
MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
DNR
MICHIGAN
TM
2015 - 2025
GREAT LAKES
CISCOES
Wildlife Action Plan
Today's Priorities, Tomorrow's Wildlife

WHAT ARE GREAT LAKES CISCOES?

Great Lakes Cisco are an ecologically and economically important group of fishes that include Cisco, chubs, and whitefish belonging to the genus *Coregonus*. Historically, these species supported large commercial fisheries and provided a critical food source for predatory fishes such as Lake Trout, Northern Pike, and Walleye. By the middle of the 20th century, however, over-fishing, habitat destruction, and predation and competition from invasive species caused entire populations of these formerly widespread and abundant fishes to collapse in all five of the Great Lakes (Christie 1974). Only remnant populations of four of the six formally recognized Cisco species persist today, and this group remains among the most imperiled native species in the Great Lakes.

The genus *Coregonus* is comprised of the large-bodied Lake Whitefish (*C. clupeaformis*) and a group of six smaller-bodied and taxonomically-difficult species known as “Ciscoes” or “chubs”. Lake Whitefish is an important food fish in the Great Lakes, and populations have recovered to the point that they support commercial, tribal, and recreational fisheries (Fleischer 1992). Although their numbers are declining in Lake Ontario, Lake Erie, and Southern Lake Michigan, Lake Whitefish currently are not considered a Species of Greatest Conservation Need. Three of the six cisco species, Deepwater Cisco (*C. johannae*), Shortnose Cisco (*C. reighardi*), and Kiyi (*C. kiyi kiyi*), represent evolutionary novelties in that they evolved in the Great Lakes 6,000-10,000 years ago following the last glacial retreat (Smith and Todd 1984). Deepwater Cisco and Shortnose Cisco are now considered globally extinct, and the only populations of Kiyi in the world occur in Lake Superior. The remaining three species, Cisco (*C. artedi*), Bloater (*C. hoyi*), and Shortjaw Cisco (*C. zenithicus*) were formerly abundant throughout the Great Lakes but now occur only in the upper Great Lakes. Bloater are found in Lake Superior, Lake Michigan, and Lake Huron and are not considered a Species of Greatest Conservation Need at this time. Shortjaw Cisco are restricted to Lake Superior. Ciscoes have recovered in Lake Superior and small populations exist in northern Lake Michigan and Lake Huron. Cisco and Shortjaw Cisco along with Kiyi represent the focal species for this portion of Michigan’s Wildlife Action Plan.

There is considerable interest in the reestablishement of Ciscoes in Lakes Michigan and Huron. Successful reestablishment will require knowledge of environmental, behavioral, and genetic factors that support existing stocks.

WHAT USES THE GREAT LAKES?

WHY ARE GREAT LAKES CISCOES IMPORTANT?

Protecting and rehabilitating Great Lakes Ciscoes is critical to preserving these key members of the native Great Lakes fish community. Great Lakes Ciscoes help maintain healthy predator populations, and create fishing opportunities for anglers and commercial fishers. Conservation actions for focal species outlined in this plan will help protect other Coregonid species in the Great Lakes.

PLAN CONTRIBUTORS

Central Michigan University

Little Traverse Bay Bands of Odawa Indians

Michigan Department of Natural Resources

The Nature Conservancy

WHAT IS THE HEALTH OF GREAT LAKES CISCOES HABITAT?

Ciscoes live in the open water of the Great Lakes, and use shallow and deep nearshore areas and connecting channels to spawn. By the middle of the 20th century, these habitats were degraded by pollution and altered by invasive species. Although nutrient inputs were greatly curtailed following establishment of the Clean Water Act, populations of Great Lakes Ciscoes have only rebounded in Lake Superior and in a few locations in northern Lake Huron and Lake Michigan. Recovery of Great Lakes Ciscoes is currently threatened by a more recent wave of aquatic invasive species that reduce productivity in the open water and compete with and prey upon Ciscoes. In addition, much of the southern portion of the Great Lakes Basin suffers from high levels of landscape disturbances from agricultural and urban landuses. Portions of Lake Erie, Lake Michigan, and Lake Huron continue to be degraded by excess sediment and nutrient loadings.

Spawning Reef

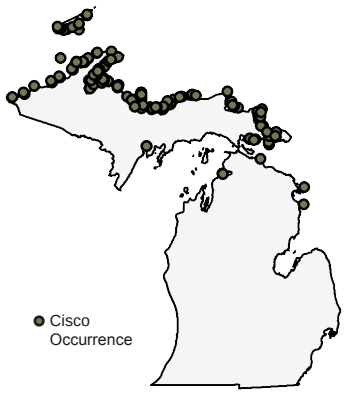
Many historical spawning reefs were damaged during Michigan's logging era. Restoration and rehabilitation of spawning reefs are critical to the recovery of Great Lakes Ciscoes.

WHAT ARE THE GREAT LAKES CISCO FOCAL SPECIES?

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

Cisco
(Coregonus artedi)
State Threatened

Formerly known as Lake Herring, Cisco are a slender, silvery fish that ranges in size from eight to 16 inches in length. Cisco exhibit highly variable body morphology among populations and were previously described as 24 subspecies (Koelz 1931). Cisco are pelagic, schooling in depths from 60 to 174 feet (Scott and Crossman 1973). Cisco are generally plankton feeders, but will consume a wide variety of foods, including insects and benthic invertebrates. Cisco once supported an important commercial fishery but have declined substantially in abundance throughout the Great Lakes (Stockwell et al. 2009). The stronghold for this species is Lake Superior, and remnant populations exist in Lakes Michigan and Huron. In more recent years, hydroacoustic surveys report a 48% decline in the biomass of the Lake Superior population (Gorman et al. 2013). Meanwhile, populations in northern Lake Michigan appear to be expanding.



GOALS

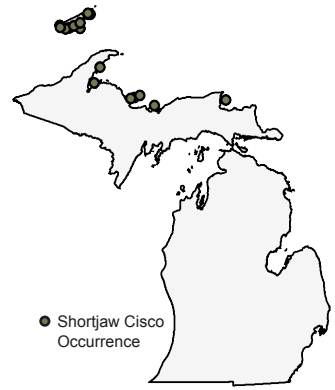
- Increase abundance of Cisco in Lakes Michigan and Huron.
- Increase the number of spawning locations for Cisco in Lakes Michigan and Huron.
- Determine reintroduction feasibility, costs and benefits, and identify best practices for Cisco management.

Kiyi
(Coregonus kiyi kiyi)
Special Concern

The Kiyi has an elongated, laterally compressed body with large silvery scales with purple iridescence. Kiyi are small fish and generally do not exceed 10 inches in length. Their mouth is small with weak teeth and their lower jaw projects beyond the upper. The Kiyi is among the deepest water forms of Great Lakes Cisco species. They are most widely distributed at depths of 450 - 600 feet during the day, and less than 250 feet at night. Spawning occurs during late-fall or early-winter at depths of 300 - 550 feet (Scott and Crossman 1973). Historically ranging throughout the Upper Great Lakes and Lake Ontario, Kiyi now only occur in Lake Superior. This formerly abundant species is extirpated from Lakes Michigan and Huron, and the Lake Ontario subspecies is extinct. Their decline is the result of over exploitation and introduced species (COSEWIC 2005; Fisheries and Oceans 2014).

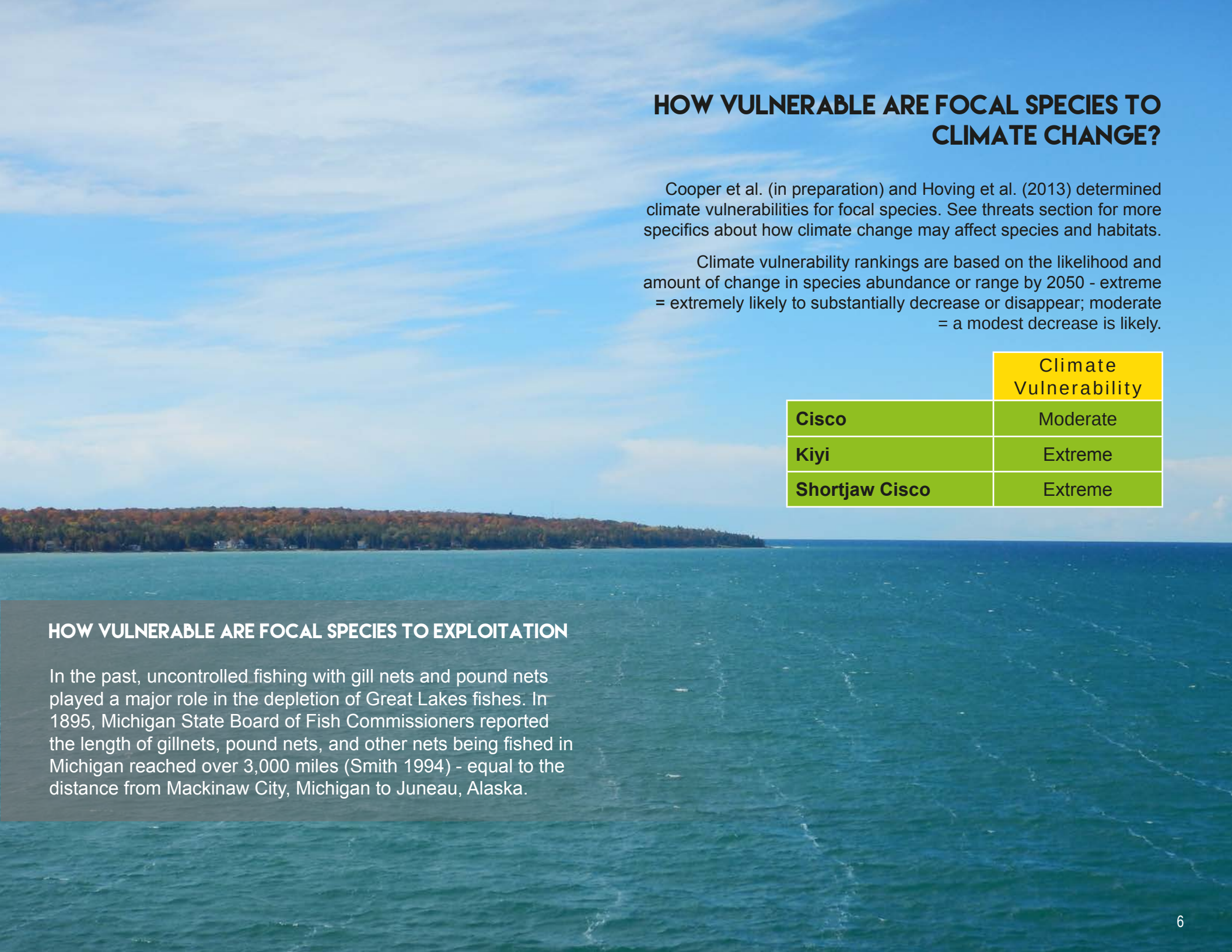
GOALS
- Determine status and trends in populations of Kiyi in Lake Superior.
- Determine reintroduction feasibility, costs and benefits of re-establishing Kiyi populations in Lakes Michigan and Huron.

GOALS
- Determine status and trends in populations of Shortjaw Cisco in Lake Superior.
- Determine reintroduction feasibility, costs and benefits of re-establishing Shortjaw Cisco populations in Lakes Michigan and Huron.



Shortjaw Cisco
(Coregonus zenithicus)
State Threatened

Shortjaw Cisco have an elliptical body covered in large, smooth scales. They are silver in color with an olive to tan back and white underbelly. Their mouth is small and toothless, and as the common name implies the lower jaw is shorter or even with the upper jaw (COSEWIC 2003). Shortjaw Cisco are pelagic and inhabit the deep, cold waters of Lake Superior at depths ranging from 60 - 490 feet. In Lake Superior spawning occurs in either spring or fall at depths of 120 - 240 feet. Shortjaw Cisco were once common throughout the upper Great Lakes, but populations have been extirpated in Lakes Michigan, Huron, and Erie due to over-exploitation for food fisheries. They have declined in Lake Superior and are at high risk of extirpation (Bronte et al. 2010).



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 rankings are based on the likelihood and amount of change in species abundance or range by 2050 - extreme = extremely likely to substantially decrease or disappear; moderate = a modest decrease is likely.

	Climate Vulnerability
Cisco	Moderate
Kiyi	Extreme
Shortjaw Cisco	Extreme

HOW VULNERABLE ARE FOCAL SPECIES TO EXPLOITATION

In the past, uncontrolled fishing with gill nets and pound nets played a major role in the depletion of Great Lakes fishes. In 1895, Michigan State Board of Fish Commissioners reported the length of gillnets, pound nets, and other nets being fished in Michigan reached over 3,000 miles (Smith 1994) - equal to the distance from Mackinaw City, Michigan to Juneau, Alaska.

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 Great Lakes Ciscoes

Invasive & Problematic Species, Pathogens & Genes

- Predatory invasive species, such as Round Goby, consume eggs; Rainbow Smelt consume larvae; and Sea Lamprey parasitize adults (COSEWIC 2003; Fisheries and Oceans 2014).
- Food web changes induced by colonization of Dreissenid mussels may decrease population stability and resiliency.

Lack of Knowledge

- Management is hindered by a lack of information regarding population trends (COSEWIC 2003), genetic structure of remaining populations (Todd 2003), and interspecific competition (Derosier 2007).

Transportation & Service Corridors

- Dredging and shoreline development cause loss of spawning habitat through siltation and sedimentation (Fisheries and Oceans 2014).

Human Intrusions & Disturbance

- Over-fishing has resulted in the extirpation of focal species in Lakes Michigan and Huron. Increased fishing pressure could jeopardize remaining populations in Lake Superior (COSEWIC 2003; COSEWIC 2005).
- Conflicting agency priorities may result in management actions that negatively impact Ciscoes.

Climate Change

- Climate change could have a variety of effects: lack of ice cover increases physical stress on eggs in the winter, food availability and timing of phytoplankton and zooplankton blooms may shift.

Species Management

CLS1. Focus efforts on conservation of existing populations.

CLS2. Focal species are present in waters shared by the United States and Canada. Conservation efforts should be coordinated and implemented through existing collaborative groups such as the Great Lakes Fishery Commission's Lake and Technical Committees. [Kiyi]

Conservation Designation & Planning

CLS3. Develop and implement a Cisco management plan for Michigan. [FD]

Law & Policy

CLS4. Protect key Cisco spawning and production areas through the environmental permit review process.

CLS5. 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

CLS6. Determine stock structure, mortality sources, and population trends. [LSBCS 2.7]

CLS7. Determine how strong year classes affect overall population numbers.

CLS8. Develop an adaptive management strategy for harvest in relation to potential population declines. [LSBCS 2.4]

CLS9. Develop habitat suitability models, climate change assessments, and priority conservation maps.

CLS10. Gather information on population dynamics of focal species and the associated fish community, including clarifying the role of focal species in the Lake Superior fish community and offshore food web. [Kiyi]

Conservation ACTIONS for Ciscos in Lakes Michigan & Huron

Species Management

CMH1. Implement a pilot project to rehabilitate the Cisco spawning reef in Bays de Noc.

Conservation Designation & Planning

CMH2. Develop guidelines and best practices for restoration efforts of Cisco.

CMH3. Develop and implement a Cisco management plan for Michigan. [FD]

Law & Policy

CMH4. Protect spawning and nursery areas using the environmental permit review process.

CMH5. Evaluate and implement fishery regulations to protect small Cisco populations and populations subject to active rehabilitation.

CMH6. 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

CMH7. Determine Cisco bottlenecks at different life stages, and evaluate differences among lakes.

CMH8. Determine Cisco status, distribution, and sources of mortality. [LHBCS]

CMH9. Identify and map new Cisco spawning locations.

CMH10. Determine genetic and phenotypic variability of Cisco to inform re-introduction efforts.

CMH11. Identify risks and benefits of reintroduction using different genotypes and phenotypes of Cisco. [LMBCS 6.6]

CMH12. Determine if remnant populations are present in southern Lake Michigan.

CMH13. Develop habitat suitability models, climate change assessments, and priority conservation maps.

Law & Policy

KS1. Protect spawning and nursery areas using the environmental permit review process.

KS2. 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

KS3. Verify recent records of Kiyi and Shortjaw Cisco in Lakes Michigan and Huron.

KS4. Evaluate feasibility of reintroduction efforts for Kiyi and Shortjaw Cisco in Lakes Michigan and Huron, and identify potential brood stock from Lake Superior.

KS5. Determine population trends for Kiyi and Shortjaw Cisco in Lake Superior. [LSBCS 2.7]

KS6. Determine if bycatch and misidentification are threats to Kiyi and Shortjaw Cisco in Lake Superior.

KS7. Evaluate and implement fishery regulations to protect small populations or populations subject to active rehabilitation.

KS8. Determine the mechanisms that have led to the loss of Kiyi and Shortjaw Cisco from Lakes Michigan and Huron to inform conservation efforts for the remaining Lake Superior populations. [Kiyi]

KS9. Develop habitat suitability models, climate change assessments, and priority conservation maps.

WHERE ARE THERE PLACES FOR PARTNERSHIP?

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

This map is based on focal species occurrences.

HOW WILL WE MONITOR?

Assessing status and measuring progress towards goals.

ALL FOCAL SPECIES

- Continue and expand fall gillnetting surveys to confirm the presence of spawning Cisco populations and gather evidence of their continued recovery.
- Continue young-of-year recruitment surveys to evaluate spawning success.
- Continue annual U.S. Geological Survey status and trends assessments of nearshore and offshore fish communities in Lake Superior.
- Continue annual interagency assessments of pelagic fishes in Lakes Michigan and Huron.

WITH ADDITIONAL RESOURCES

- Conduct acoustic mid-water trawl to identify spawning habitat; current trawl sampling does not occur during the right time of year to identify spawning habitats for Ciscoes.
- Quantify abundance and trends of extant Cisco populations in Lakes Huron and Michigan using hydroacoustics and mid-water trawls.

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.

[FD] Charting the Course: Fisheries Division's framework for managing aquatic resources (DNR 2013)

[Kiyi] Management plan for Kiyi, Upper Great Lakes (*Coregonus kiyi kiyi*) in Canada [Proposed] (Fisheries and Oceans Canada 2014)

[LHBCS] The Sweetwater Sea: An international biodiversity conservation strategy for Lake Huron - Technical Report (Franks et al. 2010)

[LMBCS] Michigami: Great Water - Strategies to conserve the biodiversity of Lake Michigan -Technical Report (Pearsall et al. 2012)

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

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Photo Credits

Kiyi, Cisco, Lake Whitefish, Steelhead, Menominee - Joseph Tomelleri

Bloater - Todd & Goode

Lake Trout – U.S. Fish and Wildlife Service, Eric Engbretson

Lake Superior – Autumn Spitzley

Schooling Cisco – National Park Service, Paul Brown

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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/dnrwildlifeactionplan.