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MICHIGAN 2015 - 2025

BIG RIVERS

Wildlife Action Plan

Today's Priorities, Tomorrow's Wildlife

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WHAT ARE MICHIGAN'S BIG RIVERS?

Big Rivers are the largest rivers in Michigan and are defined in this plan as having watersheds greater than 300 square miles. These landscape features are among the most biologically diverse systems in the state owing to the myriad of habitat types they possess. As Big Rivers descend from higher elevations and flow to the Great Lakes, they encompass many instream features including, pools, riffles, glides, backwaters, eddies, undercut banks, fallen trees and spring seeps that collectively maintain a diversity of aquatic habitats. In addition, Big Rivers support important riparian features including emergent wetlands, floodplain forests, Great Lakes wetlands and bayous. Not surprisingly, a host of aquatic and terrestrial species make their home in and around Big Rivers. The environmental character of Big Rivers and the fish and wildlife they support are shaped by the large network of upstream tributaries and their watersheds and by their connections to the Great Lakes.

Bald Eagle

Lake Sturgeon

Logperch

River Redhorse

PLAN CONTRIBUTORS

- Central Michigan University
- Michigan Department of Environmental Quality
- Michigan Department of Natural Resources
- Michigan Sea Grant
- Michigan State University Extension
- Upper Midwest and Great Lakes Landscape Conservation Cooperative
- U.S. Fish and Wildlife Service

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WHY ARE BIG RIVERS IMPORTANT?

The Big Rivers of Michigan have played an important role in our states' history, from the days of the fur traders plying their heavy canoes in the 1600s to the log drives of the 1800s, these waterways were the main thoroughfares for transportation, commerce, and communication between early settlements. Through Michigan's settlement these Big Rivers were harnessed for power, provided seemingly endless fisheries, and were used to convey waste products during the early industrial era. Our rivers have fueled the growth of our economy, and have shaped the heart of many of our cities. Can you imagine Grand Rapids without the Grand River? Ann Arbor without the Huron River? Today Michigan's Big Rivers have recovered from the early abuses and support some of the highest quality fisheries in the upper Midwest. Recreational fishing is a significant past time for many Michiganders and provides local economic benefits. Big Rivers also provide many opportunities for paddling sports, bird watching, boating, and other outdoor pursuits. Protecting the integrity of Big Rivers ensures quality aquatic habitats and healthy fish and wildlife communities, which directly support many outdoor recreational opportunities and other societal and economic benefits.

WHAT USES BIG RIVERS?

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WHAT IS THE HEALTH OF BIG RIVERS?

During Michigan's development many of our Big Rivers were dammed for logging and power generation, severing the linkage to the Great Lakes and impounding rare high-gradient stretches of river. Consequently, connectivity in Big Rivers is severely limited by high levels of fragmentation from dams (Cooper et al., in preparation). Big Rivers drain large areas of land, and their water quality and flow regimes are influenced by human activities throughout their watersheds. Currently, approximately 25% of Big Rivers exhibit moderate to severe levels of human disturbance from agricultural and urban land uses, with human disturbance being more intense in the southern half of the Lower Peninsula (Cooper et al. in preparation). In addition, humans have intentionally and unintentionally introduced non-native aquatic species. These introductions, coupled with reductions in native plants and animals, have resulted in highly-altered biological communities in many of our current day Big Rivers.

GOALS

- Increase public awareness of the significance of Big Rivers.
- Increase connectivity in Big Rivers through the removal of dams.
- Increase habitat protection in Big Rivers.

Dam Removal

Dams fragment river systems restricting fish movement, creating isolated populations and preventing long distance migrations to historical spawning grounds. Removal of deteriorated dams that no longer have value or provide service is a high priority action for the conservation of Big River focal species.

MICHIGAN'S LONGEST BIG RIVERS	
Grand River	252 miles
Muskegon River	216 miles
St. Joseph River	206 miles
Manistee River	190 miles
River Raisin	139 miles
Au Sable River	138 miles
Huron River	130 miles
Kalamazoo River	130 miles
Shiawassee River	120 miles
Menominee River	116 miles

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WHAT ARE THE BIG RIVERS FOCAL SPECIES?

Where we are now and what we think we can realistically achieve over the next 10 years.

Lake Sturgeon
(Acipenser fulvescens)
State Threatened

The Lake Sturgeon is Michigan's largest fish species and is often referred to as a living fossil. They can grow up to well over six feet in length and weigh over 200 pounds. Lake Sturgeon have five rows of bony plates along the body, a relatively long snout with four barbels, and a shark-like tail. During spawning season, large Lake Sturgeon can be seen leaping and breaching the water surface. The preferred habitats for Lake Sturgeon include Great Lakes nearshore areas and large, shallow lakes and rivers. Lake Sturgeon feed in shallows that provide abundant prey. Spawning habitats include gravel-cobble shoals and large rubble in rivers (Daugherty et al. 2008). Shallow waters with fine substrates are crucial nursery habitats. Currently there are 24 Lake Sturgeon populations identified by major Michigan watershed: 11 from Lake Michigan, nine from Lake Huron, two from Lake Erie and two from Lake Superior. Of the 24 populations, 12 are at high risk of extirpation, four are small populations at high risk of decline, three are considered medium in size, and five are large, stable populations (Hayes and Caroffino 2012).

GOALS

- Increase public awareness of the significance of Lake Sturgeon.
- Conserve and maintain populations that are currently self-sustaining.
- Increase natural reproduction and recruitment.
- Rehabilitate depressed populations so they become self-sustaining.

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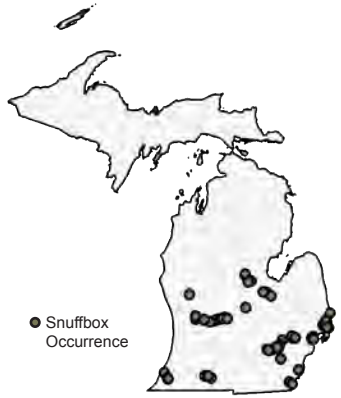
River Redhorse
(Moxostoma carinatum)
State Threatened

River Redhorse is the largest of six redhorse suckers found in Michigan. Adults can attain lengths over 30 inches and exceed ten pounds. The River Redhorse is one of three Michigan redhorse species with red fins. The River Redhorse is a late-maturing, long-lived species that requires access to medium- to large-sized warmwater river habitats (Jenkins and Burkhead 1994) although they can also be found in small streams and connected lake and impoundment habitats (COSEWIC 2006). River Redhorse spawn over clean-swept gravel and cobble substrate and thrive in areas with clean water and substrate that is free of silt. Fewer than 10 populations of River Redhorse exist in Michigan occurring in the Muskegon, Grand, and St. Joseph watersheds.

GOALS
- Increase public awareness of the importance and status of River Redhorse.
- Establish baseline status and distribution.

GOALS
- Increase public awareness of the importance and status of Snuffbox.
- Establish baseline status and distribution. [SB]
- Develop and expand propagation and captive rearing capacity.
- Quantify genetic structure of existing populations and determine potential brood stock.



Snuffbox
(Epioblasma triquetra)
Federally and State Endangered

The Snuffbox is a small to medium-sized mussel reaching up to three inches in length. The shell surface is yellowish-green to brown and is adorned with dark green rays or chevron-like marks. During early life stages all mussels, including the Snuffbox, are parasitic and require a fish host to complete their life cycle. The primary fish host for Snuffbox is the Logperch (*Percina caprodes*), a member of the perch family. Female Snuffbox are “trappers” and will clamp onto the snout of unsuspecting Logperch as they forage for aquatic insect larvae and other prey items. The female then releases her larvae, which attach themselves to the Logperch’s gills, where they will reside until they mature and drop off to settle in the streambed. After transferring her brood, the female Snuffbox releases the Logperch unharmed (unionid.missouristate.edu/gallery/epioblasma/). The Snuffbox is found in small to medium-sized streams to large rivers in swift currents of riffles and shoals composed of gravel and sand with occasional cobble and boulders. Mussels occur chiefly in flow refuges, where substrates are relatively stable and shear stress is low. Snuffbox are typically found burrowed deep into the substrate, except when spawning or attempting to attract a host fish (Butler 2007). Snuffbox populations have been identified in the Grand River, Flat River, and Maple River in the Lake Michigan drainage and in the Pine, Belle, and Clinton in the Lake St. Clair drainage, and the Huron River in the Lake Erie drainage. Most Snuffbox populations in Michigan are restricted, small to medium-sized, with limited recent recruitment and viability (USFWS 2012).

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HOW VULNERABLE ARE FOCAL SPECIES TO CLIMATE CHANGE?

Cooper et al. (in preparation) and Hoving et al. (2013) determined climate vulnerabilities for focal species. See threats section for more specifics about how climate change may affect species and habitats.

	Climate Vulnerability
Lake Sturgeon	High
River Redhorse	Stable
Snuffbox	Low

DID YOU KNOW?

The freshwater mussels of North America have been identified as the most imperiled of any major group of animals. Nearly half of Michigan's native freshwater mussels are in decline and are listed as Endangered, Threatened, or Special Concern. The primary causes of decline are habitat loss from dam construction, siltation, and impaired water quality.

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WHAT ARE THE CONSERVATION THREATS & ACTIONS?

Major threats that need to be addressed and key actions that need to be implemented over the next 10 years.

THREATS to Habitat

Natural Systems Modifications

- Channelization often results in decreased habitat diversity and increased channel instability (Wesley 2005).
- Loss of natural riparian vegetation and floodplain habitats and placement of infrastructure (e.g., bridges) can result in bank instability and erosion. As river channels adjust to changes in sediment transport, bank armoring is often prescribed, resulting in further degradation and fragmentation of habitats (Smith et al. 2008).
- Removal of riparian vegetation increases stream temperatures, nutrients, and sediments (Francis and Hass 2006).
- Removal of log jams and other coarse woody structure results in loss of habitat diversity and reduction in available cover for wildlife (Hanshue and Harrington 2015).

Agriculture & Aquaculture

- Surface water and groundwater extraction reduces stream flow (Hamilton and Seelbach 2011).
- Drains and tiling increase high flows and decrease low flows, altering the natural hydrologic regime (Wesley and Duffy 1999).

Energy Production & Mining

- Dams operating outside of run-of-river flow requirements reduce the quality and stability of downstream habitats; this is especially deleterious during spawning (Wesley 2005).

Transportation & Service Corridors

- Dredging and channelization for navigation simplifies habitats (Hanshue and Harrington 2015).

Pollution

- Road and rail crossings can increase sediments and pollutants and be an issue locally, as well as have cumulative impacts (Francis and Haas 2006).
- Contaminants of emerging concern, including microplastics and pharmaceuticals (Alliance for the Great Lakes 2010; Pal et al. 2010).

Climate Change

- Climate change could have a variety of impacts: changing water levels in the Great Lakes and human responses may decrease available habitats in lower reaches (Pryor et al. 2014).

Conservation ACTIONS for Habitat

Land & Water Management

H1. Require run-of-river operations at all dams to maintain sufficient streamflow during spawning and egg incubation, and through nursery habitats to ensure successful recruitment of focal species. [LHBCS 2.15; GRA; KRA]

H2. Continue early detection rapid response efforts for invasive species. [AIS; CC-7.3]

H3. Implement Michigan's Aquatic Invasive Species State Management Plan. [AIS]

Raising Awareness

H4. Promote voluntary best management practices for forest management. [LSBCS 6.6; MTA; ORA; MRA]

H5. Work with watershed groups to promote focal species and their habitats, and ways to protect habitats through ordinances or best practices. [LMBCS-6.2; CRA; GRA; KRA; MTA; ORA; SJR; LRBOI; MSG]

Livelihood, Economic & Moral Incentives

H6. Work with Farm Bill programs including the Environmental Quality Incentives Program (EQIP) and Wetland Reserve Easements (WRE) to benefit Big Rivers and focal species. [GRA; KRA]

Conservation Designation & Planning

H7. Identify and prioritize dams to remove to restore hydrology and increase available habitat, as well as those that may be important to keep for mitigating hydrologic changes, Sea Lamprey and other invasive species impacts, and climate change effects. [CC-7.3; LEBCS 6.6; LHBCS 2.5, 2.11 & 2.17; CRA; GRA; KRA; MRA; ORA; LSBCS 5.1, 5.2]

H8. Participate in the Upper Midwest and Great Lakes Landscape Conservation Cooperative's Aquatic Habitat Connectivity Collaborative. [LCC]

H9. Work with the U.S. Fish and Wildlife Service, the Federal Energy Regulatory Commission, and hydroelectric dam owners to mitigate the effects of dam operations on focal species. [LHBCS 2.15; KRA; GRA]

H10. Complete stream crossing inventories and identify priority sites for rehabilitation. [KRA; GRA]

Law & Policy

H11. Protect focal species and their habitats through the environmental permit review process. [CRA; GRA; KRA; MRA; MTA; ORA; SJA]

H12. Continue to administer an effective Michigan Department of Environmental Quality protection program for wetlands, lakes, and streams, and provide incentives for conservation practices.

H13. Take appropriate enforcement actions for violations of the Invasive Species Order, and maintain the Prohibited and Restricted Species list pursuant to the Natural Resources and Environmental Protection Act, 451 of 1994, as amended. [AIS]

Research & Monitoring

H14. Determine impacts of aquatic invasive species on Big Rivers and focal species. [LRBOI]

H15. Refine species maps, habitat suitability models, and priority maps based on field data, updated GIS layers, and updated downscaled climate projections (Cooper et al. in preparation; Wehrly et al. in preparation; Yeh et al. in preparation).

H16. Develop and implement targeted habitat surveys.

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THREATS to Lake Sturgeon

Lack of Knowledge

- Lack of knowledge on the early life history of Lake Sturgeon, especially in Big Rivers that have short reaches between the first dam and the Great Lakes (LRBOI 2008).
- Loss of genetic diversity due to population size and distribution (Hayes and Caroffino 2012).

Invasive & Other Problematic Species, Genes & Diseases

- Sea Lamprey treatments have known toxic effects on Lake Sturgeon, and poorly timed treatments could result in significant mortality (DNR Observation).
- Invasive species can compete for food resources and prey upon eggs and larvae (e.g., Round Goby and Rusty Crayfish), as well as degrade spawning shoals by providing low-quality habitat for egg deposition (e.g., Zebra Mussels; LRBOI 2008).

Energy Production & Mining

- Dams fragment rivers restricting fish movements, creating isolated populations, and preventing long distance migrations to historical spawning grounds (Wesley 2005, Hanshue and Harrington 2015).
- Juvenile Lake Sturgeon become trapped in power plant cooling water intakes (DNR Observation).

Human Intrusions & Disturbance

- Incidental/illegal harvest during spawning (DNR Observation).

Climate Change & Severe Weather

- Increasing water temperatures due to climate change could decrease survival of Lake Sturgeon and cause altered timing of reproduction and sex ratios.

Conservation ACTIONS for Lake Sturgeon

Species Management

LS1. Implement Michigan's Lake Sturgeon Rehabilitation Strategy. [LS; LSBCS 2.3]

LS2. Install spawning reefs for Lake Sturgeon in the Kalamazoo River, evaluate their effectiveness, and expand as warranted. [LS; KRA]

LS3. Continue and expand Lake Sturgeon guarding program to protect spawning adults. [LSBCS 2.3]

LS4. Use modified Sea Lamprey abatement treatment protocols where documented natural reproduction of Lake Sturgeon occurs. [LS2]

Law Enforcement & Prosecution

LS5. Work with DNR Law Enforcement Division and local authorities to police known spawning areas to deter poaching.

Law & Policy

LS6. Protect Lake Sturgeon and their habitats through the environmental permit review process.

Research and Monitoring

LS7. Evaluate threats to Lake Sturgeon recruitment, including invasive species impacts. [LS; GRA; KRA; LRBOI]

LS8. Evaluate the appropriateness and feasibility of fish passage at key sites for Lake Sturgeon. [LS; GRA; KRA; MRA]

LS9. Develop and implement alternative Sea Lamprey control strategies in rivers with known populations of Lake Sturgeon. [LS2]

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THREATS to River Redhorse

Lack of Knowledge

- Lack of knowledge on distribution, spawning locations, specific micro-habitat needs, early life history, seasonal movements, population trends and co-occurring fish communities (Stagliano 2001; COSEWIC 2006).
- Difficulty with proper identification hampers conservation and protection efforts (COSEWIC 2006).

Invasive & Other Problematic Species, Genes & Diseases

- Incompatible management of aquatic plants occurs in known habitat for River Redhorse (DNR Observation).
- Competition and predation from invasive species such as Round Goby and Rusty Crayfish (COSEWIC 2006).

Energy Production & Mining

- Dams fragment rivers restricting fish movements, creating isolated populations, and preventing long distance migrations to historical spawning grounds (COSEWIC 2006).

Human Intrusions & Disturbance

- Over-harvest of adults during the spawning run (DNR Observation).

Conservation ACTIONS for River Redhorse

Raising Awareness

RR1. Create education and outreach opportunities for biologists on River Redhorse, hold identification workshops, and promote www.moxostoma.com. [MSG]

Law Enforcement & Prosecution

RR2. Work with law enforcement at key spawning sites to protect adult River Redhorse.

Conservation Designation & Planning

RR3. Develop best practices for collecting data and photos to aid in River Redhorse identification. [MSG]

RR4. Protect River Redhorse and their habitats through the environmental permit review process.

RR5. Review fishing regulations that may affect River Redhorse. Given the difficulty in identification, fishing closures during spawning at critical sites may be warranted.

Research and Monitoring

RR6. Determine basic life history and population status of River Redhorse. [GRA]

RR7. Identify essential habitat needs for River Redhorse.

RR8. Explore using genetic information (e.g., eDNA or tissue samples) to understand distribution and population structure of River Redhorse.

RR9. Determine impacts of aquatic invasive species on River Redhorse populations, including toxicity and effects of lampricides on early life stages.

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THREATS to Snuffbox

Lack of Knowledge

- Lack of knowledge on spawning, larval and juvenile life stages, genetics and the potential for reintroduction, host fish, population trends, microhabitat needs, and co-occurring communities (Morris and Burridge 2006, Butler 2007).

Invasive & Other Problematic Species, Genes & Diseases

- Epizootic colonization and competition by Zebra Mussels can lead to extirpation of Snuffbox through suffocation and habitat loss (Schloesser et al. 1996).
- Sea Lamprey treatments are known to be toxic to Logperch, the primary host fish for Snuffbox. High mortality of Logperch could result in further decline of Snuffbox (Boogaard et al. 2015).
- Round Gobies directly compete with known host fish, Logperch, for habitat and food resources (Leino and Mensinger 2015).

Energy Production & Mining

- Dams fragment rivers restricting fish movements and hence mussel movements, creating isolated populations (Haag 2012).

Pollution

- Snuffbox larvae (glochidia) and newly released juveniles are sensitive to contaminants (e.g. ammonia, heavy metals, chlorine, and pesticides) present in the effluents of wastewater treatment plants and agricultural runoff (USFWS 2012; Schloesser et al. 1996).

Conservation ACTIONS for Snuffbox

Species Management

SB1. Develop a large-scale Snuffbox hatchery and refine propagation methods.

Raising Awareness

SB2. Re-print, promote, and distribute the Freshwater Mussels of Michigan poster. [SB-viii]

Conservation Designation & Planning

SB3. Work with the Michigan Mollusk workgroup to develop a conservation plan for Snuffbox and other mussels, which aligns with the National Freshwater Mollusk Conservation Strategy.

Law & Policy

SB4. Protect Snuffbox and their habitats through the environmental permit review process. Require surveys and relocation of individuals when avoidance is not an option.

Research and Monitoring

SB5. Describe microhabitat for Snuffbox to aid management. [SB-iii]

SB6. Quantify and rank threats at known Snuffbox sites, including aquatic invasive species, streamflow issues, etc. [SB-v]

SB7. Quantify the variability in Snuffbox spawning across populations.

SB8. Work across state borders to determine gene flow among Snuffbox populations to inform reintroduction or supplementation planning.

SB9. Determine the distribution of Logperch and other potential host fish to aid conservation planning. [SB-ii]

SB10. Determine the potential impact of invasive species control methods on Snuffbox, including the effects of lampricides on larvae and juveniles. [SB-v]

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HOW WILL WE MONITOR?

Assessing status and measuring progress towards goals.

HABITAT

- Monitor the number of dams and barriers removed in Big Rivers, and the subsequent number of river miles opened up.
- Continue Michigan Department of Environmental Quality macroinvertebrate, aquatic habitat, and water quality monitoring at sites with focal species.
- Continue U.S. Geological stream flow and water quality monitoring in Big Rivers.

LAKE STURGEON

- Continue annual juvenile Lake Sturgeon index monitoring in the Great Lakes with the U.S. Fish and Wildlife Service and tribal partners. [LS]
- Continue adult abundance and spawning estimates in Big Rivers with remnant populations. [LS; GRA; KRA]
- Continue and expand fall recruitment monitoring by conducting young-of-year visual surveys. [LS]
- Continue to update element occurrences in the state's Natural Heritage Database.

RIVER REDHORSE

- Conduct targeted surveys during spawning to understand distribution and relative abundance.
- Conduct targeted surveys to determine distribution of River Redhorse; develop a regular schedule for monitoring known sites.
- Continue to update element occurrences in the state's Natural Heritage Database.

SNUFFBOX

- Conduct regular targeted surveys using standard mussel survey protocol (Strayer and Smith 2003) to determine distribution, relative abundance, and trends.
- Implement new technologies (e.g. eDNA) where possible to improve detection of juveniles.
- Continue to update element occurrences in the state's Natural Heritage Database.

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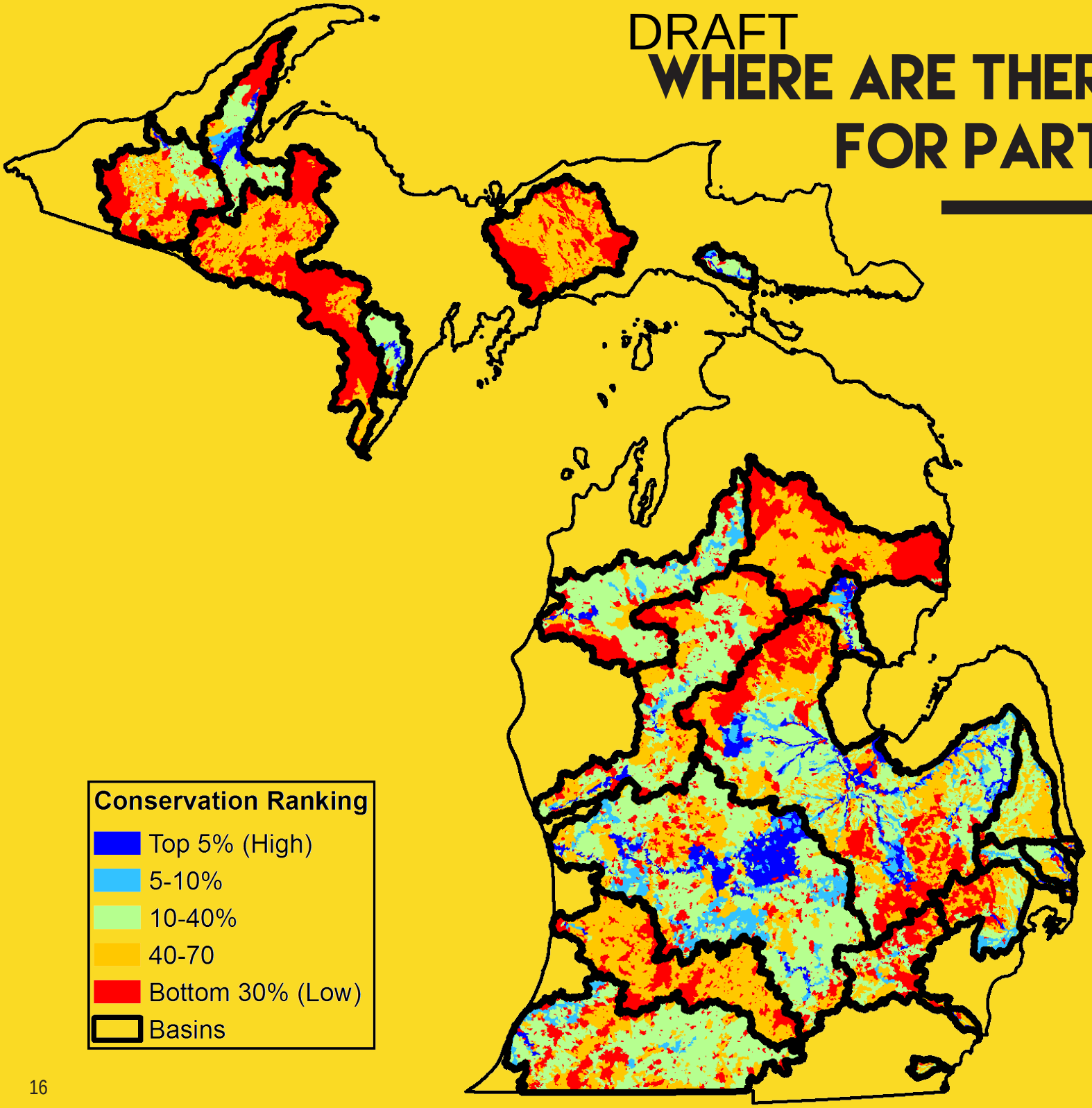
WHERE ARE THERE PLACES FOR PARTNERSHIP?

This map is designed to help partners connect around important places for focal species. Working together on conservation actions on a voluntary basis provides great benefits to wildlife and people.



HOW DOES THIS PLAN LINK WITH OTHER CONSERVATION PLANS?

There has been a multitude of relevant planning efforts across the state and country over the past ten years. Bracketed superscripts throughout the Wildlife Action Plan indicate where the conservation action, goal, or monitoring strategy aligns with those from another plan. For conservation plans with distinct objectives, the objective or strategy number is also included. This linking of plans is meant to facilitate the expansion of partnerships.

[AIS] Michigan's aquatic invasive species state management plan 2013 Update (DEQ et al. 2013)

[CC] National fish, wildlife and plants climate adaptation strategy. (National Fish, Wildlife and Plants Climate Adaptation Partnership 2012)

[CRA] Clinton River assessment (Francis and Haas 2006)

[GRA] Grand River assessment (Hanshue and Harrington 2015)

[KRA] Kalamazoo River assessment (Wesley 2005)

[LCC] Upper Midwest and Great Lakes Landscape Conservation Cooperative aquatic habitat connectivity workgroup objectives (Upper Midwest and Great Lakes Landscape Conservation Cooperative)

[LEBCS] Returning to a healthy lake: Lake Erie biodiversity conservation strategy - technical report (Pearsall et al. 2012)

[LHBCS] The Sweetwater Sea: an international biodiversity conservation strategy for Lake Huron - technical report (Franks Taylor et al. 2010)

[LRBOI] Nmé (Lake Sturgeon) stewardship plan for the Big Manistee River and 1836 Reservation (LRBOI 2008)

[LSBCS] A biodiversity conservation strategy for Lake Superior (Lake Superior Binational Program 2015)

[LS] Michigan's lake sturgeon rehabilitation strategy (Hayes and Caroffino 2012)

[LS2] Lake sturgeon rehabilitation strategy (Hay-Chmielewski and Whelan 1997)

[MRA] Muskegon River assessment (Oneal 1997)

[MSG] Michigan Sea Grant strategic plan 2014-2017 (Michigan Sea Grant College Program 2012)

[MTA] Manistee River assessment (Rozich 1998)

[ORA] Ontonagon River assessment (Gunderman and Baker 2008)

[SB] Recovery strategy for Northern Riffleshell, Snuffbox, Round Pigtoe, Mudpuppy Mussel and Rayed Bean in Canada (Morris and Burridge 2006)

[SJA] St. Joseph River assessment (Wesley and Duffy 1999)

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ABOUT THE WILDLIFE ACTION PLAN

Today's Priorities, Tomorrow's Wildlife

Every state has a Wildlife Action Plan, which taken together create a national conservation strategy for safeguarding wildlife and their habitats for current and future generations. Each state's action plan is uniquely designed to serve the needs of that state. These plans provide a framework for proactive conservation and management of fish and wildlife before they become imperiled, which is more straightforward, cost-efficient, and effective.

Michigan's Wildlife Action Plan was developed by conservation partners across the state. It provides information about those species in greatest conservation need. The plan is organized by chapters or mini-plans. Each mini-plan outlines priorities for the next 10 years. The mini-plans detail priority habitats and focal species of greatest conservation need, status of species and habitats, critical threats, needed conservation actions, places for partnerships, monitoring needs, and goals. This is one of 15 mini-plans. For more information about how the plan was built and to read other mini-plans, please visit:www.michigan.gov/wildlifeactionplan.