmentation; incompatible natural resource mgmt; invasive plants & animals; lack of scientific knowledge; climate vulnerability: highly vulnerable with very high confidence

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats. Protection and recovery efforts need to address declines in host plant, prairie cord-grass, *Spartina pectinata*. Displacement of host plant populations by *Phragmites* sp. invasion is a significant risk to the species. Prescribed fire is an important management tool, but care should be taken to ensure that occupied areas are only partially burned. Mosquito spraying is an issue.

County Occurrences of
Pygarctia spraguei



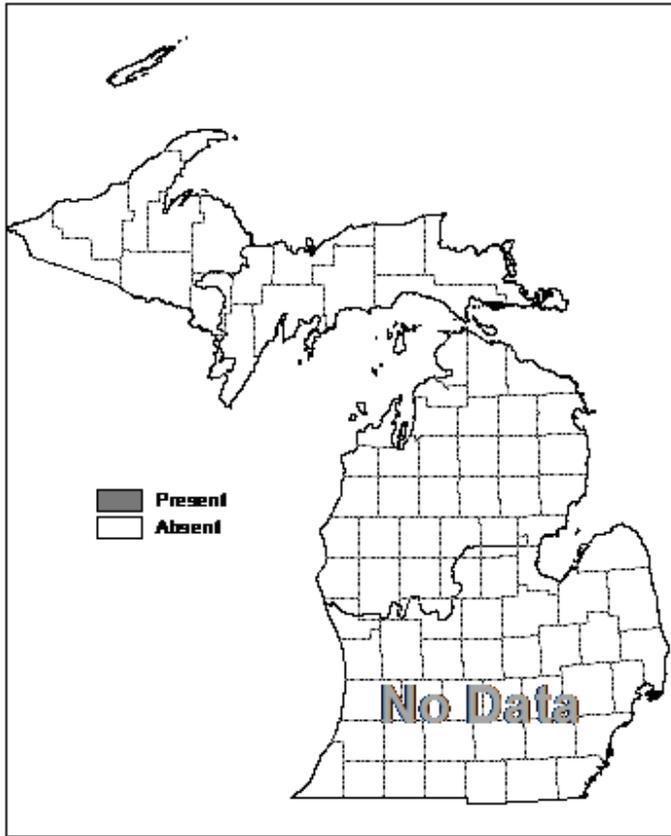
Sprague's pygarctia
(Pygarctia spraguei)

DISTRIBUTION & ABUNDANCE: State listed as special concern. It is considered rare in the State and may be imperiled. There are no recent records, five occurrences were recorded in the 1990's.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; right-of-way; savanna; dry hardwood; forest opening

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; grazing & mowing patterns; incompatible natural resource mgmt; mining practices; industrial/residential/ recreational development; invasive plants & animals; lack of scientific knowledge; forestry practices; non-consumptive recreation; pesticides & herbicides; climate vulnerability: moderately vulnerable with low confidence

COMMENTS: Tied to the host plant *Euphorbia corollata* and requires a fire regime. Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats. Prescribed fire is an important management tool, but care should be taken to ensure occupied areas are only partially burned. At some sites sand mining and ORV traffic may threaten populations.



sulfur rosinweed stem borer
(Eucosma bipunctella)

DISTRIBUTION & ABUNDANCE: Recommended for special concern in Michigan. Most recent specimen is from 48 years ago.

ASSOCIATED LANDSCAPE FEATURES: fen

ASSOCIATED THREATS: Lack of knowledge.

COMMENTS: Larvae feed only in stems of *Silphium* spp., all of which are rare and intensely local in State. Single flight in June-July (Miller 1987). Due to flight timing, lepidopterists sampling for *Papaipema* will not encounter this species.

County Occurrences of
Calephelis mutica



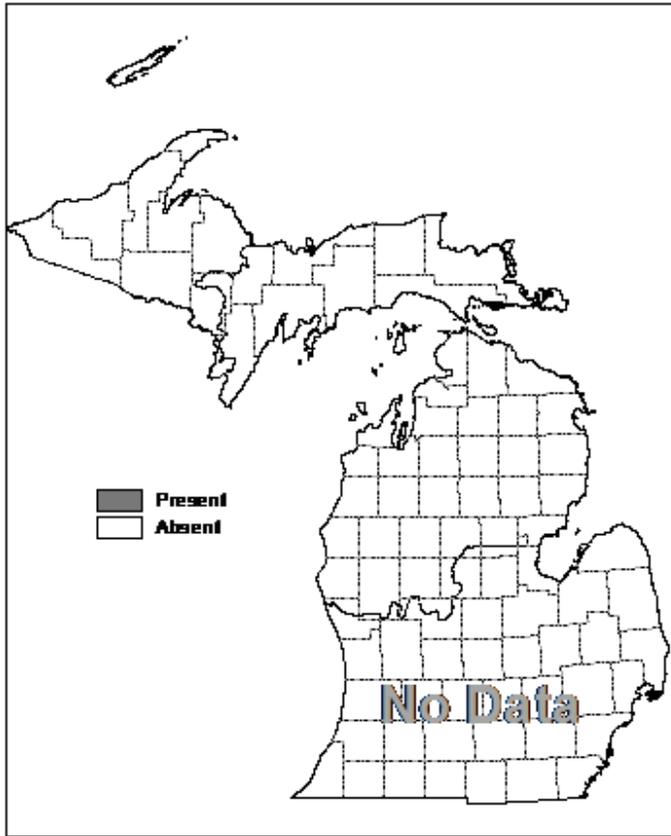
swamp metalmark
(Calephelis mutica)

DISTRIBUTION & ABUNDANCE: Currently state listed as special concern with the recommendation to elevate to endangered. Scattered throughout much of the Southern Lower Peninsula but last confirmed record is from 2008. This species is rare and is considered imperiled or critically imperiled in the State. It is considered vulnerable globally.

ASSOCIATED LANDSCAPE FEATURES: lowland shrub; lowland conifer; forest opening; bog; fen; ephemeral wetland; swamp; pond; inland lake; river/stream/riparian/floodplain corridor

ASSOCIATED THREATS: conversion to agriculture lands; dams; altered fire regime; fragmentation; grazing & mowing patterns; altered hydrologic regimes; industrial/residential/ recreational development; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; removal of wildlife; wetland modifications; climate vulnerability: highly vulnerable with moderate confidence

COMMENTS: Need surveys to assess abundance and distribution; need to assess threats. Need to maintain hydrologic integrity at occupied sites.



the relic

(Dichagyris reliqua)

DISTRIBUTION & ABUNDANCE: Recommended listing as special concern in Michigan. Extremely rare and local rangewide.

ASSOCIATED LANDSCAPE FEATURES: dry prairie; limestone outcrops

ASSOCIATED THREATS: Lack of knowledge.

COMMENTS: High priority for survey.

County Occurrences of
Pachypolia atricornis



three-horned moth

(Pachypolia atricornis)

DISTRIBUTION & ABUNDANCE: State listed as special concern. This species is considered extremely rare in Michigan and may be critically imperiled in the State.

ASSOCIATED LANDSCAPE FEATURES: lowland hardwood; mesic hardwood; lowland conifer; mesic conifer

ASSOCIATED THREATS: industrial/residential/recreational development; lack of scientific knowledge; pesticides & herbicides; unknown; climate vulnerability: moderately vulnerable with low confidence

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats. Development has probably already resulted in significant habitat loss. Mosquito spraying may pose a significant threat.

County Occurrences of
Catocala amestris



three-staff underwing
(Catocala amestris)

DISTRIBUTION & ABUNDANCE: State listed as endangered. It is considered extremely rare in Michigan and is critically imperiled.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; right-of-way; savanna; upland shrub; dry hardwood; forest opening

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; fragmentation; incompatible natural resource mgmt; invasive plants & animals; lack of scientific knowledge; removal of wildlife; climate vulnerability: extremely vulnerable with very high confidence

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats. Site management for this species requires fire to negate vegetative succession, particularly from the invasive autumn olive. However, excessive fire coverage in occupied areas should be avoided to prevent or minimize incidental take. In some cases, emphasis may be on restoration of highly degraded sites, with subsequent reintroductions.

County Occurrences of
Proserpinus flavofasciata



yellow-banded day-sphinx
(Proserpinus flavofasciata)

DISTRIBUTION & ABUNDANCE: State listed as special concern. It is considered rare in the State and may be imperiled. Data on current distribution and abundance is unavailable.

ASSOCIATED LANDSCAPE FEATURES: right-of-way; lowland conifer; mesic conifer; dry conifer; forest opening; edge; unknown

ASSOCIATED THREATS: altered fire regime; lack of scientific knowledge; pesticides & herbicides; unknown; climate vulnerability: highly vulnerable with moderate confidence
COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats.

FISHFLIES



A fishfly

(Neohermes concolor)

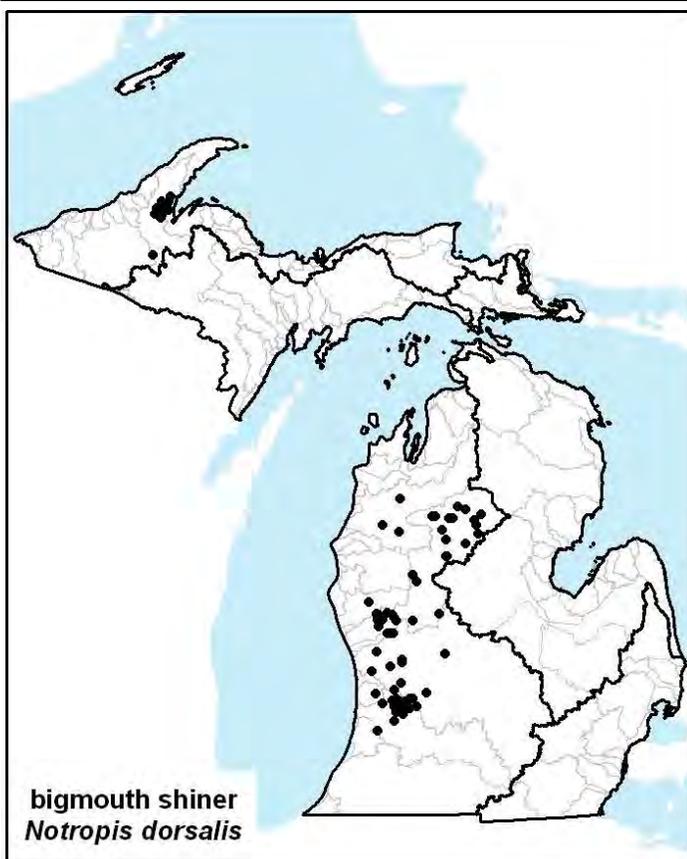
DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: clear water; cool headwaters and small tributaries

ASSOCIATED THREATS: dredging & channelization; altered sediment loads; urban, municipal & industrial pollution; other (collection as fish bait); climate vulnerability: unknown

COMMENTS: Need surveys to assess abundance and distribution; need information on life history and ecology; need to assess threats.

FISH



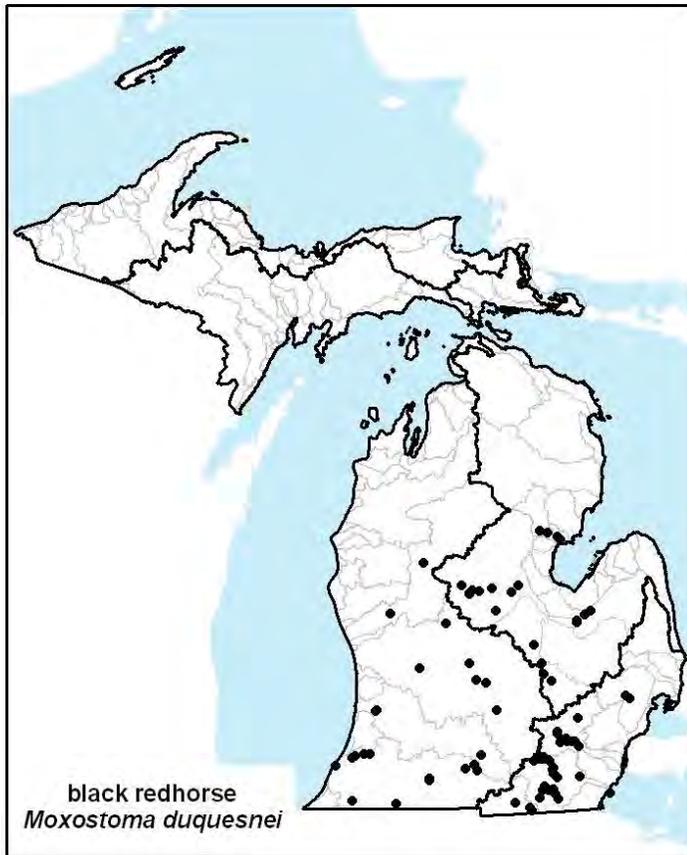
bigmouth shiner (*Notropis dorsalis*)

DISTRIBUTION & ABUNDANCE: Currently state listed as special concern with the recommendation to elevate to threatened. Experts believe there has been a 50% reduction in the number of occurrences compared to historic records. Latta (2005) indicated there are fewer than ten populations remaining in Michigan. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: small lakes; medium lakes; cool headwaters & small tributaries; warm headwaters & small tributaries; cool medium rivers; warm medium rivers; cool large rivers; warm large rivers; gradient: slow; gradient: moderate; rock substrates; soft substrates; turbid water; clear water

ASSOCIATED THREATS: altered nutrient inflows; other biological interactions (hybridization, competition with silverjaw minnow, *Notropis buccatus*); riparian modification; urban, municipal, and industrial pollution

COMMENTS: Spawning habits and movements are unknown. The silverjaw minnow has been suggested to be displacing the bigmouth shiner; this relationship needs to be further explored. Population status needs to be determined.



black redhorse

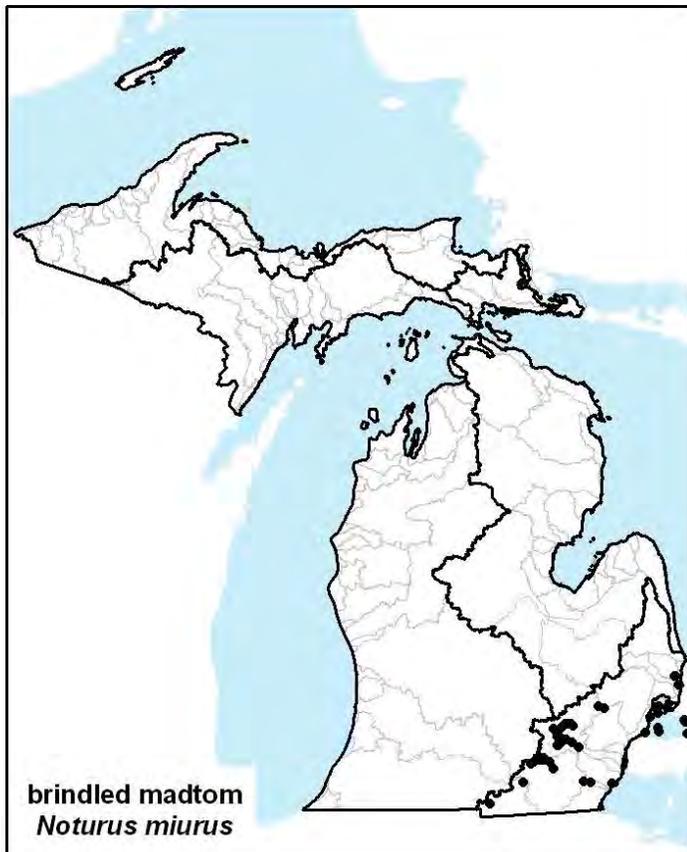
(*Moxostoma duquesnei*)

DISTRIBUTION & ABUNDANCE: Proposed listing as special concern. Occasionally found in the Lower Peninsula, however experts believe this species has suffered a 50% reduction in occurrences compared to historic records. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: cool headwaters & small tributaries; warm headwaters & small tributaries; cool medium rivers; warm medium rivers; cool large rivers; warm large rivers; gradient: slow; gradient: moderate; gradient: fast; rock substrates; vegetation; clear water

ASSOCIATED THREATS: altered sediment loads, disease, pathogens and parasites

COMMENTS: Movements unknown. Status needs to be tracked. Elusive species, hence extensive sampling with diversified gears is needed. Spawning habitats need to be located and spawning effort monitored.



brindled madtom

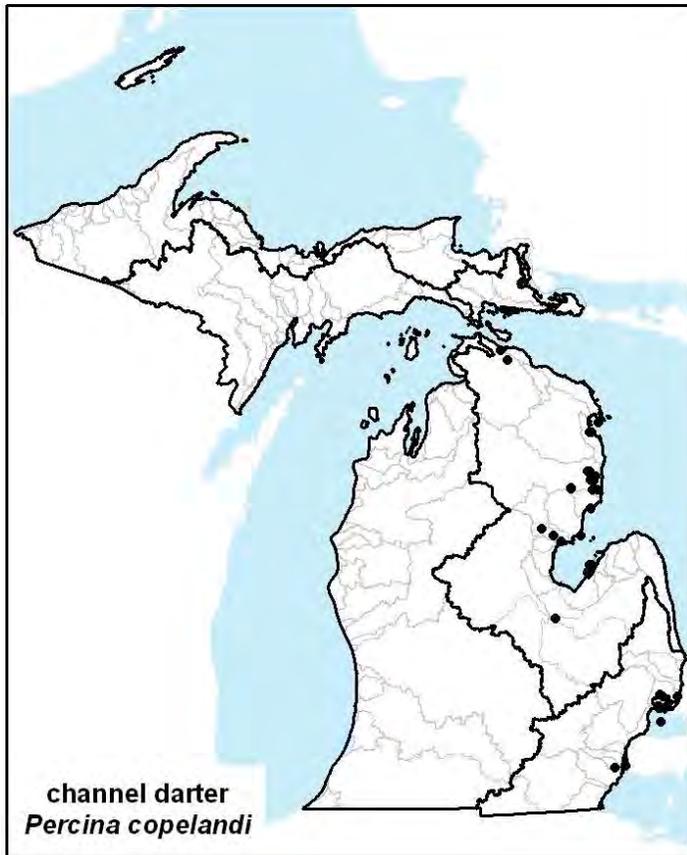
(*Noturus miurus*)

DISTRIBUTION & ABUNDANCE: Currently state listed as special concern with the recommended elevation to threatened. Only found in the Lake Erie basin. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: shoreline; nearshore; small lakes; medium lakes; large lakes; headwaters & small tributaries; medium rivers; large rivers; gradient: slow; rock substrates; soft substrates; vegetation

ASSOCIATED THREATS: altered sediment loads; other biological interactions (hybridization); pesticides & herbicides; urban, municipal, and industrial pollution

COMMENTS: Michigan is the northern edge of range for this species. Movements are unknown. Effective sampling techniques are needed to adequately assess population status. Population status needs to be determined.



channel darter

(*Percina copelandi*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Rare along the eastern side of the Lower Peninsula. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: shoreline; nearshore; cold headwaters & small tributaries; cool headwaters & small tributaries; cold medium rivers; cool medium rivers; cold large rivers; cool large rivers; gradient: slow; rock substrates; rock substrates; soft substrates

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; disease, pathogens and parasites other biological interactions (hybridizes with logperch); thermal changes

COMMENTS: Michigan is the northern edge of range for this species. This species has a very patchy and disjunct distribution across its range. Population status needs to be determined.



creek chubsucker

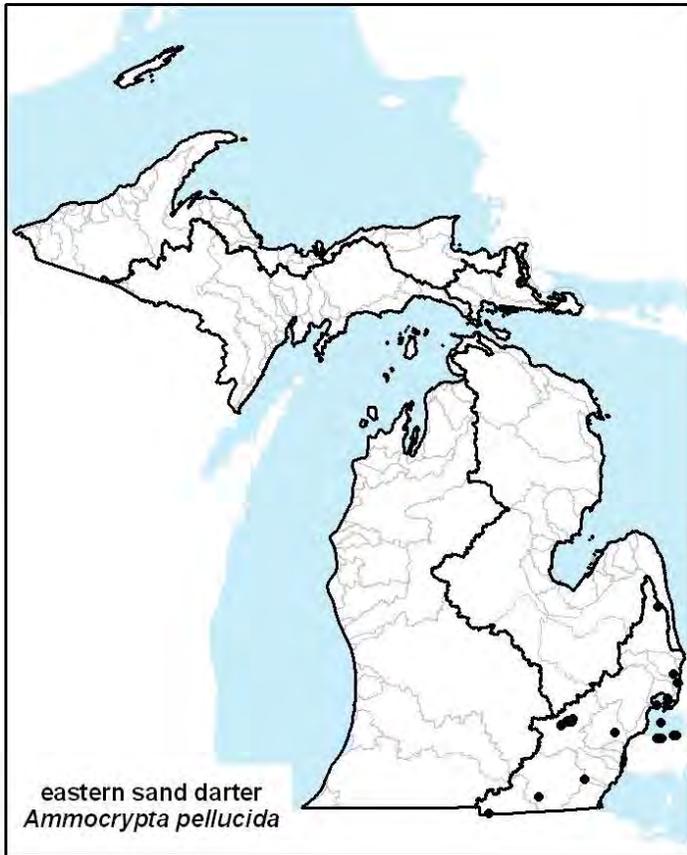
(*Erimyzon claviformis*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: warm headwaters & small tributaries; warm medium rivers; gradient: slow; rock substrates; soft substrates; vegetation; clear water

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads

COMMENTS: Michigan is northern edge of range for this species. Population status needs to be determined. This species may also be known by the name *Erimyzon oblongus*



eastern sand darter

(*Ammocrypta pellucida*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Only found in the Lake Erie basin. Rare. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: shoreline; nearshore; small lakes; medium lakes; large lakes; wave-washed shore; cool headwaters & small tributaries; warm headwaters & small tributaries; cool medium rivers; warm medium rivers; gradient: moderate; gradient: fast; rock substrates; soft substrates; turbid water; clear water

ASSOCIATED THREATS: altered sediment loads; dams; dredging & channelization; fragmentation; mining practices; pesticides & herbicides; urban, municipal, and industrial pollution

COMMENTS: Michigan is the northwestern edge of range for this species. Research is needed on movements, microhabitat use, and population variability. Population status needs to be determined.



Ives lake cisco

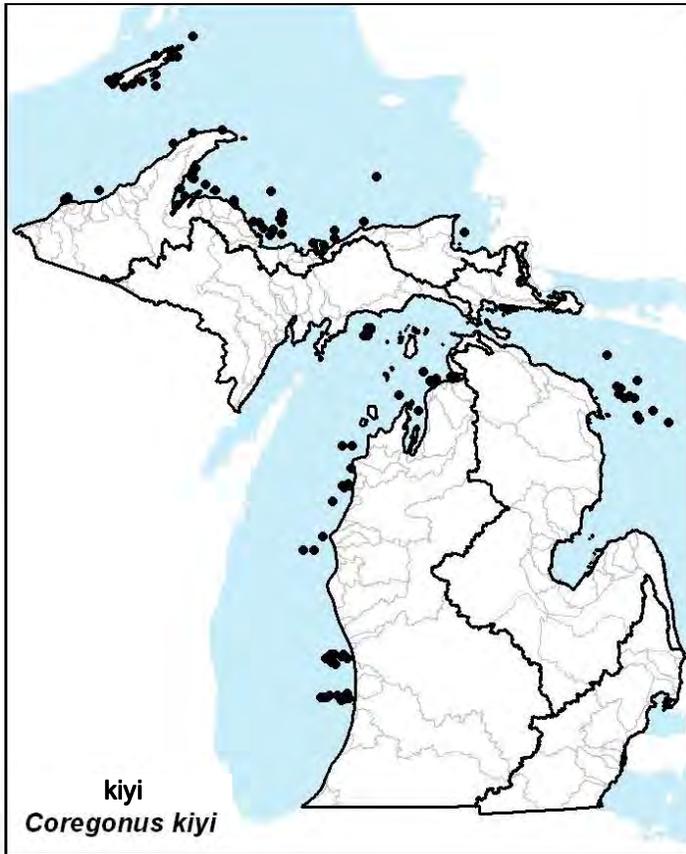
(*Coregonus hubbsi*)

DISTRIBUTION & ABUNDANCE: Currently state listed as threatened with a recommendation to list as special concern. This species is only found in a secure inland lake. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: nearshore; offshore

ASSOCIATED THREATS: altered nutrient inflows; invasive plants & animals; removal of wildlife

COMMENTS: Population status needs to be determined.



kiyi

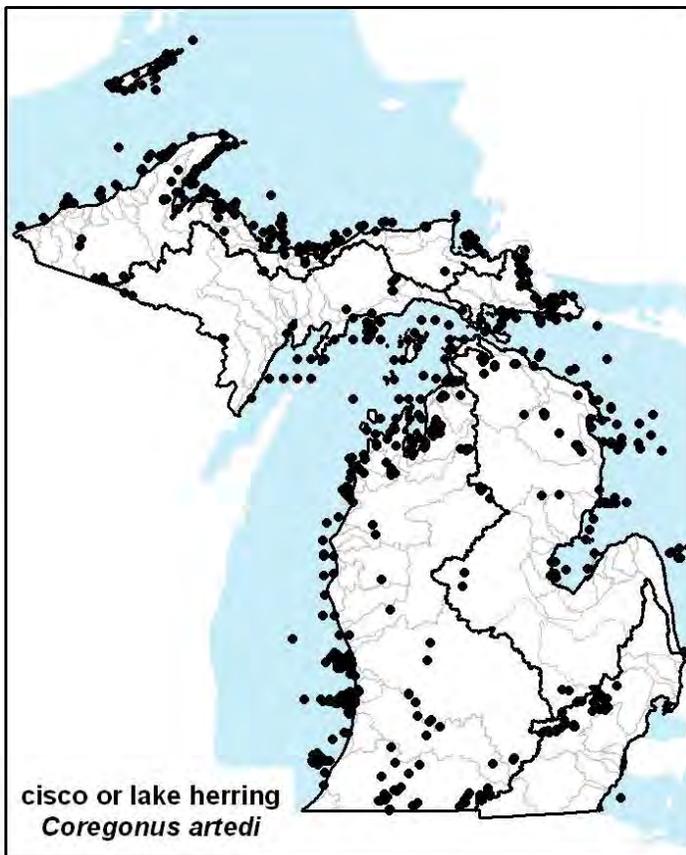
(*Coregonus kiyi*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. This species occurs throughout lakes Huron, Michigan, and Superior. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: offshore; trophic status: oligotrophic; clear water; cold water

ASSOCIATED THREATS: altered nutrient inflows; invasive plants & animals; removal of wildlife

COMMENTS: This species is endemic to the Great Lakes (except Lake Erie). Spawning habitat requirements unknown. Threats and population status need to be determined.



cisco or lake herring

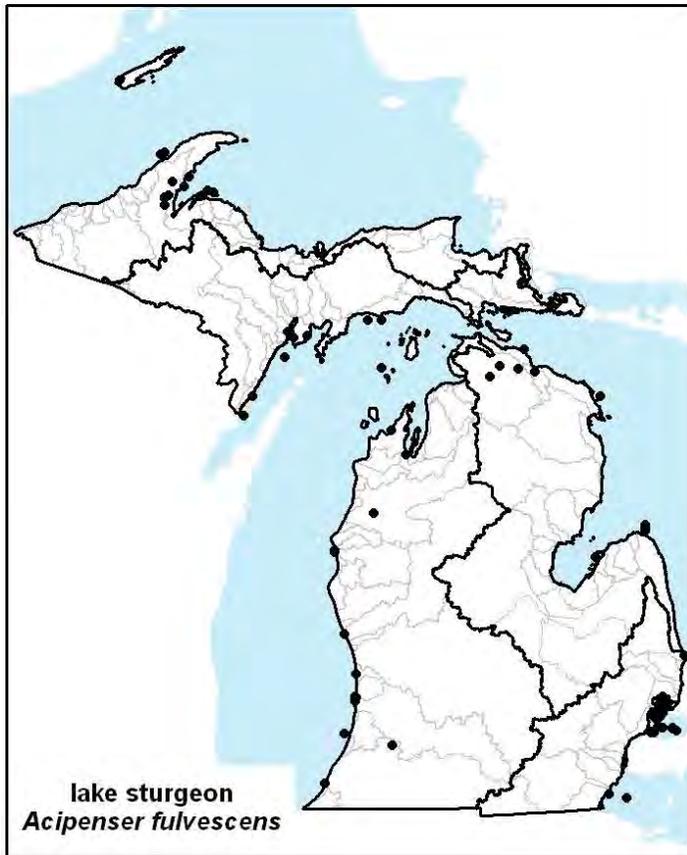
(*Coregonus artedi*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. This species occurs throughout Michigan. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: shoreline; nearshore; offshore; medium lakes; large lakes; trophic status: eutrophic; trophic status: mesotrophic; trophic status: oligotrophic; stratified; cold large rivers; cool large rivers; cold very large rivers; cool very large rivers; rock substrates; soft substrates; vegetation; clear water

ASSOCIATED THREATS: altered nutrient inflows; invasive plants & animals; removal of wildlife

COMMENTS: Spawning and rearing habitats need to be located. Population status needs to be determined. Ives lake cisco (*Coregonus hubbsi*) are considered subspecies of lake herring in this report until a definitive determination is made of whether these are separate species.



lake sturgeon

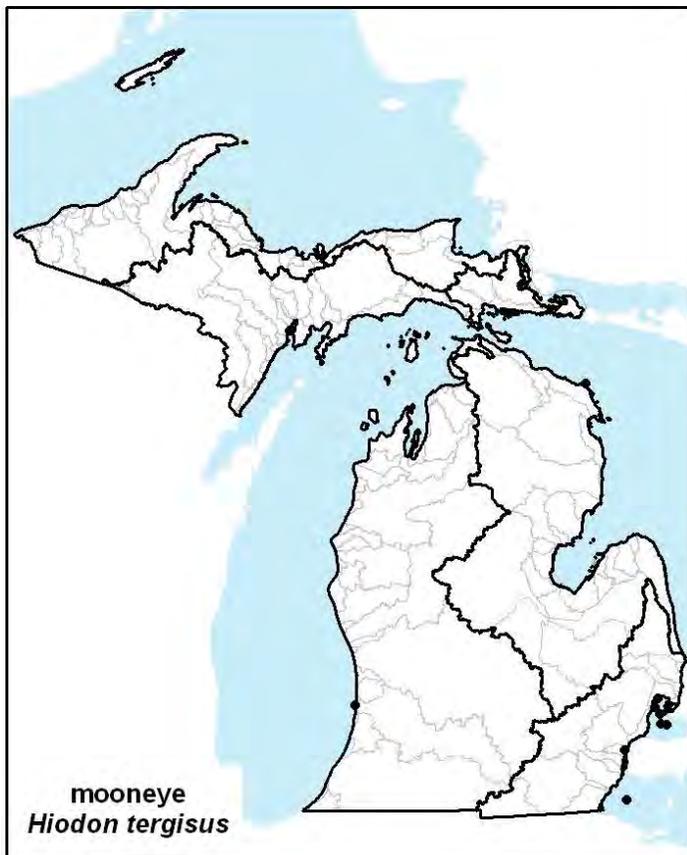
(*Acipenser fulvescens*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Common in Lake St. Clair; unknown abundance in other Great Lakes areas; declining populations in inland lakes except for Otsego Lake which is a put-grow-take fishery.

ASSOCIATED LANDSCAPE FEATURES: shoreline; nearshore; large lakes; wave-washed shore; trophic status: mesotrophic; trophic status: oligotrophic; cold medium rivers; cool medium rivers; warm medium rivers; cold large rivers; cool large rivers; warm large rivers; cold very large rivers; cool very large rivers; warm very large rivers; gradient: slow; gradient: moderate; gradient: fast; banks: rock; banks: rock; rock substrates; soft substrates; clay substrates; vegetation; clear water

ASSOCIATED THREATS: altered hydrologic regimes; altered sediment loads; dredging & channelization; fragmentation; other biological interactions (loss of mussels and gastropods for food); removal of wildlife; urban, municipal, and industrial pollution

COMMENTS: Management of species addressed in MDNR, FD, Lake Sturgeon Rehabilitation Strategy and fisheries objective of GLFC Technical committees.



mooneye

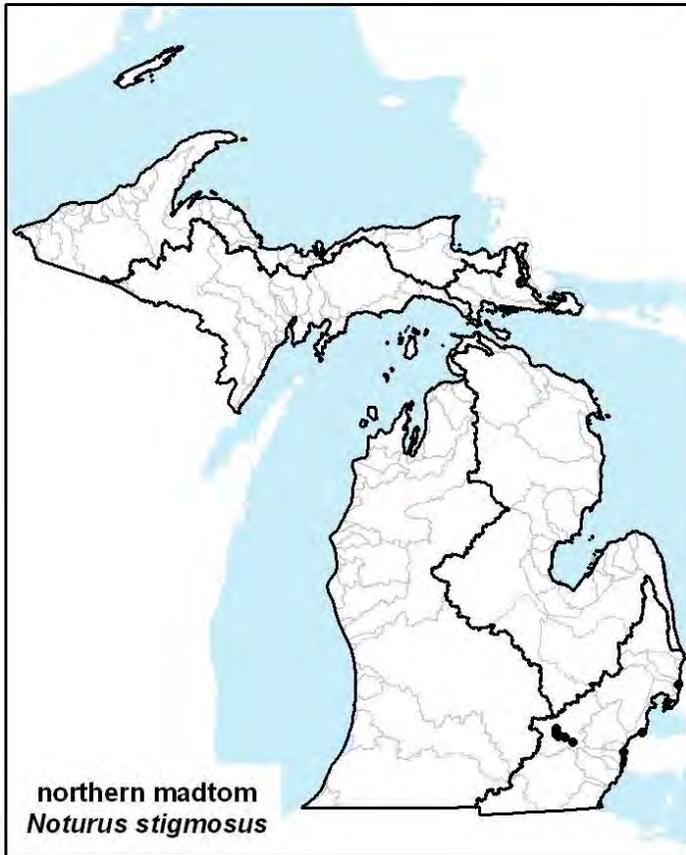
(*Hiodon tergisus*)

DISTRIBUTION & ABUNDANCE: Currently state listed as threatened with a recommendation to elevate to endangered. Within last 20 years has only been found in Lake St. Clair and the St. Clair River in low numbers. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: shoreline; nearshore; medium lakes; large lakes; trophic status: mesotrophic; cool medium rivers; warm medium rivers; cool large rivers; warm large rivers; cool very large rivers; warm very large rivers; gradient: slow; gradient: moderate; gradient: fast; rock substrates; vegetation; clear water

ASSOCIATED THREATS: altered sediment loads; lack of scientific knowledge; unknown

COMMENTS: Michigan is the northern edge of range for this species. Spawning locations need to be determined and protected. Population status needs to be determined. Relative severity of listed threats is not well known and other currently unknown threats may exist for this species; a threats assessment is needed for this species.



northern madtom

(*Noturus stigmosus*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. This species is very rare and critically imperiled throughout their range outside of Michigan. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: medium rivers; large rivers; gradient: fast; rock substrates

ASSOCIATED THREATS: altered sediment loads; invasive plants & animals; pesticides & herbicides; urban, municipal, and industrial pollution

COMMENTS: Michigan is the northern edge of range for this species. This species has isolated populations and a very patchy distribution across its range. Little is known about the life history of this species. May compete with round gobies (*Neogobius melanostomus*) for spawning sites. Goodchild (1993) suggests this species has widely fluctuating populations, hence effective sampling methods and efforts are needed. Population status needs to be determined.



orangethroat darter

(*Etheostoma spectabile*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Limited distribution in Michigan, abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: headwaters & small tributaries; gradient: slow; rock substrates

ASSOCIATED THREATS: altered sediment loads; pesticides & herbicides; urban, municipal, and industrial pollution

COMMENTS: Michigan is the northeastern edge of range for this species. This species is considered a pioneer species and may be an indicator species for restored habitats. Movements need to be determined. Population status needs to be determined.



pugnose minnow

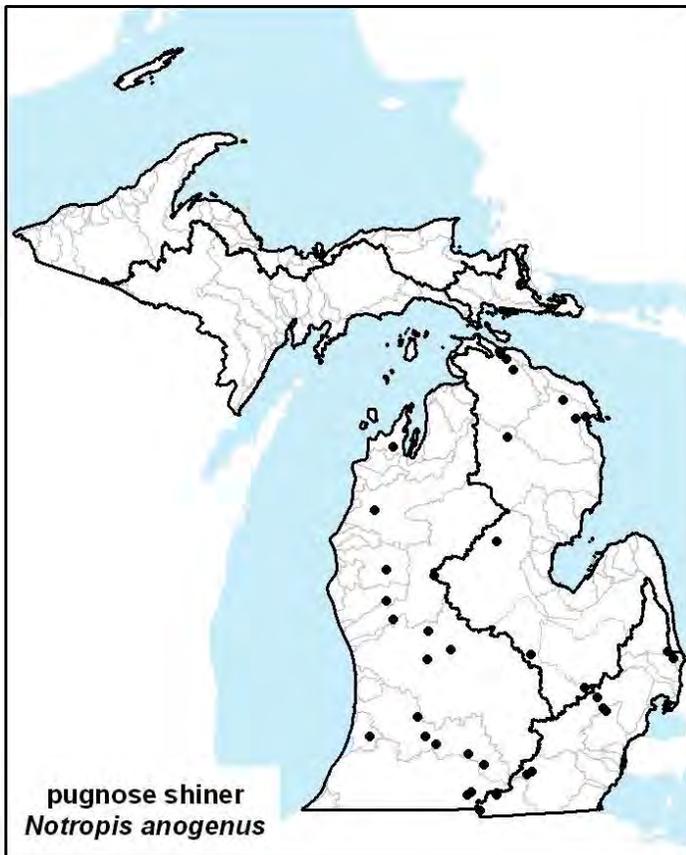
(*Opsopoeodus emiliae*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. This is a rare species with three or fewer stable populations in the state. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: small lakes; medium lakes; large lakes; warm medium rivers; warm large rivers; warm very large rivers; gradient: slow; soft substrates; vegetation

ASSOCIATED THREATS: altered sediment loads; lack of scientific knowledge; unknown

COMMENTS: Spawning habitats and movements are unknown. Targeted surveys for this species are needed. Existing populations need to be actively protected. Population status needs to be determined. Relative severity of listed threats is not well known and other currently unknown threats may exist for this species; a threats assessment is needed for this species.



pugnose shiner

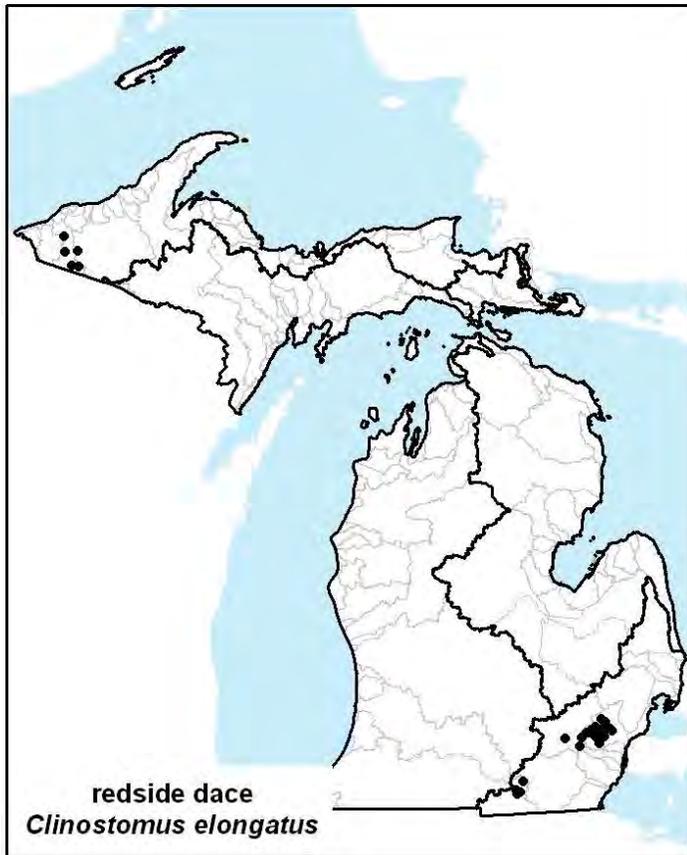
(*Notropis anogenus*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Current abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: small lakes; medium lakes; cool headwaters & small tributaries; warm headwaters & small tributaries; cool medium rivers; warm medium rivers; gradient: slow; rock substrates; soft substrates; vegetation; clear water

ASSOCIATED THREATS: altered sediment loads; macrophyte removal

COMMENTS: Spawning habits and movements are unknown. Need to determine best sampling methods for this fish, traditional methods are not effective in its habitat of dense vegetation. Population status needs to be determined.



reidside dace

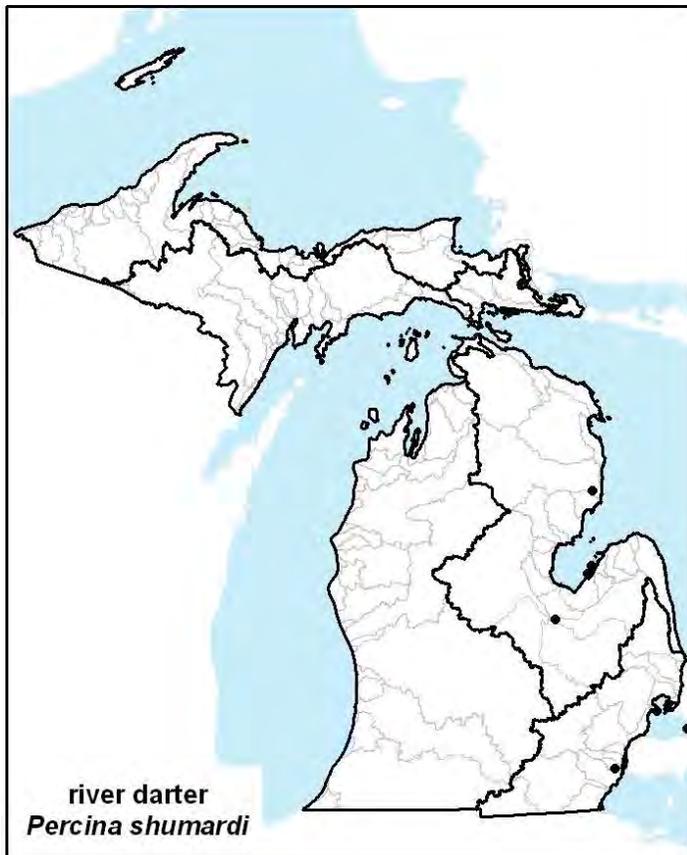
(*Clinostomus elongatus*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Only three populations remain in Michigan. Overall range for this species is disjunct and is decreasing. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: cold headwaters & small tributaries; cool headwaters & small tributaries; gradient: slow; gradient: moderate; rock substrates; clear water; other (overhanging vegetation important)

ASSOCIATED THREATS: altered sediment loads; other biological interactions (hybridization); riparian modification

COMMENTS: Extent of movements need to be determined. Current viable populations need to be actively protected. Population status needs to be determined. Habitat continues to be degraded and lost.



river darter

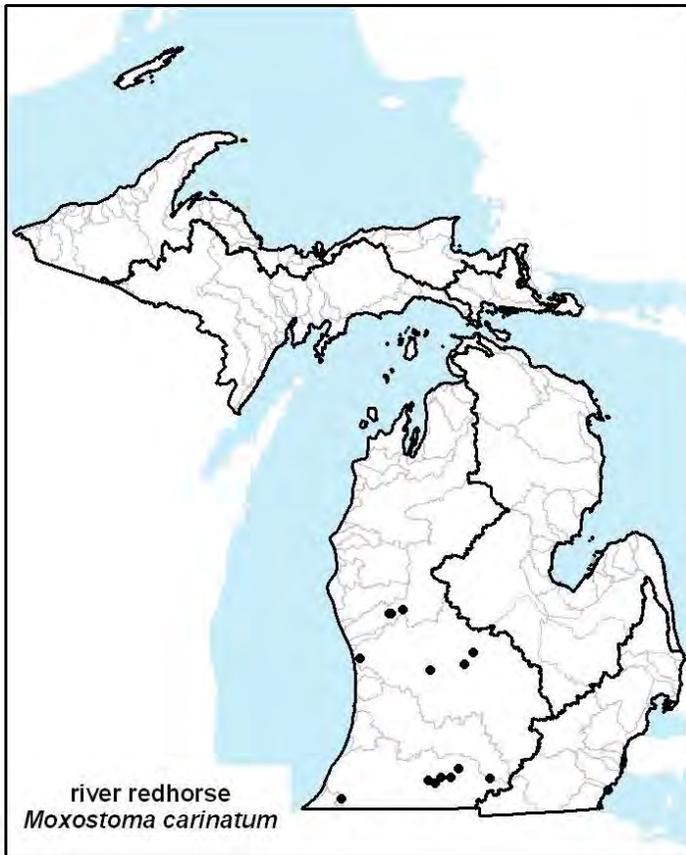
(*Percina shumardi*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Rare and abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: shoreline; nearshore; wave-washed shore; cool medium rivers; warm medium rivers; cool large rivers; warm large rivers; gradient: slow; gradient: moderate; gradient: fast; rock substrates; soft substrates; turbid water

ASSOCIATED THREATS: dams; dredging & channelization; pesticides & herbicides; urban, municipal, and industrial pollution

COMMENTS: Movements unknown. Population status needs to be determined.



river redhorse

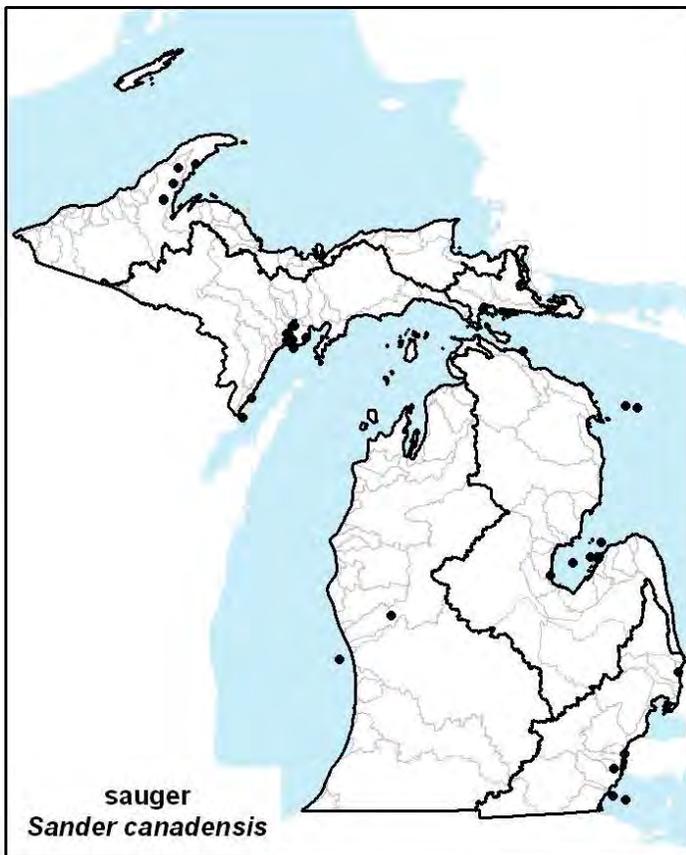
(*Moxostoma carinatum*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Found in three watersheds and has fewer than ten populations in Michigan. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: nearshore; medium lakes; large lakes; wave-washed shore; cool large rivers; warm large rivers; cool very large rivers; warm very large rivers; gradient: slow; gradient: moderate; gradient: fast; rock substrates; clear water

ASSOCIATED THREATS: altered sediment loads; dams; fragmentation; other biological interactions (mainly feeds on mollusks); urban, municipal, and industrial pollution

COMMENTS: Patchy distribution throughout range. Movements are unknown. Population status needs to be determined.



sauger

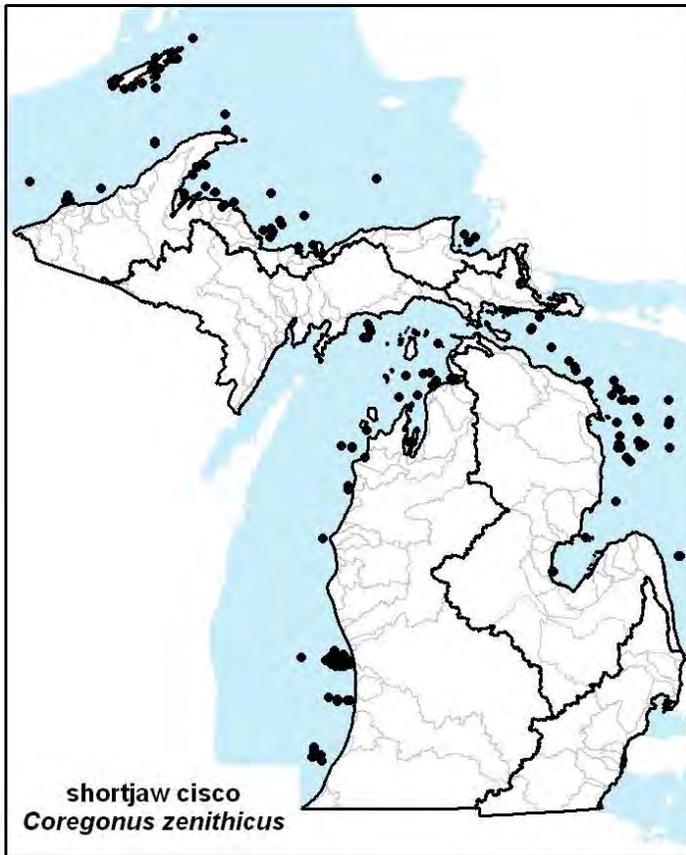
(*Sander canadensis*)

DISTRIBUTION & ABUNDANCE: Currently state listed as threatened with a recommended elevation to endangered. Rare in Michigan. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: shoreline; nearshore; offshore; large lakes; cool large rivers; warm large rivers; cool very large rivers; warm very large rivers; gradient: slow; rock substrates; turbid water; clear water

ASSOCIATED THREATS: other biological interactions (hybridization - with walleye); unknown

COMMENTS: Population status needs to be determined. This species may also be known by the name *Stizostedion canadense*. Relative severity of listed threats is not well known and other currently unknown threats may exist for this species; a threats assessment is needed for this species.



shortjaw cisco

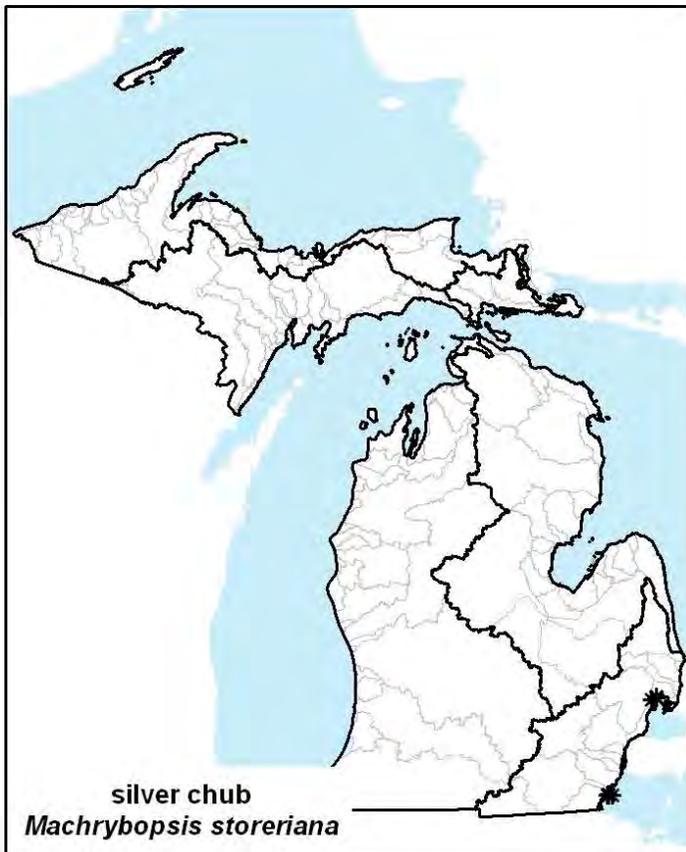
(*Coregonus zenithicus*)

DISTRIBUTION & ABUNDANCE: Currently state listed as threatened with the recommendation to elevate to endangered. This species occurs throughout lakes Huron, Michigan, and Superior. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: nearshore; offshore; trophic status: oligotrophic; clay substrates; clear water; cold water

ASSOCIATED THREATS: invasive plants & animals; other biological interactions (hybridization with bloater); removal of wildlife; urban, municipal, and industrial pollution

COMMENTS: Michigan is the southern edge of range for this species. Population status needs to be determined.



silver chub

(*Machrybopsis storeriana*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. This species is quite rare and appears to have small populations in Michigan. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: shoreline; nearshore; trophic status: mesotrophic; cool very large rivers; gradient: slow; gradient: moderate; gradient: fast; rock substrates; soft substrates; vegetation; turbid water; clear water

ASSOCIATED THREATS: altered nutrient inflows; altered sediment loads; removal of wildlife

COMMENTS: Michigan is the edge of the range for this species. Spawning habitats and movements are unknown.



silver shiner

(Notropis photogenis)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Only two known populations in Michigan. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: cool medium rivers; cool large rivers; gradient: moderate; gradient: fast; rock substrates; clear water

ASSOCIATED THREATS: altered sediment loads; dams; dredging & channelization; pesticides & herbicides; urban, municipal, and industrial pollution

COMMENTS: Critical habitats such as spawning areas need to be determined. Population status needs to be determined.



Siskiwit lake cisco

(Coregonus bartlettii)

DISTRIBUTION & ABUNDANCE: Currently state listed as threatened with a recommendation to list as special concern. Currently secure in Isle Royale National Park. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: offshore; cold; large lakes

ASSOCIATED THREATS: altered nutrient inflows; invasive plants & animals; removal of wildlife

COMMENTS: Population status needs to be determined; taxonomy needs to be considered



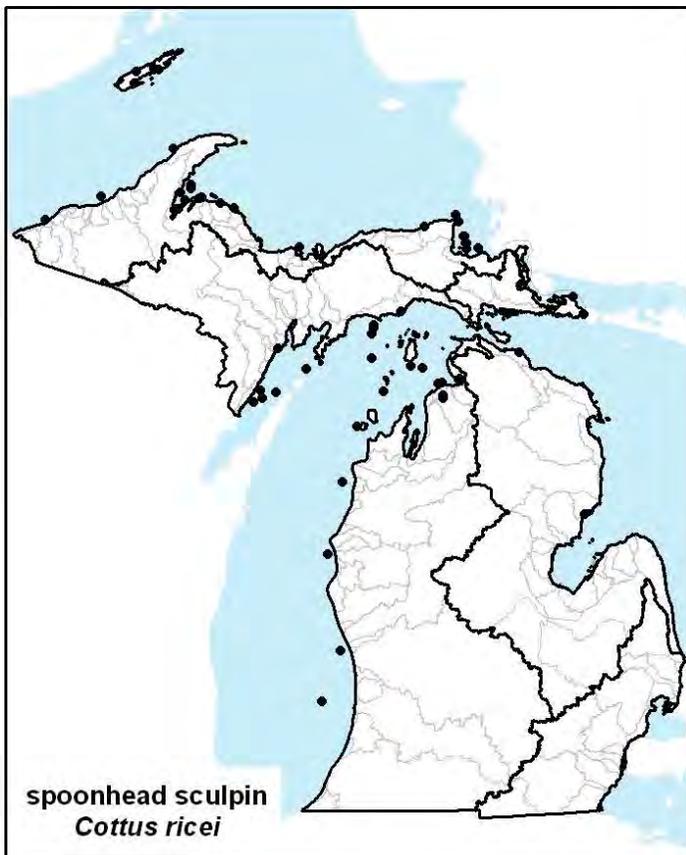
southern redbelly dace (*Phoxinus erythrogaster*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. This species is rare in Michigan and is estimated to have three or fewer populations. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: cool headwaters & small tributaries; warm headwaters & small tributaries; rock substrates; woody structure; clear water; other (over hanging banks)

ASSOCIATED THREATS: altered sediment loads; dredging & channelization; other biological interactions (hybridization); removal of wildlife; riparian modification

COMMENTS: Movements unknown. This species may compete with stoneroller (*Camptostoma anomalum*) and bluntnose minnow (*Pimephales notatus*), relationships need to be explored. Existing populations need to be actively protected. Population status needs to be determined.



spoonhead sculpin (*Cottus ricei*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Rare in Michigan. Stable in Lake Superior but extirpated from other Great Lakes. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: shoreline; nearshore; offshore; small lakes; medium lakes; large lakes; cold headwaters & small tributaries; cold medium rivers; cold very large rivers; gradient: fast; turbid water

ASSOCIATED THREATS: altered sediment loads; invasive plants & animals; other biological interactions (predation by or competition with alewife); pesticides & herbicides

COMMENTS: Michigan is the southern edge of range for this species. Little is known about the life history of this species, especially spawning habitats. Threats need to be assessed. Population status needs to be determined.



starhead topminnow

(*Fundulus dispar*)

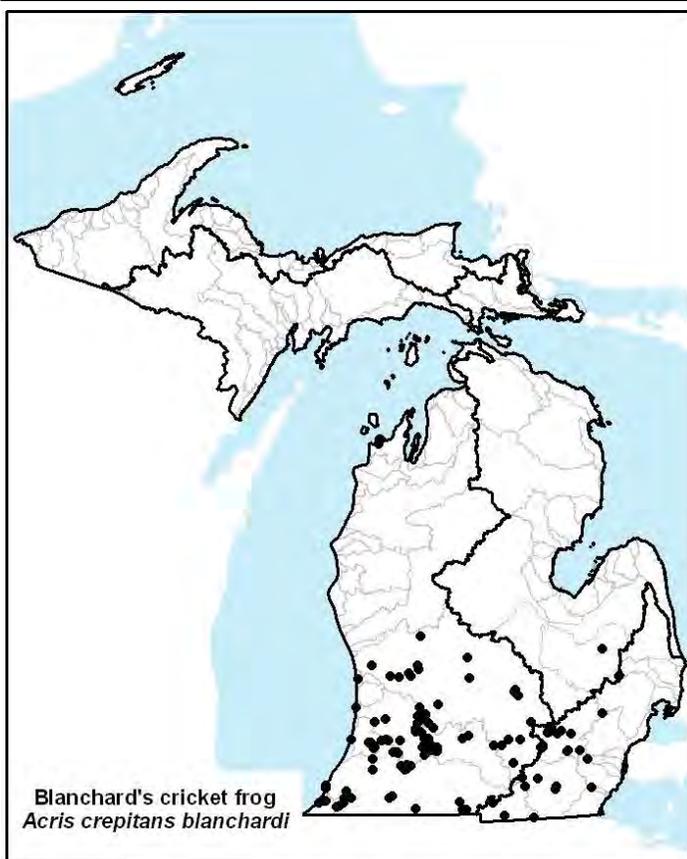
DISTRIBUTION & ABUNDANCE: State listed as special concern. Rare species, abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: ponds; small lakes; warm headwaters & small tributaries; gradient: slow; ephemeral wetland; inland emergent wetland; swamp; soft substrates; vegetation

ASSOCIATED THREATS: altered hydrologic regimes; dredging & channelization; wetland modifications

COMMENTS: Michigan is the northern edge of range for this species. Population status needs to be determined. This species may also be known by the name *Fundulus notti*.

AMPHIBIANS



Blanchard's cricket frog (*Acris crepitans blanchardi*)

DISTRIBUTION & ABUNDANCE: State listed as threatened; abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* ponds; small lakes; medium lakes; headwaters & small tributaries; medium rivers; gradient: slow; bog; soft substrates; vegetation; woody structure; *terrestrial:* prairie; idle/old field; pasture; bog; inland emergent wetland; fen; ephemeral wetland; pond; inland lake; river/stream/riparian/floodplain corridor; coastal emergent wetland

ASSOCIATED THREATS: unknown; conversion to agriculture lands; altered fire regime; grazing & mowing patterns; altered hydrologic regimes; industrial/residential/ recreational development; invasive plants & animals; pesticides & herbicides; urban, municipal, and industrial pollution; wetland modifications

COMMENTS: Research is needed to determine relationships between this species and vegetation succession; climate fluctuations; drought; competition with other frogs; and contaminated wetlands. Population status needs to be determined. Relative severity of listed threats is not well known and other currently unknown threats may exist for this species; a threats assessment is needed for this species.



boreal chorus frog

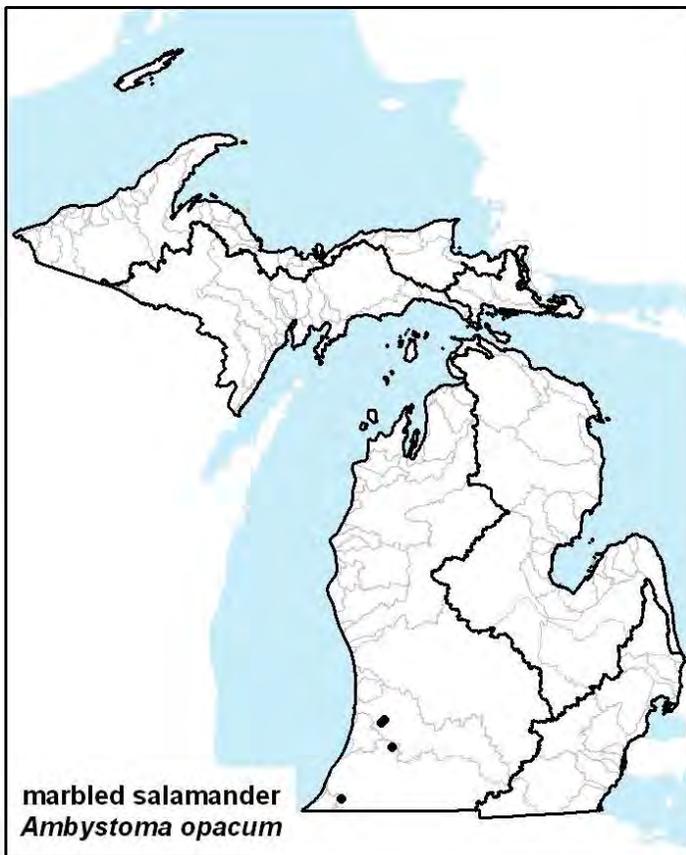
(*Pseudacris triseriata maculata*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Known only from Isle Royale. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* ponds; ephemeral wetland; inland emergent wetland; swamp; floodplain; *terrestrial:* lowland hardwood; lowland conifer; inland emergent wetland; ephemeral wetland; swamp; pond; river/stream/riparian/floodplain corridor; coastal emergent wetland; down woody debris

ASSOCIATED THREATS: altered hydrologic regimes; industrial/residential/recreational development; pesticides & herbicides; urban, municipal, and industrial pollution

COMMENTS: Distribution and population status need to be determined.



marbled salamander

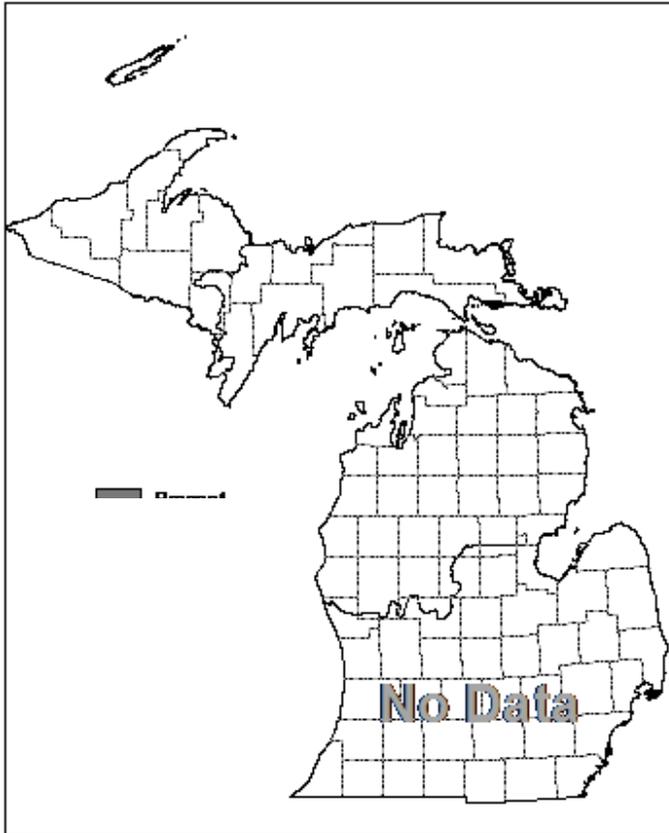
(*Ambystoma opacum*)

DISTRIBUTION & ABUNDANCE: Currently state listed as endangered with the recommendation to be delisted to special concern. The current distribution and abundance are unknown but no observations have been reported since the 1980s. The species is possibly extirpated.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* ephemeral wetland; swamp; woody structure; *terrestrial:* lowland hardwood; mesic hardwood; dry hardwood; forest opening; ephemeral wetland; swamp; river/stream/riparian/ floodplain corridor; down woody debris

ASSOCIATED THREATS: other biological interactions (shows density-dependent regulation during larval stage); climate change; conversion to agriculture lands; fragmentation; altered hydrologic regimes; industrial/residential/recreational development; lack of scientific knowledge; forestry practices; wetland modifications

COMMENTS: Populations in Michigan are considered relict populations. This species may be a good indicator of general climate change. Population status needs to be determined.



mink frog

(*Rana septentrionalis*)

DISTRIBUTION & ABUNDANCE: The historical and current range of the mink frog extends through the Upper Peninsula, but current records and field reports suggest its abundance is declining.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* ponds; inland emergent wetland; swamp; floodplain; *terrestrial:* lowland hardwood; lowland conifer; inland emergent wetland; ephemeral wetland; swamp; pond; river/stream/riparian/floodplain corridor; coastal emergent wetland; down woody debris

ASSOCIATED THREATS: altered hydrologic regimes; industrial/residential/recreational development; pesticides & herbicides; urban, municipal, and industrial pollution

COMMENTS: Most current observations come from volunteer calling surveys, which may miss this late-breeding species; modification of the survey protocol is recommended to ensure detection. Due to reduced area of occupancy, the T&E Technical Advisory Committee recommends that mink frog be a Species of Greatest Conservation Need. Distribution and population status need to be determined.



mudpuppy

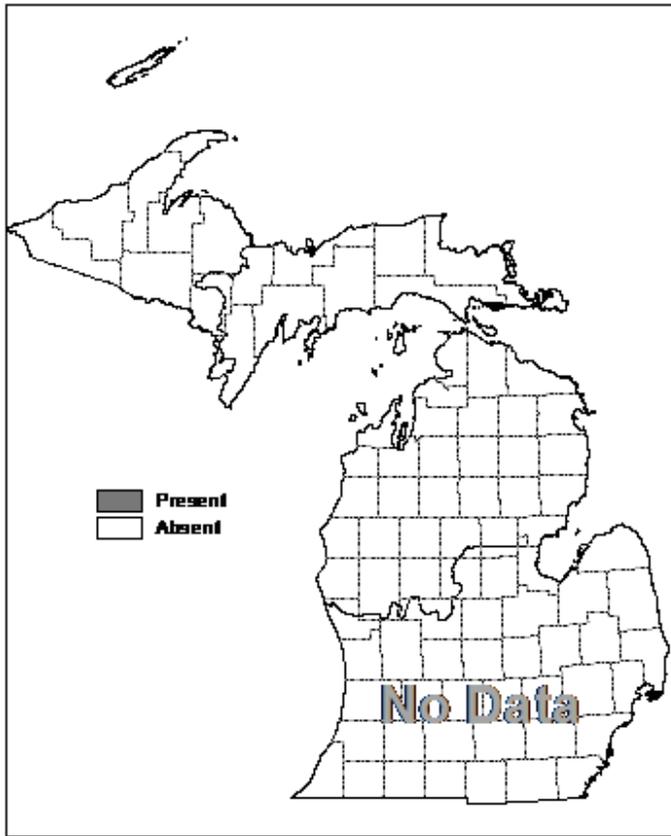
(*Necturus maculosus maculosus*)

DISTRIBUTION & ABUNDANCE: Proposed listing as special concern. Abundance is unknown. Appears to be declining, absent where once common.

ASSOCIATED LANDSCAPE FEATURES: shoreline; nearshore; small lakes; medium lakes; large lakes; headwaters & small tributaries; medium rivers; gradient: slow; rock substrates; vegetation; woody structure

ASSOCIATED THREATS: altered sediment loads; pesticides & herbicides; social attitudes; urban, municipal, and industrial pollution

COMMENTS: Distribution and population status needs to be determined. Effects from lampricides need to be clarified.



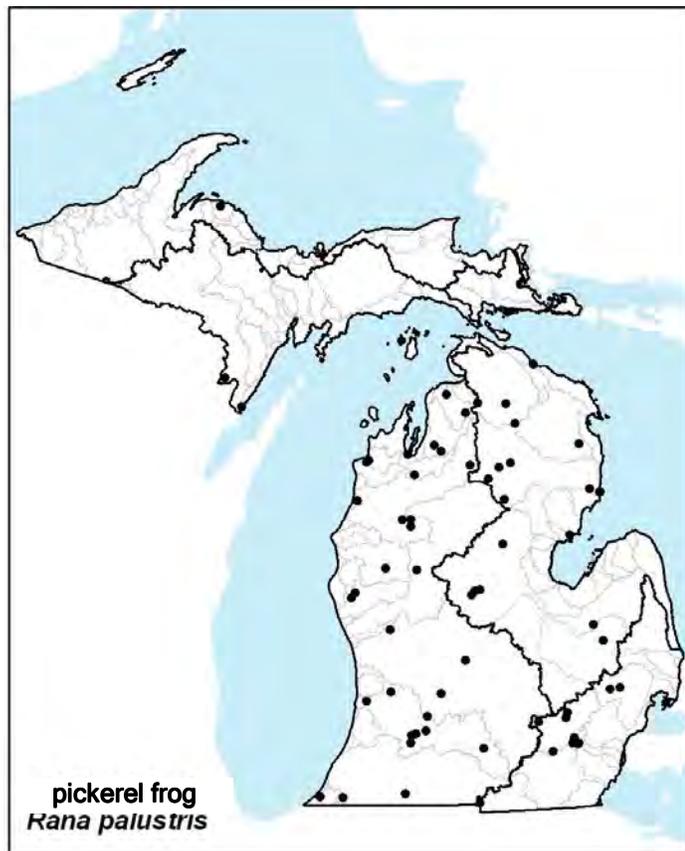
northern dusky salamander
(Desmognathus fuscus)

DISTRIBUTION & ABUNDANCE: There is a single extant population in Tuscola county however there is limited data and it is currently unknown if the species is native.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* headwaters and small tributaries; gradient: moderate; rock substrates; woody structure; *terrestrial:* lowland hardwood; mesic hardwood; dry hardwood; lowland conifer; mesic conifer; river/stream/riparian/floodplain corridor; swamp; down woody debris

ASSOCIATED THREATS: conversion to agricultural lands; fragmentation; industrial/residential/recreational development; lack of scientific knowledge; removal of wildlife; urban, municipal, and industrial pollution

COMMENTS: Distribution, population status, and native status need to be determined.



pickerel frog
(Rana palustris)

DISTRIBUTION & ABUNDANCE: Proposed listing as special concern. Appears to be declining. Not reported as often as historical records would suggest in Frog and Toad Surveys. Found throughout both peninsulas, but observations are very localized.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* ponds; small lakes; medium lakes; cool headwaters & small tributaries; bog; fen; inland emergent wetland; swamp; soft substrates; vegetation; woody structure; clear water; *terrestrial:* prairie; idle/old field; forest opening; bog; inland emergent wetland; fen; swamp; pond; inland lake; river/stream/riparian/floodplain corridor; down woody debris

ASSOCIATED THREATS: climate change; conversion to agriculture lands; disease, pathogens & parasites; fragmentation; altered hydrologic regimes; incompatible natural resource mgmt; industrial/residential/ recreational development; invasive plants & animals; non-consumptive recreation; pesticides & herbicides; urban, municipal, and industrial pollution; wetland modifications

COMMENTS: Populations have spotty distributions. Distribution and population status need to be determined. Calls may be mis-identified as leopard frogs, leading to potentially incomplete data sets.



smallmouth salamander
(Ambystoma texanum)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Rare in Michigan and restricted to Lake Erie basin. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* ponds; headwaters & small tributaries; gradient: slow; ephemeral wetland; swamp; rock substrates; vegetation; woody structure; *terrestrial:* prairie; idle/old field; right-of-way; savanna; lowland shrub; lowland hardwood; mesic hardwood; dry hardwood; lowland conifer; forest opening; ephemeral wetland; swamp; pond; river/stream/riparian/floodplain corridor; down woody debris

ASSOCIATED THREATS: invasive plants & animals; conversion to agriculture lands; fragmentation; altered hydrologic regimes; industrial/residential/recreational development; lack of scientific knowledge; forestry practices; other biological interactions (hybridization); pesticides & herbicides; removal of non-timber flora; wetland modifications

COMMENTS: It is believed the species has experienced a population decline in the state of at least 80% over the last 30 years. Population assessment is needed.



southern two-lined salamander
(Eurycea bislineata cirrigera)

DISTRIBUTION & ABUNDANCE: There is a single extant population in Tuscola county however there is limited data and it is currently unknown if the species is native.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* headwaters and small tributaries; gradient: moderate; rock substrates; woody structure; *terrestrial:* lowland hardwood; mesic hardwood; dry hardwood; lowland conifer; mesic conifer; river/stream/riparian/floodplain corridor; swamp; down woody debris

ASSOCIATED THREATS: conversion to agricultural lands; fragmentation; industrial/residential/recreational development; lack of scientific knowledge; removal of wildlife; urban, municipal, and industrial pollution

COMMENTS: Distribution, population status, and native status need to be determined.



western lesser siren

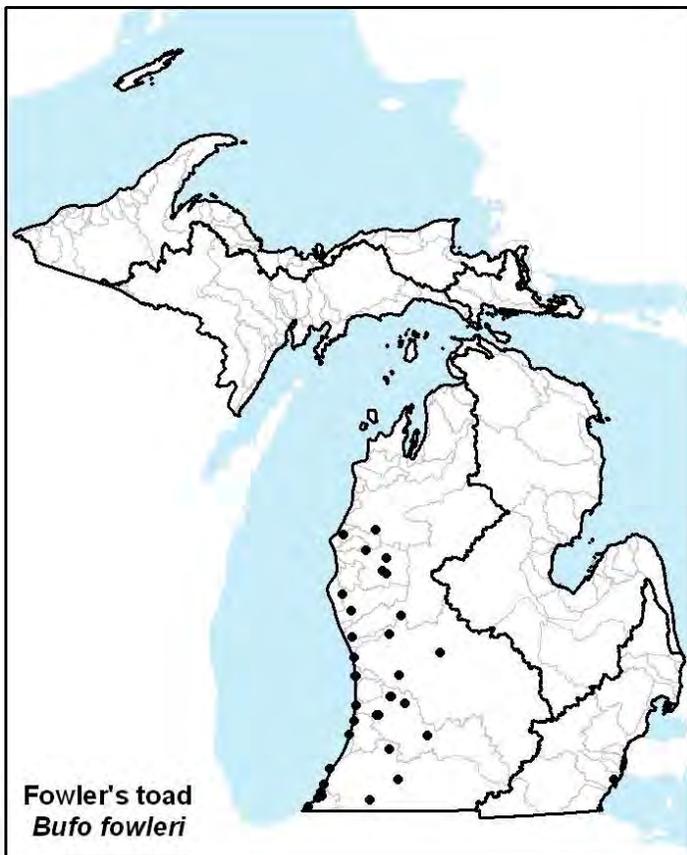
(*Siren intermedia nettingi*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Distribution and abundance are unknown.

ASSOCIATED LANDSCAPE FEATURES: ponds; small lakes; warm headwaters & small tributaries; gradient: slow; ephemeral wetland; swamp; soft substrates; vegetation

ASSOCIATED THREATS: pesticides & herbicides; social attitudes; lack of scientific knowledge; unknown

COMMENTS: Distribution and population status needs to be determined. Rely on permanent wetlands. Difficult to survey. Relative severity of listed threats is not well known and other currently unknown threats may exist for this species; a threats assessment is needed for this species.



Woodhouse's toad

(*Bufo fowleri*)

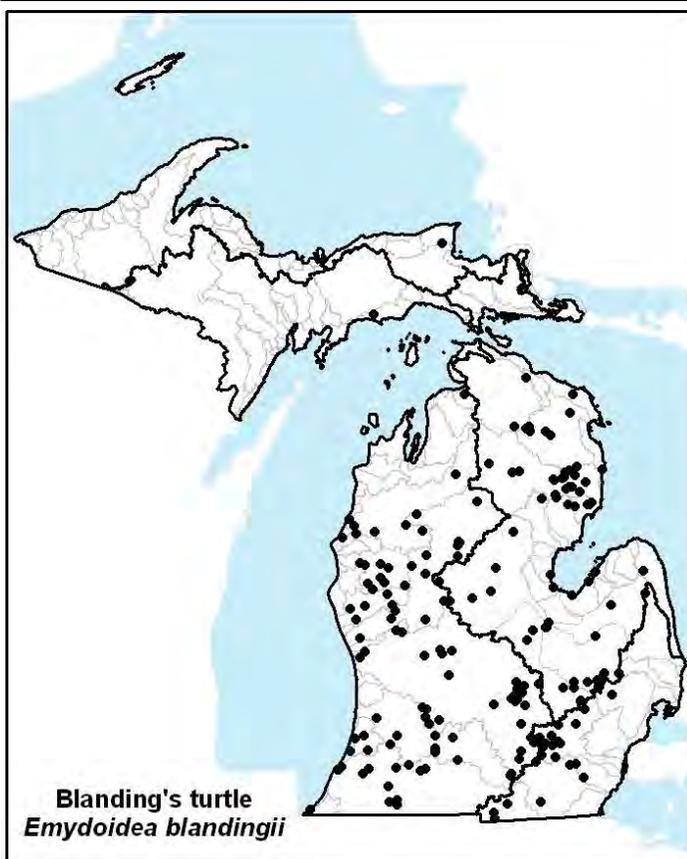
DISTRIBUTION & ABUNDANCE: Proposed listing as special concern. This species is found along the western edge of Michigan; however the population has been reduced at least 30% over ten years due to loss of critical habitat.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* shoreline; ponds; small lakes; medium lakes; large lakes; headwaters & small tributaries; medium rivers; inland ephemeral wetland; emergent wetland; *terrestrial:* prairie; idle/old field; pasture; savanna; lowland hardwood; lowland conifer; forest opening; inland emergent wetland; ephemeral wetland; pond; inland lake; river/stream/riparian/floodplain corridor; coastal dune/beach; suburban/ small town; other (closely associated with sand soils)

ASSOCIATED THREATS: conversion to agriculture lands; fragmentation; altered hydrologic regimes; industrial/residential/recreational development; non-consumptive recreation; pesticides & herbicides; wetland modifications

COMMENTS: Population status needs to be determined. This species is an indicator of quality sand dune habitats and is vulnerable to off-road recreational vehicles.

REPTILES



Blanding's turtle

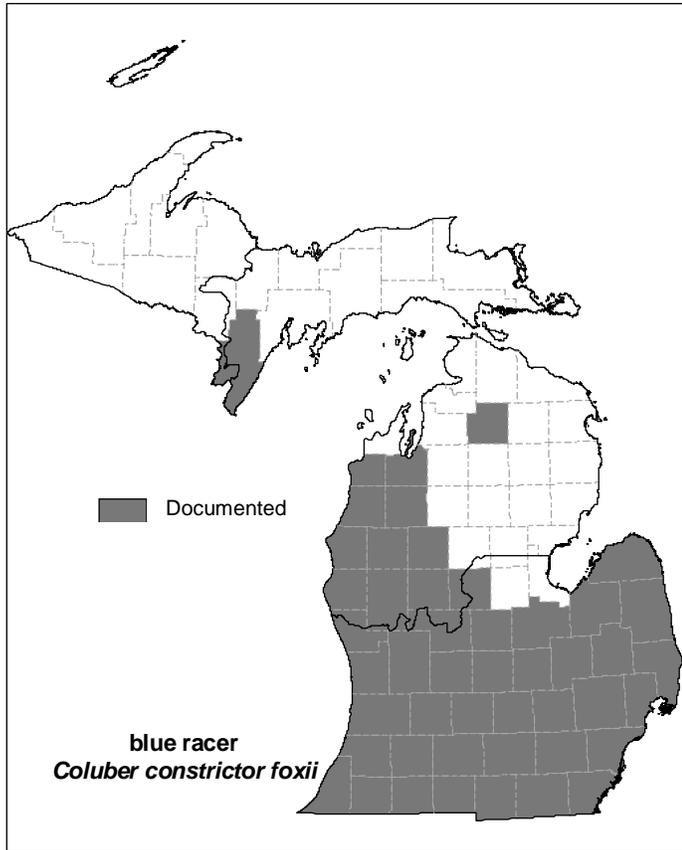
(*Emydoidea blandingii*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Occurs throughout the Lower Peninsula and is very rare in the Upper Peninsula. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* ponds; medium lakes; trophic status: eutrophic; headwaters & small tributaries; medium rivers; gradient: slow; inland emergent wetland; swamp; soft substrates; vegetation; woody structure; *terrestrial:* prairie; idle/old field; hayland; pasture; row crop; savanna; upland shrub; forest opening; bog; inland emergent wetland; submergent wetland; fen; ephemeral wetland; swamp; pond; inland lake; river/stream/riparian/floodplain corridor; coastal emergent wetland; suburban/small town; other

ASSOCIATED THREATS: removal of wildlife; social attitudes; dams; dredging & channelization; fragmentation; altered hydrologic regimes; industrial/residential/ recreational development; invasive plants & animals; pesticides & herbicides; wetland modifications

COMMENTS: Population status needs to be determined. This species may also be known by the name *Emys blandingii*.



blue racer

(*Coluber constrictor foxii*)

DISTRIBUTION & ABUNDANCE: Distribution is likely the same as historical range, but current abundance is unknown and some populations appear to be declining.

ASSOCIATED LANDSCAPE FEATURES: prairie; prairie; idle/old field; hayland; pasture; right-of-way; fence row; savanna; orchard; lowland shrub; upland shrub; forest opening; bog; inland emergent wetland; fen; ephemeral wetland; inland lake; edge; inland rock/cliff/ledge; large contiguous natural landscape; down woody debris

ASSOCIATED THREATS: conversion to agriculture lands; fragmentation; grazing & mowing patterns; industrial/residential/recreational development; pesticides & herbicides; social attitudes; climate vulnerability: presumed stable with very high confidence

COMMENTS: Distribution and population status need to be determined. Hibernate in only a few favored winter dens. Very vulnerable to agricultural and urban/suburban development and human persecution. This species & also be known by the name *Coluber constrictor flaviventris*.



butler's garter snake

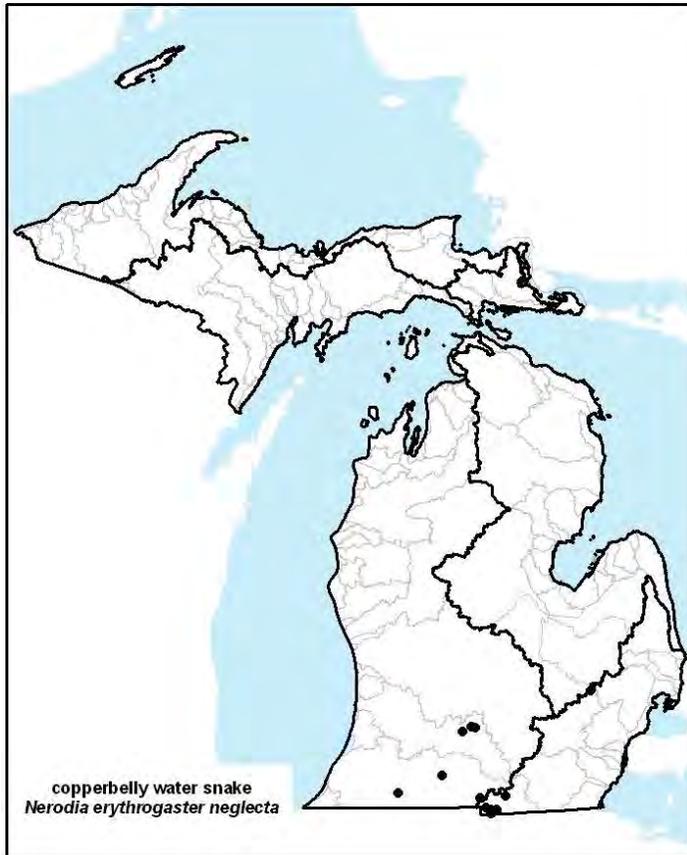
(*Thamnophis butleri*)

DISTRIBUTION & ABUNDANCE: Proposed listing as special concern. Distribution and abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: idle/old field; fence row; savanna; orchard; pasture; right-of-way; prairie; down woody debris

ASSOCIATED THREATS: fragmentation; social attitudes; non-consumptive recreation; removal of wildlife; climate vulnerability: moderately vulnerable with low confidence

COMMENTS: Experiencing a population reduction across its range with the greatest effect in southeast Michigan



copperbelly water snake

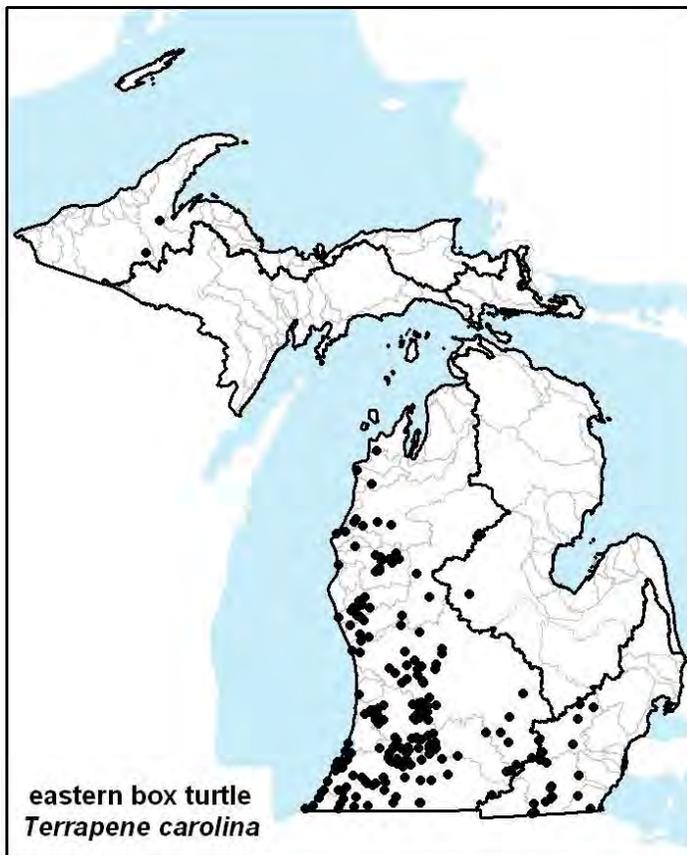
(*Nerodia erythrogaster neglecta*)

DISTRIBUTION & ABUNDANCE: State listed as endangered, and federally listed as threatened. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* ponds; small lakes; headwaters & small tributaries; medium rivers; gradient: slow; bog; fen; ephemeral wetland; swamp; woody structure; *terrestrial:* idle/old field; hayland; pasture; row crop; right-of-way; fence row; lowland shrub; upland shrub; lowland hardwood; mesic hardwood; dry hardwood; forest opening; bog; fen; ephemeral wetland; swamp; pond; inland lake; river/stream/riparian/floodplain corridor; edge; large contiguous natural landscape; down woody debris

ASSOCIATED THREATS: social attitudes; conversion to agriculture lands; dams; dredging & channelization; altered fire regime; fragmentation; grazing & mowing patterns; altered hydrologic regimes; incompatible natural resource mgmt; industrial/residential/ recreational development; invasive plants & animals; lack of scientific knowledge; forestry practices; non-consumptive recreation; pesticides & herbicides; removal of wildlife; scientific research; wetland modifications

COMMENTS: Michigan is the northern edge of range for this species. Home range is 20 hectares or more. Natural corridors are important to this species survival. Population status needs to be determined.



eastern box turtle

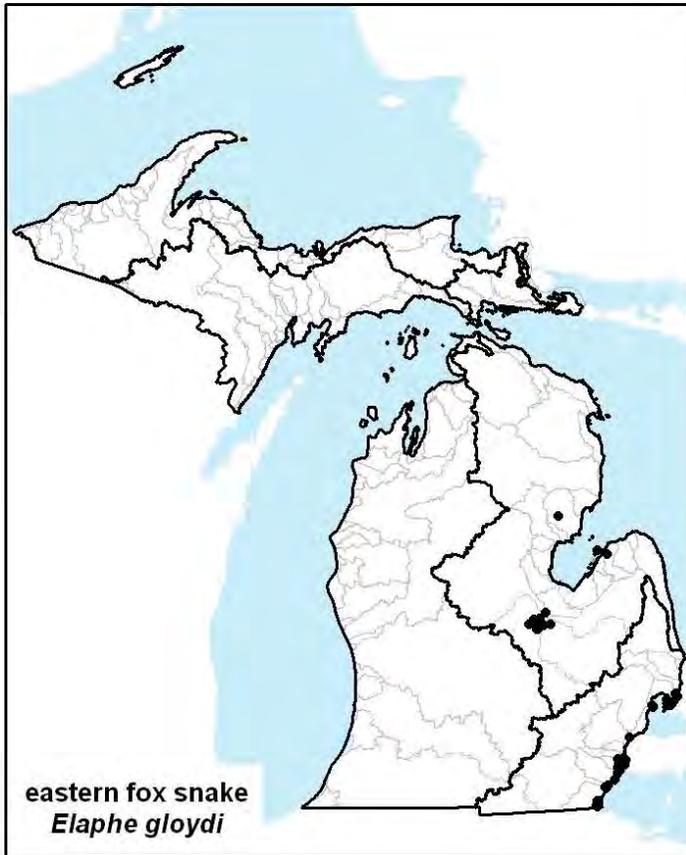
(*Terrapene carolina carolina*)

DISTRIBUTION & ABUNDANCE: Currently state listed as special concern with the recommendation to be elevated to threatened. Occurs throughout the Lower Peninsula of the Lake Michigan basin and Lake Erie basin, however this species is rare in the Huron and Superior basins. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* ponds; headwaters & small tributaries; bog; ephemeral wetland; fen; inland emergent wetland; swamp; soft substrates; *terrestrial:* prairie; idle/old field; pasture; fence row; savanna; orchard; lowland shrub; upland shrub; lowland hardwood; mesic hardwood; dry hardwood; lowland conifer; mesic conifer; dry conifer; forest opening; bog; inland emergent wetland; fen; ephemeral wetland; swamp; pond; river/stream/riparian/floodplain corridor; coastal dune/ beach; edge; suburban/small town; down woody debris

ASSOCIATED THREATS: conversion to agriculture lands; disease, pathogens & parasites; fragmentation; grazing & mowing patterns; incompatible natural resource mgmt; industrial/residential/recreational development; invasive plants & animals; forestry practices; non-consumptive recreation; removal of wildlife

COMMENTS: Michigan northern edge of range. Home ranges - 1.5-16 ha. Data clearly indicate that populations of this species are rapidly declining in the state and population reductions likely exceed 30% over three



eastern fox snake

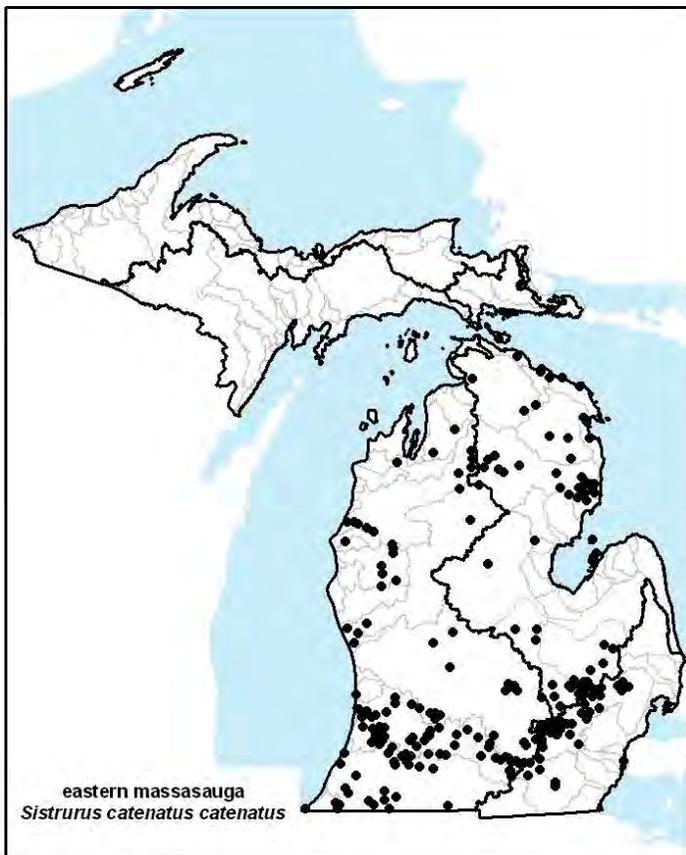
(*Pantherophis gloydi*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Locally common, however abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* shoreline; ponds; ephemeral wetland; inland emergent wetland *terrestrial:* prairie; idle/old field; hayland; pasture; lowland shrub; upland shrub; lowland hardwood; mesic hardwood; forest opening; inland emergent wetland; pond; inland lake; river/stream/riparian/floodplain corridor; coastal emergent wetland; coastal dune/beach; Great Lakes island; suburban/small town; down woody debris

ASSOCIATED THREATS: conversion to agriculture lands; fragmentation; wetland modifications; industrial/residential/ recreational development; removal of wildlife; social attitudes

COMMENTS: Often mistaken for poisonous snake due to its habit of tail-buzzing. Population status needs to be determined. This species may also be known by the name *Elaphe vulpina gloydi*.



eastern massasauga

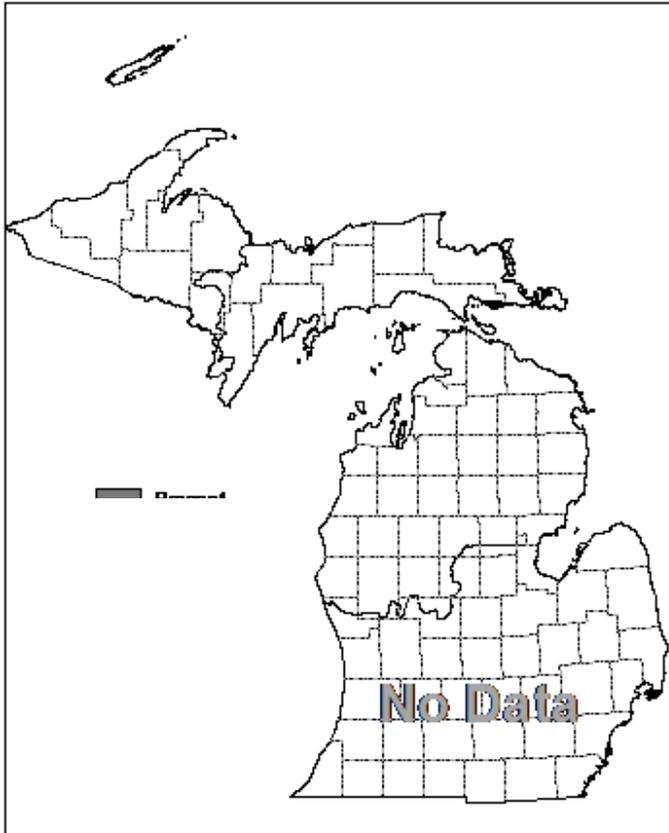
(*Sistrurus catenatus catenatus*)

DISTRIBUTION & ABUNDANCE: State listed as special concern and Federal candidate species. This species is found throughout the Lower Peninsula. It is still found in abundance at numerous locations within the State. Michigan is currently the core of this species' range.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* ponds; bog; fen; ephemeral wetland; inland emergent wetland; swamp; floodplain; *terrestrial:* prairie; idle/old field; hayland; pasture; row crop; right-of-way; fence row; savanna; lowland shrub; upland shrub; lowland hardwood; mesic hardwood; dry hardwood; lowland conifer; mesic conifer; dry conifer; forest opening; bog; inland emergent wetland; submergent wetland; fen; ephemeral wetland; swamp; pond; inland lake; inland island; river/stream/riparian/ floodplain corridor; coastal emergent wetland; coastal dune/beach; Great Lakes island; edge; inland rock/cliff/ledge; suburban/small town; large contiguous natural landscape; down woody debris

ASSOCIATED THREATS: conversion to agriculture lands; disease, pathogens & parasites; altered fire regime; fragmentation; grazing & mowing patterns; altered hydrologic regimes; incompatible natural resource mgmt; industrial/residential/recreational development; lack of scientific knowledge; forestry practices; military maneuvers; removal of wildlife; social attitudes; wetland modifications

COMMENTS: Public perception is a major issue.



eastern musk turtle

(Sternotherus odoratus)

DISTRIBUTION & ABUNDANCE: Unknown.

ASSOCIATED LANDSCAPE FEATURES: gradient: slow; soft substrates; medium river; large river

ASSOCIATED THREATS: Incompatible natural resources management; macrophyte removal; climate vulnerability: moderately vulnerable with low confidence

COMMENTS: Targeted monitoring is recommended as this species requires high water quality and is an ideal species for monitoring water quality.

County Occurrences of *Pantherophis spiloides*



gray rat snake

(Pantherophis spiloides)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; hayland; pasture; fence row; savanna; lowland shrub; upland shrub; lowland hardwood; mesic hardwood; dry hardwood; lowland conifer; mesic conifer; dry conifer; forest opening; bog; inland emergent wetland; ephemeral wetland; swamp; river/stream/riparian/floodplain corridor; edge; inland rock/cliff/ledge; urban; down woody debris

ASSOCIATED THREATS: conversion to agriculture lands; fragmentation; industrial/residential/recreational development; forestry practices; removal of wildlife; social attitudes; climate vulnerability: presumed stable with moderate confidence

COMMENTS: Population status needs to be determined. This species may also be known by the names *Elaphe obsoleta*, *Elaphe obsoleta obsoleta*, *Pantherophis obsoleta*, or *Elaphe spiloides*.



Kirtland's snake

(*Clonophis kirtlandii*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; pasture; lowland hardwood; lowland conifer; forest opening; inland emergent wetland; fen; ephemeral wetland; river/stream/riparian/floodplain corridor; urban; suburban/ small town; down woody debris

ASSOCIATED THREATS: conversion to agriculture lands; fragmentation; industrial/residential/recreational development; lack of scientific knowledge; pesticides & herbicides; removal of wildlife; social attitudes; wetland modifications

COMMENTS: Persecution is an issue for this species. Population status needs to be determined.



northern ribbon snake

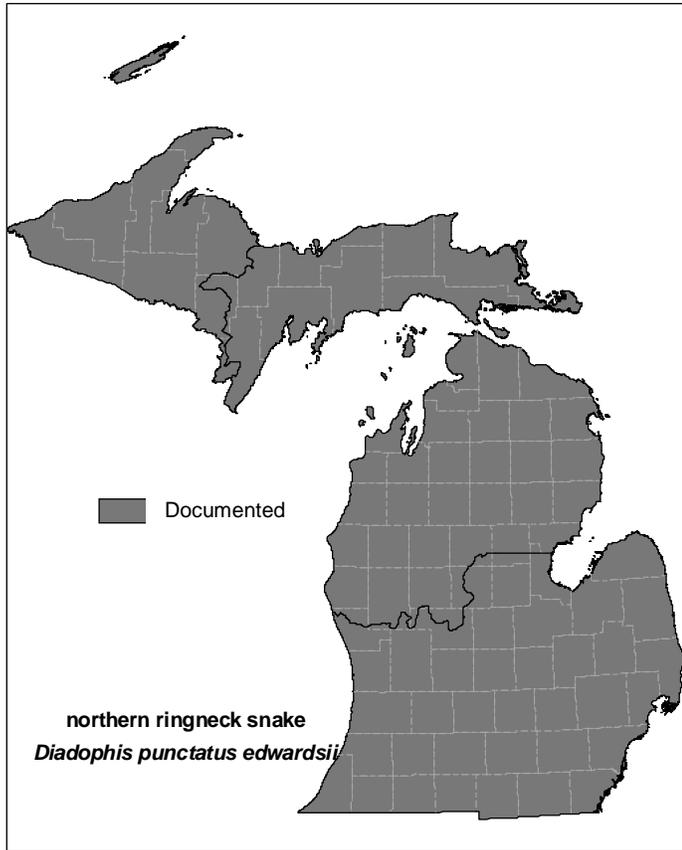
(*Thamnophis sauritus septentrionalis*)

DISTRIBUTION & ABUNDANCE: Distribution and abundance are unknown.

ASSOCIATED LANDSCAPE FEATURES: river/stream/riparian/floodplain corridor; ponds; small lakes

ASSOCIATED THREATS: wetland modifications; invasive plants & animals; riparian modifications; lack of scientific knowledge; non-consumptive recreation; industrial, residential & recreational development; climate vulnerability: moderately vulnerable with low confidence

COMMENTS: Considering the lack of scientific knowledge and various threats, the T&E Technical Advisory Committee recommends that the species be listed as a species of greatest conservation need.



northern ringneck snake

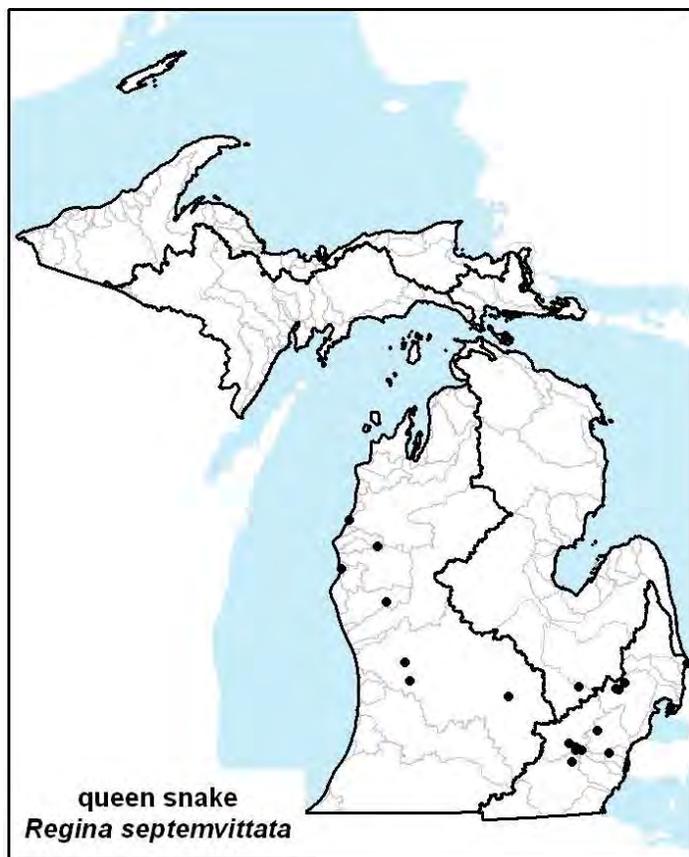
(*Diadophis punctatus edwardsii*)

DISTRIBUTION & ABUNDANCE: Unknown. Populations appear to be declining.

ASSOCIATED LANDSCAPE FEATURES: idle/old field; lowland hardwood; mesic hardwood; lowland conifer; mesic conifer; forest opening; coastal dune/beach; Great Lakes island; edge; inland rock/cliff/ledge; down woody debris

ASSOCIATED THREATS: conversion to agriculture lands; fragmentation; industrial/residential/recreational development; forestry practices; pesticides & herbicides

COMMENTS: Distribution and population status need to be determined. Species is colonial.



queen snake

(*Regina septemvittata*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Occurs in southern and western portions of the Lower Peninsula and an isolated population occurs on Bois Blanc Island. Abundance is unknown. Populations may be declining.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* ponds; small lakes; headwaters & small tributaries; gradient: slow; gradient: moderate; ephemeral wetland; rock substrates; woody structure; *terrestrial:* right-of-way; lowland hardwood; lowland conifer; inland emergent wetland; ephemeral wetland; pond; inland lake; river/stream/ riparian/floodplain corridor; Great Lakes island; other (require rocky-bottomed streams with moderate-fast currents); down woody debris

ASSOCIATED THREATS: altered sediment loads; pesticides & herbicides; social attitudes; conversion to agriculture lands; dredging & channelization; industrial/residential/ recreational development; invasive plants & animals; lack of scientific knowledge; urban, municipal, and industrial pollution

COMMENTS: Distribution and population status need to be determined. Feeds on crayfish and is rarely found away from water. Often confused with other species, hence targeted surveys are needed.

County Occurrences of
Aspidoscelis sexlineata



six-lined racerunner

(*Aspidoscelis sexlineata*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Only known to occur in Tuscola county.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; savanna; river/stream/riparian/floodplain corridor; coastal dune/beach; down woody debris

ASSOCIATED THREATS: conversion to agriculture lands; incompatible natural resource mgmt; industrial/residential/ recreational development; invasive plants & animals; lack of scientific knowledge; pesticides & herbicides; climate vulnerability: highly vulnerable with very high confidence.

COMMENTS: Distribution and population status need to be determined. This species may also be known by the name *Cnemidophorus sexlineatus*.



smooth green snake

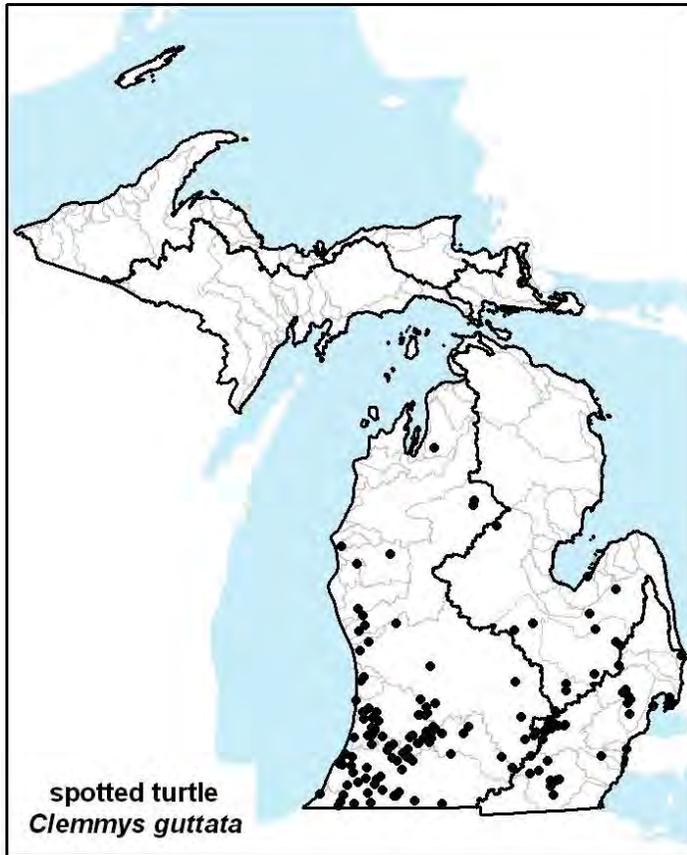
(*Liochlorophis vernalis*)

DISTRIBUTION & ABUNDANCE: Proposed listing as special concern. Occurs in both the Upper and Lower Peninsula of Michigan and Isle Royal. Abundance is unknown. Population are known to be declining and are believed to be locally extirpated from some parts of the state.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; pasture; right-of-way; savanna; lowland hardwood; mesic hardwood; dry hardwood; lowland conifer; mesic conifer; dry conifer; forest opening; bog; inland emergent wetland; ephemeral wetland; inland lake; edge; down woody debris

ASSOCIATED THREATS: conversion to agriculture lands; industrial/residential/recreational development; pesticides & herbicides; climate vulnerability: presumed stable with low confidence

COMMENTS: Distribution and population status need to be determined. Vulnerable to pesticides. This species may also be known by the name *Opheodrys vernalis*.



spotted turtle

(*Clemmys guttata*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. This species is found throughout southern lower Michigan. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* ponds; headwaters & small tributaries; bog; fen; ephemeral wetland; inland emergent wetland; swamp; soft substrates; vegetation; *terrestrial:* prairie; idle/old field; pasture; savanna; lowland shrub; lowland hardwood; lowland conifer; forest opening; bog; inland emergent wetland; submergent wetland; fen; ephemeral wetland; swamp; pond; inland lake; river/stream/riparian/floodplain corridor; coastal emergent wetland

ASSOCIATED THREATS: macrophyte removal; conversion to agriculture lands; dredging & channelization; altered fire regime; fragmentation; grazing & mowing patterns; incompatible natural resource mgmt; industrial/residential/ recreational development; invasive plants & animals; pesticides & herbicides; removal of wildlife; riparian modifications; social attitudes; urban, municipal, and industrial pollution; wetland modifications

COMMENTS: Michigan is the north-western edge of range for this species. Home ranges range from 0.5 to 3.5 ha. Population status needs to be determined.



wood turtle

(*Glyptemys insculpta*)

DISTRIBUTION & ABUNDANCE: Currently state listed as special concern with the recommendation to elevate to threatened. Found throughout the Northern Lower Peninsula and the Upper Peninsula. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: *aquatic:* headwaters & small tributaries; medium rivers; gradient: moderate; bog; inland emergent wetland; swamp; floodplain; rock substrates; soft substrates; woody structure; clear water; *terrestrial:* idle/old field; right-of-way; lowland shrub; upland shrub; lowland hardwood; mesic hardwood; forest opening; bog; inland emergent wetland; swamp; river/stream/riparian/floodplain corridor; other (little or no vegetation for nesting); down woody debris

ASSOCIATED THREATS: incompatible natural resources management; pesticides & herbicides; removal of wildlife; riparian modifications; fragmentation; grazing & mowing patterns; industrial/residential/recreational development; invasive plants & animals; forestry practices; non-consumptive recreation; social attitudes; urban, municipal, and industrial pollution

COMMENTS: Home range between 1 and 5 ha. Population status needs to be determined. This species may also be known by the name *Clemmys insculpta*.

BIRDS

County Occurrences of
Botaurus lentiginosus



American Bittern

(*Botaurus lentiginosus*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. The species may be locally common, especially in the Upper Peninsula, however surveys indicate that the species has continued to decline.

ASSOCIATED LANDSCAPE FEATURES: prairie; hayland; lowland shrub; bog; inland emergent wetland; ephemeral wetland; swamp; pond; inland lake; coastal emergent wetland

ASSOCIATED THREATS: conversion to agriculture lands; disease, pathogens, & parasites; altered hydrologic regimes; industrial/residential/recreational development; non-consumptive recreation; pesticides & herbicides; wetland modifications; climate vulnerability: moderately vulnerable with very high confidence

COMMENTS: Reducing the encroachment of woody vegetation into herbaceous wetlands is key to maintaining suitable habitat.

County Occurrences of
Haliaeetus leucocephalus



Bald Eagle

(*Haliaeetus leucocephalus*)

DISTRIBUTION & ABUNDANCE: State listed as special concern and globally secure. There were estimated to be 482 breeding pairs in Michigan in 2006 and the population has undergone a significant increase since MBBA I.

ASSOCIATED LANDSCAPE FEATURES: lowland hardwood; mesic hardwood; dry hardwood; lowland conifer; mesic conifer; dry conifer; pond; inland lake; inland island; river/stream/riparian/floodplain corridor; Great Lakes offshore; Great Lakes nearshore; coastal dune/beach; Great Lakes island; inland rock/cliff/ledge; large contiguous natural landscape; late successional forest

ASSOCIATED THREATS: conversion to agriculture lands; dams; disease, pathogens, & parasites; dredging & channelization; fragmentation; altered hydrologic regimes; industrial/residential/recreational development; forestry practices; military maneuvers; non-consumptive recreation; pesticides & herbicides; scientific research; urban, municipal, and industrial pollution; climate vulnerability: increase likely with moderate confidence

COMMENTS: Pesticides and heavy metals may continue to pose significant risks. Scavenging along roadsides may make these birds vulnerable to collisions.

County Occurrences of
Tyto alba



Barn Owl

(*Tyto alba*)

DISTRIBUTION & ABUNDANCE: State listed as endangered, the Barn Owl is extremely rare in the State and is currently known to breed in few isolated sites in the Southern Lower Peninsula. The last confirmed breeding in the State dates from the 1980s and if Barn Owl is not documented as a breeding species within the time period to the next review of the T&E list, it should be changed to Extirpated. (Chartier et al. 2011).

ASSOCIATED LANDSCAPE FEATURES: prairie; hayland; pasture; right-of-way; inland emergent wetland; ephemeral wetland; inland rock/cliff/ledge; suburban/small town; snag/cavity; other (barns); large contiguous natural landscape

ASSOCIATED THREATS: climate change; conversion to agriculture lands; altered fire regime; fragmentation; incompatible natural resource mgmt; industrial/residential/recreational development; other biological interactions (predation by great horned owl); pesticides & herbicides; wetland modifications; climate vulnerability: presumed stable with very high confidence

COMMENTS: Nesting is predominantly associated with artificial structures, specifically barns, rather than natural nesting substrates. Conversion of unfragmented grassland, hayland, and pasture to brushland and row crop has reduced habitat. Roadside grasslands may be attractive and contribute to vehicular mortality. Some secondary poisoning by rodenticides may occur.

County Occurrences of
Chlidonias niger



Black Tern

(*Chlidonias niger*)

DISTRIBUTION & ABUNDANCE: Currently state listed as a species of special concern, there is a recommendation to elevate the species to state threatened. There is a general concern about black tern population declines throughout much of its range. According to the most recent (2007-2009) decadal survey of colonial waterbirds along the Great Lakes shoreline, the number of black tern nest detected declined by 42% compared to the previous survey done during 1997-1999 (Cuthbert and Wires 2013). The total number of nests detected in Michigan dropped by about 32% and the number of nesting colonies declined from 12 in 1997-1999 to 5 during the recent survey (Cuthbert and Wires 2013).

ASSOCIATED LANDSCAPE FEATURES: inland emergent wetland; submergent wetland; ephemeral wetland; pond; inland lake; inland island; coastal emergent wetland; Great Lakes island; large contiguous natural landscape

ASSOCIATED THREATS: conversion to agriculture lands; dams; disease, pathogens, & parasites; dredging & channelization; industrial/residential/recreational development; invasive plants & animals; non-consumptive recreation; other biological interactions (possible competition from mute swans; predation of nests and young); scientific research; urban, municipal, and industrial pollution; wetland modifications; climate vulnerability: moderately vulnerable with very high confidence

County Occurrences of
Picoides arcticus



Black-backed Woodpecker

(*Picoides arcticus*)

DISTRIBUTION & ABUNDANCE: State listed as special concern, Michigan lies at the southern edge of the Black-backed Woodpecker's range, and they are most abundant in the Upper Peninsula. There is an estimated population of 2,000 in Michigan. Their range in Michigan seems to be relatively stable. Blackbacked Woodpeckers have always been an uncommon to rare species, inhabiting their rather small niche in the ecology of Michigan's forests and they seem ready to continue to do so. (Chartier et al. 2011; Partners in Flight Science Committee 2013)

ASSOCIATED LANDSCAPE FEATURES: savanna; lowland conifer; dry conifer; forest opening; bog; submergent wetland; swamp; pond; snag/cavity

ASSOCIATED THREATS: altered fire regime; incompatible natural resource mgmt; forestry practices; climate vulnerability: increase likely with very high confidence

County Occurrences of
Nycticorax nycticorax



Black-crowned Night-heron
(Nycticorax nycticorax)

DISTRIBUTION & ABUNDANCE: State listed as a species of special concern, the Black-crowned Night-heron may be found in scattered colonies, mostly along the Great Lakes shorelines and on Great Lakes islands. There have been significant declines in both colony size and abundance since the early 1900s. Twelve breeding colonies were documented during MBBA II. MBBA II indicated an increase in northward nesting for the species and there are many newer observations from inland habitat.

ASSOCIATED LANDSCAPE FEATURES: lowland shrub; inland emergent wetland; swamp; pond; inland lake; inland island; coastal emergent wetland; snag/cavity

ASSOCIATED THREATS: dams; disease, pathogens, & parasites; dredging & channelization; incompatible natural resource mgmt; industrial/residential/recreational development; invasive plants & animals; forestry practices; non-consumptive recreation; pesticides & herbicides; removal of wildlife; urban, municipal, and industrial pollution; wetland modifications; climate vulnerability: increase likely with moderate confidence

COMMENTS: Development and human disturbance may directly impact production.

County Occurrences of
Sterna caspia



Caspian Tern
(Sterna caspia)

DISTRIBUTION & ABUNDANCE: State listed as a threatened species in Michigan, the Caspian Tern has never been common in the State. There is an estimated 1,572 pairs in Michigan which indicates an increasing trend. Currently, they are locally distributed in the Eastern Upper Peninsula and Northern Lower Peninsula in colonies along the shores of Lake Michigan and Lake Huron.

ASSOCIATED LANDSCAPE FEATURES: inland lake; inland island; coastal dune/beach; Great Lakes island

ASSOCIATED THREATS: invasive plants & animals; other biological interactions (competition with gulls and cormorants for nest sites; predation by owls and gulls); removal of wildlife; urban, municipal, and industrial pollution; climate vulnerability: moderately vulnerable with moderate confidence

COMMENTS: Contamination by PCBs or heavy metals may cause colony abandonment. Mortality caused by entanglement in fishing lines is poorly documented but may be significant.

County Occurrences of
Dendroica cerulea



Cerulean Warbler
(Dendroica cerulea)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Breeding Bird Survey trend data suggest a significant decline in this species between 1966 and 2010, showing a 2.98% decline annually during this period (Buehler et al. 2013, Sauer et al. 2011). There is an estimated population of 5,000 in Michigan. This species appears to be declining at a similar level, 2.95% per year, within its core range in the Appalachian Mountains (Buehler et al. 2013). (Partners in Flight Science Committee 2013)

ASSOCIATED LANDSCAPE FEATURES: lowland hardwood; mesic hardwood; dry hardwood; forest opening; river/stream/riparian/floodplain corridor; large contiguous natural landscape; late successional forest

ASSOCIATED THREATS: conversion to agriculture lands; disease, pathogens, & parasites; fragmentation; industrial/ residential/recreational development; invasive plants & animals; forestry practices; climate vulnerability; moderately vulnerable with very high confidence

COMMENTS: Nest parasitism by Cowbirds (*Molothrus ater*) may be significant. The loss of tree species to disease and pests as well as even-aged forest management may reduce suitable breeding habitat.

County Occurrences of
Gavia immer



Common Loon
(Gavia immer)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Historically, Common Loons were regular residents of the entire State. Declines were noted by the early 1900s.

ASSOCIATED LANDSCAPE FEATURES: submergent wetland; inland lake; inland island; river/stream/riparian/floodplain corridor; Great Lakes offshore; Great Lakes nearshore; coastal emergent wetland

ASSOCIATED THREATS: disease, pathogens, & parasites; altered hydrologic regimes; industrial/residential/ recreational development; non-consumptive recreation; other biological interactions (intraspecific competition due to territoriality; predation by fish, birds, mammals, and turtles); pesticides & herbicides; removal of wildlife; social attitudes; urban, municipal, and industrial pollution; climate vulnerability; highly vulnerable with very high confidence

COMMENTS: Human disturbance, either from development or recreational activities, directly impacts the productivity of nesting loons. Incidental mortality in fishing nets may be significant, though poorly documented at a statewide level.



Common Moorhen

(*Gallinula chloropus*)

DISTRIBUTION & ABUNDANCE: Currently state listed as threatened, Common Moorhens are regularly found in the Southern Lower Peninsula and are often observed in singles or pairs in Great Lakes coastal marshes throughout the Lower Peninsula and the Eastern Upper Peninsula.

ASSOCIATED LANDSCAPE FEATURES: inland emergent wetland; submergent wetland; pond; inland lake; coastal emergent wetland; climate vulnerability: presumed stable with very high confidence

ASSOCIATED THREATS: incompatible natural resource mgmt; lack of scientific knowledge; wetland modifications; also called *Gallinula galeata*, the Common Gallinule



Common Nighthawk

(*Chordeiles minor*)

DISTRIBUTION & ABUNDANCE: The Common Nighthawk is locally common throughout the State though succession and development have reduced the available breeding habitat and led to declining numbers. There are an estimated 20,000 in the state. (Chartier et al. 2011; Partners in Flight Science Committee 2013)

ASSOCIATED LANDSCAPE FEATURES: row crop; savanna; mesic conifer; dry conifer; pond; inland lake; coastal dune/beach; urban; suburban/small town

ASSOCIATED THREATS: altered fire regime; incompatible natural resource mgmt; pesticides & herbicides; climate vulnerability: increase likely with moderate confidence

County Occurrences of
Sterna hirundo



Common Tern

(*Sterna hirundo*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. While Common Tern numbers appear to have been relatively stable in recent years, the overall population remains much lower than in previous decades. Populations have declined from highs of over 6,000 breeding pairs to estimates of less than 1,500 breeding pairs from the early 1990s.

ASSOCIATED LANDSCAPE FEATURES: inland emergent wetland; inland lake; inland island; river/stream/riparian/ floodplain corridor; coastal emergent wetland; coastal dune/ beach; Great Lakes island

ASSOCIATED THREATS: disease, pathogens, & parasites; altered hydrologic regimes; industrial/residential/ recreational development; invasive plants & animals; non-consumptive recreation; other biological interactions (competition with gulls for nest sites; predation by gulls, mammals, reptiles, and other birds); pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: moderately vulnerable with moderate confidence

COMMENTS: Contamination by organochlorides and heavy metals may affect production. Residential and recreational development along shorelines eliminates current and potential breeding habitat.

County Occurrences of
Spiza americana



Dickcissel

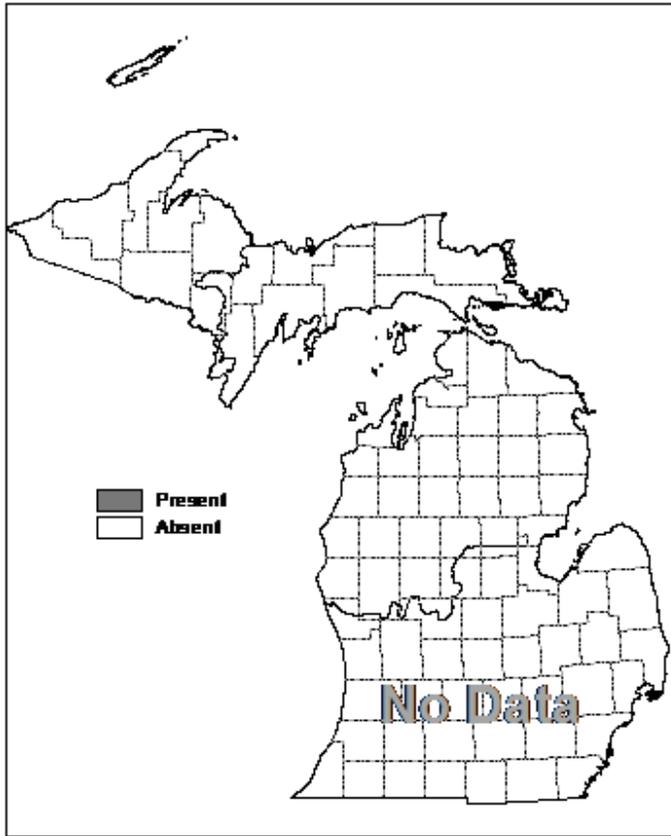
(*Spiza americana*)

DISTRIBUTION & ABUNDANCE: State listed as a species of special concern. The population estimate for this species in Michigan is 4,000. Their distribution continues to be statewide. It is unclear what the trends for this species are in Michigan; within Region 3 they appear to have a decreasing trend. (Chartier et al. 2011; Partners in Flight Science Committee 2013)

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; hayland; pasture; right-of-way; fence row; savanna

ASSOCIATED THREATS: grazing & mowing patterns; invasive plants & animals; pesticides & herbicides; climate vulnerability: increase likely with very high confidence

COMMENTS: Nest parasitism by Cowbirds (*Molothrus ater*) may be significant. Accidental poisoning of roosting birds on the wintering grounds in Venezuela due to pesticide application may have an impact.



eastern red knot

(Calidris canutus rufa)

DISTRIBUTION & ABUNDANCE: Federally listed as threatened and proposed listing as threatened in Michigan. This subspecies experienced a rapid decline from about 82,000 individuals in the 1980s to about 30,000 in 2010 (Baker et al. 2013).

ASSOCIATED LANDSCAPE FEATURES: coastal dune/beach

ASSOCIATED THREATS: Climate vulnerability: unknown; unknown

COMMENTS: Only appear in Michigan briefly and rarely during migration.

County Occurrences of *Sterna forsteri*



Forster's Tern

(Sterna forsteri)

DISTRIBUTION & ABUNDANCE: State listed as threatened, forster's Tern is uncommon in the State, with its highest densities along the shores of Lake Huron and Lake St. Clair. Recent surveys estimate a 55% decline in the total number of nests since a 1997-1999 survey.

ASSOCIATED LANDSCAPE FEATURES: inland emergent wetland; inland lake; inland island; river/stream/ riparian/floodplain corridor; coastal emergent wetland; Great Lakes island

ASSOCIATED THREATS: dams; industrial/residential/recreational development; non-consumptive recreation; urban, municipal, and industrial pollution; climate vulnerability: moderately vulnerable with very high confidence

COMMENTS: Recreational boating wakes may have a detrimental impact on aquatic vegetation which is used for nesting.



Golden-winged Warbler
(Vermivora chrysoptera)

DISTRIBUTION & ABUNDANCE: The range of the Golden-winged Warbler has contracted northward as the Blue-winged Warbler has expanded its range into Michigan. This species was common in southern Lower Michigan and now is actively losing range in the state, moving northward. Based on Partners in Flight population estimates database, Golden-winged Warbler's population estimate in Michigan is about 20,000. Michigan is the core of this species range. The USFWS is considering this species for federal listing. (Partners in Flight Science Committee 2013)

ASSOCIATED LANDSCAPE FEATURES: idle/old field; lowland shrub; upland shrub; lowland hardwood; mesic hardwood; forest opening; bog; swamp; edge

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; incompatible natural resource mgmt; industrial/residential/recreational development; invasive plants & animals; forestry practices; climate vulnerability; increase likely with low confidence

COMMENTS: Encroachment of autumn olive (*Elaeagnus umbellata*) may degrade nesting habitat. Nest parasitism by Cowbirds (*Molothrus ater*) and hybridization with Blue-winged Warblers (*Vermivora pinus*) may be significant. Loss of wintering habitat due to deforestation may have an impact.

County Occurrences of
Ammodramus savannarum



Grasshopper Sparrow
(Ammodramus savannarum)

DISTRIBUTION & ABUNDANCE: State listed as a species of special concern. Many decades of population declines at multiple scales suggest a strong need for continued concern. There is a current population estimate of 180,000. (Chartier et al. 2011; Partners in Flight Science Committee 2013)

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; hayland; pasture; right-of-way; savanna

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; grazing & mowing patterns; industrial/residential/recreational development; invasive plants & animals; climate vulnerability; presumed stable with moderate confidence

COMMENTS: Nest parasitism by Cowbirds (*Molothrus ater*) may be significant. Conversion of grasslands either to intensive agriculture or to forest through succession reduce suitable nesting habitat.



Henslow's Sparrow *(Ammodramus henslowii)*

DISTRIBUTION & ABUNDANCE: State listed as endangered. There is an estimated population of 5,000 in Michigan. The Breeding Bird Survey data indicate an alarming 9.39% annual decline in Henslow's Sparrow in Michigan between 1966 and 2012, though this has slowed somewhat to a 5.65% annual decline between 2002 and 2012. Declines appear to be continuing at an alarming rate. (Chartier et al. 2011; Partners in Flight Science Committee 2013; Sauer et al. 2014)

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; hayland; pasture

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; fragmentation; grazing & mowing patterns; industrial/residential/recreational development; other biological interactions (nest predation); wetland modifications; climate vulnerability: presumed stable with very high confidence.



Hooded Warbler *(Wilsonia citrina)*

DISTRIBUTION & ABUNDANCE: Designated as a species of special concern in Michigan. The population estimate for this specie is 6,000. Comparison of the data from the two Atlases indicates both a small local increase in the breeding population of Hooded Warblers in Michigan and a range expansion. (Chartier et al. 2011; Partners in Flight Science Committee 2013)

ASSOCIATED LANDSCAPE FEATURES: lowland shrub; upland shrub; lowland hardwood; mesic hardwood; dry hardwood; river/stream/riparian/floodplain corridor; large contiguous natural landscape; late successional forest

ASSOCIATED THREATS: dredging & channelization; fragmentation; invasive plants & animals; forestry practices; climate vulnerability: presumed stable with very high confidence.

COMMENTS: Nest parasitism by Cowbirds (*Molothrus ater*) may be significant. Also called *Setophaga citrina*.

County Occurrences of
Rallus elegans



King Rail
(Rallus elegans)

DISTRIBUTION & ABUNDANCE: State listed as endangered in Michigan, the King Rail was once abundant in the marshes along the banks of Lake Erie. Declines are attributed to loss and degradation of cattail and sedge marshes. Targeted surveys have been largely unsuccessful and this species is clearly down to perilously low levels in Michigan (Chartier et al. 2011; Rabe 1986).

ASSOCIATED LANDSCAPE FEATURES: lowland shrub; inland emergent wetland; coastal emergent wetland

ASSOCIATED THREATS: disease, pathogens, & parasites; altered hydrologic regimes; industrial/residential/ recreational development; pesticides & herbicides; wetland modifications; climate vulnerability: presumed stable with very high confidence

COMMENTS:

County Occurrences of
Dendroica kirtlandii



Kirtland's Warbler
(Dendroica kirtlandii)

DISTRIBUTION & ABUNDANCE: Federally and state listed as endangered. The Kirtland's Warbler is extremely rare and breeds almost exclusively in Michigan's Northern Lower Peninsula. Although the rate of population increase has slowed, the male count has more than doubled since 1994. There is a current population estimate of 1,420 singing males. The recovery team is working on delisting the species. (Chartier et al. 2011)

ASSOCIATED LANDSCAPE FEATURES: savanna; upland shrub; dry conifer; forest opening; large contiguous natural landscape

ASSOCIATED THREATS: disease, pathogens, & parasites; altered fire regime; fragmentation; invasive plants & animals; forestry practices; military maneuvers; pesticides & herbicides; climate vulnerability: presumed stable with very high confidence

COMMENTS: Conservation of wintering grounds in the Bahamas through international partnerships is needed. The Kirtland's Warbler is very selective in regards to both vegetation species composition and structural composition of nesting sites. Nest parasitism by Cowbirds (*Molothrus ater*) is significant, and Cowbird control is ongoing. Also known as *Setophaga kirtlandii*.

County Occurrences of
Ixobrychus exilis



Least Bittern

(*Ixobrychus exilis*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. It is currently uncommon and scattered across the Lower Peninsula and rare in the Upper Peninsula. The JV Waterbird Group estimates that there are 835 in Michigan.

ASSOCIATED LANDSCAPE FEATURES: lowland shrub; ephemeral wetland; pond; inland lake; coastal emergent wetland

ASSOCIATED THREATS: conversion to agriculture lands; disease, pathogens, & parasites; dredging & channelization; altered hydrologic regimes; industrial/residential/recreational development; invasive plants & animals; lack of scientific knowledge; other biological interactions (predation by crows, mammals, snakes, snapping turtles, and bullfrogs); pesticides & herbicides; scientific research; social attitudes; urban, municipal, and industrial pollution; wetland modifications; climate vulnerability: moderately vulnerable with very high confidence

COMMENTS: Threats to Least Bittern and their relative severity are poorly documented.

County Occurrences of
Asio otus



Long-eared Owl

(*Asio otus*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. The Long-eared Owl is uncommon statewide with local breeding in the western half of the Southern Lower Peninsula, southern half of the Northern Lower Peninsula, and scattered records throughout the Eastern Upper Peninsula. During the Michigan Breeding Bird Atlas (MBBA) II this species was reported in just 1.55% of southern Lower Peninsula townships, with the only report of confirmed breeding coming from Muskegon County.

ASSOCIATED LANDSCAPE FEATURES: lowland shrub; upland shrub; lowland conifer; mesic conifer; forest opening

ASSOCIATED THREATS: conversion to agriculture lands; industrial/residential/recreational development; other biological interactions (competition with Great Horned Owl); pesticides & herbicides; removal of wildlife; urban, municipal, and industrial pollution; climate vulnerability: presumed stable with high confidence

County Occurrences of
Seiurus motacilla



Louisiana Waterthrush
(Seiurus motacilla)

DISTRIBUTION & ABUNDANCE: State listed as threatened, the Louisiana Waterthrush was probably more common presettlement, though likely not far beyond the Southern Lower Peninsula. Hull (2011) concluded this species suffered a substantial decline in the southern Lower Peninsula, and a slight increase in the northern Lower Peninsula between the two breeding bird atlases. This species is data deficient. (Chartier et al. 2011)

ASSOCIATED LANDSCAPE FEATURES: lowland hardwood; inland emergent wetland; swamp; river/stream/ riparian/floodplain corridor; late successional forest

ASSOCIATED THREATS: fragmentation; industrial/residential/recreational development; forestry practices; urban, municipal, and industrial pollution; wetland modifications; climate vulnerability: presumed stable with very high confidence

COMMENTS: Also known as *Parkesia motacilla*.

County Occurrences of
Falco columbarius



Merlin
(Falco columbarius)

DISTRIBUTION & ABUNDANCE: Currently listed as threatened in Michigan, a down-listing to special concern is recommended. The southern edge of the Merlin's range includes the Upper Peninsula and parts of the Northern Lower Peninsula. Small pockets of breeding birds may be found in the Upper Peninsula along the shore of Lake Superior and on Isle Royale; elsewhere merlins are rare or absent. Merlins have experienced a widespread increase in numbers in Michigan and the whole Great Lakes region in recent years.

ASSOCIATED LANDSCAPE FEATURES: savanna; lowland hardwood; mesic hardwood; dry hardwood; lowland conifer; mesic conifer; dry conifer; forest opening; edge; inland rock/cliff/ledge; suburban/small town; snag/cavity

ASSOCIATED THREATS: conversion to agriculture lands; industrial/residential/recreational development; pesticides & herbicides; climate vulnerability: presumed stable with very high confidence

COMMENTS: Habitat loss and pesticide use on the Merlin's wintering grounds in Central and South America may be significant.

County Occurrences of
Lanius ludovicianus migrans



Migrant Loggerhead Shrike *(Lanius ludovicianus migrans)*

DISTRIBUTION & ABUNDANCE: State listed as endangered in Michigan. None of the sites that held nesting shrikes during the 1993-1998 Michigan Breeding Bird Atlas period were occupied by shrikes in 2002-2008 Atlas period, and no breeding was confirmed anywhere in the state. The last confirmed breeding record in Michigan was apparently in 2001 in Kalamazoo County (Chartier et al. 2011). Since 2008, single shrikes have been reported in Michigan, most in Upper Peninsula and northern Lower Peninsula counties (Sullivan et al. 2009). There have been no recent nesting reports.

ASSOCIATED LANDSCAPE FEATURES: pasture; row crop; right-of-way; fence row; savanna; orchard; upland shrub; mesic hardwood; other (perches (utility poles, etc.))

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; grazing & mowing patterns; incompatible natural resource mgmt; industrial/residential/recreational development; lack of scientific knowledge; other biological interactions (competition on the wintering grounds); pesticides & herbicides; climate vulnerability: presumed stable with very high confidence

COMMENTS: This species was also known by the name *Lanius ludovicianus*. Education and partnerships with private landowners to maintain fencerows with brush and trees is a key strategy for this species.

County Occurrences of
Accipiter gentilis



Northern Goshawk *(Accipiter gentilis)*

DISTRIBUTION & ABUNDANCE: State listed as a species of special concern, the Northern Goshawk is uncommon and widely scattered across the Upper Peninsula and Northern Lower Peninsula. The population estimate for this species is 1,500.

ASSOCIATED LANDSCAPE FEATURES: savanna; lowland hardwood; mesic hardwood; dry hardwood; lowland conifer; mesic conifer; dry conifer; forest opening; suburban/small town; large contiguous natural landscape; late successional forest

ASSOCIATED THREATS: conversion to agriculture lands; disease, pathogens, & parasites; fragmentation; forestry practices; non-consumptive recreation; other biological interactions (great horned owl predation; mammal predation); pesticides & herbicides; removal of wildlife; climate vulnerability: presumed stable with very high confidence

COMMENTS: Creation of forest openings and the fragmentation of large forested blocks due to timber harvest reduce available habitat and favor the Goshawk's competitors, such as Red-tailed Hawks (*Buteo jamaicensis*) and Great Horned Owl (*Bubo virginianus*).

County Occurrences of
Circus cyaneus



Northern Harrier
(Circus cyaneus)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Population estimate is 3,000 in Michigan. Harrier populations are possibly in decline, and these birds appear to be declining across their range.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; hayland; pasture; row crop; fence row; lowland shrub; dry conifer; forest opening; inland emergent wetland; ephemeral wetland; river/stream/riparian/floodplain corridor; coastal emergent wetland; snag/cavity; other (perches (stumps, posts, etc.))

ASSOCIATED THREATS: conversion to agriculture lands; disease, pathogens, & parasites; altered fire regime; fragmentation; grazing & mowing patterns; altered hydrologic regimes; incompatible natural resource mgmt; industrial/ residential/recreational development; invasive plants & animals; mining practices; non-consumptive recreation; other biological interactions (mammal and bird nest predators, trampling of nests by deer); pesticides & herbicides; removal of non-timber flora; urban, municipal, and industrial pollution; wetland modifications; climate vulnerability: moderately vulnerable with moderate confidence

COMMENTS: Low perches are necessary for successful foraging.

County Occurrences of
Pandion haliaetus



Osprey
(Pandion haliaetus)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Osprey were among the bird species to suffer dramatic declines due to pesticide exposure through the middle of the 20th century. Counts of breeding pairs in the State doubled from the 1970s to the 1980s in response to restrictions on pesticide use and construction of nesting platforms. The population appears to be increasing, especially in the Southern Lower Peninsula.

ASSOCIATED LANDSCAPE FEATURES: lowland conifer; inland emergent wetland; submergent wetland; ephemeral wetland; swamp; pond; inland lake; inland island; river/stream/riparian/floodplain corridor; snag/cavity; other (man-made structure)

ASSOCIATED THREATS: dams; disease, pathogens, & parasites; dredging & channelization; altered hydrologic regimes; incompatible natural resource mgmt; industrial/residential/ recreational development; military maneuvers; non-consumptive recreation; pesticides & herbicides; removal of wildlife; urban, municipal, and industrial pollution; wetland modifications; climate vulnerability: Presumed stable with low confidence

COMMENTS: Osprey will use artificial nesting platforms if provided. Bioaccumulation of toxic compounds as well as collisions with high tension wires, cell towers, and their supporting structures may result in significant mortality.

County Occurrences of
Falco peregrinus



Peregrine Falcon
(Falco peregrinus)

DISTRIBUTION & ABUNDANCE: Currently state listed as endangered, a downgrade to threatened is recommended. While never abundant, Peregrine Falcon populations declined dramatically in the middle of the 20th century, due primarily to the use of DDT. By 1960, the Peregrine Falcon was believed extirpated from Michigan. Intensive restoration efforts began nationally in the 1970s, in 2008, there were 25 Peregrine pairs in Michigan (13 successful, 10 with non-known nests; Redig et al. 2012).

ASSOCIATED LANDSCAPE FEATURES: river/stream/riparian/floodplain corridor; Great Lakes nearshore; Great Lakes island; inland rock/cliff/ledge; urban; suburban/small town; other (inner city skyscrapers)

ASSOCIATED THREATS: disease, pathogens, & parasites; industrial/residential/recreational development; mining practices; pesticides & herbicides; urban, municipal, and industrial pollution; climate vulnerability: moderately vulnerable with very high confidence.

COMMENTS: Much of the breeding of Peregrine Falcons in Michigan occurs on man-made structures, primarily tall buildings in population centers.

County Occurrences of
Charadrius melodus



Piping Plover
(Charadrius melodus)

DISTRIBUTION & ABUNDANCE: Federally and State listed as endangered. Populations are still critically low, however Great Lakes Piping Plovers continue a moderate recovery reaching 70 pairs in the population in 2014, of these 54 nested in Michigan. The species is still vulnerable to extirpation in the Great Lakes (Cuthbert 2011).

ASSOCIATED LANDSCAPE FEATURES: coastal emergent wetland; coastal dune/beach; Great Lakes island; large contiguous natural landscape

ASSOCIATED THREATS: disease, pathogens, & parasites; fragmentation; altered hydrologic regimes; industrial/ residential/recreational development; non-consumptive recreation; other biological interactions (nest predation); pesticides & herbicides; climate vulnerability: moderately vulnerable with moderate confidence

COMMENTS: Protection of breeding pairs and nest sites from human recreational disturbance and shoreline development is pivotal to successful production and eventual recovery. Public education and awareness is important in avoiding disturbance to nesting plovers. The natural processes that maintain dune ecosystems (e.g., disturbance from wind and water erosion, periodic blowouts) must be protected in order to insure long-term persistence of this species.

County Occurrences of
Dendroica discolor



Prairie Warbler

(*Dendroica discolor*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. While this warbler seems to be somewhat stabilized in Michigan it remains a very rare species, primarily clinging on in Lake Michigan dune areas. With continued range-wide declines the current status of Endangered should be maintained.

ASSOCIATED LANDSCAPE FEATURES: prairie; savanna; upland shrub; dry conifer; coastal dune/beach

ASSOCIATED THREATS: disease, pathogens, & parasites; altered fire regime; incompatible natural resource mgmt; industrial/residential/recreational development; invasive plants & animals; other biological interactions (nest predation by snakes) ; climate vulnerability: increase likely with very high confidence

COMMENTS: Nest parasitism by Cowbirds (*Molothrus ater*) may be significant. Also known as *Setophaga discolor*.

County Occurrences of
Protonotaria citrea



Prothonotary Warbler

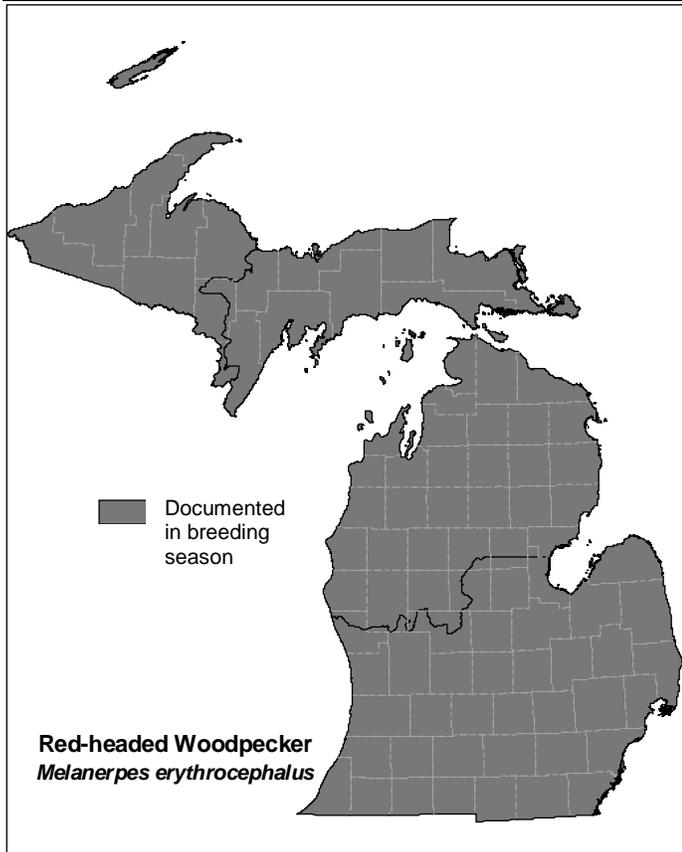
(*Protonotaria citrea*)

DISTRIBUTION & ABUNDANCE: The Prothonotary Warbler is a species of special concern in Michigan, and Michigan lies on the northern boundary of its breeding range. Population estimate for this species in Michigan is 2,000. Their range in the state has stayed relatively stable over the last 20 years, it is unclear if their populations are stable or slightly declining. (Chartier et al. 2011; Partners in Flight Science Committee 2013)

ASSOCIATED LANDSCAPE FEATURES: lowland hardwood; swamp; river/stream/riparian/floodplain corridor; snag/cavity; late successional forest

ASSOCIATED THREATS: invasive plants & animals; other biological interactions (predation; competition with house wrens); wetland modifications; climate vulnerability: increase likely with low confidence

COMMENTS: Nest parasitism by Cowbirds (*Molothrus ater*) may be significant.



Red-headed Woodpecker
(Melanerpes erythrocephalus)

DISTRIBUTION & ABUNDANCE: Red-headed Woodpeckers are fairly common in the Southern Lower Peninsula with lower densities in the Northern Lower Peninsula and scattered reports from the Upper Peninsula. Partners in Flight population estimate for this species in Michigan is 7,000. The species is considered common but in steep decline across its range. (Chartier et al. 2011; Cornell Lab of Ornithology 2015; Partners in Flight Science Committee 2013)

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; row crop; savanna; lowland hardwood; mesic hardwood; dry hardwood; dry conifer; forest opening; swamp; river/stream/riparian/floodplain corridor; edge; snag/cavity; late successional forest; down woody debris

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; industrial/residential/recreational development; other biological interactions (competition with starlings for nest sites); climate vulnerability; increase likely with very high confidence

COMMENTS: Clean farming practices reduce the value of edge in and near agricultural features.

County Occurrences of
Buteo lineatus



Red-shouldered Hawk
(Buteo lineatus)

DISTRIBUTION & ABUNDANCE: State listed as threatened. This species is locally common in the Northern Lower Peninsula, scattered and uncommon in the Southern Lower Peninsula, and rare across the Upper Peninsula although increasing survey and research effort appears to result in more element occurrences. There is an estimated population of 4,000 in Michigan.

ASSOCIATED LANDSCAPE FEATURES: lowland shrub; lowland hardwood; mesic hardwood; dry hardwood; lowland conifer; mesic conifer; dry conifer; forest opening; inland emergent wetland; submergent wetland; ephemeral wetland; swamp; river/stream/riparian/floodplain corridor; coastal emergent wetland; edge; suburban/small town; snag/cavity; large contiguous natural landscape; late successional forest

ASSOCIATED THREATS: conversion to agriculture lands; dams; disease, pathogens, & parasites; dredging & channelization; fragmentation; altered hydrologic regimes; incompatible natural resource mgmt; industrial/residential/ recreational development; invasive plants & animals; forestry practices; non-consumptive recreation; pesticides & herbicides; removal of wildlife; urban, municipal, and industrial pollution; wetland modifications; climate vulnerability: presumed stable with very high confidence

COMMENTS: Human disturbance and timber harvest may

County Occurrences of
Tympanuchus phasianellus



Sharp-tailed Grouse

(*Tympanuchus phasianellus*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. There are long term viability concerns for this species in Michigan and the current population is estimated to be 900 in the state. Populations appear to be declining.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; hayland; pasture; row crop; fence row; savanna; lowland shrub; upland shrub; dry conifer; forest opening; bog; inland emergent wetland; fen; ephemeral wetland; river/stream/riparian/floodplain corridor; snag/cavity; large contiguous natural landscape

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; fragmentation; grazing & mowing patterns; incompatible natural resource mgmt; industrial/residential/recreational development; forestry practices; non-consumptive recreation; other biological interactions (predation by birds and mammals); pesticides & herbicides; removal of wildlife; social attitudes; climate vulnerability; presumed stable with moderate confidence

COMMENTS: Year round Michigan residents.

County Occurrences of
Asio flammeus



Short-eared Owl

(*Asio flammeus*)

DISTRIBUTION & ABUNDANCE: State listed as endangered. The Short-eared Owl was probably never common in the State, and it has been undergoing recent declines in numbers due to grassland habitat loss to development and succession. There is an estimated population of 110 in Michigan. (Chartier et al. 2011; Partners in Flight Science Committee 2013)

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; hayland; pasture; savanna; bog; inland emergent wetland; fen; ephemeral wetland; coastal emergent wetland; large contiguous natural landscape

ASSOCIATED THREATS: conversion to agriculture lands; disease, pathogens, & parasites; altered fire regime; fragmentation; grazing & mowing patterns; altered hydrologic regimes; industrial/residential/recreational development; other biological interactions (nest predation by mammals); removal of wildlife; wetland modifications; climate vulnerability; presumed stable with moderate confidence.

County Occurrences of
Falcipennis canadensis



Spruce Grouse

(*Falcipennis canadensis*)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Distribution and abundance are unknown.

ASSOCIATED LANDSCAPE FEATURES: lowland hardwood; lowland conifer; mesic conifer; dry conifer; forest opening; other (low berries (especially blueberry)); down woody debris

ASSOCIATED THREATS: altered fire regime; fragmentation; incompatible natural resource mgmt; industrial/residential/ recreational development; forestry practices; other biological interactions (predation by birds and mammals); removal of wildlife; climate vulnerability: moderately vulnerable with very high confidence

COMMENTS: Low berries, especially blueberry, are a vital food source. Both presence and condition of spruce-jack pine forest are important: fire suppression results in over mature stands; recreational development along lakeshores removes stands, and conversion to pine plantations reduces their value to Spruce Grouse.

County Occurrences of
Cygnus buccinator



Trumpeter Swan

(*Cygnus buccinator*)

DISTRIBUTION & ABUNDANCE: Currently state listed as threatened with the recommendation to down-list to special concern because their restoration goal has been exceeded and breeding distribution and numbers continue to expand slowly statewide. Efforts to restore a breeding population of Trumpeter Swans in Michigan were begun in the 1980s.

ASSOCIATED LANDSCAPE FEATURES: inland emergent wetland; submergent wetland; pond; inland lake; inland island; other (frequently nests on muskrat houses or beaver lodges)

ASSOCIATED THREATS: disease, pathogens, & parasites; industrial/residential/recreational development; invasive plants & animals; non-consumptive recreation; removal of wildlife; social attitudes; urban, municipal, and industrial pollution; climate vulnerability: moderately vulnerable with high confidence.

COMMENTS: Nesting islands are important; muskrat houses or beaver lodges may be used when present. Restored swans which lack migratory behavior tend to congregate, leaving them vulnerable to disease, starvation, and catastrophic events. Interactions with humans, including feeding, recreational boating, hiking, and bird watching can affect the birds' behavior and productivity. Invasive Mute Swans (*Cygnus olor*) may provide competitive pressure.

County Occurrences of
Sturnella neglecta



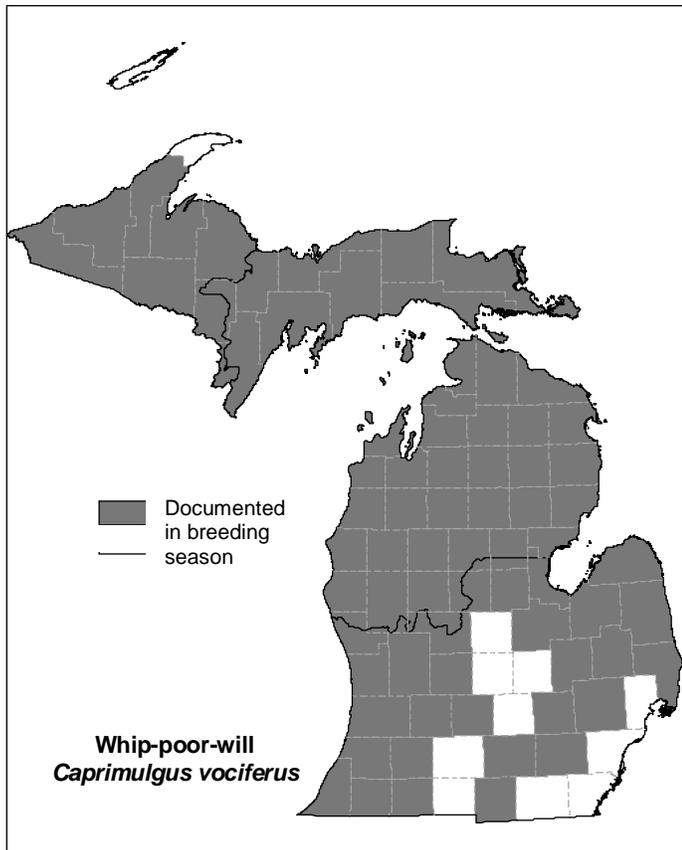
Western Meadowlark
(Sturnella neglecta)

DISTRIBUTION & ABUNDANCE: State listed as a species of special concern. Most data indicate this species is declining throughout its range. Population estimate in Michigan is 1,000 individuals. (Partners in Flight Science Committee 2013)

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; hayland; pasture; right-of-way; savanna; dry conifer; forest opening; ephemeral wetland; large contiguous natural landscape

ASSOCIATED THREATS: fragmentation; invasive plants & animals; other biological interactions (predation by raptors, crows, and mammals); climate vulnerability: presumed stable with very high confidence

COMMENTS: Nest parasitism by Cowbirds (*Molothrus ater*) may be significant.



Whip-poor-will
(Caprimulgus vociferus)

DISTRIBUTION & ABUNDANCE: While the Whip-poor-will may be found statewide, it is common nowhere and is currently in decline due to loss of habitat to development and agriculture. There are an estimated 100,000 in the state, however there is a long-term declining trend. (Chartier et al. 2011; Partners in Flight Science Committee 2013; Sauer et al. 2014)

ASSOCIATED LANDSCAPE FEATURES: dry hardwood; dry conifer; forest opening

ASSOCIATED THREATS: conversion to agriculture lands; industrial/residential/recreational development; lack of scientific knowledge; other biological interactions (food competition with bats and small owls); pesticides & herbicides; social attitudes; climate vulnerability: increase likely with low confidence

COMMENTS: The paving of rural roads may lead to higher vehicle speeds and a greater likelihood of collision mortality for foraging individuals.

County Occurrences of
Phalaropus tricolor



Wilson's Phalarope
(Phalaropus tricolor)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Wilson's Phalarope has few confirmed breeding records from Michigan. The few birds which have been observed have been near or along the shores of the Great Lakes, primarily in Saginaw Bay and along Lake Huron. There have been indications of breeding sporadically since the 1960s (Chartier et al. 2011).

ASSOCIATED LANDSCAPE FEATURES: inland emergent wetland; ephemeral wetland; pond; inland lake; suburban/small town

ASSOCIATED THREATS: wetland modifications; climate vulnerability: presumed stable with very high confidence

County Occurrences of
Coturnicops noveboracensis



Yellow Rail
(Coturnicops noveboracensis)

DISTRIBUTION & ABUNDANCE: State listed as threatened. It is estimated that Michigan's population is 100 birds and that the population is stable. Of nine elemental occurrences, four are viable. They are uncommon and have primarily been observed in the Eastern Upper Peninsula.

ASSOCIATED LANDSCAPE FEATURES: hayland; bog; inland emergent wetland; fen; ephemeral wetland

ASSOCIATED THREATS: disease, pathogens, & parasites; altered fire regime; altered hydrologic regimes; industrial /residential/recreational development; other biological interactions (invasion of purple loosestrife; mammal, bird, and herp predators); wetland modifications; climate vulnerability: moderately vulnerable with moderate confidence

COMMENTS: Little survey data exists to be able to accurately assess current or historic abundance. This is a secretive bird which nests in habitats which are not frequently censused. Encroachment of woody vegetation on breeding sites is probably the most significant threat to Yellow Rails.

County Occurrences of
Xanthocephalus xanthocephalus



Yellow-headed Blackbird

(Xanthocephalus xanthocephalus)

DISTRIBUTION & ABUNDANCE: State listed as a species of special concern. The Great Lakes area represents an eastern projection of this species range. They did not nest in Michigan until the 1950s. Michigan does not have substantial numbers of Yellow-headed Blackbirds; the highest total reported during the Michigan Breeding Bird Atlas II was 30 in Bay Co. (Chartier et al. 2011)

ASSOCIATED LANDSCAPE FEATURES: inland emergent wetland; submergent wetland; pond; coastal emergent wetland

ASSOCIATED THREATS: altered hydrologic regimes; industrial/ residential/recreational development; wetland modifications; climate vulnerability: moderately vulnerable with very high confidence

COMMENTS: Succession toward closed marsh communities reduces available breeding habitat.

County Occurrences of
Dendroica dominica



Yellow-throated Warbler

(Dendroica dominica)

DISTRIBUTION & ABUNDANCE: State listed as a threatened species, Michigan lies at the edge of the Yellow-throated Warbler's range. This warbler may have been extirpated from the State for the bulk of the 20th century. Since 1969, at least one to three singing males have been observed in Berrien County annually, representing the only self-sustaining breeding population in Michigan. Intensive surveys in the 1980s documented anywhere from 14 to 21 pairs.

ASSOCIATED LANDSCAPE FEATURES: lowland hardwood; swamp; river/stream/riparian/floodplain corridor

ASSOCIATED THREATS: invasive plants & animals; forestry practices ; climate vulnerability: increase likely with moderate confidence

COMMENTS: Nest parasitism by Cowbirds (*Molothrus ater*) may be significant. Also known as *Setophaga dominica*.

MAMMALS

County Occurrences of
Nycticeius humeralis



evening bat

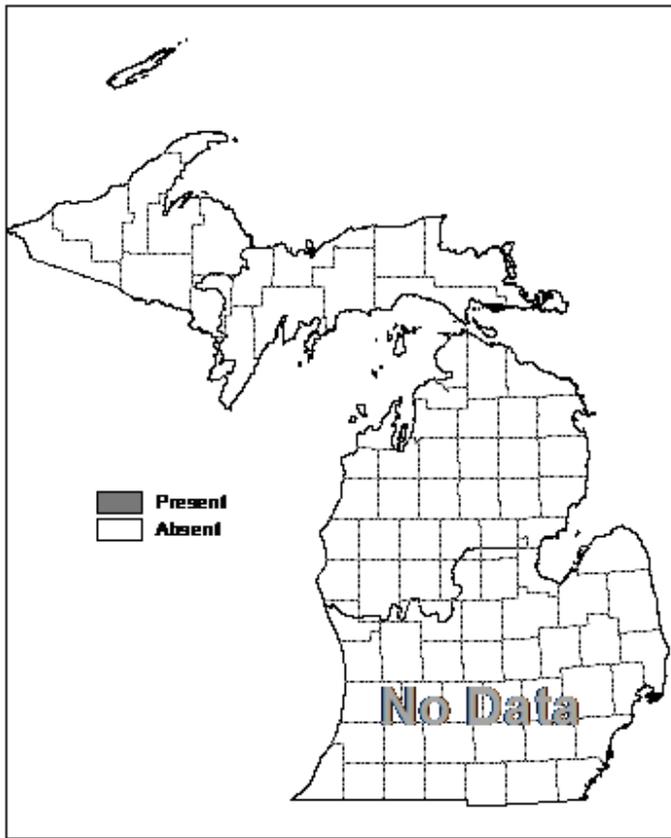
(*Nycticeius humeralis*)

DISTRIBUTION & ABUNDANCE: State listed as threatened. Michigan lies at the northern extent of the evening bat's range. This species is extremely rare within the State and may be found only in the Southern Lower Peninsula.

ASSOCIATED LANDSCAPE FEATURES: idle/old field; pasture; right-of-way; fence row; lowland hardwood; dry hardwood; mesic conifer; forest opening; pond; river/stream/riparian/floodplain corridor; edge; suburban/small town; snag/cavity

ASSOCIATED THREATS: conversion to agriculture lands; dredging & channelization; altered fire regime; incompatible natural resource mgmt; industrial/residential/recreational development; invasive plants & animals; lack of scientific knowledge; forestry practices; other biological interactions (declining in barns with the increase in big brown bats); pesticides & herbicides; removal of non-timber flora; social attitudes; climate vulnerability: moderately vulnerable with very high confidence

COMMENTS: There is a need to identify whether nesting or maternal conditions are contributing to recent population declines in this species. Their decline in barns may result from the corresponding increase in big brown bats. House cats (including feral cats) may pose a significant threat to this species.



little brown bat

(*Myotis lucifugus*)

DISTRIBUTION & ABUNDANCE: Although not currently listed, there is a recommendation to list the species as threatened in Michigan due to White-nose syndrome. The species is globally listed as vulnerable for the same reason. Abundance is unknown.

ASSOCIATED LANDSCAPE FEATURES: idle/old field; pasture; right-of-way; fence row; upland shrub; lowland hardwood; mesic hardwood; dry hardwood; forest opening; pond; river/stream/riparian/floodplain corridor; edge; suburban/small town; cave/mine; snag/cavity

ASSOCIATED THREATS: disease, pathogens & parasites; non-consumptive recreation; climate vulnerability: unknown

COMMENTS:

County Occurrences of
Alces americanus



moose

(*Alces americanus*)

DISTRIBUTION & ABUNDANCE: State listed as a species of special concern. The moose in Michigan is restricted to the Upper Peninsula and Isle Royale. Current population levels may be constrained by brainworm (*Parelaphostrongylus tenuis*) infestation as much as by habitat availability. There are an estimated 433 animals in the Western UP and likely less than 100 animals in the Eastern UP.

ASSOCIATED LANDSCAPE FEATURES: lowland shrub; lowland hardwood; lowland conifer; forest opening; inland emergent wetland; inland lake; river/stream/riparian/floodplain corridor; large contiguous natural landscape

ASSOCIATED THREATS: climate change; disease, pathogens, & parasites; fragmentation; incompatible natural resource mgmt; industrial/residential/recreational development; forestry practices; non-consumptive recreation; wetland modifications; climate vulnerability: highly vulnerable with very high confidence

COMMENTS: Moose are a game species in Michigan, but there is currently no open season designated. Need more research on the impacts and potential for control of brainworm. In logging areas, size of clearcuts does not seem to be important, however, the extent and configuration of the remaining forested areas does seem to be important (Potvin et al. 1999). This species will benefit from a better understanding of forest configuration needs and integrated wildlife-forest management efforts.



northern bat or northern myotis

(Myotis septentrionalis)

DISTRIBUTION & ABUNDANCE: Currently state listed as special concern an elevation to threatened is recommended due to the appearance of White-nose syndrome.

ASSOCIATED LANDSCAPE FEATURES: idle/old field; pasture; right-of-way; fence row; upland shrub; lowland hardwood; mesic hardwood; dry hardwood; lowland conifer; forest opening; submergent wetland; ephemeral wetland; pond; inland lake; river/stream/riparian/floodplain corridor; edge; suburban/small town; cave/mine; snag/cavity

ASSOCIATED THREATS: conversion to agriculture lands; incompatible natural resource mgmt; lack of scientific knowledge; forestry practices; mining practices; non-consumptive recreation; social attitudes; wetland modifications; climate vulnerability: presumed stable with very high confidence

COMMENTS: Because excessive logging and conversion of forest to plantations are significant threats, this species would benefit from integrated wildlife-forest planning efforts. Disturbance at hibernation sites can severely impact populations.



northern flying squirrel

(Glaucomys sabrinus)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Estimates of northern flying squirrel abundance range from present in favorable habitat to abundant. Populations are poorly documented due to the species secretive and nocturnal habits. Some evidence exists that the species' range is constricting northward.

ASSOCIATED LANDSCAPE FEATURES: lowland hardwood; mesic hardwood; dry hardwood; lowland conifer; mesic conifer; dry conifer; swamp; snag/cavity; down woody debris

ASSOCIATED THREATS: climate change; altered fire regime; fragmentation; incompatible natural resource mgmt; invasive plants & animals; forestry practices; climate vulnerability: moderately vulnerable with very high confidence.

COMMENTS: Northward expansion of southern flying squirrels (*Glaucomys volans*) may be causing increased competition for resources with this species. This species is susceptible to fragmentation due to weak dispersal ability. House cats (including feral cats) may pose a significant threat to this species.

County Occurrences of
Microtus ochrogaster



prairie vole

(*Microtus ochrogaster*)

DISTRIBUTION & ABUNDANCE: State listed as endangered in Michigan, the prairie vole is restricted to the southwestern corner of the Southern Lower Peninsula. Its populations are poorly documented, but abundance may be somewhat common in suitable habitat.

ASSOCIATED LANDSCAPE FEATURES: prairie; idle/old field; hayland; row crop; right-of-way; fence row; savanna; orchard; edge; other

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; grazing & mowing patterns; invasive plants & animals; pesticides & herbicides; climate vulnerability: presumed stable with very high confidence.

COMMENTS: House cats (including feral cats) may pose a significant threat to this species.

County Occurrences of
Sorex fumeus



smoky shrew

(*Sorex fumeus*)

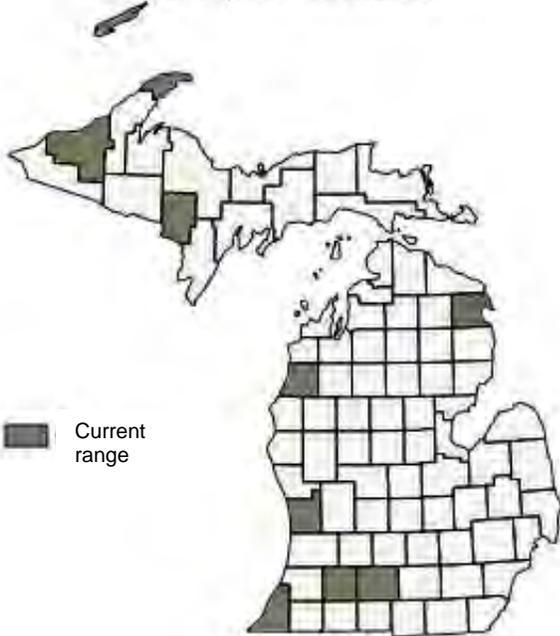
DISTRIBUTION & ABUNDANCE: Currently state listed as threatened, but recommended a down-list to special concern. Secure population found on Sugar Island and the species is doing well in other parts of its range.

ASSOCIATED LANDSCAPE FEATURES: idle/old field; lowland hardwood; mesic hardwood; dry hardwood; lowland conifer; mesic conifer; dry conifer; forest opening; bog; ephemeral wetland; swamp; river/stream/riparian/ floodplain corridor; inland rock/cliff/ledge; snag/cavity; down woody debris

ASSOCIATED THREATS: lack of scientific knowledge; climate vulnerability: highly vulnerable with very high confidence; unknown

COMMENTS: A threats assessment is needed for this species.

County Occurrences of
Perimyotis subflavus



tricolored bat

(Perimyotis subflavus)

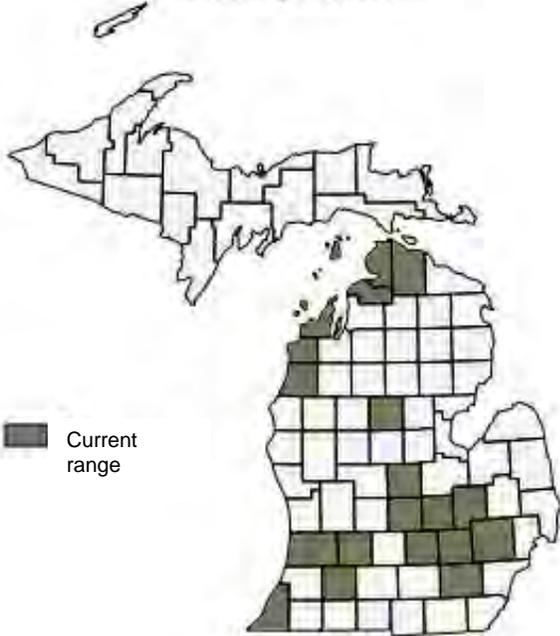
DISTRIBUTION & ABUNDANCE: Currently state designated as a special concern species, there is a recommendation to elevate their status to threatened due to white nose syndrome. The eastern pipistrelle is virtually unknown from Michigan with occurrences recorded only in the Western Upper Peninsula and rare instances in the Southern Lower Peninsula.

ASSOCIATED LANDSCAPE FEATURES: idle/old field; pasture; right-of-way; fence row; upland shrub; lowland hardwood; mesic hardwood; dry hardwood; forest opening; pond; river/stream/riparian/floodplain corridor; edge; suburban/small town; cave/mine; snag/cavity

ASSOCIATED THREATS: conversion to agriculture lands; altered fire regime; fragmentation; incompatible natural resource mgmt; industrial/residential/recreational development; lack of scientific knowledge; forestry practices; mining practices; non-consumptive recreation; pesticides & herbicides; removal of non-timber flora; social attitudes; urban, municipal, and industrial pollution; wetland modifications; climate vulnerability: presumed stable with very high confidence

COMMENTS: Mine exploration can disturb hibernation colonies and may significantly impact the population. This can be resolved by gating of mine openings.

County Occurrences of
Microtus pinetorum



woodland vole

(Microtus pinetorum)

DISTRIBUTION & ABUNDANCE: State listed as special concern. Distribution and abundance are not well known in Michigan.

ASSOCIATED LANDSCAPE FEATURES: right-of-way; fence row; savanna; orchard; lowland hardwood; mesic hardwood; dry hardwood; lowland conifer; mesic conifer; dry conifer; bog; inland emergent wetland; ephemeral wetland; swamp; river/stream/riparian/floodplain corridor; edge; inland rock/cliff/ledge; down woody debris

ASSOCIATED THREATS: fragmentation; invasive plants & animals; other biological interactions (increased predation from higher densities of coyote, raccoon, fox, opossum, crow)); social attitudes; climate vulnerability: presumed stable with very high confidence

COMMENTS: House cats (including feral cats) may pose a significant threat to this species. It may also be affected by increased predation from high densities of coyote, raccoon, fox and opossum. Use of poisons by humans may also pose a threat to woodland vole populations.

LITERATURE REFERENCED FOR SGCN SUMMARIES

A list of citations follows this table.

Taxonomic Group	References
Mussels	Arey 1932, Barnhart et al. 1998a, Barnhart et al. 1998b, Brady et al. 2004, Burch 1973, Clarke 1981, Clarke and Berg 1959, Coker et al. 1921, Cummings and Mayer 1992, Detroit Zoological Institute 2005, Fuller 1978, Goodrich 1932, Hill 1986, Hillegass and Hove 1997, Hove 1995, Hove 1997, Hove and Anderson 1997, Hove et al. 1994, Hove et al. 1995a, Hove et al. 1995b, Hove et al. 1997, Hove and Kurth 1998, Howard 1913, Howard 1914, Howard 1915, Howard and Anson 1922, Howard 1951, Lefevre and Curtis 1912, Matteson 1948, Matteson 1955, McGill et al. 2002, Mermilliod 1974, MNFI 2015, NAWQA 2005, O'Dee and Watters 2000, Oesch 1984, Riusech and Barnhart 1998, Steg and Neves 1997, Surber 1913, Teztloff 2001, Watters 1995a, Watters 1996, Watters and O'Dee 1997a, Watters and O'Dee 1997b, Watters et al. 1999, Weir 1977, Wilson 1916, Wilson and Ronald 1967, Yeager and Saylor 1995, Young 1911, Zale and Neves 1982a, Zale and Neves 1982b, Zale and Neves 1982c
Freshwater Snails	Baker 1919, Baker 1935, Burch and Tottenham 1980, Burch 1982, Burch and Jung 1992, Clarke 1981, MNFI 2015, Nekola 1998, van der Schalie and Dundee 1955, van der Schalie and Getz 1962a, van der Schalie and Getz 1962b, van der Schalie and Getz 1963
Land Snails	Burch and Jung 1988, Cohen et al. 2015, Kudell-Ekstrum 2003a, Kudell-Ekstrum 2003b, Kudell-Ekstrum 2003c, Kudell-Ekstrum 2003d, Kudell-Ekstrum 2003e, Lee 2001, Lee 2002, MNFI 2015, NatureServe 2013, Nekola 1998
Crayfish	NatureServe 2013, MNFI 2015
Insects: Mayflies	NAWQA 2005, Randolph and McCafferty 1998
Insects: Dragonflies and Damselflies	Brighman et al. 1982, Bright 2004, Hilton 1987, Langstaff 2002, Merritt and Cummins 1996, MNFI 2015, NAWQA 2005, NatureServe 2013, Needham and Westfall 1955, Nikula et al. 2001, Vogt and Cashatt 1994, Walker 1958, Walker and Corbet 1978, Williams and Feltmate 1992
Insects: Stoneflies	NAWQA 2005, Stark et al. 1998, Stewart and Stark 1988
Insects: Grasshoppers and Crickets	Albert 1999, Albert and Kost 1998, Anderson et al. 1989, Ballard Jr. 1991, Barimo and Young 2002, Bland 2003, Cohen et al. 2015, MNFI 2015, NatureServe 2013, Otte 1981, Otte 2002, Rabe et al. 1996, Rabe 1999, Sjogren 2001, Squitier and Capinera 2002, Vickery and Kevan 1985
Insects: Cicadas and Hoppers	Albert and Kost 1998, Bess and Hamilton 1999, Dunn et al. 2002, MNFI 2015, NatureServe 2013, Spieles et al. 1999, Summerville and Clampitt 1999, USFS 2004, Wilsman 1994
Insects: Beetles	Albert 1999, Bentzien 1985, Bess 2000, Creighton and Schnell 1998, Hilsenhoff and Schmude 1992, Larson and Roughley 1990, MNFI 2015, NAWQA 2005, NatureServe 2013, Opler 1985, Perry et al. 1974, Schmude 1992, USFS 2003, USFS 2005, Wallis 1961, Wilsman 1994, Young 1953
Insects: Caddisflies	NAWQA 2005, Wiggins 2000
Insects: Butterflies and Moths	Albert 1999, Albert and Kost 1998, Bess 1998, Cohen et al. 2015, Evers 1994, Ferguson 1971, Haack 1993, Hodges 1971, Kriegel and Nielsen 2000, Lee 2000, MNFI 2015, NatureServe 2013, New 1991, Nielsen 1999, Opler 1998, Opler et al. 1995, Parshall 2002, Poole 1995, Rabe 2001, Sargent 1976, Scott 1975, Schweitzer 1982, Schweitzer 1985, Shapiro 1974, Shapiro 1984, Shuey 1994, Shuey 1996, Shuey 1997, Smith 1999, Summerville and Crist 2004, USFWS 1997, USFWS 2003, Wagner et al. 1995, Wilsman 1994
Insects: Flies	NAWQA 2005, Data and information for these species was primarily limited to that provided through personal communications with species experts.
Insects: True Bugs	Blatchley 1926, McPherson and Packauskas 1986, Data and information for

MICHIGAN'S WILDLIFE ACTION PLAN 2015-2025
SGCN DISTRIBUTION, STATUS, HABITATS & THREATS

Taxonomic Group	References
	these species was primarily limited to that provided through personal communications with species experts.
Insects: Alderflies, Dobsonflies, and Fishflies	NAWQA 2005, Data and information for these species was primarily limited to that provided through personal communications with species experts (Appendix D).
Fish	Andersen 2002, Baldwin 1988, Bailey et al. 2004, Balon 1975, Becker 1983, Carlson 1997, Coon 1993, Evers 1994, Facey 1998, Goodchild 1993a, Goodchild 1994, Grandmaison et al. 2003, Hay-Chmielewski 1987, Hay-Chmielewski and Whelan 1997, Holm and Mandrak 1996, Holm and Mandrak 2001, Houston 1987, Houston 1988, Houston 1990, Jenkins and Burkhead 1993, Kott et al. 1979, Latta 1996, Latta 2003, Latta 2005, MacInnis 1998, Mandrak and Crossman 1996, Novinger and Coon 2000, O'Keefe 2002/2003?, Page and Burr 1991, Parker 1988b, Parker 1989a, Parker 1989b, Parker and McKee 1984a, Parker and McKee 1984b, Parker and McKee 1984c, Parker and McKee 1984d, Parker and McKee 1987, Parker et al. 1987a, Parker et al. 1987b, Parker et al. 1988, Pfeleiger 1975, Scott and Crossman 1973, Simon 1993, Slack et al. 1997, Smith 1985, Smith 1979, Tompkins 1987, Trautman 1981, Wallus and Buchanan 1989
Amphibians	Donovan et al. 2004, Evers 1994, Harding 2000, Kingsbury and Gibson 2002, Minton 1972, Minton 1973, MNFI 2005, Petranka 1998, Phillips et al. 1999, Plingsten and Downs 1989, Smith 1961, University of Michigan 2005
Reptiles	Donovan et al. 2004, Ernst et al. 1994, Evers 1994, Harding 2000, Johnson et al. 2000, Minton 1972, MNFI 2015, Phillips et al. 1999, Smith 1961, University of Michigan 2005
Birds	Ammann 1957, Barrows 1912, Brewer et al. 1991, Donovan et al. 2004, Hands et al. 1989a, Hands et al. 1989b, Hands et al. 1989c, Hands et al. 1989d, Hands et al. 1989f, Hands et al. 1989g, Hands et al. 1989h, Hands et al. 1989i, KNC et al. 2000, Maples and Soulliere 1996, MNFI 2015, NatureServe 2013, Potter et al. 2007a, Potter et al. 2007 b, Schroeder 1982, Shuford 1999, Soulliere et al. 2007a, Soulliere et al. 2007b, UMRGLR JV, 2007, Wood 1951
Mammals	Baker 1983, BCI 2001, Carey 2000, Carey et al. 1999, D'Eon et al. 2002, De Bellefueuille et al. 2001, Doepker et al. 2001, Donovan et al. 2004, Feldhamer et al. 2003, Fenton 2003, Foster and Kurta 1999, Francl et al. 2004, Hadley and Wilson 2004, Johnston et al. 2003, Jung et al. 1999, Klenner and Sullivan 2003, Kurta 1995, Martell and Radvanyi 1977, Marzulff et al. 2002, McCay et al. 2004, Mech and Hallett 2001, MNFI 2015, Myers 2004, NatureServe 2013, Owen et al. 2003, Potvin et al. 1999, Racey and Euler 1982, Snaith et al. 2002, Tibbels and Kurta 2003, Unger and Kurta 1998, USFWS 1999, Whitaker and Gummer 2003

Citations

- Albert, D.A. 1999. Natural community abstract for open dunes. Michigan Natural Features Inventory. Lansing, Michigan 5 pp.
- Albert, D.A. and M.A. Kost. 1998. Natural community abstract for lakeplain wet prairie. Michigan Natural Features Inventory, Lansing, Michigan 4 pp.
- Ammann, G.A. 1957. The Prairie Grouse of Michigan. Michigan Department of Conservation, Game Division. Lansing, MI 200 pp.
- Andersen, J.J. 2002. Status of redbside dace, *Clintostomus elongatus*, in the Lynde and Pringle creek watersheds of Lake Ontario. Canadian Field-Naturalist 116(1): 76-80.
- Anderson, R.C., T. Leahy and S.S. Dhillon. 1989. Numbers and biomass of selected insect groups on burned and unburned sand prairie. The American Midland Naturalist 112 (1): 151-162.
- Arey, L.B. 1932. The formation and structure of the glochidial cyst. Biological Bulletin (Woods Hole) 62(2):212-221.

MICHIGAN'S WILDLIFE ACTION PLAN 2015-2025
SGCN DISTRIBUTION, STATUS, HABITATS & THREATS

- Bailey, R.M., W.C. Latta, and G.R. Smith. 2004. An atlas of Michigan fishes with keys and illustrations for their identification. Miscellaneous Publications, Museum of Zoology, University of Michigan, No. 192. Ann Arbor, Michigan.
- Baker, F.C. 1919. The ecology of North American Lymnaeidae. *Science*, New Series 49(1274): 519-521.
- Baker, F.C. 1935. Land and freshwater Mollusca from North Star Lake and vicinity, Itasca county, Minnesota. *The American Midland Naturalist* 16(3): 257-274.
- Baker, R.H. 1983. Michigan Mammals. Michigan State University Press, Lansing, MI.
- Baldwin, M.E. 1988. Updated status of the silver shiner, *Notropis photogenis*, in Canada. *Canadian Field-Naturalist* 102(1): 147-157.
- Ballard Jr., H.E. 1991. First report of *Allonemobius Griseue* and *Psindia Fenestralis* in Ohio (Orthoptera: Gryllidae and Acrididae). *The Great Lakes Entomologist* 24(3): 181-182.
- Balon, E.K. 1975. Reproductive guilds of fishes: A proposal and definition. *Journal of the Fisheries Research Board of Canada* 32: 821-864.
- Barimo, J.F. and D.R. Young. 2002. Grasshopper (Orthoptera: Acrididae)–plant-environmental interactions in relation to zonation on an Atlantic Coast barrier island. *Environmental Entomology* 31(6): 1158-1167.
- Barnhart, C., F. Riusech and M. Baird. 1998a. Hosts of salamander mussel (*Simpsonaias ambigua*) and snuffbox (*Epioblasma triquetra*) from the Meramec River system, Missouri. *Triannual Unionid Report* (16): 34.
- Barnhart, C., F. Riusech and M. Baird. 1998b. Drum is host of the scaleshell, *Leptodea leptodon*. *Triannual Unionid Report* (16): 35.
- Barrows, W.B. 1912. Michigan Bird Life. Agricultural College Special Bulletin. East Lansing, Michigan 822 pp.
- (BCI) Bat Conservation International. 2001. Bats in eastern woodlands. Bat Conservation International. 307 pp.
- Becker, G.C. 1983. Fishes of Wisconsin. The University of Wisconsin Press, Madison, Wisconsin. 1053 pp.
- Bentzien, M.M. 1985. Threatened: sugar maple longhorn beetle *Dryobius sexnotatus* Linsley. Special Publication Carnegie Museum of Natural History 11: 89-91.
- Bess, J. 1998. A report on surveys for the golden borer moth (*Papaipema cerina* Grote) along the ANR Pipeline Company proposed supply link, Berrien County, Michigan. OTIS Enterprises. Wanatah, Indiana 15 pp.
- Bess, J. 2000. The imperiled insect fauna of Kentucky. *The Nature Conservancy: Kentucky News*.
- Bess, J.A. and K.G.A. Hamilton. 1999. A New Flexamia (Homoptera: Cicadellidae: Deltocephalinae). *The Great Lakes Entomologist* 32(1/2): 9-14.
- Bland, R.G. 2003. The orthoptera of Michigan – biology, keys, and descriptions of grasshoppers, katydids, and crickets. Michigan State University Extension, Extension bulletin E-2815, East Lansing, Michigan 220 pp.
- Blatchley, W.S. 1926. Heteroptera or true bugs of eastern North America with especial reference to the faunas of Indiana and Florida. Nature Publishing Company, Indianapolis, Indiana 1116 p.
- Brady, T., M. Hove, C. Nelson, R. Gordon, D. Hornbach and A. Kapuscinski. 2004. Suitable host fish determined for hickorynut and pink heelsplitter. *Ellipsaria* 6(1): 14-15.
- Brewer, R., G.A. McPeck, and R.J. Adams, Jr, eds. 1991. The atlas of breeding birds of Michigan. Michigan State University Press. East Lansing, Michigan 594 pp.
- Brighman, A.R., W.U. Brigham, and A. Gnilka, eds. 1982. Aquatic insects and oligochaetes of North and South Carolina. Midwest Aquatic Enterprises, Mahomet, Illinois 837 pp.
- Bright, E. 2004. Aquatic Insect of Michigan. Museum of Zoology Insect Division University of Michigan. Web site: <http://insects.ummz.lsa.umich.edu/~ethanbr/aim/index.html>
- Burch, J.B and J.L. Tottenham. 1980. North American freshwater snails: species list, ranges and illustrations. *Walkerana* 1(3): 215.

MICHIGAN'S WILDLIFE ACTION PLAN 2015-2025
SGCN DISTRIBUTION, STATUS, HABITATS & THREATS

- Burch, J.B. 1973. Freshwater Unionacean clams (Mollusca: Pelecypoda) of North America. Identification Manual No. 11, Project #18050ELD, for the Environmental Protection Agency.
- Burch, J.B. 1982. Freshwater snails (Mollusca: Gastropoda) of North America. EPA-600/3-82-026, 294 pp.
- Burch, J.B. and Y. Jung. 1992. Freshwater snails of The University of Michigan Biological Station Area. *Walkerana* 6(15): 1-218.
- Burch, J.G. and Y. Jung. 1988. Land snails of The University of Michigan Biological Station area. *Walkerana* 3(9):1-177.
- Carey, A.B., J. Kershner, B. Biswell and L. Dominguez-De-Toledo. 1999. Ecological scale and forest development: squirrels, dietary fungi, and vascular plants in managed and unmanaged forests. *Wildlife Monographs* 142: 1-71.
- Carey, A.G. 2000. Effects of new forest management strategies on squirrel populations. *Ecological Applications* 10(1): 248-257.
- Carlson, D.M. 1997. Status of the pugnose and blackchin shiners in the St. Lawrence River in New York, 1993-95. *Journal of Freshwater Ecology* 12(1): 131-139.
- Clarke, A.H. 1981. The freshwater mollusks of Canada. National Museum of Natural Sciences, National Museums of Canada. Ottawa, Ontario, Canada 446 pp.
- Clarke, A.H. and C.O. Berg. 1959. The freshwater mussels of central New York. Memoir Cornell University Agricultural Experiment Station, N.Y. State College of Agriculture, Ithaca, New York. 367:1-79.
- Cohen, J.G., M.A. Kost, B.S. Slaughter and D.A. Albert. 2015. A field guide to the natural communities of Michigan. Michigan State University Press, East Lansing, Michigan.
- Coker, R.E., A.F. Shira, H.W. Clark and A.D. Howard. 1921. Natural history and propagation of fresh-water mussels. *Bulletin of the Bureau of Fisheries*. [Issued separately as U.S. Bureau of Fisheries Document 893]. 37(1919-20):77-181 + 17 plates.
- Coon, T.G. 1993. Projected impact of wastewater discharge on redbside dace, *Clinostomus elongatus*, in Seeley Drain, Michigan. Michigan State University, unpublished report, East Lansing, Michigan 34pp.
- Cummings, K.S. and C.A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. Champaign, Illinois 194 pp.
- Cuthrell, D.L. 1999a. Special animal abstract for *Papaipema sciata* (Culver's root borer). Michigan Natural Features Inventory. Lansing, Michigan 3 pp.
- Cuthrell, D.L. 1999b. Special animal abstract for *Euxoa aurulenta* (dune cutworm). Michigan Natural Features Inventory. Lansing, Michigan 2 pp.
- Cuthrell, D.L. 1999c. Special animal abstract for *Papaipema beeriana* (blazing star borer). Michigan Natural Features Inventory. Lansing, Michigan 3 pp.
- Cuthrell, D.L. 1999d. Special Animal Abstract for *Prosapia ignipectus* (Red-legged Spittlebug). Michigan Natural Features Inventory. Lansing, Michigan 3pp.
- Cuthrell, D.L. 2000. Special animal abstract for *Papaipema silphii* (silphium borer moth). Michigan Natural Features Inventory. Lansing, MI 3 pp.
- Cuthrell, D.L. 2001a. Special animal abstract for *Hesperia ottoe* (ottoe skipper). Michigan Natural Features Inventory. Lansing, Michigan 3 pp.
- Cuthrell, D.L. 2001b. Special animal abstract for *Lycaeides idas nabokovi* (northern blue butterfly). Michigan Natural Features Inventory. Lansing, Michigan 2 pp.
- D'Eon, R.G., S.M. Glen, I. Parfitt and M.J. Fortin. 2002. Landscape connectivity as a function of scale and organism vagility in a real forested landscape. *Conservation Ecology* 6(2): 10. URL: <http://www.consecol.org/vol6/iss2/art10/>
- Dalton, K.W. 1990b. Status of the river darter, *Percina shumardi*, in Canada. *Canadian Field-Naturalist* 104(1): 59-63.
- DePhilip, Michele. 2001. Aquatic ecoregional planning in the U.S. portion of the Great Lakes watershed. The Nature Conservancy, Great Lakes Program. Chicago, Illinois.

MICHIGAN'S WILDLIFE ACTION PLAN 2015-2025
SGCN DISTRIBUTION, STATUS, HABITATS & THREATS

- Detroit Zoological Institute, Belle Isle Aquarium. Accessed: 2005. Mussel Database. Detroit, Michigan.
- (DNR) Michigan Department of Natural Resources. Accessed 2005. Fisheries Division Boundaries. Lansing, Michigan.
- Doepker, R.V., L.E. Thomasma and S.A. Thomasma. 2001. MIWildHab – Michigan Wildlife Habitats [Computer Program]. MDNR, Wildlife Division, Lansing, Michigan and Two by Two Wildlife Consulting, Grand Rapids, Michigan
- Donovan, M.L., G.M. Nesslage, J.J. Skillen, and B.A. Maurer. 2004. The Michigan Gap Analysis Project final report. Wildlife Division, Michigan Department of Natural Resources, Lansing, MI.
- Dunn, J.P., C.J. Summerfield and M. Johnson. 2002. Distribution, seasonal cycle, host-plant records, and habitat evaluation of a Michigan threatened insect: the great plains spittlebug, *Lepyronia Gibbosa* (Homoptera: Cercopidae). *The Great Lakes Entomologist* 35 (2): 121-129.
- Ernst, C.H., J.E. Lovich and R.W. Barbour. 1994. *Turtles of the United States and Canada*. Smithsonian Institution Press, Washington, D.C. 578pp.
- Evers, D.C. 1994. *Endangered and threatened wildlife of Michigan*. The University of Michigan Press, Ann Arbor, Michigan 412pp.
- Facey, D.E. 1998. The status of the eastern sand darter, *Ammocrypta pellucida*, in Vermont. *Canadian Field-Naturalist* 112(4): 596-601.
- Feldhamer, G.A., T.C. Carter, A.T. Morzillo and E.H. Nicholson. 2003. Use of bridges as day roosts by bats in southern Illinois. *Transactions of the Illinois State Academy of Science* 96(2): 107-112.
- Fenton, M.B. 2003. Science and the conservation of bats: where to next? *Wildlife Society Bulletin* 31(1): 6-15.
- Ferguson, D.C. 1971. *The Moths of America North of Mexico*. Fas. 20.2A. Bombycoidea: Saturniidae (Part). E.W. Classey Ltd. and R.B.D. Publ., Inc. London. 153pp.
- Foster, R.W. and A. Kurta. 1999. Roosting ecology of the northern bat (*Myotis septentrionalis*) and comparisons with the endangered Indiana bat (*Myotis sodalis*). *Journal of Mammalogy* 80(2): 659-672.
- Francl, K.E., S.B. Castleberry and W.M. Ford. 2004. Small mammal communities of high elevation central Appalachian wetlands. *American Midland Naturalist* 151(2): 388-398.
- Fuller, S.L.H. 1978. Fresh-water mussels (Mollusca: Bivalvia: Unionidae) of the Upper Mississippi River: observations at selected sites within the 9-foot channel navigation project on behalf of the U.S. Army Corps of Engineers. Final Report 78-33. Academy of Natural Sciences. Philadelphia, Pennsylvania 401 pp.
- Goodchild, C.D. 1993a. Status of the northern madtom, *Noturus stigmosus*, in Canada. *Canadian Field-Naturalist* 107(4): 417-422.
- Goodchild, C.D. 1994. Status of the channel darter, *Percina copelandi*, in Canada. *Canadian Field-Naturalist* 107(4): 431-439.
- Goodrich, C. 1932. *The mollusca of Michigan*. Michigan Handbook Series No. 5, The University of Michigan Press. Ann Arbor, Michigan 120pp + 7 plates.
- Grandmaison, D., J. Mavasich and D. Etnier. 2003. Eastern sand darter status assessment (first draft). Report to US Fish and Wildlife Service, NRRI Technical Report No. NRRI/TR-2003/40, 34pp.
- Haack, R.A. 1993. Doll's Merolonche: *Merolonche dolli* Barnes and McDunnough. USDA Forest Service, North Central Forest Experiment Station, East Lansing, Michigan 2 pp.
- Hadley, G.L. and K.R. Wilson. 2004. Patterns of density and survival in small mammals in ski runs and adjacent forest patches. *Journal of Wildlife Management* 68(2): 288-298.
- Hands, H.M., R.D. Drobney and M.R. Ryan. 1989a, Status of the least bittern in the northcentral United States. U.S. Fish and Wildlife Service. Twin Cities, Minnesota. 13 pp.
- Hands, H.M., R.D. Drobney and M.R. Ryan. 1989b, Status of the American bittern in the northcentral United States. U.S. Fish and Wildlife Service. Twin Cities, Minnesota. 13 pp.

MICHIGAN'S WILDLIFE ACTION PLAN 2015-2025
SGCN DISTRIBUTION, STATUS, HABITATS & THREATS

- Hands, H.M., R.D. Drobney and M.R. Ryan. 1989c, Status of the Henslow's sparrow in the northcentral United States. U.S. Fish and Wildlife Service. Twin Cities, Minnesota. 12 pp.
- Hands, H.M., R.D. Drobney and M.R. Ryan. 1989d, Status of the black tern in the northcentral United States. U.S. Fish and Wildlife Service. Twin Cities, Minnesota. 15 pp.
- Hands, H.M., R.D. Drobney and M.R. Ryan. 1989f, Status of the common barn-owl in the northcentral United States. U.S. Fish and Wildlife Service. Twin Cities, Minnesota. 19 pp.
- Hands, H.M., R.D. Drobney and M.R. Ryan. 1989g, Status of the loggerhead shrike in the northcentral United States. U.S. Fish and Wildlife Service. Twin Cities, Minnesota. 15 pp.
- Hands, H.M., R.D. Drobney and M.R. Ryan. 1989h, Status of the common loon in the northcentral United States. U.S. Fish and Wildlife Service. Twin Cities, Minnesota. 26 pp.
- Hands, H.M., R.D. Drobney and M.R. Ryan. 1989i, Status of the red-shouldered hawk in the Northcentral United States. U.S. Fish and Wildlife Service. Twin Cities, Minnesota. 21 pp.
- Harding, J.H. 2000. Amphibians and reptiles of the Great Lakes region. The University of Michigan Press. Ann Arbor, Michigan 378 pp.
- Hay-Chmielewski, E.M. 1987. Habitat preferences and movement patterns of the lake sturgeon (*Acipenser fulvescens*) in Black Lake Michigan. Michigan Department of Natural Resources, Fisheries Research Report 1949. Ann Arbor, Michigan 39 pp.
- Hay-Chmielewski, E.M. and G.E. Whelan. 1997. Lake sturgeon rehabilitation strategy. Michigan Department of Natural Resources, Fisheries Division Special Report No. 18. 51 pp.
- Hill, D.M. 1986. Cumberlandian Mollusks Conservation Program, activity 3: identification of fish hosts. Office of Natural Resources and Economic Development, Tennessee Valley Authority, Knoxville, Tennessee 57 pp.
- Hillegass, K.R. and M.C. Hove. 1997. Suitable fish hosts for glochidia of three freshwater mussels: strange floater, ellipse, and snuffbox. Triannual Unionid Report (13): 25.
- Hilsenhoff, W.L. and K.L. Schmude. 1992. Riffle beetles of Wisconsin (Coleoptera: Dryopidae, Elmidae, Lutrochidae, Psephenidae) with notes on distribution, habitat and identification. The Great Lakes Entomologist 25(3): 191-213.
- Hilton, D. 1987. Odonata of peatlands and marshes in Canada, pp. 57-63 in Rosenberg, D.M. and H.V. Danks, eds. Aquatic insects of peatlands and marshes in Canada, Mem., Ent. Soc. Canada, No. 140.
- Hodges, R.W. 1971. The moths of America north of Mexico, including Greenland. Fascicle 21 Sphingoidea. E.W. Classey Limited and R.B.D. Publications Inc. London 158 pp.
- Holm. E. and N.E. Mandrak. 1996. The status of the eastern sand darter, *Ammocrypta pellucida*, in Canada. Canadian Field-Naturalist 110(3): 462-469.
- Holm. E. and N.E. Mandrak. 2001. Updated status of the northern madtom, *Noturus stigmosus*, in Canada. Canadian Field-Naturalist 115(1): 138-144.
- Houston, J.J. 1987. Status of the lake sturgeon, *Acipenser fulvescens*, in Canada. Canadian Field-Naturalist 101(2): 171-185.
- Houston, J.J. 1988. Status of the shortjaw cisco, *Coregonus zenithicus*, in Canada. Canadian Field-Naturalist 102(1): 97-102.
- Houston, J.J. 1990. Status of the spoonhead sculpin, *Cottus ricei*, in Canada. Canadian Field-Naturalist 104(1): 14-19.
- Hove, M. 1997. Ictalurids serve as suitable hosts for the purple wartyback. Triannual Unionid Report (11):4.
- Hove, M.C. and J.E. Kurth. 1998. Darters, sculpins, and sticklebacks serve as suitable hosts for *Venustaconcha ellipsiformis* glochidia. Triannual Unionid Report (14): 8.
- Hove, M.C. 1995. Suitable fish hosts of the lilliput, *Toxolasma parvus*. Triannual Unionid Report (8):9.
- Hove, M.C. and T.W. Anderson. 1997. Mantle-waving behavior and suitable fish hosts of the ellipse. Triannual Unionid Report (11):3.

MICHIGAN'S WILDLIFE ACTION PLAN 2015-2025
SGCN DISTRIBUTION, STATUS, HABITATS & THREATS

- Hove, M. C., R. A. Engelking, M. E. Peteler, E. M. Peterson, A. R. Kapuscinski, L. A. Sovell and E. R. Evers. 1997. Suitable fish hosts for glochidia of four freshwater mussels. p. 21-25 in K. S. Cummings, A. C. Buchanan, C. A. Mayer and T. J. Naimo, eds. Conservation and Management of Freshwater Mussels II: Initiatives for the Future. Proceedings of a UMRCC symposium, 16-18 October 1995, St. Louis, Missouri. Upper Mississippi River Conservation Committee, Rock Island, Illinois.
- Hove, M.C., R.A. Engelking, E. Evers, M.E. Peteler and E.M. Peterson. 1994. *Cyclonaias tuberculata* host suitability tests. Triannual Unionid Report (5): 9.
- Hove, M.C., R.A. Engelking, E.M. Long, M.E. Peteler and E.M. Peterson. 1995a. *Anodontoides ferussacianus* and *Anodonta imbecillis* host suitability tests. Triannual Unionid Report (6): 22.
- Hove, M.C., R.A. Engelking, E.M. Long, M.E. Peteler and E.M. Peterson. 1995b. Life history research on the creek heelsplitter, *Lasmigona compressa*. Triannual Unionid Report (6): 21.
- Howard, A.D. 1913. The catfish as a host for fresh-water mussels. Transactions of the American Fisheries Society 42: 65-70.
- Howard, A.D. 1914. Experiments in propagation of fresh-water mussels of the *Quadrula* group. Report of the U.S. Commissioner of Fisheries for 1913. Appendix 4:1-52 + 6 plates. [Issued separately as U.S. Bureau of Fisheries Document No. 801].
- Howard, A.D. 1915. Some exceptional cases of breeding among the Unionidae. Nautilus 29(1): 4-11.
- Howard, A.D. 1951. A river mussel parasitic on a salamander. Natural History Miscellanea 77: 1-6.
- Howard, A.D. and B.J. Anson. 1922. Phases in the parasitism of the Unionidae. Journal of Parasitology 9(2): 68-82 + 2 plates.
- Jenkins, R.E. and N.M. Burkhead. 1993. Freshwater fishes of Virginia. American Fisheries Society, Bethesda, Maryland 1079 pp.
- Johnson, G., B. Kingsbury, R. King, C. Parent, R. Seigel and J. Szymanski. 2000. The eastern massasauga rattlesnake: a handbook for land managers. U.S. Fish and Wildlife Service, Fort Snelling, MN 52 pp. + appdx.
- Johnson, G.D., W.P. Strickland, M.F. Shepherd, D.A. Shepherd and S.A. Sarappo. 2003. Mortality of bats at a large-scale wind power development at Buffalo Ridge, Minnesota. American Midland Naturalist 150(2): 332-342.
- Jung, T.S., I.D. Thompson, R.D. Titman and A.P. Applejohn. 1999. Habitat selection by forest bats in relation to mixed-wood stand types and structure in central Ontario. Journal of Wildlife Management 63(4): 1306-1319.
- Kingsbury B. and J. Gibson. 2002. Habitat management guidelines for amphibians and reptiles of the Midwest. Partners in Amphibian and Reptile Conservation Technical Publication HMG-1, 1st Edition. 57 pp.
- Klenner, W. and T.P. Sullivan. 2003. Partial and Clear-cut Harvesting of High-Elevation Spruce-Fir Forests: Implications for Small Mammal communities. Canadian Journal of Forest Research. v. 33 p.2283-2296
- (KNC, DNR & MNFI) Kalamazoo Nature Center, Michigan Department of Natural Resources, Michigan Natural Features Inventory. 2000. The 1991 Michigan Atlas of Breeding Birds Spatial Database. Michigan Department of Natural Resources, Wildlife Division. Lansing, Michigan. Vector digital data.
- Kott, E., R.E. Jenkins, and G. Humphreys. 1979. Recent collections of the black redhorse, *Moxostoma duquesnei*, from Ontario. Canadian Field-Naturalist 93(1): 63-66.
- Kriegel, R.D. and M. C. Nielsen. 2000. A Survey of *Boloria freija* and *B. frigga* in Northern Michigan Sphagnum Heath Bogs. Unpublished Michigan Lepidoptera Survey prepared for Michigan Nongame Wildlife Fund.
- Kudell-Ekstrum, J. 2003a. Conservation assessment for (*Euconulus alderi*). USDA Forest Service, Eastern Region. Escanaba, Michigan 11 pp.
- Kudell-Ekstrum, J. 2003b. Conservation assessment for six-whorled vertigo (*Vertigo morsei*). USDA Forest Service, Eastern Region. Escanaba, Michigan 11 pp.
- Kudell-Ekstrum, J. 2003c. Conservation assessment for delicate vertigo (*Vertigo bollesiana*) (E.S. Morse, 1865). USDA Forest Service, Eastern Region. Escanaba, Michigan 11 pp.

MICHIGAN'S WILDLIFE ACTION PLAN 2015-2025
SGCN DISTRIBUTION, STATUS, HABITATS & THREATS

- Kudell-Ekstrum, J. 2003d. Conservation assessment for mystery vertigo (*Vertigo paradoxa*). USDA Forest Service, Eastern Region. Escanaba, Michigan 12 pp.
- Kudell-Ekstrum, J. 2003e. Conservation assessment for *Catinella exile*. USDA Forest Service, Eastern Region. Escanaba, Michigan 10 pp.
- Kurta, A. 1995. Mammals of the Great Lakes region. The University of Michigan Press. Ann Arbor, Michigan xii + 376pp.
- Langstaff, L.L. 2002. Species at risk: the Hine's emerald dragonfly. *Endangered Species Update* 19(6): 241-247.
- Larson, D.J. and R.E. Roughley. 1990. A review of the species *Liodessus Guignot* of North America north of Mexico with the description of a new species (Coleoptera: Dytiscidae). *Journal of the New York Entomological Society* 98(2): 233-245.
- Latta, W.C. 1996. Status of some of the endangered, threatened, special-concern and rare fishes of Michigan in 1996. Report to the Natural Heritage Program, Michigan Department of Natural Resources 54 pp.
- Latta, W.C. 2003. Distribution and abundance of Michigan fishes collected 1993-2001. Report to the Natural Heritage Program, Michigan Department of Natural Resources 158 pp.
- Lee, Y. 2000. Special animal abstract for *Neonympha mitchellii mitchellii* (Mitchell's satyr butterfly). Michigan Natural Features Inventory. Lansing, Michigan 4 pp.
- Lee, Y. 2001. Special animal abstract for *Hendersonia occulta* (cherrystone drop). Michigan Natural Features Inventory. Lansing, Michigan 4 pp.
- Lee, Y. M. 2002. Special animal abstract for *Appalachina sayanus* (spike-lipped crater). Michigan Natural Features Inventory. Lansing, Michigan 4 pp.
- Lefevre, G. and W.C. Curtis. 1912. Studies on the reproduction and artificial propagation of fresh-water mussels. *Bulletin of the Bureau of Fisheries*. 30(1910):105-201 + 12 plates. [Issued separately as U.S. Bureau of Fisheries Document 756. Reprinted in *Sterkiana* 47, 48 (1972); 49,51 (1973); 57 (1975); and 61, 63, 64 (1976)].
- MacInnis, A.J. 1998. Reproductive biology of the northern madtom, *Noturus stigmosus* (Actinopterygii: Ictaluridae) in Lake St. Clair, Ontario. *Canadian Field-Naturalist* 112(2): 245-249.
- Maples, T.E. and G.J. Soulliere. 1996. Status of Michigan Sharp-tailed Grouse in the 1990's. Wildlife Division Report Number 3256. Michigan Department of Natural Resources. Lansing, Michigan 37 pp.
- Martell, A.M. and A. Radvanyi. 1977. Changes in small mammal populations after clear cutting of a northern Ontario black spruce forest. *Canadian Field-Naturalist* 91(1): 41-46.
- Marzullf, J.M., J.J. Millspaugh, K.R. Ceder, C.D. Oliver, J. Withey, J.B. McCarter, C.L. Mason and J. Conmnick. 2002. Modeling changes in wildlife habitat and timber revenues in response to forest management. *Forest Science* 48(2): 191-202.
- Matteson, M.R. 1948. Life history of *Elliptio complanatus* (Dillwyn, 1817). *American Midland Naturalist* 40(3): 690-723.
- Matteson, M.R. 1955. Studies on the natural history of the Unionidae. *American Midland Naturalist* 53(1): 126-145.
- McCay, T.S., M.J. Lovallo, W.M. Ford and M.A. Menzel. 2004. Assembly rules for functional groups of North American shrews: effects of geographic range and habitat partitioning. *Oikos* 107(1): 141-147.
- McGill, M., M. Hove, T. Diedrich, C. Nelson, W. Taylor and A. Kapuscinski. 2002. Several fishes are suitable hosts for creek heelspiltter glochidia. *Ellipsaria* 4(2): 18-19.
- Mech, S.G. and J.G. Hallett. 2001. Evaluating the effectiveness of corridors: a genetic approach. *Conservation Biology* 15(2): 467-474.
- Mermilliod, W. 1974. An investigation for the natural host of the glochidia of *Toxolasma parva*. Undergraduate Research Paper, Louisiana State University. Baton Rouge, Louisiana.
- Merritt, R.W. and K.W. Cummins. 1996. An introduction to the aquatic insects of North America, third edition. Kendall/Hunt Publishing Company. Dubuque, Iowa, 862 pp.

MICHIGAN'S WILDLIFE ACTION PLAN 2015-2025
SGCN DISTRIBUTION, STATUS, HABITATS & THREATS

- Minton, S.A., Jr. 1972. Amphibians and reptiles of Indiana. The Indiana Academy of Science. Indianapolis, Indiana 346 pp.
- (MNFI) Michigan Natural Features Inventory. 1990. [Draft] Leadplant flower moth *Schinia lucens* (Morrison). Lansing, Michigan 3 pp.
- (MNFI) Michigan Natural Features Inventory. 2015. Statewide Biotics 4 Database. Lansing, Michigan.
- (NAWQA) National Water Quality Assessment Program, 2005 April 14. Accessed: 2005. U.S. Department of the Interior Geological Survey. URL: <http://water.usgs.gov/nawqa/>
- NatureServe. 2004. NatureServe Explorer: an online encyclopedia of life [web application]. Version 4.0. NatureServe, Arlington, Virginia. URL <http://www.natureserve.org/explorer>. (Accessed: September 2004).
- Needham, J.G. and M.J. Westfall, Jr. 1955. A manual of the dragonflies of North America (Anisoptera): including the greater Antilles and the provinces of the Mexican border. University of California Press. Berkeley, California 615 pp.
- Nekola, J.C. 1998. Terrestrial gastropod inventory of the Niagaran Escarpment and Keweenaw Volcanic Belt in Michigan's Upper Peninsula. Final Report to the Michigan Department of Natural Resources, Natural Heritage Program. Lansing, Michigan 133 pp.
- New, T.R. 1991. Butterfly conservation. Oxford University Press. Melbourne, Australia. 224 pp.
- Nielsen, M.C. 1999. Michigan butterflies and skippers: a field guide and reference. Michigan State University Extension Bulletin E-2675. 248 pp.
- Nikula, B.J., J.L. Sones and J.R. Trimble. 2001. New and notable records of Odonata from Massachusetts. Northeastern Naturalist 8(3): 337-342.
- Novinger, D.C. and T.G. Coon. 2000. Behavior and physiology of the redbreast dace, *Clinostomus elongatus*, a threatened species in Michigan. Environmental Biology of Fishes 57: 315-326.
- O'Keefe, D.M. 2002/2003?. Range expansion of the river redhorse (*Moxostoma carinatum*) in Michigan. Report to the Natural Heritage Program, Michigan Department of Natural Resources 18pp.
- O'Dee, S.H. and G.T. Watters. 2000. New or confirmed host identifications for ten freshwater mussels. Pp. 77-82 in Tankersley, R.A., D.I. Warmoltz, G.T. Watters, B.J. Armitage, P.D. Johnson and R.S. Butler, eds. Proceedings of the Conservation, Captive Care, and Propagation of Freshwater Mussels Symposium. Ohio Biological Survey. Columbus, Ohio.
- Oesch, R.D. 1984. Missouri naiads: a guide to the mussels of Missouri. Missouri Department of Conservation 271 pp.
- Opler, P.A., ed. 1985. Invertebrates. Pages 81-165 in H.H. Genoways and F.J. Brenner, eds. Species of Special Concern in Pennsylvania. Carnegie Museum Natural History Special Publication No. 11, vi + 430 pp.
- Opler, P.A. 1998. The Peterson field guides series, a field guide to eastern butterflies. Houghton Mifflin Company, Boston, Massachusetts 128 pp.
- Opler, P.A., H. Pavulaan and R.E. Stanford (coordinators). 1995. Butterflies of North America. Northern Prairie Wildlife Research Center. URL: <http://www.npwrc.usgs.gov/resource/distr/lepid/bflyusa/bflyusa.htm> (Version 12DEC2003).
- Otte, D. 1981. The North American grasshoppers. vol 1. Acrididae: Gomphocerinae and Acridinae. Harvard University Press. Cambridge, Massachusetts. 275 pp.
- Otte, D. 2002. Studies of Melanoplus. review of the Viripes group (Acrididae: Melanoplineae). Journal of Orthoptera Research. 11(2): 91-118.
- Owen, S.F., M.A. Menzel, W.M. Ford, B.R. Chapman, K.V. Miller, J.W. Edwards, and P.B. Wood. 2003. Home-range size and habitat used by the northern myotis (*Myotis septentrionalis*). American Midland Naturalist 150(2): 352-359.
- Page, L.M. and B.M. Burr. 1991. A field guide to freshwater fishes: North America north of Mexico. Houghton Mifflin Company, Boston, Massachusetts 432 pp.
- Parker, B. and P. McKee. 1984a. Status of the river redhorse, *Moxostoma carinatum*, in Canada. Canadian Field-Naturalist 98(1): 110-114.

MICHIGAN'S WILDLIFE ACTION PLAN 2015-2025
SGCN DISTRIBUTION, STATUS, HABITATS & THREATS

- Parker, B. and P. McKee. 1984d. Status of the silver shiner, *Notropis photogenis*, in Canada. Canadian Field-Naturalist 98(1): 91-97.
- Parker, B. and P. McKee. 1987. Status of the brindled madtom, *Noturus miurus*, in Canada. Canadian Field-Naturalist 101(2): 226-230.
- Parker, B., P. McKee and R.R. Campbell. 1987a. Status of the silver chub, *Hybopsis storeriana*, in Canada. Canadian Field-Naturalist 101(2): 190-194.
- Parker, B., P. McKee and R.R. Campbell. 1987b. Status of the pugnose minnow, *Notropis emiliae*, in Canada. Canadian Field-Naturalist 101(2): 208-212.
- Parker, B., P. McKee and R.R. Campbell. 1988. Status of the redbreast dace, *Clintostomus elongatus*, in Canada. Canadian Field-Naturalist 120(1): 163-169.
- Parker, B.J. 1988b. Updated status of the river redhorse, *Moxostoma carinatum*, in Canada. Canadian Field-Naturalist 102(1): 140-146.
- Parker, B.J. 1989a. Status of the kiyi, *Coregonus kiyi*, in Canada. Canadian Field-Naturalist 103(2): 171-174.
- Parker, B.J. 1989b. Status of the black redhorse, *Moxostoma duquesnei*, in Canada. Canadian Field-Naturalist 103(2): 175-179.
- Parshall, D.K. 2002. Conservation Assessment for the southern grizzled skipper (*Pyrgus centaureae wyandot*). Unpublished report for U.S. Forest Service.
- Perry, R.H., R.W. Surdick and D.M. Anderson. 1974. Observations on the biology, ecology, behavior, and larvae of *Dryobius sexnotatus* Linsley (Coleoptera: Cerambycidae). The Coleopterists Bulletin. 28(4): 169-176.
- Petranka, J.W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press. Washington, D.C. 587pp.
- Pfingsten, R.A. and F.L. Downs, eds. 1989. Salamanders of Ohio. Bulletin of the Ohio Biological Survey New Series 7(2) 315 pp.
- Pflieger, W.L. 1975. The fishes of Missouri. Missouri Department of Conservation. Columbia, Missouri 343 pp.
- Phillips, C.A., R.A. Brandon and E.O. Moll. 1999. Field guide to amphibians and reptiles of Illinois. Illinois Natural History Survey. Champaign, Illinois 282 pp.
- Poole, R.W. 1995. The moths of America north of Mexico. Fascicle 26.1 Noctuoidea: Noctuidae (Part). The Wedge Entomological Research Foundation. Washington D.C. 249 pp.
- Potter B.A., G.J. Soulliere, D.N. Ewert, M.G. Knutson, W.E. Thogmartin, J.S. Castrale, and M.J. Roell. 2007a. Upper Mississippi River and Great Lakes Region Joint Venture landbird habitat conservation strategy. U.S. Fish and Wildlife Service, Fort Snelling, MN. 124 pp.
- Potter B.A., R.J. Gates, G.J. Soulliere, R.P. Russell, D.A. Granfors, and D.N. Ewert. 2007b. Upper Mississippi River and Great Lakes Region Joint Venture shorebird habitat conservation strategy. U.S. Fish and Wildlife Service, Fort Snelling, MN. 101 pp.
- Potvin, F., R. Courtois and L. Belanger. 1999. Short-term response of wildlife to clear-cutting in Quebec boreal forest: multiscale effects and management implications. Canadian Journal of Forest Research 29(7): 1120-1127.
- Rabe, M.L. 1999. Special animal abstract for *Trimerotropis huroniana* (Lake Huron locust). Michigan Natural Features Inventory. Lansing, Michigan 3 pp.
- Rabe, M.L. 2001. Special animal abstract for *Lycaeides melissa samuelis* (Karner blue). Michigan Natural Features Inventory. Lansing, Michigan 6 pp.
- Rabe, M.L., J.T. Legge and D.A. Hyde. 1996. Special animal abstract for *Appalachia arcana* (secretive locust). Michigan Natural Features Inventory. Lansing, Michigan 2 pp.
- Racey, G.D. and D.L. Euler. 1982. Small mammal and habitat response to shoreline cottage development in central Ontario Canada. Canadian Journal of Zoology 60(5): 865-880.

MICHIGAN'S WILDLIFE ACTION PLAN 2015-2025
SGCN DISTRIBUTION, STATUS, HABITATS & THREATS

- Randolph, R.P. and W.P. McCafferty. 1998. Diversity and distribution of the mayflies (Ephemeroptera) of Illinois, Indiana, Kentucky, Michigan, Ohio, and Wisconsin. Ohio Biological Survey Bulletin (New Series) 13(1): 188 pp.
- Riusech, F.A. and M.C. Barnhart. 1998. Host suitability differences among populations of *Venustaconcha ellipsiformis* (Bivalvia, Unionidae) from different river drainages. Conservation, Captive Care, & Propagation, Freshwater Mussel Symposium, Columbus, Ohio, Program & Abstracts: 32
- Sargent, T.D. 1976. Legion of night: the underwing moths. University of Massachusetts Press, Amherst, Massachusetts 222 pp.
- Schmude, K.L. 1992. Revision of the riffle beetle genus *Stenelmis* (Coleoptera: Elmidae) with notes on bionomics. Ph.D. Thesis. University of Wisconsin-Madison 388 pp.
- Schroeder, R.L. 1982. Habitat suitability index models: yellow-headed blackbird. U.S. Dept. Int., Fish and Wildlife Service. FWS/OBS-82/10.26. 12 pp.
- Schweitzer, D.F. 1985. Effects of prescribed burning on rare Lepidoptera. Memo to The Nature Conservancy, Eastern and Midwestern Regions. March 27, 1985.
- Schweitzer, D.F. 1982. Field observations of foodplant overlap among sympatric *Catocala* feeding on Juglandaceae. Journal of the Lepidopterists' Society 36(4): 256-263.
- Scott, J.A. 1975. Movements of *Euchloe ausonides* (Pieridae). Journal of the Lepidopterists' Society 29(1): 24-31.
- Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184. Ottawa, Ontario 966 pp.
- Shapiro, A.M. 1974. Partitioning of resources among lupine-feeding Lepidoptera. American Midland Naturalist 91: 243-248.
- Shapiro, A.M. 1984. "Edge effect" in oviposition behavior: a natural experiment with *Euchloe ausonides* (Pieridae). Journal of the Lepidopterists' Society 38(3): 242-245.
- Shuey, J.A. 1996. Another new *Euphyes* from the southern United States coastal plain (Hesperiidae). Journal of the Lepidopterists Society 50(1): 46-53.
- Shuey, J.A. 1997. Conservation status and natural history of Mitchell's satyr, *Meonympha mitchelli mitchelli* French (Insecta: Lepidoptera: Nymphalidae). Natural Areas Journal 17(2): 153-162.
- Shuford, W.D. 1999. Status assessment and conservation plan for the black tern (*Chlidonias niger surinamensis*) in North America. U.S. Dept. of Interior, Fish and Wildlife Service. Denver, Colorado 129 pp.
- Simon, T.P. 1993. Assessment of the range of the threatened darter, *Ammocrypta pellucida* (Putnam), from the Maumee River basin, Indiana. Proceedings of the Indiana Academy of Science 102: 139-145.
- Sjogren, M. 2001. Conservation assessment of Lake Huron locust (*Trimerotropis huroniana*). Unpublished report for U.S. Forest Service. 12pp.
- Slack, W.T., M.T. O'Connell, T.L. Peterson, J.A. Ewing III and S.T. Ross. 1997. Ichthyofaunal and habitat associations of disjunct populations of southern redbelly dace. *Phoxinus erythrogaster* (Teleostei: Cyprinidae) in Mississippi. American Midland Naturalist 137: 251-265.
- Smith, C.L. 1985. The inland fishes of New York State. New York State Department of Environmental Conservation, Albany, New York 522 pp. + 8 color plates.
- Smith, P.W. 1961. The amphibians and reptiles of Illinois. Illinois Natural History Survey Bulletin 28(1) 298pp.
- Smith, P.W. 1979. The fishes of Illinois. University of Illinois Press, Urbana, Illinois 314 pp.
- Smith, W.A. 1999. The endangered and threatened invertebrates of Wisconsin. Wisconsin Department of Natural Resources, Bureau of Endangered Resources. PUB-ER-085-99. Madison, WI.
- Snaith, T.V., K.F. Beazley, F. MacKinnon and P. Kuinker. 2002. Preliminary habitat suitability analysis for moose in mainland Nova Scotia, Canada. Alces 38: 73-88.

MICHIGAN'S WILDLIFE ACTION PLAN 2015-2025
SGCN DISTRIBUTION, STATUS, HABITATS & THREATS

- Soulliere, G.J., B.A. Potter, D.J. Holm, D.A. Granfors, M.J. Monfils, S.J. Lewis, and W.E. Thogmartin. 2007a. Upper Mississippi River and Great Lakes Region Joint Venture waterbird habitat conservation strategy. U.S. Fish and Wildlife Service, Fort Snelling, MN. 68pp.
- Soulliere G.J., B.A. Potter, J.M. Coluccy, R.C. Gatti., C.L. Roy, D.R. Luukkonen, P.W. Brown, and M.W. Eichholz. 2007b. Upper Mississippi River and Great Lakes Region Joint Venture waterfowl habitat conservation strategy. U.S. Fish and Wildlife Services, Fort Snelling, Minnesota, USA. 117pp.
- Squitier, J.M. and J.L. Capinera. 2002. Habitat associations of Florida grasshoppers (Orthoptera: Acrididae). Florida Entomologist 85(1): 235-244.
- Stark, B.P., S.W. Szczytko and C.R. Nelson. 1998. American stoneflies: a photographic guide to the Plecoptera. The Caddis Press. Columbus, Ohio 126pp.
- Steg, M.B. and R.J. Neves. 1997. Fish host identification for Virginia listed unionids in the upper Tennessee River drainage. Triannual Unionid Report (13): 34.
- Stewart, K.W. and B.P. Stark. 1988. Nymphs of North American stonefly genera (Plecoptera). Entomological Society of America, Thomas Say Foundation Memoirs 12: 1-460.
- Summerville, K.S. and C.A. Clampitt. 1999. Habitat characterization of five rare insects in Michigan (Lepidoptera: Hesperidae, Riodinidae, Satyridae; Homoptera: Cercopidae). The Great Lakes Entomologist 32(3): 225-238.
- Summerville, K.S. and T.O. Crist. 2004. Contrasting effects of habitat quantity and quality on moth communities in fragmented landscapes. Ecology 85(1): 3-12.
- Surber, T. 1913. Notes on the natural hosts of fresh-water mussels. Bulletin of the Bureau of Fisheries [Issued separately as U.S. Bureau of Fisheries Document 778]. 32(1912):103-116 + 3 plates.
- Tibbels, A.E. and A. Kurta. 2003. Bat activity is low in thinned and unthinned stands of red pine. Canadian Journal of Forest Research 33(12): 2436-2442.
- Tompkins, A. 1987. Status of the bigmouth shiner, *Notropis dorsalis*, in Canada. Canadian Field-Naturalist 101(2): 195-202.
- Trautman, M.B. 1981. The fishes of Ohio with illustrated keys. Second edition. Ohio State University Press. Columbus, Ohio 782 pp.
- (USFWS) U.S. Fish and Wildlife Service. 1997. Recovery plan for Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii* French). Ft. Snelling, Minnesota viii+71 pp.
- (USFWS) U.S. Fish and Wildlife Service. 1999. Agency draft Indiana bat (*Myotis sodalis*) revised recovery plan. Fort Snelling, Minnesota 53 pp.
- (USFWS) U.S. Fish and Wildlife Service. 2003. Final recovery plan for the Karner blue butterfly (*Lycaeides melissa samuelis*). Fort Snelling, Minnesota 273 pp.
- (USFS) U.S. Forest Service. 2003. Tripoli East vegetation management project, Appendix G. White Mountain National Forest, U.S. Department of Agriculture Forest Service. Plymouth, NH 9 pp.
- (USFS) U.S. Forest Service. 2004. Michigan SVE database.
- (USFS) U.S. Forest Service. 2005. Forest Plan Revision for White Mountain National Forest, Species Viability Evaluation. White Mountain National Forest, U.S. Department of Agriculture Forest Service. URL: http://www.fs.fed.us/r9/white/3_WM_fpr_Web/forest_plan/revision/viability/sve.html
- UMRGLR JV. 2007. Upper Mississippi River and Great Lakes Region Joint Venture implementation plan (compiled by G.J. Soulliere and B.A. Potter). U.S. Fish and Wildlife Service, Fort Snelling, Minnesota, USA. 75 pp.
- Unger, C. and A. Kurta. 1998. Status of the eastern pipistrelle (Mammalia: Chiroptera) in Michigan. Final Report to the Michigan Department of Natural Resources, Natural Heritage Program. Lansing, Michigan
- University of Michigan, Museum of Zoology, Division of Reptiles and Amphibians. Accessed:2005. Amphibian and reptile database. Ann Arbor, Michigan.

MICHIGAN'S WILDLIFE ACTION PLAN 2015-2025
SGCN DISTRIBUTION, STATUS, HABITATS & THREATS

- van der Schalie, H. and L.L. Getz. 1962a. Distribution and natural history of the snail *Pomatiopsis cincinnatiensis* (Lea). American Midland Naturalist 68(1): 203-231.
- van der Schalie, H. and L.L. Getz. 1962b. Reproductive isolation in the snails, *Pomatiopsis lapidaria* and *P. cincinnatiensis*. American Midland Naturalist 68(1): 189-191.
- van der Schalie, H. and L.L. Getz. 1963. Comparison of temperature and moisture responses of the snail genera *Pomatiopsis* and *Oncomelania*. Ecology 44(1): 73-83.
- van der Schalie, H. and S.D. Dundee. 1955. The distribution, ecology and life history of *Pomatiopsis cincinnatiensis* (Lea), an amphibious, operculate snail. Transaction of the American Microscopic Society 74(2): 119-133.
- Vickery, V.R. and D.K.M. Kevan. 1985. The grasshoppers, crickets, and related insects of Canada and adjacent regions. Agriculture Canada Publication 1777 918 pp.
- Vogt, T.E. and E.D. Cashatt. 1994. Distribution, habitat and field biology of *SOMATOCHLORA HINEANA* (Odonata: Corduliidae). Annals of the Entomological Society of America 87(5):599-603.
- Wagner, D.L., J.W. Peacock, J.L. Carter and S.E. Talley. 1995. Spring caterpillar fauna of oak and blueberry in a Virginia deciduous forest. Annals of the Entomological Society of America 88(4): 416-426.
- Walker, E.M. 1958. The Odonata of Canada and Alaska, volume two part III: the Anisoptera – four families. University of Toronto Press. Toronto, Ontario, Canada 318 pp.
- Walker, E.M. and P.S. Corbet. 1978. The Odonata of Canada and Alaska, volume two part III: the Anisoptera – three families. University of Toronto Press. Toronto, Ontario, Canada 308 pp.
- Wallis, J. B. 1961. The Cincidelidae of Canada. University of Toronto Press. Toronto, Ontario, Canada 74 pp.
- Wallus, R. and J.P. Buchanan. 1989. Contributions to the reproductive biology and early life ecology of moon-eye in the Tennessee and Cumberland Rivers. American Midland Naturalist 122: 204-207.
- Watters, G.T. 1995a. A guide to the freshwater mussels of Ohio, revised 3rd edition. The Ohio Department of Natural Resources. Columbus, Ohio 122 pp.
- Watters, G.T. 1996. Hosts for the northern riffle shell (*Epioblasma torulosa rangiana*). Triannual Unionid Report (10):14.
- Watters, G.T. and S.H. O'Dee. 1997a. Identification of potential hosts. Triannual Unionid Report (13): 38-39.
- Watters, G.T. and S.H. O'Dee. 1997b. Potential hosts for *Villosa iris* (Lea, 1829). Triannual Unionid Report (12): 7.
- Watters, G.T., S.H. O'Dee, S. Chordas and D. Glover. 1999. Seven potential hosts for *Ligumia recta* (Lamarck, 1819). Triannual Unionid Report (18): 5.
- Weir, G.P. 1977. An ecology of the Unionidae in Otsego Lake with special references to immature stages. Occasional Paper SUNY Oneonta Biological Field Station at Copperstown, New York 4:1-108.
- Whitaker, J.O.Jr. and S.L. Gummer. 2003. Current status of the evening bat, *Nycticeius humeralis*, in Indiana. Proceedings of the Indiana Academy of Science 112(1): 55-60.
- Wiggins, G.B. 2000. Larvae of the North American caddisfly genera (Trichoptera), 2nd Edition. University of Toronto Press. Toronto, Ontario, Canada 457pp.
- Williams, D.D. and B.W. Feltmate. 1992. Aquatic insects. C.A.B. International. Wallingford, Oxford xiii, 358 pp.
- Wilsmann, L. A. 1994. Insects: species accounts. pp. 332-392 in D. C. Evers, ed. Endangered and threatened wildlife of Michigan. University of Michigan Press. Ann Arbor, Michigan 412 pp.
- Wilson, C.B. 1916. Copepod parasites of fresh-water fishes and their economic relations to mussel glochidia. Bulletin of the Bureau of Fisheries [Issued separately as U.S. Bureau of Fisheries Document 824]. 34:333-374 + 15 plates.
- Wilson, K.A. and K. Ronald. 1967. Parasite fauna of the sea lamprey (*Petromyzon marinus* von Linné) in the Great Lakes region. Canadian Journal of Zoology 45(6): 1083-1092.

MICHIGAN'S WILDLIFE ACTION PLAN 2015-2025
SGCN DISTRIBUTION, STATUS, HABITATS & THREATS

- Wires, L.R., S.J. Lewis, G.J. Soulliere, S.W. Matteson, D.V. "Chip" Weseloh, R.P. Russell, and F.J. Cuthbert. 2010. Upper Mississippi Valley/Great Lakes waterbird conservation plan. A plan associated with the Waterbird Conservation for the Americas Initiative. Final Report submitted to the U.S. Fish and Wildlife Service, Fort Snelling, MN.
- Wood, N.A. 1951. The Birds of Michigan. Miscellaneous Publications, Museum of Zoology, University of Michigan, No. 75. University of Michigan Press. Ann Arbor, Michigan 559 pp.
- Wright, V.F., R.L. Huber and C.L. Huber. 2003. Butterflies (Lepidoptera) of Konza Prairie Biological Station: an annotated checklist. *Journal of the Kansas Entomological Society* 76(3): 469-476.
- Yeager, B.L. and C.F. Saylor. 1995. Fish hosts for four species of freshwater mussels (Pelecypoda: Unionidae) in the Upper Tennessee River drainage. *American Midland Naturalist* 133(1): 1-6.
- Young, D. 1911. The implantation of the glochidium on the fish. *University of Missouri Bulletin, Science Series* 2: 1-20.
- Young, F.N. 1953. A new species of *Bidessus* from southern Michigan (Coleoptera: Dytiscidae). *Bulletin of the Brooklyn Entomological Society* 48: 111-112.
- Zale, A.V. and R.J. Neves. 1982a. Fish hosts of four species of lampsiline mussels (Mollusca: Unionidae) in Big Moccasin Creek, Virginia. *Canadian Journal of Zoology* 60(11): 2535-2542.
- Zale, A.V. and R.J. Neves. 1982b. Identification of a fish host for *Alasmidonta minor* (Mollusca: Unionidae). *American Midland Naturalist* 107(2): 386-388.
- Zale, A.V. and R.J. Neves. 1982c. Reproductive biology of four freshwater mussel species (Mollusca: Unionidae) in Virginia. *Freshwater Invertebrate Biology* 1(1): 17-28.