Chapter 4. Species of Greatest Conservation Need

4.0 Sources of Information

Wildlife species not threatened with extinction, or not managed as game animals, are generally not given sufficient consideration in land-use decisions in the context of large geographic regions or in relation to their actual habitats. Simply creating a consistent spatial framework for storing, retrieving, manipulating, analyzing, and updating the totality of our knowledge about the status of each animal species is a necessary and basic element for preventing the further degradation of biological resources (Covert and Simonson 2007).

The Division of Wildlife acquires information regarding the distribution and abundance of fish and wildlife species through a number of channels described throughout this Action Plan. For example, the Division regularly conducts surveys of reptiles and amphibians, neo-tropical songbirds, butterflies, waterfowl, as well as state-listed species. Aquatic species are surveyed similarly. For example, the Division has implemented an annual sampling/survey schedule on all inland waters to ascertain fish and aquatic wildlife populations. In addition, when necessary, both terrestrial and aquatic species are sampled or surveyed by third parties such as universities, private consultants, non-governmental organizations, and individuals recognized as species experts by the Division. This arrangement assures that the Division routinely obtains the most current and reliable information to make the best management decisions for Ohio's wildlife resources.

Information regarding the distribution and abundance of terrestrial and aquatic wildlife species for this Action Plan was assembled through a number of channels, beginning with the SGCN list from our 2005 CWCS (Ohio's Action Plan for 2005-2015). Data from surveys conducted since the completion of the 2005 CWCS were also included. Routinely conducted surveys by the Division of Wildlife were combined with a vast amount of data collected by agencies such as the US Fish and Wildlife Service (USFWS), US Geological Survey (USGS), US Environmental Protection Agency (USEPA), Ohio EPA, and Ohio Department of Natural Resources (ODNR) divisions (Parks, Natural Areas, Soil and Water, Forestry), as well as universities, non-governmental conservation organizations, and private consultants. Examples of sources of species information used to determine SGCN lists include:

Literature

- Ohio Breeding Bird Atlas
- Salamanders of Ohio Atlas
- Amphibians of Ohio
- Ohio Crayfish and Shrimp Atlas
- Mammals of Ohio
- The Fishes of Ohio
- The Freshwater Mussels of Ohio
- Annual *Ohio Wildlife Population Status Report*
- Literature Cited section of this Action Plan

Databases

- Ohio Natural Heritage Database
- Division of Wildlife's Wildlife Diversity Database
- Division of Wildlife's Fisheries Database
- Ohio ECOS
- USFWS National Wetlands Inventory
- USFWS Endangered Species
- NatureServe *Explorer*
- IUCN Redlist
- Butterflies and Moths of North America
- North American Breeding Bird Survey

- Ohio Wetland Breeding Bird Survey
- Ohio Frog and Toad Call Survey
- Longterm Butterfly Monitoring Survey
- Ohio Odonata Survey

Non-government Organizations
- The Nature Conservancy – Ohio Chapter
- Midwest Biodiversity Institute
- Ohio Biological Survey, Inc.
- Ohio Lepidopterists
- Ohio Odonata Society
- The Ohio State University

State/Federal Agencies
- Ohio EPA
- USEPA
- USFWS
- USGS
- USACOE
- ORSANCO (interstate commission)
- ODNR, divisions of Forestry, Natural Areas, Parks, Watercraft, Wildlife

Individuals
- Ryan Argo (fish) ORSANCO
- Dr. Brian Armitage (aquatic insects) Ohio Biological Survey
- Justin Baker (fish) OSU
- Dave Berg (mussels) Miami University (OH)
- Robert Glotzhober (odonates) Ohio Historical Society
- Dr. Mike Hoggarth (mussels) Otterbein University
- Marc Kibbey (fish) OSU
- Dr. Robert Krebs (mussels) Cleveland State University
- Kody Kuehnl (mussels) Franklin University
- Greg Lipps (amphibians) OSU
- Zac Loughman (crayfish) West Liberty University (WV)
- Larry Rosche (odonates) author
- Dr. Kristin Stanford (reptiles) OSU
- Nate Tessler (fish) ODOT
- Roger Thoma (crayfish) Midwest Biodiversity Institute
- Dr. G. Thomas Watters (mussels) OSU
- Doug Wynn (reptiles) species expert
- Brian Zimmerman (fish) OSU

4.1 SGCN List Development and Rationale

With the exception of invasive species, all native and naturalized wildlife species in Ohio were considered for Species of Greatest Conservation Need (SGCN) in this State Wildlife Action Plan revision. To help prioritize conservation efforts for species, we used the scoring system described by Millsap et al. (1990), modified slightly to fit Ohio (see Conservation Status Criteria below). This system had been used in Ohio's original CWCS to determine SGCN lists for terrestrial species, consequently we had experience with it and were comfortable that it met our needs. In addition, AFWA's Best Practices for SWAP's recommended that states use some kind of standardized ranking system to develop SGCN lists. The "Florida system" developed by Millsap et al. was one of the recommended systems.

All species for which there was sufficient information to calculate scores were scored within taxa groups (with the exception of avian species - see Avian Species Scoring below). Teams of internal and external species experts were assembled for amphibian, avian, butterfly, skipper, crayfish, dragonfly, damselfly, fish, mammal, mussel, and reptile taxa groups. Team members from outside of the Division of Wildlife included individuals from the Midwest Biodiversity Institute, Ohio Chapter of the Nature Conservancy, Ohio EPA, Ohio Biological Survey, Inc., The Ohio State University Department of Evolution, Ecology and Organismal Biology, other ODNR divisions, and numerous individuals recognized as species experts.

These teams used the best information available, and the scoring system described below to develop draft conservation status ranks for each species in these groups. These draft SGCN lists were then made available for review to additional species experts, stakeholders, conservationists, and members of the public at the 2014 and 2015 Ohio Wildlife Diversity Conference (~ 950 participants/event), the 2013 and 2014 Ohio Wildlife Diversity Leadership Conference (~ 50 participants/event), and 2014 Wildlife District Open Houses (5 sites around the state). In addition, the draft SGCN lists were posted on the Division's website for review and comment by the public. After combining all available data and considering input from all reviewers, the lists of SGCN were assigned final conservation status ranks which created the conservation priority order for species within each taxa group.

Working towards determining the final SGCN lists, a primary consideration was how much could realistically be accomplished during the life of the Action Plan. Using the complete list of scored species within each taxa group, internal species experts considered how much work could be completed during the 10-year life of the Plan. Projections were made regarding staff levels, available time, available funding, and conservation partner participation during the next 10 years. Based upon these estimates, SGCN lists were truncated for each taxa group. Using the truncated lists, consideration was then given to (1) the percentage of SGCN from the previous CWCS that were included on the new lists, (2) the percentage of state listed species included on the new lists, and (3) the percentage of federally listed species included on the new lists. Our feeling was that the new SGCN lists should contain a high percentage of species from these three categories. To generate the final SGCN lists then, the line of truncation (using conservation status ranks) was adjusted to include at least 75 percent of the species from the three categories above, with a very few minor exceptions. These exceptions were species that either could not be scored, or were SGCN from the 2005 CWCS for which work will continue during the 2015 SWAP.

Conservation Status ranks for species within these taxa groups are contained in tables 4-12 along with rankings for each species, notes describing species listing (if applicable), habitat association, rangewide occurrence, statewide occurrence, and Ohio population trend are also contained in the tables. The species lists, and ranks within lists within each SGCN table are considered working drafts, and as such are open for future discussion and modification.

4.2 Conservation Status Criteria

As discussed above, all native and naturalized wildlife species in Ohio – mammals, reptiles, amphibians, butterflies & skippers (within the terrestrial invertebrates group), dragonflies & damselflies (within the aquatic invertebrates group), fish, mussels, crayfish – with the exception of avians were scored using the Florida Fish and Wildlife Conservation Commission (FWC) Species Ranking developed by Millsap et al. (1990), with slight modifications to fit Ohio (described below).

To determine individual species scores using the FWC Species Ranking system, species experts were brought together to work through the scoring criteria as a team. Teams varied in size (usually 3-8 individuals), but were kept small enough that consensus could be reached on the many scoring criteria used in this system. Because teams were small, selection was based upon level of knowledge of the taxa group being scored, rather than affiliation of the team members. For this reason, some teams did not include Division of Wildlife personnel as scorers. Historical and current distribution and abundance data and extensive knowledge from species experts were used to determine scores for each criterion. Where differences of opinion occurred, discussion ensued, and consensus was reached. When consensus could not be reached, scores were averaged for each criterion across scorers (this was occasionally the

case for fish and mussels). Scoring "meetings" were facilitated by Division of Wildlife SWAP Advisory Team members.

4.2.1 Modifications to FWC Species Ranking system

Aside from substituting "Ohio" for "Florida" throughout the document, two minor modifications were made to allow the FWC system to be used for scoring Ohio species.

(1) *Biological Variables* - #3 Range Size – size categories were adjusted to fit the state of Ohio in terms of land area.

(2) *Supplemental Variables* - #5 Harvest of the Taxon – for clarification purposes, the word "collected" was added to "harvested" so that each scoring choice read "harvested/collected". Most native wildlife species in Ohio are not harvested, but many are collected.

4.2.2 Conservation Status and Numeric Ranks in SGCN Tables

In order to prioritize species of greatest conservation need within taxa groups, we chose to use a scoring system developed by Millsap et al. (1990) to determine a numeric rank conservation status for each species. This scoring system ranks species according to biological vulnerability, extent of current knowledge of population status, and management needs. Primary components of the system are biological scores, action scores, and supplemental variables. A detailed description of these components is presented in Chapter 3 Monitoring, Evaluation, and Adaptive Management.

The score from which conservation status (numeric rank in our SGCN tables) is derived is the sum of the biological score and action score for each species. As the Florida system functions, higher biological scores for a given species indicate a greater degree of imperilment. Conversely, lower action scores for a given species indicate a higher level of knowledge about the species itself, and a higher level of management activities focused on the species.

Species that score high in the biological and action categories have the highest conservation rank in our SGCN tables. High biological and action scores are reflective of species that (1) have a higher degree of imperilment, and (2) about which our knowledge of, and management activities directed towards - are lacking. Species which score low in both biological and action categories rank towards the bottom of our SGCN tables. In this case, degree of imperilment is low, and our knowledge about and management of the species is high. Species in the middle portion of the SGCN tables are there because they had high biological scores coupled with low action scores, or low biological scores coupled with high action scores. The second scenario here (low biological scores/high action scores) can cause listed species to rank lower in the SGCN tables than would be expected if the reader interprets the tables only as a measure of degree of imperilment.

4.2.3 Avian Species Scoring

As mentioned above, avian species were the one taxa group that was not scored using the Florida system. Attempts to use the Florida system for avian species failed because consensus could not be reached on many of the scoring criteria. Where other taxa group scoring teams were able to work out differences in such cases, the avian scoring group could not. A point was reached where we were forced to develop a system of our own to determine avian SGCN. That system was a weighted matrix that we used to identify the native and naturalized Ohio breeding avian species for prioritizing future conservation efforts. The matrix included an assessment of the following:

- the status of the species: Endangered, Threatened, Species of Concern, Species of Special Interest, Extirpated (scoring point values were Endangered = 3, Threatened = 2, Species of Concern = 1)
- the species ability to be self-sustained within designated conservation opportunity areas (COA) (scoring point values were 1 point for each COA (maximum of 10 possible points))
- species conservation status in the 2010 Ohio Bird Conservation Plan: Highest, High, or Moderate (scoring point values were highest = 3, high = 2, moderate = 1)
- no points were assigned to species identified as viable and broadly distributed in Ohio

4.3 Ohio's Species of Greatest Conservation Need

Ohio's 405 SGCN include species from the taxa groups mammals, birds, reptiles, amphibians, terrestrial invertebrates, aquatic invertebrates, fish, mussels, and crayfish (Table 3). In the case of invertebrates, these groups are represented by thousands of terrestrial and aquatic species for which varying degrees of data exist, and statutory authority varies. For these reasons, we were only able to calculate scores (and thus conservation priority ranks) for dragonflies, damselflies, butterflies, and skippers. However, there were some species that in our opinion needed to be included on SGCN lists, but for which no scores could be calculated. Our opinion was based on local knowledge as well as NatureServe and IUCN Red List information. These species were added to both the aquatic and terrestrial invertebrate SGCN lists, with notation indicating that scores could not be calculated at this time.

The majority of species on the following SGCN lists are species that have little or no dedicated funding. Most of these species have conservation needs that are not funded through the Endangered Species Act, and most are not directly funded with hunting/fishing license dollars. This Plan and the funds from the State Wildlife Grants program will provide the backbone for their conservation over the next 10 years.

Table 3. Ohio's SGCN by taxa group and associated number of state listed species.

SGCN		Listed Species Categories				
Taxonomic Group	**Number of Species**	**Endangered**	**Threatened**	**Species of Concern**	**Special Interest**	**Extirpated**
Mammals	30	3	1	16	1	1
Birds	61	11	5	11	3	0
Reptiles	26	5	4	8	0	0
Amphibians	23	5	1	1	0	0
Fishes	64	20	12	5	0	6
Mussels	57	24	4	7	0	9
Crayfishes	15	0	1	2	0	0
Aquatic Invertebrates	76	16	6	1	0	0
Terrestrial Invertebrates	53	10	1	2	1	0
Total	**405**	**94**	**35**	**53**	**5**	**16**

The species in Table 3 are distributed by taxa group in the SGCN tables that follow in this chapter. In the 10-year life of this Action Plan, it would be impossible to focus conservation actions and associated projects directly on each of the 405 species designated as SGCN. Time and resources being limited, will have to be apportioned carefully, and on high priority species and habitats. The conservation needs of the species in the table above vary from reintroduction/restoration on one end of the spectrum, to basic distribution and abundance surveys on the other. In the next 10 years, some species will receive a lot of attention in terms of research and management, and other species will likely receive none. Under Required Element 5, sub-element C calls for the Action Plan to explain why monitoring efforts for a species or group of species in the Plan may not be appropriate, necessary, or possible. For a small number of extirpated species (described in taxa group sections), conditions in Ohio are no longer conducive to their existence here. For the vast majority of the 405 SGCN in Ohio, we consider some kind of conservation effort for to be both appropriate and necessary – however, even under the best of circumstances, not always possible. Given that reality, we need to focus our conservation efforts on maximizing the "amount of good done" to "effort expended" ratio. We need to harness our conservation coalition to maximize coverage, keep our technical people focused on technical issues, utilize our citizen scientist network for the collection of basic information, and promote habitat projects that have the potential to benefit the largest number of species for the effort. As this Plan unfolds from this point forward, it will go without saying that conservation efforts not identified for a species or species group has

everything to do with limited time, money, and resources – and nothing to do with whether efforts are appropriate or necessary.

4.4.1 Ohio's SGCN Taxa Groups – history and status of listed species

Given its past geologic and glacial history, Ohio contains a diversity of habitats that support an abundance of terrestrial and aquatic species. Three hundred and eighty terrestrial vertebrate wildlife species are recognized as native and naturalized. In addition, Ohio supports a diverse and abundant aquatic species community represented in part by 173 species of fish, 79 species of mussels, and 21 crayfish species. These numbers are presented as highlights, and are not meant to be a complete listing of species from Table 3 above. Also, these values represent historic numbers of species, and as such are not meant to align directly with SGCN lists.

Unfortunately, Ohio's landscape has changed significantly since settlement, and that has had a profound effect on resident fish and wildlife species. Changes to the quality and quantity of habitats have resulted in the extirpation of some species, and caused various levels of imperilment for others. Aquatic species constitute the majority of Ohio's threatened and endangered species and also represent the majority of extinctions and extirpations. Fish and mollusks, the two species groups for which the most historical information exists, appear to have been impacted the most by changes to Ohio's landscape since settlement.

The following sections describing the history and status of listed species for each taxa group contain only information on species that are considered SGCN in Ohio (tables 4-12). Some listed species from the SGCN tables are not included in these sections due to a lack of sufficient information. As data gaps are filled during the life of this Action Plan, this information will be added and these sections will be updated.

4.4.2 Taxa Group: Mammals

The species assemblage, abundance, and distribution of mammals have changed dramatically since Ohio was settled. This taxa group is extremely sensitive to natural and anthropogenic factors that affect its habitat and impact population levels. Mammals as a group require considerable space to sustain populations due to individual energy needs. In addition, low reproductive rates relative to other taxa groups make them more vulnerable to issues like habitat loss and overharvest, and slower to recover from the population reductions that result. Mammals have been subjected to habitat loss, degradation, and fragmentation since settlement. Their value to humans for meat and fur has been an issue for some species, and other species have been reduced or extirpated in the name of protection of people and livestock. The assemblage that remains in Ohio today is a reflection of all this taxa group has endured in the past, and its ability to adapt to the modern landscape.

Extirpated Mammals

Historically at least 10 mammals have been extirpated from Ohio. Mountain lions and gray wolves were eliminated from Ohio shortly after European settlement by over-trapping, habitat loss, and eradication due to an effort to protect people, livestock, and game species. Elk and bison were killed for their meat and hides. The marten and Canada lynx were probably never common in Ohio, and both species are currently confined to northern U.S. coniferous forests. All of these species were extirpated by the 1850s. The unique habitat and space required by them for survival and reproduction are no longer present in Ohio; thus, reintroduction is not a feasible option. The marsh rice rat, a semiaquatic North American rodent found primarily in the eastern and southern United States, has not been reported in Ohio since historic times. Their Ohio occurrence is known only from bones found in Native American archaeological sites. Reintroduction of this species is also not being considered.

The porcupine, which was extirpated by 1900, was once common in northeastern and northwestern Ohio. Although porcupines occasionally enter the state on their own, there are no plans to reintroduce this species because of possible conflicts with humans. However, recently a number of spatially concentrated sightings in Jefferson County suggest the possible establishment of a small breeding population. Fishers, one of the few natural predators of porcupines, are widespread throughout the northern forests of North America, and were once widespread in the Midwest, but similar to other extirpated predators, over-trapping and habitat loss eliminated them from Ohio by the mid-1800s. An isolated population exists in

the Appalachians of West Virginia, and they were reintroduced to Pennsylvania in 1994 by the Pennsylvania Game Commission. Currently, they are abundant in parts of Pennsylvania - some within a 1-2 county radius of Ohio's eastern border, and occasional sightings of fishers occur in eastern Ohio and are becoming more frequent - although the presence of a breeding population is doubtful at this point. Nonetheless, the success of Pennsylvania's fishers and the self-repatriation of fishers in other parts of their range, suggest they may re-establish small breeding populations in Ohio in the future. Monitoring of porcupine and fisher sightings, and initiation of surveys in areas of possible re-establishment are warranted. Bobcats, once extirpated have returned to the state in numbers, occupying much of the southeastern portion of Ohio.

Endangered Mammals

The black bear, Indiana myotis (bat), and Allegheny woodrat are the endangered listed mammals from Ohio's SGCN list. Black bears were extirpated by 1850, but have returned to Ohio from adjacent states as Ohio's forest land recovered. They are provided full protection under the law as their population becomes established and grows. Black bear sightings have remained relatively consistent over the past decade. More importantly, the number of sightings of sows with cubs has remained low and fairly consistent, indicating a small but stable breeding population. Young female black bears tend to settle into home ranges adjacent to their mother, whereas young males tend to travel considerable distances before settling into a new home range. Because the peak of sightings (June and July) corresponds with the peak of breeding and dispersal, most of the sightings likely represent dispersing males. This is supported by the fact that all bears killed (most due to vehicle-related mortality) or trapped by ODOW employees (for relocation due to repeated bear-human conflicts) in Ohio to date (n = 20) have been males. For 3 years, extensive surveys utilizing techniques proven effective to survey black bears in nearby states (i.e., hair snares, camera traps) have failed to detect black bears in Ohio. This includes surveys located in the immediate vicinity of recent verified sightings, with survey stations at twice the minimum recommended density. These data suggest the possibility that a small and stable to slowly growing bear population exists in Ohio. Further monitoring of verified sightings, particularly those of females with cubs is warranted. Additional field surveys will be warranted when verified observations indicate a potential increase in bear population numbers that will make field surveys effective.

The Indiana bat was listed as endangered at the federal level in 1967 and at the state level in 1974 primarily due to loss of summer habitat and large numbers of deaths caused by human disturbance during hibernation. As is the case with many bat species, Indiana bat are extremely vulnerable to disturbance while they hibernate. Furthermore, because they hibernate in large numbers in only a few caves (the largest hibernation caves support from 20,000 to 50,000 bats) the loss of even one hibernaculum represents a huge loss for the species. More than 85% of the range-wide population of Indiana bat occupies nine "Priority One" hibernacula (i.e., hibernacula with recorded populations of >30,000 bats since 1960). Other threats include commercialization of caves, loss of summer habitat, pesticides and other contaminants, and most recently, white-nose syndrome (WNS). Ohio is home to a "Priority Two" hibernaculum (>500 but <30,000 bats) in Preble County (~9,000 Indiana bats prior to WNS in Ohio). Assessing hibernacula survey results at Ohio hibernacula from pre-WNS (pre-2011) to the most current (2014, post-WNS) results, the Division has reported approximately an 85% decline in the winter bat population, to include a 48% decline in Indiana bats. Continued monitoring and protection of hibernacula and summer habitat is imperative. Evaluation of maternity sites and hibernacula (mines and caves) are warranted. Further, description and delineation of summer habitat is needed. Protection of summer habitat and continued monitoring for WNS and associated population declines are also necessary to ensure the bat's protection in Ohio.

The Allegheny woodrat has always had a limited distribution in Ohio and has been listed as endangered since 1974. It has not been observed outside of Adams County for several years. The rapid decline of Allegheny woodrat populations throughout the northern portion of its range caused much concern about the species' future. The declines prompted researchers to examine possible causative factors. A primary factor is the parasite *Baylisascaris procyonis* (raccoon roundworm), a nematode that is fatal to woodrats. Increased habitat fragmentation may also be a factor. Fragmentation from roads and development causes loss of habitat, isolation, and increased exposure to parasitism, because these corridors also provide easy access for parasite hosts such as raccoons. Methods to protect remaining populations

should be investigated (e.g., anthelminthic drugs), and intact forests that provide habitat for this species must be protected from further fragmentation and development. Furthermore, augmentation of Ohio's woodrat population via reintroduction into suitable habitats should be considered if roundworm prevalence can be curtailed.

Threatened Mammals
The eastern harvest mouse and Northern long-eared bat are presently Ohio's only threatened mammals. The mouse is in old fields, marshes, and wet meadows in the eastern United States. Little is known about this species' population distribution and trend in Ohio.

All counties within Ohio are within the summer and winter range of Northern long-eared bat. Literature has suggested that the habitat requirements for this species are associated with mature interior forests and the species is sensitive to fragmentation and destruction of forested habitat. The species has a significant site fidelity to their natal forests for future maternity sites and could be affected by winter alterations of habitat when they return for the summer. During the summer the species is known to move frequently (every 2-3 days) from roost tree to roost tree within a forested area, therefore the entire forested habitat is as important as the individual trees that they roost in. Populations of this species have declined significantly since white-nose syndrome (WNS) was first detected. Ohio has also experienced the rapid spread of the disease since the winter of 2011-2012 and has now confirmed in 20 counties across the state. Hibernacula counts that have occurred for more than 20 years in Ohio have detected significant declines in northern long-eared bats and other species. Furthermore, from 2011 and 2014, there has been a declining trend in the number of bat detections recorded during the mobile acoustic surveys, especially the *Myotids*. Continued monitoring and protection of hibernacula and summer habitat is imperative. Evaluation of maternity sites and hibernacula (mines and caves) are warranted. Further, description and delineation of summer habitat and continued monitoring for WNS and associated population declines are also necessary to ensure the bat's protection in Ohio.

Mammal Species of Concern
Of Ohio's mammal SGCN, 16 are designated as species of concern. These include the pygmy shrew, star-nosed mole, woodland jumping mouse, and southern red-backed vole. Pietkiewicz and Harder (pers. communication) conducted small mammal trapping throughout Ohio for 10 target species, including the species of concern. A total of 2,176 specimens, representing 19 of Ohio's 22 small mammal species were collected. Pygmy shrews accounted for only 4 captures, star-nosed moles 3 captures, woodland jumping mice 1 capture, and no southern red-backed voles were captured. Further research is needed to determine abundance and distribution, as well as factors limiting populations of these small mammals. Additional surveys will be required to determine if the southern red-backed vole continues to exist in Ohio or has been extirpated.

Ohio is within the summer and winter range of little brown bats, big brown bats, tri-colored bats, and eastern small-footed bats. Many of these species have seen winter population declines because of white-nose syndrome. Based on a 5 year average prior to white-nose syndrome compared to hibernacula surveys in 2014, little brown bats have declined 98-99.5%, big brown bats have declined approximately 40%, and tri-colored bats have seen a 97-98% decline. There are only five records of Eastern small-footed in Ohio during the summer, and no records for the winter thus little is known about the distribution and population size of this species. Eastern small-footed bats preference for shale habitat, which is unique among the sympatric bat species, makes it also vulnerable to mining and development. Ohio has historic records of Rafinesque's big-eared bat, but no recent records. Evening bats are rarely detected in Ohio, in part due to Ohio being on the edge of the range for this species. Silver-haired bats, Eastern red bats, and hoary bats (the migratory tree bats) are known to migrate through and summer in Ohio. Little is known about the statewide distribution and populations of these species. Surveys to determine the status of these species, including basic ecological requirements such as summer roost habitat characteristics, migration routes, and hibernacula, are needed.

Two carnivores, the ermine and badger are listed as species of concern. It is unknown if reproducing populations of ermines exist in Ohio. From the 1930's to 1987, three observations of ermines have been recorded, including 1 each in Cuyahoga, Lake, and Ashtabula counties. However, a study was conducted

in 1987 in which trapping, specifically to document ermine presence, was conducted in Ashtabula and Trumbull counties. In a total of 243 trap nights resulted in the capture of 1 female and 4 male ermine. Thus, ermine may be rarely observed in areas they occur. Ermine occur throughout Michigan and Pennsylvania, and they are easily mistaken for the larger long-tailed weasel. Consequently, ermine may occur in Ohio in the extreme northeastern or northwestern portions of the state. The badger occurs primarily in western Ohio and primarily utilizes combinations of small agricultural patches and linear habitat corridors, such as hedgerows, grassland buffers, and riparian areas. These small agricultural patches are relics that have remained after the vast agricultural transformation in Ohio. Management of suitable habitat is a key factor in conserving this species. Additional surveys to determine population size and range in Ohio are warranted for these species, particularly the ermine.

Table 4. Ohio's Mammal Species of Greatest Conservation Need
The conservation status (rank) for each species represents input from professionals in mammal taxonomy, distribution, and abundance. This table represents the best professional knowledge available at this time, and as such is subject to modification as additional data is obtained.

Conservation Status Rank*	Common Name	Scientific Name	Species Listing Fed	Species Listing State	Habitat Association	Rangewide Occurrence	Statewide Occurrence	Ohio Population Trend
1	Eastern Small-footed Bat	*Myotis leibii*		SC	B, D	A	D	U
2	Northern Long-eared Bat	*Myotis septentrionalis*	T	T	B, D, Q, I	A	A	D
3	Rafinesque's Big-eared Bat	*Corynorhinus rafinesquii*		SC	B, D	B	E	U
4	Silver-haired Bat	*Lasionycteris noctivagans*		SC	B	A	E	U
5	Evening Bat	*Nycticeius humeralis*		SI	B	B	C	U
6	Eastern Red Bat	*Lasiurus borealis*		SC	B	A	E	U
7	Indiana Bat	*Myotis sodalis*	E	E	B, D, H, I	A	A	D
7	Tri-colored Bat	Perimyotis subflavus		SC	B, D	A	B	D
9	Hoary Bat	*Lasiurus cinereus*		SC	B	A	E	U
9	Southern Flying Squirrel	*Glaucomys volans*			B	A	A	U
11	Pygmy Shrew	*Sorex hoyi*		SC	A	A	B	U
12	Least Shrew	*Cryptotis parva*			A	A	A	U
13	Southern Red-backed Vole	*Myodes gapperi*		EX	G	B	U	U
14	Little Brown Bat	*Myotis lucifugus*		SC	B, D, H, I, Q	A	A	D
14	Big Brown Bat	*Eptesicus fuscus*		SC	B, D, I, Q	A	A	D
16	Ermine	*Mustela erminea*		SC	C, G	B	B	U
16	Thirteen-lined Ground Squirrel	*Spermophilus tridecemlineatus*			A, E, I	B	A	U
16	Badger	*Taxidea taxus*		SC	A, E	B	B	U
19	Pine Vole	*Microtus pinetorum*		SC	B	A	B	U
19	Smoky Shrew	*Sorex fumeus*		SC	B	A	B	U
19	Eastern Harvest Mouse	*Reithrodontomys humulis*		T	A	A	A	U
22	Hairy-tailed Mole	*Parascalops breweri*			B	B	B	U
22	Woodland Jumping Mouse	*Napaeozapus insignis*		SC	B, G	B	B	U

24	Allegheny Woodrat	*Neotoma magister*	E	B, D	B	D	U
25	Star-nosed Mole	*Condylura cristata*	SC	C	A	B	U
25	Eastern Chipmunk	*Tamias striatus*		B, I	A	A	U
25	Bobcat	*Felis rufus*		B	A	B	I
28	Meadow Jumping Mouse	*Zapus hudsonius*		A, H	A	A	U
28	Black Bear	*Ursus americanus*	E	B	A	B	I
n/r	Snowshoe Hare	*Lepus americanus*	SC	G	B	D	D

* Rank derived from Conservation Status Score calculated using Millsap et al. (1990) modified for Ohio. The order in which species with the same conservation status rank (i.e., ties) are listed does not imply differences between these species.

n/r added to SGCN list because of research and management activities that may continue under this this Action Plan

Habitat Association Key
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Statewide Occurrence Key
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Rangewide Occurrence Key
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D = center of range in/near Ohio
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Ohio Population Trend Key
D = decreasing
I = increasing
S = stable
U = unknown

Species Listing Key
E = endangered
T = threatened
SC = species of concern
SI = species of interest
EX = extirpated

4.4.3 Taxa Group: Birds

Historically, a total of 421 avian species have been recorded in the state. Of the 421 species recorded, 40 of those have only been seen once. About 300 species occur in Ohio annually, and of these, about 180 species breed in Ohio every year. The birds on our SGCN list (N=53) are a subset of the 180 birds presently considered to breed in Ohio. They were chosen according to the criteria described in section 4.1 SGCN List Development and Rationale. Additionally there are 22 avian species which occasionally breed in the state but their densities are relatively low. Their numbers in Ohio are dependent upon the success of their rangewide population. Two avian species, the passenger pigeon and Carolina parakeet, are extinct.

Extirpated Birds

The Swallow-tailed kite, greater prairie chicken, ivory-billed woodpecker, and Bachman's sparrow have been extirpated from Ohio for many years. Based on radiocarbon dating of materials from a Scioto County site, the ivory-billed woodpecker is believed to have disappeared from Ohio during the 15th or 16th century. Swallow-tailed kites nested in Ohio during the first half of the 19th century, but habitat destruction and human persecution eliminated this species. Swallow-tailed kites breed in mature, wetland forests and most of the remaining birds live in the southeastern U.S, primarily Florida. The greater prairie chicken was extirpated from the state by 1880 because of market hunting and the conversion of woodlands and prairie habitat to cropland. Greater prairie chickens require very large tracts of prairie grassland habitat. The last documented sighting of Bachman's sparrow was from Scioto County in 1978. There is no clear reason for their disappearance from Ohio or other adjacent states. They prefer pine woodlands and are a conservation concern in all states where they still exist. Ivory-billed woodpeckers, Greater prairie chickens, and Bachman's sparrows are all red list species on the National Audubon Society's Watchlist (i.e., declining rapidly and/or have very small populations or limited ranges and face major conservation threats). The swallow-tailed kite is a yellow list species (i.e., either declining or rare with national conservation concern). Because of their low population numbers and lack of required habitats in Ohio, reintroduction of these species is not biologically feasible at this time.

The golden-winged warbler, once locally common in the Oak Openings region, has been likely extirpated from the state. No nests were recorded in the 1980s and only 1 nest was recorded in the 1990s. The Breeding Bird Atlas II (2006-2011) has recorded 3 possible and 2 probable nests but no nests that were confirmed. Golden-winged warblers are a red list species on the American Bird Conservancy and National Audubon Society's Watchlist (i.e., declining rapidly and/or have very small populations or limited ranges and face major conservation threats). Declines have been caused by habitat loss, competition and hybridization with the blue-winged warbler, and nest site parasitism by brown-headed cowbirds.

Bewick's wrens are now believed to be extirpated from Ohio. Rapid declines of remnant populations of Bewick's wrens occurred from the mid-1950s to the mid-1960s. They were extremely rare by the 1990s. The 1982-1987 Breeding Bird Atlas verified 3 breeding pairs during this time, and summarized that Ohio probably had a maximum of 5 breeding pairs annually across the state. Only 1 possible nest was located during the Breeding Bird Atlas II in northern Ohio. Declines are believed to be from interspecific competition with house wrens and habitat loss. The USFWS lists Bewick's wrens as species of Conservation Concern in BCRs 13 and 28.

Endangered Birds

Recovery efforts are in place for the common tern and sandhill crane. Common terns have been monitored annually since 1993 for reproductive effort and population size. Efforts were made to establish secure artificial nest structures and to deter predators during the nesting season. Numbers of nests have ranged from 65-350 and young fledged have ranged from 3-345 over the last 16 years. Recovery efforts should continue for common terns with the goal of delisting. Sandhill cranes were last recorded nesting in Ohio in 1926 until a nest was confirmed in Wayne County in 1987. Since then cranes have been monitored annually to determine abundance and distribution in the state. Successful nest sites have varied from 1-41 since 1997. Sandhills have been located in 15 counties with an increasingly large non-breeding flock staying at Funk Bottoms Wildlife Area in Wayne County. Continued monitoring is necessary to assess their population status.

The upland sandpiper is a grassland bird that was very numerous after the forests of pre-settlement Ohio were replaced by open fields. However, the conversion of grassland to crops and market hunting severely reduced their population. Upland sandpipers require a variety of grassland heights for nesting, brood rearing and foraging. The Breeding Bird Atlas I found 5 possible, 8 probable, and 10 confirmed nests from 1982-1987. The Breeding Bird Atlas II so far has documented 1 possible nest, 13 probable nests, and 1 confirmed upland sandpiper nest, 2006-2010. The USFWS lists the upland sandpiper as a species of Conservation Concern in BCRs 13, 22 and 28.

Lark sparrows are at the extreme eastern limit of their range in Ohio and are unlikely to ever occur in viable numbers (>200 breeding pairs). Because Ohio is on the extreme edge of these birds' ranges, it is unlikely that management efforts would result in significant increases in their populations within the state. Therefore, with the exception of efforts to protect occupied areas, minimal management efforts will be directed for these species.

The American bittern, king rail, and black tern declined in Ohio with the loss of wetlands. They now breed in very limited numbers in Ohio, mostly on the shores of western Lake Erie. American bitterns, king rails, and black terns are listed in the "High" and "Highest" categories of Birds of Conservation Concern with the U.S. Fish and Wildlife Service (USFWS) in Bird Conservation Regions (BCR) 13 and 22. King rails have declined significantly in Ohio and over their entire breeding range. The USFWS developed a King Rail Conservation Plan that calls for 250 hectares (617 acres) of additional breeding habitat in Ohio to help increase the Midwestern population of king rails to 524 individuals. All 3 of these species are considered focal species for monitoring efforts and should be given conservation priority according to the Upper Mississippi Valley/Great Lakes (UMVGL) Waterbird Conservation Plan. Unless the amount of quality wetland habitat is increased considerably, these species will probably not return to viable population levels. Currently habitat that does exist for these species should be protected and improved whenever possible.

West Sister Island in Lake Erie contains the largest colonies of snowy egrets (10-15 pairs) and cattle egrets (8-12 pairs) in the Great Lakes. Although these species nest in low numbers in Ohio, habitat destruction by double-crested cormorants may decrease their numbers further. Control strategies that reduce the impact of cormorants on island vegetation need to be continued.

Northern harriers are associated with large grasslands, wet meadows, wet prairies, pastures, hayfields, and reclaimed surface-mined lands. Their numbers declined with the loss of grassland and wetland habitats, and through persecution. Harriers were rare in the 1950s through the 1980s with a slight increase in the 1990s, although few nests were reported in Ohio. The Breeding Bird Atlas I (1982-1987) reported 28 possible nests, 3 probable, and 4 confirmed nests. The Breeding Bird Atlas II (2006-2011) lists 71 possible nests, 9 probable, and 7 confirmed nests. Northern harriers have declined throughout their range from habitat loss. Management and restoration of large grasslands in Ohio would benefit this species. Continued monitoring is necessary to access population status.

Surveys for the loggerhead shrike at former breeding locations and surface-mined lands owned by the Division of Wildlife produced no observations of the species in 2002-2003. The Ohio Breeding Bird Atlas II found 1 confirmed nest of loggerhead shrikes in southwestern Ohio and 4 possible breeding locations in northern counties. They have declined across their range; the USFWS lists the loggerhead shrike as a Bird of Conservation Concern in BCRs 22 and 28. Declines are believed to be because of habitat loss and possibly poor over-winter survival in the southeastern U.S.

Threatened Birds

The trumpeter swan was downgraded from endangered to threatened in 2013, and the population continues to increase. Ohio released 154 trumpeter swans from 1996-2003 as part of a restoration effort. Since 2006, over 20 trumpeter swan nests have been observed each year and 44-73 cygnets have been produced annually. Reintroduction has been completed but trumpeter swans continue to be monitored annually to assess their recovery and re-evaluate their status.

Black-crowned night herons are considered a focal species for monitoring efforts and should be given high priority according to the UMVGL Waterbird Conservation Plan for monitoring in the Great Lakes. The plan calls for increasing populations in BCRs 13 and 22 by managing and protecting high-quality breeding habitats. Succession and damage by double-crested cormorants are currently reducing the vegetation necessary for black-crowned night herons to successfully nest on West Sister Island in Lake Erie. Control strategies need to be evaluated that will reduce the impact of succession and cormorants on island vegetation. Protection of nesting sites for black-crowned night herons on West Sister Island is imperative for the viability of this species in Ohio.

Before Ohio lost 90% of its wetlands, least bitterns were quite common in Ohio. The most dramatic declines were from the 1930s through 1965 when many marshes were drained. Least bitterns still nest in small numbers in the Western Lake Erie marshes and in very local, scattered inland marshes. They are listed as a species of Conservation Concern by the USFWS in BCRs 13 and 22. Least bitterns are considered a focal species and a high priority for monitoring efforts and should be given conservation priority according to the UMVGL Waterbird Conservation Plan.

Recovery programs are currently ongoing for barn owls. Barn owls and peregrine falcons have been down-listed from Ohio endangered to threatened status because of these recovery efforts. Peregrine falcons were also delisted from the Federal Threatened and Endangered Species list in 1999.

Bird Species of Concern
Henslow's sparrows (BCRs 13, 22, 28), cerulean warblers (BCRs 13, 22, 28), prothonotary warblers (BCR 22), and sedge wrens (BCR 28) are listed by the USFWS as species of Conservation Concern in several Ohio BCRs. Henslow's sparrows, cerulean warblers and prothonotary warblers are also focal species in the UMVGL Landbird Conservation Plan. The plan lists them as a high priority for monitoring efforts and should be given conservation priority. The National Audubon Society and the American Bird Conservancy's Watch List classifies Henslow's sparrows as red (i.e., declining rapidly and/or have very small populations or limited ranges and face major conservation threats) and cerulean warblers and prothonotary warblers as yellow (i.e., species that are either declining or rare, typically species of national conservation concern). These species should be given priority for monitoring and research to assess their status and to develop habitat plans to protect or restore critical habitats essential to their recovery when possible.

Populations of the northern bobwhite quail were decimated after severe winters in 1977 and 1978. Statewide survey indices have shown some population recovery in southwestern Ohio, but quail numbers have never reached pre-1977 levels. The North American Breeding Bird Survey (BBS) index for bobwhites in Ohio has declined by 6.3% per year since 1966 and by 9.4% annually since 1996. The Breeding Bird Atlas I listed 100 possible, 180 probable, and 122 confirmed nests. Breeding Bird Atlas II has recorded 97 possible, 265 probable, and 17 confirmed nests. The Northern Bobwhite Conservation Initiative (NBCI) plan states that the northern bobwhite may approach extirpation in some states by the end of the decade. The NBCI plan lists population and management goals for BCRs 22, 24, and 28 in Ohio. Monitoring and restoration of bobwhite quail and their habitat should continue, especially in the southwestern portion of the state.

Other species listed under this category should be monitored to assess their population status, and/or develop methods to learn more about their populations in Ohio.

Table 5. Ohio's Avian Species of Greatest Conservation Need
The conservation status (rank) for each species represents input from professionals in avian taxonomy, distribution, and abundance. This table represents the best professional knowledge available at this time, and as such is subject to modification as additional data is obtained.

Conservation Status Rank*	Common Name	Scientific Name	Species Listing Fed	Species Listing State	Habitat Association	Rangewide Occurrence	Statewide Occurrence	Ohio Population Trend
1	Cerulean Warbler	*Setophaga cerulea*		SC	B	A	C	D
1	Henslow's Sparrow	*Ammodramus henslowii*		SC	A, I	A	A	S
3	Northern Bobwhite	*Colinus virginianus*		SC	A	A	C	D
3	Sedge Wren	*Cistothorus platensis*		SC	A, C	A	D	S
5	Northern Harrier	*Circus cyaneus*		E	A, C	A	D	S
5	King Rail	*Rallus elegans*		E	C	A	C	U
5	Virginia Rail	*Rallus limicola*		SC	C	A	C	S
5	Sora	*Porzana carolina*		SC	C	A	C	S
5	Marsh Wren	*Cistothorus palustris*		SC	C	A	C	S
10	American Bittern	*Botaurus lentiginosus*		E	C	A	C	S
10	Upland Sandpiper	*Bartramia longicauda*		E	A, I	A	C	D
10	Common Tern	*Sterna hirundo*		E	C, J	A	D	S
10	Black Tern	*Chlidonias niger*		E	C, F	A	D	U
10	American Black Duck	*Anas rubripes*		SI	C	A	C	U
10	Least Bittern	*Ixobrychus exilis*		T	C	A	C	S
10	Black-crowned Night-Heron	*Nycticorax nycticorax*		T	C, F	A	C	S
10	Blue-winged Warbler	*Vermivora cyanoptera*			B	A	A	D
10	Worm-eating Warbler	*Helmitheros vermivorum*			B	A	B	S
10	Great Egret	*Ardea alba*		SC	C, F, H	A	A	S
10	Sharp-shinned Hawk	*Accipiter striatus*		SC	B	A	A	S
10	Common Gallinule	*Gallinula galeata*			C	A	C	D
10	Prothonotary Warbler	*Protonotaria citrea*		SC	C, H, O	A	A	U
10	Bobolink	*Dolichonyx oryzivorus*		SC	A	A	A	D

24	Snowy Egret	*Egretta thula*	E	C, F	A	D	U
24	Loggerhead Shrike	*Lanius ludovicianus*	E	A	A	D	S
24	American Woodcock	*Scolopax minor*		B, C	A	A	S
24	Wood Thrush	*Hylocichla mustelina*		B	A	A	S
24	Trumpeter Swan	*Cygnus buccinator*	T	C	B	C	I
24	Blue-winged Teal	*Anas discors*		A, C	A	C	S
24	Peregrine Falcon	*Falco peregrinus*		I	A	C	I
24	Black-billed Cuckoo	*Coccyzus erythropthalmus*		B	A	A	S
24	Barn Owl	*Tyto alba*	T	A, I	A	C	I
24	Eastern Whip-poor-will	*Antrostomus vociferus*		B	A	B	D
24	Red-headed Woodpecker	*Melanerpes erythrocephalus*		B	A	A	D
24	Prairie Warbler	*Setophaga discolor*		B	A	B	D
24	Sandhill Crane	*Grus canadensis*	E	A, C	A	B	I
24	Cattle Egret	*Bubulcus ibis*	E	A, C, F	B	D	U
38	Lark Sparrow	*Chondestes grammacus*	E	A, E, I	B	C	U
38	Acadian Flycatcher	*Empidonax virescens*		B	A	A	S
38	Wood Duck	*Aix sponsa*		B, H, C	A	A	S
38	Great Blue Heron	*Ardea herodias*		C, F, H	A	A	S
38	Wilson's Phalarope	*Phalaropus tricolor*	SI	A, C	B	D	U
38	Yellow-billed Cuckoo	*Coccyzus americanus*		B, H	A	A	D
38	Short-eared Owl	*Asio flammeus*	SI	A, C	B	D	U
38	Great Crested Flycatcher	*Myiarchus crinitus*		B	A	A	S
38	Bell's Vireo	*Vireo bellii*	SI	A	B	C	U
38	Yellow-throated Vireo	*Vireo flavifrons*		B	A	A	S
38	Blue-gray Gnatcatcher	*Polioptila caerulea*		B	A	A	S
38	Veery	*Catharus fuscescens*		B	A	B	S
38	Black-and-white Warbler	*Mniotilta varia*		B	A	A	S
38	American Redstart	*Setophaga ruticilla*		B	A	A	S

38	Vesper Sparrow	*Pooecetes gramineus*		A, I	A	A	S
38	Eastern Meadowlark	*Sturnella magna*		A	A	A	D
n/r	Dickcissel	*Spiza americana*		A	B	A	S
n/r	Yellow-breasted Chat	*Icteria virens*		B	A	A	D
n/r	Chimney Swift	*Chaetura pelagica*		I	A	A	S
n/r	Hooded Warbler	*Setophaga citrina*		B	A	A	S
n/r	Louisiana Waterthrush	*Parkesia motacilla*		H	A	A	S
n/r	Grasshopper Sparrow	*Ammodramus savannarum*		A	A	A	D
n/r	Field Sparrow	*Spizella pusilla*		A	A	A	S
n/r	Kentucky Warbler	*Geothlypis formosa*		B	A	A	S

* Rank derived from Conservation Status Score calculated using weighted matrix described in the Avian Species Scoring section. The order in which species with the same conservation status rank (i.e., ties) are listed does not imply differences between these species.

n/r added to SGCN list because of research and management activities that need to be conducted under this Action Plan

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4.4.4 Taxa Group: Reptiles

This taxa group consists of snakes, turtles, lizards, and skinks. Habitat alteration, limited mobility, and human persecution have shaped the abundance and distribution of Ohio's reptiles. Much remains to be learned about this species group. Their generally secretive nature makes them prime candidates for habitat loss as well as direct mortality from human activities. Until more distribution information on both the macro and micro-scale is obtained, it will be difficult to protect habitat for some species. Improving public perception of certain species (snakes for example) will help to alleviate human persecution issues. Overall, basic life history and ecology information for reptiles lags behind that of other taxa groups, and limits our ability to conserve many of these species.

Endangered Reptiles

There are 2 endangered reptiles on Ohio's SGCN list. They have suffered habitat destruction, degradation, and fragmentation, as well as intentional killing and over-collecting. In addition, they have very limited statewide distributions.

Recovery efforts are currently underway for the timber rattlesnake. Timber rattlesnakes are a woodland species. The Division's management plan for this species is to protect existing populations as opposed to increasing their occupied range. Public sightings and annual surveys are important sources of information concerning their distribution and relative abundance. Educational programs aimed at segments of the public most likely to encounter rattlesnakes are exceptionally valuable tools in conserving populations of these venomous snakes

U.S. Fish and Wildlife Service Recovery Plans have been completed for the copperbelly watersnake. The principle limiting factor for copperbelly watersnakes is the availability of wetland/upland complexes of sufficient size (hundreds of acres are needed to maintain a population). Additional factors include human persecution, inadequate habitat management, and road-related mortality. The copperbelly watersnake is known only to persist in Ohio in Williams County. The CRP State Acres for Wildlife Enhancement (SAFE) program in Ohio is aimed at creating conservation practices to address high priority objectives through targeted habitat restoration. Williams County is within a priority area, and the copperbelly watersnake is a target species.

Threatened Reptiles

The 3 threatened reptiles on Ohio's SGCN list have been primarily impacted by habitat loss and alteration, although exploitation from the pet trade has also taken a toll. The Kirtland's snake occupies moist, open meadow or wet prairie habitats. Their occupied Ohio range appears to be declining, but because of their secretive nature and habitat preference, confirmed sightings are infrequent. The ecology and behavior of Kirtland's snake are also poorly understood and warrant further research. The presence of crayfish burrows seems to be an important factor because they are the presumed hibernation, aestivation, and refuge sites. They appear to rely heavily on earthworms as prey. Suitable habitat may also remain unoccupied due to chemical contamination. The spotted turtle is associated with fens. Spotted turtles frequently use a multitude of wetland areas, and shift between them often. Uplands are used extensively, and provide important habitats for nesting, aestivating, and as travel corridors between wetlands. Blanding's turtle is essentially imperiled rangewide in the U.S., and it has been given state conservation status in 14 of the 15 states in which it occurs. Both diet and reproduction are essential elements for the species recovery, however both are tied to the quality and availability of habitat. Current research in Ohio, failed to document recruitment of Blanding's turtles. Management plans for the Kirtland's snake, spotted turtle, and Blanding's turtle should be focused on maintaining and increasing required habitat components in the landscape.

Reptile Species of Concern

There are 8 reptiles designated as species of concern. Habitat destruction and fragmentation has impacted the eastern box turtle. This isolates individuals from mates and/or food, increases road crossings, and subsequently increases mortality. The commercial pet trade also has had a tremendous impact on eastern box turtles. Their slow reproductive rate increases recovery time for this species. The eastern black kingsnake is limited in Ohio to Adams, Scioto, Jackson, and Lawrence counties, and even in this area it is relatively uncommon. It shows a marked preference for the Scioto and Ohio River

bottomlands. The apparent decline in populations across the range is somewhat surprising given their broad diet and habitat capacity. Understanding basic ecological requirements and behavior of eastern kingsnakes is paramount to successful conservation and management in Ohio.

The preferred habitat for the short-headed garter snake has largely disappeared as old farms have been developed or abandoned and reforested in some areas. A population of short-headed garter snakes in Youngstown (Mahoning County) exists, although it is uncertain whether these snakes were introduced or native. The northern rough greensnake lives in the extreme southern quarter of the state and is comparatively uncommon throughout its range. It may be reduced in some areas where insecticides are applied.

The queensnake is found in small rivers and streams with rocky shores and bottoms. Rarity is largely due to loss of habitat, and water pollution and sedimentation affect both habitat quality and food availability. This species is known to communally hibernate in old bridge abutments, fractured dams, and in some deep rip-rap, and is vulnerable when actions are taken to repair or remove these structures. Freshly molted crayfish provide more than 90% of the queensnake's diet. Information on other aspects of its natural history is lacking. Results of a recent study suggested an overall decline in the queensnake.

The smooth earthsnake occurs only in the southern quarter of the state, especially in the forested area of Shawnee and Pike state forests. It is extremely secretive and little is known concerning its biology. The smooth greensnake is also comparatively uncommon throughout its range, and has likely been reduced by habitat destruction and widespread use of insecticides. The Ouachita map turtle appears to have a very limited distribution in Ohio, being found only in the Scioto River and associated oxbows. Status and distribution are poorly understood because of identification problems and confusion in the literature. Research is needed to document the distribution and abundance of this species, and to fill in gaps in our knowledge concerning their natural history.

Table 6. Ohio's Reptile Species of Greatest Conservation Need
The conservation status (rank) for each species represents input from professionals in reptile taxonomy, distribution, and abundance. This table represents the best professional knowledge available at this time, and as such is subject to modification as additional data is obtained.

Conservation Status Rank*	Common Name	Scientific Name	Species Listing Fed	Species Listing State	Habitat Association	Rangewide Occurrence	Statewide Occurrence	Ohio Population Trend
1	Shortheaded Garter Snake	Thamnophis brachystoma		SC	I	B	D	I
2	Eastern Smooth Earth Snake	*Virginia valeriae valeriae*		SC	B	B	B	D
3	Rough Green Snake	*Opheodrys aestivus*		SC	B, H, M, N	B	D	D
4	Spotted Turtle	*Clemmys guttata*		T	C, G	A	C	D
5	Kirtland's Snake	*Clonophis kirtlandii*		T	A, C	D	C	D
6	Eastern Hognose Snake	*Heterodon platirhinos*		SC	B, E, H	A	A	D
7	Midland Smooth Softshell	*Apalone mutica mutica*			H, K, M, N	A	A	D
8	Butler's Garter Snake	*Thamnophis butleri*			A	B	C	D
8	Black Racer	*Coluber constrictor constrictor*			A, B	A	A	D
8	Blue Racer	*Coluber constrictor flaviventrus*			A	A	A	D
8	Smooth Green Snake	*Liochlorophis vernalis*		E	A	A	C	D
12	Broadhead Skink	*Eumeces laticeps*			B	B	C	D
13	Eastern Box Turtle	*Terrapene carolina carolina*		SC	B	A	B	D
13	Eastern Ribbon Snake	*Thamnophis sauritus sauritus*			A, C	A	A	D
13	Northern Ribbon Snake	*Thamnophis sauritus septentrionalis*			A, C	B	B	D
13	Black Kingsnake	*Lampropeltis getula nigra*		SC	B	B	D	D
17	Northern Copperhead	*Agkistrodon contortrix mokasen*			B	B	A	S
18	Timber Rattlesnake	*Crotalus horridus horridus*		E	B	B	C	D
19	Common Map Turtle	*Graptemys geographica*			C, H, K, M, N	B	C	S
19	Ouachita Map Turtle	*Graptemys ouachitensis*		SC	H, K, M, N	B	D	D
19	Queen Snake	*Regina septemvittata*		SC	H, K, M, N	A	A	D
22	Blanding's Turtle	*Emydoidea blandingii*		T	C, F	B	C	D
22	Copperbelly Water Snake	*Nerodia erythrogaster neglecta*	E	E	B, C	A	D	D

n/r	Lake Erie Water Snake	*Nerodia sipedon insularum*	T	F	E	D	S
n/r	Eastern Massasauga	*Sistrurus catenatus catenatus*	E	C	A	B	D
n/r	Eastern Plains Garter Snake	*Thamnophis radix radix*	E	A	B	D	D

* Rank derived from Conservation Status Score calculated using Millsap et al. (1990) modified for Ohio. The order in which species with the same conservation status rank (i.e., ties) are listed does not imply differences between these species.

n/r = added to SGCN list because of previous research and management activities that will continue under this Action Plan

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C = disjunct from main portion of its range; occurs in Ohio
D = center of range in/near Ohio
E = very limited range with most of its rangewide population occurring in Ohio

Ohio Population Trend Key
D = decreasing
I = increasing
S = stable
U = unknown

Species Listing Key
E = endangered
T = threatened
SC = species of concern
SI = species of interest
EX = extirpated

4.4.5 Taxa Group: Amphibians

Ohio's amphibian taxa group includes 25 species and subspecies of salamanders and 14 species of frogs and toads. The majority of amphibians spend part of their life in aquatic habitats and part of it in terrestrial habitats. This characteristic amplifies the potential impacts of habitat destruction/degradation. Protecting multiple habitat types becomes necessary for species that require different habitats during different portions of their life cycle. That, combined with their generally secretive nature makes this taxa group very vulnerable to the activities of humans on the landscape. Like reptiles, basic life history and ecology information lags behind some of the other taxa groups. Consequently, there is much work to be done to make conservation of amphibians in Ohio as effective as it can be.

Endangered Amphibians

Eastern hellbenders, blue-spotted salamanders, green salamanders, cave salamanders and the Eastern spadefoot are endangered in Ohio because of habitat loss and small populations in few, isolated locations. Eastern hellbenders, the largest amphibian in the state, are found in swift flowing streams in southeast Ohio. Ohio represents the extreme southern edge of the blue-spotted salamander's range, which is found in a few locations in the Oak Openings Region southwest of Toledo, and in Williams County. The green salamander is only known from 3 counties along the Ohio River. The cave salamander is found in limestone areas of 3 southern Ohio counties. Only 30 specimens are known from this state. There are 5 distinct populations of the eastern spadefoot, found in sandy soils associated with river valleys of 7 southern Ohio counties. Protection of the few remaining breeding locations of all 5 of these species will be critical in maintaining existing populations in Ohio.

Threatened Amphibians

The mud salamander has been found in 9 south-central Ohio counties. Ohio represents the northern edge of the mud salamander's range and only 20 voucher specimens exist for this species. Little is known about its life history or current statewide distribution. A survey of historical locations and other areas with suitable habitat should be initiated to better delineate the salamanders occupied range.

Amphibian Species of Concern

The four-toed salamander is the smallest Ohio salamander. It requires mature forests with bogs to complete their life cycle. Specimens have been found in 34 counties, however, its current range and population size needs to be assessed.

Research is also needed to assess the effects of forest management practices on survival and reproduction of all state-listed amphibians.

Table 7. Ohio's Amphibian Species of Greatest Conservation Need
The conservation status (rank) for each species represents input from professionals in amphibian taxonomy, distribution, and abundance. This table represents the best professional knowledge available at this time, and as such is subject to modification as additional data is obtained.

Conservation Status Rank*	Common Name	Scientific Name	Species Listing Fed	Species Listing State	Habitat Association	Rangewide Occurrence	Statewide Occurrence	Ohio Population Trend
1	Northern Spring Salamander	*Gyrinophilus porphyriticus porphyriticus*			B	B	B	D
2	Streamside Salamander	*Ambystoma barbouri*			B, H	A	B	D
3	Kentucky Spring Salamander	*Gyrinophilus porphyriticus duryi*			B	B	D	D
4	Smallmouth Salamander	*Ambystoma texanum*			B	A	A	D
5	Mud Salamander	*Pseudotriton montanus*		T	C, B	B	D	D
6	Green Salamander	*Aneides aeneus*		E	B	A	D	S
7	Jefferson Salamander	*Ambystoma jeffersonianum*			B, C	A	A	D
7	Northern Red Salamander	*Pseudotriton ruber ruber*			B, H	A	B	S
9	Eastern Tiger Salamander	*Ambystoma tigrinum tigrinum*			A, B, C	A	B	D
10	Marbled Salamander	*Ambystoma opacum*			A, B	A	B	D
11	Four-toed Salamander	*Hemidactylium scutatum*		SC	B, C, G	A	C	D
12	N. Ravine Salamander	*Plethodon richmondi*			B	A	B	S
13	Longtailed Salamander	*Eurycea longicauda longicauda*			B, H	A	A	S
14	Mudpuppy	*Necturus maculosus maculosus*			K, M, N, O	A	A	D
15	Cave Salamander	*Eurycea lucifuga*		E	D, I, N	B	D	D
15	Eastern Spadefoot	*Scaphiopus holbrookii*		E	B, C, I	A	D	D
17	Northern Dusky Salamander	*Desmognathus fuscus fuscus*			B, H	A	A	S
18	Mountain Chorus Frog	*Pseudacris brachyphona*			B, C	A	B	D
19	Blue-spotted Salamander	*Ambystoma laterale*		E	E	B	C	D
20	Red-spotted Newt	*Notophthalmus viridescens viridescens*			B, C, O, P	A	A	S
20	Western Chorus Frog	*Pseudacris triseriata triseriata*			A, B, C	A	B	D
22	Wood Frog	*Rana sylvatica*			B	A	A	D
23	Eastern Hellbender	*Cryptobranchus alleganiensis*		E	M	A	C	D

* Rank derived from Conservation Status Score calculated using Millsap et al. (1990) modified for Ohio. The order in which species with the same conservation status rank (i.e., ties) are listed does not imply differences between these species.

Habitat Association Key
A = grassland
B = forest
C = wetlands
D = caves & mines
E = oak savannahs
F = Lake Erie islands
G = boreal communities
H = riparian corridors
I = artificial/man-made environments
J = Lake Erie
K = Lake Erie Tributaries
L = Ohio River
M = Ohio River Tributaries
N = headwater and small inland streams
O = man-made lakes and ponds
P = natural lakes
Q = generalist

Statewide Occurrence Key
A = broadly distributed (>30 counties)
B = common (11-29 counties)
C = uncommon (6-10 counties)
D = rare (<5 counties)
E = unknown

Rangewide Occurrence Key
A = extensive range (multiple states/Canada) – which includes Ohio
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Ohio Population Trend Key
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EX = extirpated

4.4.6 Taxa Group: Fish

Two fish species that once occurred in Ohio are listed as extinct. The last reported collections for the extinct harelip sucker are from the Blanchard and Auglaize rivers in 1893, and the last blue pike was collected from Lake Erie in the late 1960s. Eight fish species are listed as extirpated, with most of them having been absent for many years, including the diamond darter (last seen in Ohio in 1899), pugnose shiner (1931), longhead darter (1939) and alligator gar (1946). Most extirpated species, including the blacknose shiner, are the victims of habitat loss, requiring conditions that no longer exist in much of Ohio. For other species like the Mississippi silvery minnow and spoonhead sculpin, Ohio likely represented the edge of their ranges. The extirpated diamond darter now occupies only a small stretch of the lower Elk River in West Virginia.

Endangered Fish

Twenty fish species are presently listed as endangered in Ohio. Cisco, once the most important commercially harvested species in Lake Erie are now a very rare species, though a small population still remains in the central and eastern basins. The popeye shiner was thought to have disappeared from Ohio prior to 1900 until a population was discovered in Scioto Brush Creek in southern Ohio in the mid 1980's. The shoal chub has not been found in Ohio waters since the early 1980's, the gilt darter since 1893, and the Scioto madtom since 1957 – these species may have become extirpated. Pirate perch had not been collected since 1942, and a reintroduction effort attempted in the 1990s does not appear to have been successful. Lake sturgeon (1971) and shovelnose sturgeon (1939) have been absent from Ohio for many years, but appear to be increasing in the Great Lakes and Ohio River drainage thanks to reintroduction programs.

As is the case with extinct and extirpated species, most of the endangered fish species are suffering from habitat loss/degradation and degraded water quality as development, dams, and agriculture have changed the landscape of Ohio. As expected, the majority of endangered fish are lesser tolerant species requiring clean, clear, often vegetated waters. Many of these now only occur in isolated locations around Ohio (e.g., goldeye, Iowa darter, northern madtom, popeye shiner, pugnose minnow, shortnose gar, spotted gar, spotted darter, western banded killifish). Ohio represents the extreme southern edge of the range of the longnose sucker.

Six of the seven species of lampreys that occur in Ohio are native, and three of those are listed as endangered (Ohio lamprey, northern brook lamprey, mountain brook lamprey). Lampreys require two or three distinctly different habitats that are connected by free flowing (free of dams) stretches of streams. Unfortunately the habitats necessary for lampreys to complete their life cycles have become degraded, and these species are now confined to a few locations around the state. Ohio lampreys are only found in the Ohio River and the lower portion of its tributary streams. Northern brook lampreys have been found in the Grand and St. Joeseph Rivers in the Lake Erie drainage and several tributaries to the Scioto River in the Ohio River drainage. However, they have only been found in the upper Grand River in recent years. Mountain brook lampreys are only found in the Mahoning river drainage in Ohio. The only known existing populations are in Eagle Creek and the West Branch of the Mahoning River.

Threatened Fish

Thirteen species of fish are listed as threatened in Ohio, and nearly all are river/stream species whose ranges have decreased as the habitat and water quality that they require has decreased. The bigeye shiner is one of several minnow species that were once much more abundant in Ohio than they are today. This species was once well distributed in the historically small, meandering, clear prairie streams of western Ohio. Today these streams have mostly been converted to straight muddy drainage ditches that are uninhabitable to this and other sensitive species. Bigmouth shiners have a small distribution in Ohio, primarily in the Rocky and Black river drainages of Lake Erie.

The western tonguetied minnow is only found in southwest Ohio in the Great Miami and Little Miami River systems. They were once rather well distributed in the upper portion of both of these river systems but today can only be found in the Mad River and tributaries of it in the Great Miami River system. The mountain madtom had been reduced to a few remnant populations but because of improvements in water quality they appear to be making a comeback. Populations now occur in parts of the Little Miami,

Muskingum, Walhonding, and Tuscarawas Rivers. Paddlefish are found in the Ohio River and up to the first dam on its larger tributaries. Historically they were much more common and could be found as far up the Ohio River as Pennsylvania. It is also probable that there was a small population in Lake Erie at one time. Today paddlefish are most common in the Ohio River from Portsmouth downstream to the Indiana state line. Blue suckers are not uncommon in fast, gravel-bottomed chutes of the lower Scioto River, from around Piketon downstream to the Ohio River. They are also present in the lower portions of the Great and Little Miami, Muskingum, and Hocking Rivers, and can be found in the Ohio River.

Historically the Tippecanoe darter was found in the Walhonding River, the lower Muskingum River, and in the Olentangy River, Big Walnut Creek, Big Darby Creek, and Deer Creek of the Scioto River drainage. Since the early 1980's they have expanded their distribution in the Scioto River drainage. Unfortunately they appear to have been extirpated from the Muskingum River drainage with the exception of a small population in the lower end of the Muskingum River.

Channel darters appear to be a victim of invasive species in a significant portion of their range. Up until the invasion of the round goby, large schools of channel darters could be observed on the bars around the Lake Erie islands. It is now likely the Lake Erie population no longer exists. They are still found in the Ohio River and the lower portion of the Scioto, Muskingum and Hocking Rivers. There may also be a small remnant population in the lower Maumee and Sandusky Rivers in the Lake Erie drainage. Greater redhorse are now largely confined to limited portions of the Sandusky, Maumee, and Grand River systems where water quality and substrates are less impacted by local land use. The river darter has historically been found in some of the larger western Lake Erie tributaries, but there are no recent reports of them from the Lake Erie drainage. This species is now limited to the Ohio River and the lower portion of larger tributaries such as the Scioto, Hocking, and Muskingum Rivers. The American eel which spends most of its life in freshwater, but spawns in saltwater may be found at times in any stream in Ohio and in Lake Erie. Sightings of this catadromous species are rare however.

Lake chubsuckers, because of the destruction of much of the permanent wetlands this species relies on, are one of the rarest sucker species found in Ohio. They are primarily found in glacially formed natural lakes often referred to as pothole or kettle lakes. Historically they were found in Nettle Lake of extreme NW Ohio, a group of small pothole lakes between Bellefontaine and Urbana Ohio, and in many small pothole lakes in NE Ohio. Today they are still present in those natural lakes that have clear water and an abundance of aquatic vegetation. Additionally, they can be found in a few larger wetlands like Killbuck marsh, and small populations may still be present in Nettle Lake, Indian Lake, and parts of the Portage Lakes.

Fish Species of Concern

Five fish are listed as species of concern on Ohio's SGCN list. Two species, (lake whitefish and burbot) are unique to Lake Erie, and are all on the southern edge of their range there. Burbot have never been extremely abundant, but lake whitefish made a substantial contribution to the Lake Erie commercial harvest in the late 1800's and early 1900's. Today both species are still present in some numbers.

River redhorse and the eastern sand darter are found in rivers/streams of both the Lake Erie and Ohio River drainage in Ohio. Both species are considered intolerant, and have consequently undergone range reductions. Least darters are relatively well distributed in the western part of Ohio in small sluggish prairie streams that have clear water and significant aquatic vegetation. They are also found in natural lakes and permanent wetlands that also contain large amounts of aquatic vegetation and clear water. Historically this species was probably more widely distributed where appropriate habitat was present.

Table 8. Ohio's Fish Species of Greatest Conservation Need
The conservation status (rank) for each species represents input from professionals in fish taxonomy, distribution, and abundance. This table represents the best professional knowledge available at this time, and as such is subject to modification as additional data is obtained.

Conservation Status Rank*	Common Name	Scientific Name	Species Listing Fed	Species Listing State	Habitat Association	Rangewide Occurrence	Statewide Occurrence	Ohio Population Trend
1	Scioto Madtom	*Noturus trautmani*	E	E	N	E	D	U
2	Diamond Darter	*Crystallaria cincotta*		EX	L, M	B	U	U
3	Popeye Shiner	*Notropis ariommus*		E	K	A	D	U
4	Longhead Darter	*Percina macrocephala*		EX	N	A	U	U
5	American Eel	*Anguilla rostrata*		T	K, L, M	A	C	U
6	Gilt Darter	*Percina evides*		E	L	A	D	U
7	Western Tonguetied Minnow	*Exoglossum laurae*		T	N	A	D	U
8	Spotted Darter	*Etheostoma maculatum*		E	N	A	D	S
9	Paddlefish	*Polyodon spathula*		T	L, M	A	B	I
10	Northern Madtom	*Noturus stigmosus*		E	N	A	D	D
11	Shoal Chub	*Macrhybopsis hyostoma*		E	L, M	B	D	D
12	Bigeye Shiner	*Notropis boops*		T	N	A	D	S
13	Ohio Lamprey	*Ichthyomyzon bdellium*		E	L, M, N	A	D	S
14	Spoonhead Sculpin	*Cottus ricei*		EX	J	B	U	U
15	Alligator Gar	*Lepisosteus spatula*		EX	L, M	B	U	U
16	Mountain Brook Lamprey	*Ichthyomyzon greeleyi*		E	N	A	D	S
17	Lake Sturgeon	*Acipenser fulvescens*		E	J, K, L, M	A	D	S
18	Blue Sucker	*Cycleptus elongatus*		T	L, M	A	D	S
19	Shovelnose Sturgeon	*Scaphirhynchus platorynchus*		E	L, M	A	C	S
20	Tippecanoe Darter	*Etheostoma tippecanoe*		T	M, N	A	D	S
21	Mountain Madtom	*Noturus eleutherus*		T	N	A	D	S
22	Blacknose Shiner	*Notropis heterolepis*		EX	J, K, N, P	A	U	U
23	Northern Brook Lamprey	*Ichthyomyzon fossor*		E	N	A	D	S
24	Mottled Sculpin	*Cottus bairdi*			J, N	A	B	S

25	Bluebreast Darter	*Etheostoma camurum*		L, M, N	A	C	I
26	Silver Lamprey	*Ichthyomyzon unicuspis*		J, K, N	A	C	S
27	Pugnose Minnow	*Opsopoeodus emiliae*	E	N	A	D	D
28	American Brook Lamprey	*Lampetra appendix*		N	A	B	I
29	Eastern Sand Darter	*Ammocrypta pellucida*	SC	J, K, L, M, N	A	C	S
30	Western Banded Killifish	*Fundulus diaphanus menona*	E	J, K, N, P	A	D	D
31	Redside Dace	*Clinostomus elongatus*		N	A	B	I
32	Gravel Chub	*Erimystax x-punctatus*		M, N	A	C	S
33	Least Darter	*Etheostoma microperca*	SC	N	A	C	I
33	Cisco	*Coregonus artedi*	E	J	B	C	D
35	Least Brook Lamprey	*Lampetra aepyptera*		N	A	B	I
36	Burbot	*Lota lota*	SC	J	A	C	S
36	Silver Chub	*Macrhybopsis storeriana*		J, K, L, M	A	B	I
38	Iowa Darter	*Etheostoma exile*	E	J, K, N, P	A	D	S
39	Goldeye	*Hiodon alosoides*	E	L, M	A	C	S
39	Rosyside Dace	*Clinostomus funduloides*		N	B	D	S
41	Streamline Chub	*Erimystax dissimilis*		M, N	A	D	S
42	Bigeye Chub	*Hybopsis amblops*		K, M, N	A	A	S
43	Central Mudminnow	*Umbra limi*		N	A	B	S
44	Channel Darter	*Percina copelandi*	T	J, K, L, M	A	C	S
45	Spotted Gar	*Lepisosteus oculatus*	E	J, K	A	C	D
46	Lake Chubsucker	*Erimyzon sucetta*	T	N, O	A	C	D
47	Longnose Sucker	*Catostomus catostomus*	E	J	B	D	D
48	Bigmouth Shiner	*Notropis dorsalis*	T	N	A	D	S
48	Black Redhorse	*Moxostoma duquesnei*		J, K, L, M, N	A	B	I
50	Mooneye	*Hiodon tergisus*		J, K, L, M	A	B	S
51	Pirate Perch	*Aphredoderus sayanus*	E	N, P	B	D	D
52	Silver Redhorse	*Moxostoma anisurum*		K, L, M, N	A	B	I

53	Variegate Darter	*Etheostoma variatum*		M, N	A	B	S
54	Southern Redbelly Dace	*Phoxinus erythrogaster*		N	A	A	I
55	Greater Redhorse	*Moxostoma valenciennesi*	T	K, N	A	C	S
56	Black Buffalo	*Ictiobus niger*		L, M	A	B	S
57	Lake Whitefish	*Coregonus clupeaformis*	SC	J	A	C	D
58	Dusky Darter	*Percina sciera*		L, M, N	A	C	S
58	Creek Chubsucker	*Erimyzon claviformis*		N	A	B	S
60	Shortnose Gar	*Lepisosteus platostomus*	E	L, M	A	D	S
61	River Darter	*Percina shumardi*	T	J, K, L, M	A	D	S
62	Mississippi Silvery Minnow	*Hybognathus nuchalis*	EX	L, M	B	U	U
63	River Redhorse	*Moxostoma carinatum*	SC	L, M	A	C	S
63	Smallmouth Redhorse	*Moxostoma breviceps*		L, M, N	A	B	I

* Rank derived from Conservation Status Score calculated using Millsap et al. (1990) modified for Ohio. The order in which species with the same conservation status rank (i.e., ties) are listed does not imply differences between these species.

Habitat Association Key
A = grassland
B = forest
C = wetlands
D = caves & mines
E = oak savannahs
F = Lake Erie islands
G = boreal communities
H = riparian corridors
I = artificial/man-made environments
J = Lake Erie
K = Lake Erie Tributaries
L = Ohio River
M = Ohio River Tributaries
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O = man-made lakes and ponds
P = natural lakes
Q = generalist

Statewide Occurrence Key
A = broadly distributed (>30 counties)
B = common (11-29 counties)
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A = extensive range (multiple states/Canada) – which includes Ohio
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4.4.7 Taxa Group: Mussels

In light of their historical decreasing abundance and distribution, mussels are generally considered to be the most imperiled group of organisms in North America. In Ohio, over half of our native mussel species are now listed (24 endangered, 4 threatened, 8 species of concern), extirpated (11), or extinct (6). Habitat degradation/destruction and harvest have historically been the primary culprits in the decline of mussel species, and recently ANS in the form of zebra mussels have contributed.

Ohio has an especially rich heritage of freshwater mussels, from both a biological and a historical perspective. Eighty species have been reported from the state. This number represents 27% of all mussel species known to be from North America (Watters et al. 2009). Major factors responsible for the decline in mussel species diversity and distribution have been the construction of impoundments, dredging of streams for navigation and flood control, sediments from agricultural and construction activities, and the addition of a wide spectrum of solid, semisolid, and liquid waste materials from the industries of a rapidly growing human population (Watters et al. 2009). Mussel research in Ohio has focused primarily on trying to stem the tide of extirpations – consequently listed mussel species have been at the forefront of most of these efforts. Recent research has included the construction of refugia for mussel species facing extirpation due to the expansion of the zebra mussel, laboratory efforts to identify hosts for imperiled mussel species, captive rearing of listed species, and reintroduction efforts.

The following species information has been assembled from Watters (1992,1995), Watters et al. (2009), NatureServe (2014), and the USFWS Midwest Endangered Species website at http://www.fws.gov/midwest/endangered/index.html unless otherwise noted.

Endangered Mussels

The northern riffleshell was historically found in the Ohio River and Maumee River drainages, and in a few tributaries of western Lake Erie. Today, the northern riffleshell occurs only in Big Darby Creek. Similarly, the clubshell historically was commonly found in the Ohio River basin and tributaries of western Lake Erie. Presently it is known from relatively few streams in Ohio, including Big Darby Creek. Efforts to augment the Big Darby Creek population of both the northern riffleshell and clubshell began in 2008 with the translocation of mussels from Pennsylvania.

The rabbitsfoot was once common in Lake Erie and Ohio River drainages. Today it is known only from Fish Creek, Killbuck Creek, Big Darby Creek, Little Darby Creek, and the Walhonding River. The rayed bean historically occurred in parts of the upper and lower Great Lakes systems, and throughout most of the Ohio and Tennessee River systems. It was common in many Ohio River system streams, and the population in Lake Erie was once considerable (but has been eliminated by the zebra mussel). Today the distribution of the rayed bean has been limited to Swan Creek, Fish Creek, Blanchard River, Tymochtee Creek, Walhonding River, Mill Creek, Big Darby Creek, Scioto Brush Creek; Great Miami River, Little Miami River (including the East Fork), and Stillwater River.

The snuffbox has been historically found in both the Lake Erie and Ohio River drainages. It has declined rangewide and is now estimated to occupy about 38 percent of originally occupied streams. It is estimated that total range reduction and overall population losses for the snuffbox each approximate 90 percent. Its current distribution Ohio is now limited to the Grand River, Ohio River, Muskingum River, Walhonding River, Killbuck Creek, Olentangy River, Big Darby Creek, Little Darby Creek, Salt Creek, Scioto Brush Creek, South Fork of Scioto Brush Creek, Little Miami River, and Stillwater River. Most populations are small and isolated, further increasing their risk of extinction.

The white cat's paw is currently known to exist only in a 3-mile portion of Fish Creek in Williams County in northwest Ohio. Records indicate that the white cat's paw historically occurred in the Maumee and St. Joseph rivers, and Fish Creek. It may have also occurred in the Ohio River. The last observation of a live white cat's paw pearly mussel occurred in 1999. The eastern pondmussel is present in Lake Erie and the Cuyahoga River, the Bass Islands of Lake Erie, and much of Lake Erie proper. Previous records from the Muskingum River are thought to be erroneous. Invasive zebra mussels are a major threat to this species in the lower Great Lakes. The purple lilliput is very rare if not extirpated. It was previously found in the

Maumee River drainage (Fish Creek, St. Joseph River, Blanchard River). Also a single record for the Little Miami River exists.

The fanshell historically occurred in the Ohio River and many of its large tributaries in Ohio. Presently, the fanshell is believed to be reproducing in only three rivers in Kentucky, Tennessee and Virginia. A few small (likely nonreproducing) populations (based on the collection of a few old specimens in the 1980s) may still persist in the Muskingum River. The pink mucket was historically found in the Ohio River tributaries in Ohio, but may now be extirpated in Ohio. The purple cat's paw historically occurred in the Ohio River and its larger tributaries in Ohio. Today it is one of the rarest mussels, considered to be on the brink of extinction. When listed as endangered in 1990 it was considered functionally extinct. However in 1994 a reproducing population was discovered in Killbuck Creek in northeast Ohio.

Historically, the sheepnose occurred in the Ohio River drainage and tributaries including the Muskingum, Tuscarawas, Walhonding, Mohican, Scioto, and Little Miami rivers. Today the sheepnose is found (but rare) in most mainstem pools of the Ohio River. Two additional rivers, the Muskingum River and its tributary the Walhonding River, have unknown populations. The ebonyshell is now extirpated from the Scioto River (where it formerly occurred up to Columbus), the lower Muskingum River, and much of the Ohio River. The butterfly is presently limited to the lower Muskingum River and Ohio River, but can be locally common.

The elephantear is common in the Ohio River and rarer in the upstream sections of smaller tributaries, but does not reach the Lake Erie drainage. It historically was found in the Scioto River to Columbus and Tuscarawas River at New Philadelphia. The longsolid is believed extirpated from the Scioto River (where it formerly occurred up to Columbus), and Great Miami River (only a single record known). It is now limited to the Muskingum River system where it is rare, including Tuscarawas and Walhonding Rivers. The pocketbook was once found in larger creeks and rivers throughout Ohio, but today may only occur in the Muskingum and Scioto River drainages (where it is rare), and perhaps Ohio Brush Creek. It is extirpated from the Black River as well as the Great Miami River.

The yellow sandshell is now extirpated from the state except for one site in lower Ohio Brush Creek where the last live specimen was collected in 1988. It is however, locally common below the Gallipolis Lock and Dam in the Ohio River. The washboard is sporadic in many streams in the southern part of the state, but may only be reproducing in the lower Muskingum River and Ohio River mainstem. It is absent from the Lake Erie drainage. The Ohio pigtoe is limited to the lower Muskingum River, Big Darby Creek, and a few sites in the Ohio River. This species was recently reported for the first time in Ohio Brush Creek (Matter et al., 2006). It is apparently extirpated from a number of other tributaries in Ohio.

The pyramid pigtoe historically occurred in the Ohio River from Marietta to Cincinnati, the Muskingum River to the Tuscarawas River, and the Scioto River in Pickaway County, but today is limited to the lowest reaches of the lower Muskingum River where it is rare. The wartyback historically may have lived in the lowest reaches of larger Ohio River tributaries, but is now limited to the Ohio River at Cincinnati and Ohio Brush Creek. It was historically as far upstream in the Ohio River as Portsmouth, and is now extirpated from the lower Great Miami River, and only a single stray record exists from the Scioto River at Columbus. The little spectaclecase is uncommon and on the northern edge of its range in Ohio, but occurs in Salt Ceek, Symmes Creek, Little Miami River, Ohio Brush Creek, Pine Creek, and several other southern Ohio creeks. The monkeyface is now limited to the lower Muskingum and Ohio Rivers.

Threatened Mussels

The black sandshell was historically found in most of Ohio, but now only in the mainstem and west branch of the St. Joseph River, Big Darby Creek, Muskingum River, and Walhonding River. The threehorn wartyback is sporadic in rivers in the southern part of the state, including Ohio Brush Creek (Hoggarth et al. 2007), the Muskingum River, Little Miami River, and Scioto River. It may be extirpated from the Lake Erie drainage. The fawnsfoot is now found in some Ohio River tributaries (Little Miami, Scioto, Muskingum, and Hocking rivers), and western Lake Erie and tributaries (Maumee, Portage, and Vermillion rivers), but is rare in the Ohio River. It was recently found in Ohio Brush Creek (Matter et al. 2006). The pondhorn is localized in prairie areas like Hellbranch Run, Big Darby Creek, Olentangy River

(all upper Scioto drainage), and Salt Creek (lower Scioto drainage) in Jackson County. It has also been found in Lake Erie embayments and tributaries.

Mussel Species of Concern
The purple wartyback is found in the Ohio River drainage (Great and Little Miami, upper Muskingum, and Scioto rivers, and Ohio Brush Creek), and the western Lake Erie drainage (absent from northeast Ohio), including the Maumee and Sandusky rivers.

The round pigtoe was historically widespread but has declined, with only a few recent records from the St. Joseph River and tributaries in Williams County, Olentangy River, Big and Little Darby creeks, Caesar Creek, Walhonding River, lower Muskingum River, and western basin of Lake Erie. The salamander mussel is considered rare (but widespread) in Ohio, and is known from the Grand River, St. Joseph River, Big Darby Creek, Little Miami River, Ohio Brush Creek, lower Little Scioto River, Salt Creek, and Symmes Creek (Raccon Creek basin) (Hoggarth et al. 2007). It was historically recorded from the Ohio Canal at New Philadelphia, Tuscarawas River, Scioto River at Columbus, Sandusky Bay, upper Scioto River, and Licking River. Weathered shells have recently been found in the Muskingum River at Marietta.

The deertoe is uncommon but apparently widespread in Ohio. Likewise, the kidneyshell is widespread but sporadic, though it can be locally abundant in locations like Fish Creek and Big and Little Darby Creeks. The elktoe has over 100 occurrences primarily in larger free-flowing creeks in many Ohio River and Lake Erie tributaries. It is rare in unglaciated Ohio and likely extirpated from Swan Creek (lower Maumee drainage) (Grabarciewicz 2008). The creek heelsplitter is found throughout (but sporadically) the Lake Erie and Ohio River drainages, Swan Creek (lower Maumee drainage) (Grabarciewicz 2008), and Raccoon Creek (Hoggarth et al. 2007).

Table 9. Ohio's Mussel Species of Greatest Conservation Need
The conservation status (rank) for each species represents input from professionals in mussel taxonomy, distribution, and abundance. This table represents the best professional knowledge available at this time, and as such is subject to modification as additional data is obtained.

Conservation Status Rank*	Common Name	Scientific Name	Species Listing Fed	Species Listing State	Habitat Association	Rangewide Occurrence	Statewide Occurrence	Ohio Population Trend
1	White Wartyback	*Plethobasus cicatricosus*	E	EX	L, M	B	U	U
2	White Catspaw	*Epioblasma obliquata perobliqa*	E	E	N	E	D	D
3	Purple Catspaw	*Epioblasma obliquata obliquata*	E	E	N	E	D	D
3	Pink Mucket	*Lampsilis abrupta*	E	E	L	B	D	U
5	Snuffbox	*Epioblasma triquetra*		E	J, K, M	C	B	D
6	Long Solid	*Fusconaia subrotunda*		E	L, M	C	C	D
7	Little Spectaclecase	*Villosa lienosa*		E	N	B	D	D
8	Pyramid Pigtoe	*Pleurobema rubrum*		E	L, M	A	D	D
8	Ebonyshell	*Fusconaia ebena*		E	L, M	A	D	U
8	Elephantear	*Elliptio crassidens*		E	L, M	A	C	D
8	Eastern Pondmussel	*Ligumia nasuta*		E	J, K	A	C	D
12	Orange-foot Pimpleback	*Plethobasus cooperianus*	E	EX	L, M	B	U	U
13	Ohio Pigtoe	*Pleurobema cordatum*		E	L, M	A	C	D
13	Sheepnose	*Plethobasus cyphyus*	E	E	L, M	A	D	D
15	Purple Lilliput	*Toxolasma lividum*		E	K, N	B	D	D
16	Monkeyface	*Quadrula metanevra*		E	L, M	A	C	D
16	Slippershell Mussel	*Alasmidonta viridis*			J, K, L, M, N	A	A	D
18	Winged Mapleleaf	*Quadrula fragosa*	E	EX	L, M	B	U	U
18	Ring Pink	*Obovaria retusa*		EX	L, M	B	U	U
18	Scaleshell	*Leptodea leptodon*		EX	L, M	B	U	U
21	Rayed Bean	*Villosa fabalis*	E	E	J, K, M, N	A	C	D
21	Butterfly	*Ellipsaria lineolata*		E	L, M	A	C	D
23	Creek Heelsplitter	*Lasmigona compressa*		SC	J, K, M, N	A	A	D
23	Pondhorn	*Uniomerus tetralasmus*		T	J, N, M	A	D	D

25	Rabbitsfoot	*Quadrula cylindrica*	T	E	K, M, N	A	C	D
25	Wartyback	*Quadrula nodulata*		E	L, M	A	D	D
25	Salamander Mussel	*Simpsonaias ambigua*		SC	K, M, N	A	C	D
25	Fanshell	*Cyprogenia stegaria*	E	E	L, M	A	D	D
29	Grooved Fingernailclam	*Sphaerium simile*			Q	A	A	U
29	Long Fingernailclam	*Musculium transversum*			Q	A	A	U
29	Ridged-back Peaclam	*Pisidium compressum*			Q	A	A	U
29	River Fingernailclam	*Sphaerium fabale*			Q	A	A	U
29	River Peaclam	*Pisidium fallax*			Q	A	A	U
29	Striated Fingernailclam	*Sphaerium striatinum*			Q	A	A	U
35	Rough Pigtoe	*Pleurobema plenum*	E	EX	L, M	A	U	U
35	Clubshell	*Pleurobema clava*	E	E	K, M, N	A	C	D
37	Yellow Sandshell	*Lampsilis teres*		E	L, M	A	D	D
37	Purple Wartyback	*Cyclonaias tuberculata*		SC	K, M, N	A	B	D
39	Spectaclecase	*Cumberlandia monodonta*		EX	L, M	A	U	U
40	Washboard	*Megalonaias nervosa*		E	L, M	B	C	D
40	Threeridge	*Amblema plicata*			J, K, L, M, N	A	A	D
42	Pocketbook	*Lampsilis ovata*		E	L, M	A	D	D
42	Round Hickorynut	*Obovaria subrotunda*			J, K, M, N	A	C	D
42	Cracking Pearlymussel	*Hemistena lata*	E	EX	L, M	A	U	U
45	Pond Fingernailclam	*Musculium securis*			Q	A	A	U
45	Ubiquitous Peaclam	*Pisidium casertanum*			Q	A	A	U
47	Black Sandshell	*Ligumia recta*		T	K, M, N	A	B	S
48	Kidneyshell	*Ptychobranchus fasciolaris*		SC	J, K, M, N	A	A	D
48	Northern Riffleshell	*Epioblasma torulosa rangiana*	E	E	J, K, L, M	A	D	D
50	Rainbowshell	*Villosa iris*			J, K, N, M	A	B	D
50	Round Pigtoe	*Pleurobema sintoxia*		SC	J, K, L, M, N	A	B	D
52	Elktoe	*Alasmidonta marginata*		SC	J, K, L, M	A	A	D

53	Deertoe	*Truncilla truncata*	SC	J, K, L, M	A	B	D
53	Fawnsfoot	*Truncilla donaciformis*	T	J, K, L, M	A	B	D
55	Threehorn Wartyback	*Obliquaria reflexa*	T	J, K, L, M	A	B	S
56	Fat Pocketbook	*Potamilus capax*	E EX	L, M	A	U	U
56	Cylindrical Papershell	*Anodontiodes ferussacianus*		J, K, M, N	A	A	S

* Rank derived from Conservation Status Score calculated using Millsap et al. (1990) modified for Ohio. The order in which species with the same conservation status rank (i.e., ties) are listed does not imply differences between these species.

Habitat Association Key
A = grassland
B = forest
C = wetlands
D = caves & mines
E = oak savannahs
F = Lake Erie islands
G = boreal communities
H = riparian corridors
I = artificial/man-made environments
J = Lake Erie
K = Lake Erie Tributaries
L = Ohio River
M = Ohio River Tributaries
N = headwater and small inland streams
O = man-made lakes and ponds
P = natural lakes
Q = generalist

Statewide Occurrence Key
A = broadly distributed (>30 counties)
B = common (11-29 counties)
C = uncommon (6-10 counties)
D = rare (<5 counties)
E = unknown

Rangewide Occurrence Key
A = extensive range (multiple states/Canada) – which includes Ohio
B = periphery of range is in Ohio
C = disjunct from main portion of its range; occurs in Ohio
D = center of range in/near Ohio
E = very limited range with most of its rangewide population occurring in Ohio

Ohio Population Trend Key
D = decreasing
I = increasing
S = stable
U = unknown

Species Listing Key
E = endangered
T = threatened
SC = species of concern
SI = species of interest
EX = extirpated

4.4.8 Taxa Group: Crayfish

The list of crayfishes of the United States and Canada includes 363 taxa. The conservation status categories of “Possibly Extinct”, “Endangered”, “Threatened”, or “Vulnerable” are recognized for 174 taxa (47.9%). Of these, 2 (< 1%) are possibly Extinct, 66 (18.2%) are Endangered, 52 (14.3%) are Threatened, and 54 (14.9%) are Vulnerable. Taxa classified as currently stable total 189 (52.1%). The number of imperiled crayfishes (48%) is on a level similar to that of freshwater mussels (Taylor et al. 2007).

For many crayfishes, limited natural range (e.g., one locality or one drainage system) drives recognition as Endangered or Threatened; but for many others, status assignments continue to be hampered by a lack of current distributional information. While progress has been made in this area, basic ecological and current distributional information are lacking for 60% of the U.S. and Canadian fauna. In addition, threats such as habitat loss and the introduction of nonindigenous crayfishes are greatly magnified by the limited distributions of many species. While taxa with restricted natural ranges are particularly vulnerable to habitat destruction or degradation, the recognized displacement abilities of nonindigenous crayfishes when coupled with a high level of endemism represent a threat of unequalled severity (Taylor et al. 2007).

Twenty-one species of crayfish occur in Ohio – on Ohio’s SGCN list the cavespring crayfish is listed as threatened, and the northern clearwater crayfish and virile crayfish are listed as species of concern.

Threatened Crayfish

The cavespring crayfish is know from only two sites in unglaciated sections of Ohio (R. Thoma, personal communication), however, rangewide there are no known major threats for this species and population numbers are believed to be stable.

Crayfish Species of Concern

The northern clearwater crayfish is confined to the Lake Erie basin, primarily in northeast Ohio where it is found in the lake and its tributaries. It has either disappeared or been reduced in abundance from much of its original Ohio range (Thoma and Jezerinac 2000). Like a number of crayfish species, it is impacted by water quality as well as the presence of rusty crayfish. The virile crayfish has a very restricted range in Ohio, being found only in the East branch of the Chagrin River. This population in the Chagrin basin is believed to be a relict remaining from a wider distribution that existed when the climate was colder (Thoma and Jezerinac 2000).

Table 10. Ohio's Crayfish Species of Greatest Conservation Need

The conservation status (rank) for each species represents input from professionals in crayfish taxonomy, distribution, and abundance. This table represents the best professional knowledge available at this time, and as such is subject to modification as additional data is obtained.

Conservation Status Rank*	Common Name	Scientific Name	Species Listing Fed	Species Listing State	Habitat Association	Rangewide Occurrence	Statewide Occurrence	Ohio Population Trend
1	Teays River Crayfish	*Cambarus sciotensis*			M	E	C	D
2	Norwood River Crayfish	*Orconectes raymondi*			M	E	D	D
3	Devil Crayfish	*Cambarus diogenes*			C, N	B	D	D
4	Northern Clearwater Crayfish	*Orconectes propinquus*		SC	J, K, N	B	C	D
5	Digger Crayfish	*Fallicambarus fodiens*			C, F	B	B	D
6	Sanborn's Crayfish	*Orconectes sanbornii*			K, M, N	D	A	D
7	Big Water Crayfish	*Cambarus robustus*			J, K, M	A	B	D
8	Paintedhand Mudbug	*Cambarus polychromatus*			C, K, M, N	A	B	S
9	Little Brown Mudbug	*Cambarus thomai*			C, K, M, N	A	A	S
10	Ortman's Mudbug	*Cambarus ortmanni*			N	A	B	S
11	Spiney Stream Crayfish	*Orconectes cristavarius*			M, N	B	D	D
12	Cave Spring Crayfish	*Cambarus tenebrosus*		T	D, N	B	D	S
13	Red Swamp Crayfish	*Procambarus clarkii*			C, J, M	C	D	I
13	Papershell Crayfish	*Orconectes immunis*			K, N, M	B	B	S
13	Virile Crayfish	*Orconectes virilis*		SC	K, N, M	B	D	D

* Rank derived from Conservation Status Score calculated using Millsap et al. (1990) modified for Ohio. The order in which species with the same conservation status rank (i.e., ties) are listed does not imply differences between these species.

Habitat Association Key
A = grassland
B = forest
C = wetlands
D = caves & mines
E = oak savannahs
F = Lake Erie islands
G = boreal communities
H = riparian corridors
I = artificial/man-made environments
J = Lake Erie
K = Lake Erie Tributaries
L = Ohio River
M = Ohio River Tributaries
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A = extensive range (multiple states/Canada) – which includes Ohio
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Species Listing Key
E = endangered
T = threatened
SC = species of concern
SI = species of interest
EX = extirpated

4.4.9 Taxa Group: Aquatic Invertebrates

The Division's statutory authority for management of aquatic invertebrates is limited to species classified as endangered only. Consequently, data on the status of the majority of aquatic invertebrates is extremely limited, and the primary reason that conservation status ranks have not been determined for most invertebrate species groups. The Division of Wildlife has statutory authority for the conservation of 22 species of aquatic invertebrates designated as endangered in Ohio, 17 of which occur on Ohio's SGCN list (13 dragonflies, 3 damselflies, 1 midge). As noted earlier in this section however, the only taxa group for which sufficient data exists to permit calculation of conservation status scores/ranks is dragonflies and damselflies.

As a group, odonates are not well understood, and our knowledge of the status of Odonata in Ohio is certainly limited by lack of information. Odonates are not an easy group to study for a number of reasons. Approximately 20% of North American species cannot be accurately identified as larvae. There are also very few detailed analyses of the total life history of Odonata species. Several species observed in Ohio are only accidentals, such as the Georgia River Cruiser, Striped Saddlebags, Little Blue Dragonlet, Band-winged Dragonlet, and Golden-winged Skimmer.

To date, 164 species of odonates have been recorded in Ohio, many of which have appeared outside of their normal range. The newest addition to Ohio's Odonata were several striped saddlebags which were found in late summer of 2006 at Magee Marsh Wildlife Area on western Lake Erie – far from their normal range in the extreme southern U.S. Dragonflies and damselflies spend the majority of their life as eggs or larvae in the water. Since Ohio has lost over 90 percent of its wetlands and many of its rivers and streams have been adversely impacted by pollution, it's not surprising that 16 species of Odonata have been listed as endangered in Ohio. The cause of endangerment in every case has been habitat destruction or degradation. The solution to protecting dragonflies and damselflies is to protect our aquatic resources.

Endangered Dragonflies & Damselflies

The yellow-sided skimmer is known from only a single site in Ohio - an acidic sphagnum pond in a sand mining site privately owned in Pike County. The racket-tailed emerald was known historically from a single boggy pond in Geauga County, but not seen there since 1924. An apparently healthy population was discovered in 1999 at Singer Lake Bog in Summit County and a smaller population was found in 2002 near the historic site in Geauga County. Since the racket-tailed emerald seems confined to boggy pond and lake edges, the draining of wetlands likely caused significant loss of this species.

Throughout its range, the elfin skimmer lives in widely scattered populations. Ohio's populations are 130 miles apart, and an equal distance from the next closest known populations. Elfins were known to occur at three areas around the state between 1930 and 1960 before they disappeared due to drainage for agriculture and other habitat changes. This species is currently known only from Cedar Bog Nature Preserve in Champaign County, and Singer Lake Bog and Myersville Fen Preserve in Summit County. It is unknown why this species does not survive at other remnant fens or bogs in Ohio.

The Hine's emerald dragonfly was discovered by Professor James Hine, first curator of natural history of the Ohio Historical Society, from specimens in a shallow stream near Indian Lake in west central Ohio. Once known from the Indian Lake area of Logan County, around Mud Lake in Williams County, and the Oak Openings of Lucas County, it is possibly now extirpated from Ohio, having not been found since 1961.

The river jewelwing has been reported from Geauga, Portage, and Williams counties.

Threatened Dragonflies & Damselflies

The riffle snaketail has been reported from Columbiana, Geauga, Jefferson, and Lake counties.

Dragonfly & Damselfly Species of Concern

The tiger spiketail has been reported from Adams, Ashland, Belmont, Fairfield, Hocking, Licking, Richland, and Ross counties.

Table 11. Ohio's Aquatic Invertebrate Species of Greatest Conservation Need
The conservation status (rank) for each species represents input from professionals in odonate taxonomy, distribution, and abundance. This table represents the best professional knowledge available at this time, and as such is subject to modification as additional data is obtained.

Conservation Status Rank*	Common Name	Scientific Name	Species Listing Fed	Species Listing State	Habitat Association	Rangewide Occurrence	Statewide Occurrence	Ohio Population Trend
1	Appalachian Jewelwing	*Calopteryx angustipennis*			K	B	D	D
2	Atlantic Bluet	*Enallagma doubledayi*			O	C	D	D
3	Riverine Clubtail	*Stylurus amnicola*			K, M	B	D	D
4	Little Blue Dragonlet	*Erythrodiplax minuscula*			N, O	B	D	D
5	Taper-Tailed Darner	*Gomphaeschna antilope*			C	B	D	D
6	Variable Darner	*Aeshna interrupta*			K, O	C	D	D
6	Incurvate Emerald	*Somatochlora incurvata*			C	B	D	U
6	Kennedy's Emerald	*Somatochlora kennedyi*			C	C	D	U
9	Spine-crowned Clubtail	*Gomphus abbreviatus*			K	B	D	D
10	Sphagnum Sprite	*Nehalennia gracilis*			C, N	A	C	D
10	Hine's Emerald	*Somatochlora hineana*	E	E	C, N	B	D	D
12	Tiaga Bluet	*Coenagrion resolutum*			C, O	B	D	D
13	Hagen's Bluet	*Enallagma hageni*			C, O	A	B	D
14	Golden-winged Skimmer	*Libellula auripennis*			K, O	B	D	D
15	Eastern Red Damsel	*Amphiagrion saucium*			C, N	A	A	S
15	Mottled Darner	*Aeshna clepsydra*		E	O	B	D	D
17	Seepage Dancer	*Argia bipunctulata*		E	N, O	C	D	D
18	Band-Winged Dragonlet	*Erythrodiplax umbrata*			C, O	C	D	D
19	Yellow-sided Skimmer	*Libellula flavida*		E	C	B	D	D
20	Umber Shadowdragon	*Neurocordulia obsoleta*			K, M, O	B	C	D
21	Green-faced Clubtail	*Gomphus viridifrons*		T	K, M	A	C	D
22	Boreal Bluet	*Enallagma boreale*		T	C, K, O	B	C	D
23	Saffron-winged Meadowhawk	*Sympetrum costiferum*			O	A	C	D
24	River Jewelwing	*Calopteryx aequabilis*		E	K, N	A	C	D

24	Marsh Bluet	*Enallagma ebrium*	T	C, O	A	B	D
24	Furtive Forktail	*Ischnura prognata*		C, O	C	D	D
24	Canada Darner	*Aeshna canadensis*	E	C	A	D	D
28	Eastern Ringtail	*Erpetogomphus designatus*		K, M	B	D	D
29	Elusive Clubtail	*Stylurus notatus*		K, M, O	A	B	S
30	Aurora Damsel	*Chromagrion conditum*		C, N	A	A	D
30	Turquoise Bluet	*Enallagma divagans*		K, M, N	A	B	D
32	Cherry-faced Meadowhawk	*Sympetrum internum*		C, K, M, O	A	C	D
33	Southern Pygmy Clubtail	*Lanthus vernalis*		N	B	D	S
34	Striped Saddlebags	*Tramea calverti*		O	C	D	U
35	American Emerald	*Cordulia shurtleffii*	E	C	B	D	D
36	Sedge Sprite	*Nehalennia irene*		C, O	A	B	D
37	Harlequin Darner	*Gomphaeschna furcillata*	T	C	B	D	S
37	Skillet Clubtail	*Gomphus ventricosus*		K, M	A	C	S
37	Northern Pygmy Clubtail	*Lanthus parvulus*		N	B	B	D
37	Brown Spiketail	*Cordulegaster bilineata*		C	A	D	D
37	Racket-tailed Emerald	*Dorocordulia libera*	E	C, O	B	D	S
42	Smokey Rubyspot	*Hetaerina titia*		K, M	A	C	D
43	Georgia River Cruiser	*Macromia illinoiensis georgina*		K	A	D	D
43	Stygian Shadowdragon	*Neurocordulia yamaskanensis*		K, M, O	A	C	D
43	Plains Emerald	*Somatochlora ensigera*		N	B	D	D
46	Gray Petaltail	*Tachopteryx thoreyi*		C	A	B	S
46	Frosted Whiteface	*Leucorrhinia frigida*	E	C, O	A	D	S
46	Elfin Skimmer	*Nannothemis bella*	E	C	A	D	D
49	Allegheny River Cruiser	*Macromia alleghaniensis*		K, M	B	C	D
49	Brush-tipped Emerald	*Somatochlora walshii*	E	C, N	B	D	D
51	Spatterdock Darner	*Aeshna mutata*		C	A	B	D
52	Northern Bluet	*Enallagma cyathigerum*	T	C, O	A	D	D

53	Rapids Clubtail	*Gomphus quadricolor*		K, M, N, O	A	B	I
53	Uhler's Sundragon	*Helocordulia uhleri*	E	N, O	B	D	D
55	Riffle Snaketail	*Ophiogomphus carolus*	T	N	B	D	D
56	Laura's Clubtail	*Stylurus laurae*		K, M, N	B	D	D
57	Tiger Spiketail	*Cordulegaster erronea*	SC	N	A	C	I
58	Splendid Clubtail	*Gomphus lineatifrons*		K, N	A	C	S
59	Dusky Clubtail	*Gomphus spicatus*		C, O	A	B	D
60	Lilypad Forktail	*Ischnura kellicotti*	E	O	B	D	S
60	Russet-tipped Clubtail	*Stylurus plagiatus*		K, M, O	B	C	S
60	Gilded River Cruiser	*Macromia pacifica*		K, M, O	B	C	I
60	Smoky Shadowdragon	*Neurocordulia molesta*		K, M	B	B	S
64	Ocellated Darner	*Boyeria grafiana*		N, O	A	C	S
64	Handsome Clubtail	*Gomphus crassus*		K, M, N	A	C	U
64	Chalk-fronted Corporal	*Libellula julia*	E	C, O	A	D	D
67	Beaverpond Baskettail	*Epitheca canis*		K, O	B	D	S
68	Common Sanddragon	*Progomphus obscurus*		K, M, N, O	A	B	I
69	Rusty Snaketail	*Ophiogomphus rupinsulensis*		N	A	B	S
69	Delta-spotted Spiketail	*Cordulegaster diastatops*		N	B	C	S
69	Twin-spotted Spiketail	*Cordulegaster maculata*		K, M, N	A	B	S/I
69	Arrowhead Spiketail	*Cordulegaster obliqua*		N	A	B	S
73	Wabash River Cruiser	*Macromia wabashensis*		K, M, O	E	D	S
74	Comet Darner	*Anax longipes*		C, O	A	B	I
74	Plains Clubtail	*Gomphus externus*	E	K, M	B	C	S/I
n/r	Midge	*Rheopelopia acra*	E	K	E	D	U

* Rank derived from Conservation Status Score calculated using Millsap et al. (1990) modified for Ohio. The order in which species with the same conservation status rank (i.e., ties) are listed does not imply differences between these species.

n/r = insufficient information on the species to calculate a Conservation Status Score using Millsap et al. (1990)

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4.4.10 Taxa Group: Terrestrial Invertebrates

The Division's statutory authority for management of terrestrial invertebrates is limited to species classified as endangered only. Consequently, data on the status of the majority of terrestrial invertebrates is extremely limited, and the primary reason that conservation status ranks have not been determined for most invertebrate species groups. As data gaps are filled in the future, more species will be given conservation status ranks. The Division of Wildlife has statutory authority for the conservation of 24 terrestrial invertebrate species designated as endangered in Ohio, 9 of which occur on Ohio's SGCN list (6 butterflies, 1 skipper, 2 beetles). As noted earlier in this section however, the only taxa group for which sufficient data exists to permit calculation of conservation status scores/ranks is butterflies and skippers.

Endangered Invertebrates

The Mitchell's satyr butterfly is associated with fens supporting lush stands of sedges and bullrush. It was recorded in 1 location in northeastern Ohio in the 1920s and may be extirpated. However, continued attempts to locate this species in Ohio and identify its host plant are needed. Both the swamp metalmark and the purplish copper butterflies are also found in association with fens. The swamp metalmark is known from only 2 locations while the purplish copper has a wider western (10 counties) distribution. Continued surveys by members of the Ohio Lepidopterists Society may find additional locations for these 2 butterflies.

The regal fritillary butterfly is associated with tall grass prairie and other open sites including wet meadows, marshes, and wet fields. It is rapidly declining over much of its range. In addition to development or conversion of grasslands to agriculture, remaining prairie has been affected by pesticide use and fire (usually prescribed burning) in ways that impact butterfly populations. A better understanding of the impact of fire on butterfly populations, and efforts to restore prairies and wetlands in areas where the regal fritillary still occur may help stabilize its population.

The eastern Persius dusky wing butterfly and the frosted elfin butterfly occur in open woods, oak savannas, and forest openings. Oak savannas in Ohio are limited to the northwestern portion of the state, in parts of Henry, Fulton, and Lucas counties. Protection of this area will provide the necessary habitat to sustain viable populations of the eastern Persius dusky wing and frosted elfin butterflies.

The grizzled skipper inhabits eastern shale barrens and has been declining in part due to the widespread spraying for gypsy moths. Immediate action should be taken to protect existing populations from further habitat degradation and loss. Fire suppression has encouraged the closing of formerly open-canopied oak and oak-pine barrens and reduced the size and quality of adjoining open lands or prairies. Managing the prairie and barrens communities, especially through carefully controlled prescribed burns is critical to the long-term survival of this skipper.

U.S. Fish and Wildlife Service Recovery Plans are being implemented for the American burying beetle. There is one cave beetle on Ohio's endangered species list. The Ohio cave beetle has been collected from a cave system in Adams County. The now extinct Kramer's cave beetle was formerly collected from this same area. There are many *Pseudanophthalmus* (cave beetle) species described from the limestone caves of Kentucky and Tennessee, but the Ohio cave beetle and Kramer's cave beetle are the only two known from north of the Ohio River. They were most likely cut off from the cave systems of Kentucky when the Teays River changed course during a glaciation event.

Threatened Invertebrates

Little is known concerning the habitat and life history requirements, or threats faced by the silver-bordered fritillary.

Invertebrate Species of Concern

The two-spotted skipper typically occupies wetland areas, whereas the dusted skipper is an inhabitant of grasslands, old fields, and savannahs. More information is needed concerning their habitat and life history requirements, as well as reasons for their declines. The olympia marblewing butterfly is designated as species of special interest. While it is occasionally documented within the state, it is not believed to have

viable populations. In the future, if increased numbers and locations of this species are found, its status will be further evaluated.

Table 12. Ohio's Terrestrial Invertebrate Species of Greatest Conservation Need
The conservation status (rank) for each species represents input from professionals in butterfly/skipper taxonomy, distribution, and abundance. This table represents the best professional knowledge available at this time, and as such is subject to modification as additional data is obtained.

Conservation Status Rank*	Common Name	Scientific Name	Species Listing Fed	Species Listing State	Habitat Association	Rangewide Occurrence	Statewide Occurrence	Ohio Population Trend
1	Mitchell's Satyr	*Neonympha mitchellii*	E	E	C, G	C	D	U
2	Persius Dusky Wing	*Erynnis persius*		E	E	B	D	D
3	Grizzled Skipper	*Pyrgus centaureae wyandot*		E	B	B	D	D
4	Olympia Marble	*Euchloe olympia*		SI	B	A	D	D
5	Gold-banded Skipper	*Autochton cellus*			B	B	C	D
6	Swamp Metalmark	*Calephelis mutica*		E	C	B	D	D
6	Confused Cloudy Wing	*Thorybes confusis*			A, B	B	D	U
6	Duke's Skipper	*Euphyes dukesi*			B, C	B	C	I
9	Diana Fritillary	*Speyeria diana*			B	B	D	D
9	Mottled Dusky Wing	*Erynnis martialis*			A, B	B	B	D
11	Regal Fritillary	*Speyeria idalia*		E	A	B	C	D
11	Harris Checkerspot	*Chlosyne harrisii liggetti*			A, C	B	C	D
11	Two-spotted Skipper	*Euphyes bimacula*		SC	C	B	C	S
14	Cobweb Skipper	*Hesperia metea*			A, B	B	C	S
14	Mulberry Wing Skipper	*Poanes massasoit*			C	B	C	S
14	Broad-winged Skipper	*Poanes viator viator*			C	A	C	I
17	Dusted Skipper	*Atryonopsis hianna*		SC	A, E	B	C	D
18	Frosted Elfin	*Incisalia irus*		E	E	B	D	D
19	Silver-bordered Fritillary	*Boloria selene myrina*		T	A, C	A	C	I
20	Dion Skipper	*Euphyes dion*			C	A	C	I
21	Black Dash Skipper	*Euphyes conspicua*			C	A	B	I
22	Silvery Blue	*Glaucopsyche lygdamus*			B	B	B	S
23	Atlantis Fritillary	*Speyeria atlantis*			B	A	C	I
23	Gray Comma	*Polygonia progne*			B, C	B	B	D

25	Zebra Swallowtail	*Eurytides marcellus*		B, H	B	A	D
26	Dusky Azure	*Celastrina nigra*		B	B	C	I
27	Northern Oak Hairstreak	*Fixsenia favonius ontario*		A, B	B	D	D
28	Falcate Orange Tip	*Anthocharis midea annickae*		B	B	B	S
28	Eastern Pine Elfin	*Incisalia niphon*		B	A	B	I
28	Northern Metalmark	*Calephelis borealis*		B	B	B	S
31	Early Hairstreak	*Erora laeta*		B	B	D	D
32	Baltimore Checkerspot	*Euphydryas phaeton*		C	A	A	S
33	Edward's Hairstreak	*Satyrium edwardsii*		A, B, E	A	C	I
34	White M Hairstreak	*Parrhasius m-album*		B	B	C	S
34	Compton Tortoise Shell	*Nymphalis l-album*		B	B	B	I
34	Eyed Brown	*Satyrodes eurydice*		C	B	B	I
37	Goatweed Butterfly	*Anaea andria*		A, B	B	C	U
37	Hayhurst's Scalloped Sootywing	*Staphylus hayhurstii*		B	B	C	S
39	Acadian Hairstreak	*Satyrium acadicum*		C	B	A	I
39	Hickory Hairstreak	*Satyrium caryaevorum*		B	A	A	I
41	Dog Face	*Colias cesonia*		A	B	C	U
41	Leonard's Skipper	*Hesperia leonardus*		A, B	B	A	S
41	Indian Skipper	*Hesperia sassacus*		A, E	A	B	I
41	Long Dash Skipper	*Polites mystic*		A	A	A	I
45	West Virginia White	*Pieris virginiensis*		B	B	C	S
45	Purplish Copper	*Lycaena helloides*	E	C	B	C	D
45	Brown Elfin	*Incisalia augustinus croesoides*		B, C	B	C	D
45	Appalachian Blue	*Celastrina negelectamajor*		B	B	B	S
45	Pepper & Salt Skipper	*Amblyscirtes hegon*		B	A	B	I
n/r1	Karner Blue	*Lycaeides melissa samuelis*	E E	E	B	D	D
n/r2	Monarch	*Danaus plexippus*		A, B, H, I	B	A	U
n/r3	American Burying Beetle	*Nicrophorus americanus*	E E	A, B	C	D	U

n/r3	Ohio Cave Beetle	*Pseudanophthalmus ohioensis*	E	D	E	D	U

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n/r1 = added to SGCN list because of previous research and management activities that will continue under this Action Plan
n/r2 = added to SGCN list while its status is updated (at which point it will be assigned a conservation status rank)
n/r3 = insufficient information on the species to calculate a Conservation Status Score using Millsap et al. (1990)

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