



Chapter 3

Maryland's Wildlife and Species of Greatest Conservation Need





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Introduction

The State Wildlife Action Plan (SWAP or Plan) compiles, evaluates, and presents summary status information for Species of Greatest Conservation Need (SGCN) (Element #1). This chapter describes the process used to select SCGN and summarizes the best available information regarding the conservation status, distribution, and abundance of all major taxonomic groups that occur in Maryland. Regional SCGN, known here as RSGCN, are also discussed as they were considered in the selection of Maryland's SCGN. Numerous experts and sources of information (e.g., scientific literature, databases, agency reports) on Maryland's wildlife abundance and distribution were consulted during the planning process and are listed throughout the Plan and in the 'Online Resources' supplementary document. A comprehensive list of state conservation plans and initiatives can be found in Appendix 9a. More detailed information regarding the status and relative abundance of Maryland's SCGN are provided in Appendices 3a, 3b, 3c, and 3j, which includes each species state and global conservation ranks, and state and federal legal status. Distributions of wildlife species and signature plants are included through their association with one or more Key Wildlife Habitats, which are discussed in detail and mapped in Chapter 4. The cross-reference table that lists these habitats for each species is found in Appendices 3j and 4a. Species distribution model maps are available for many SCGN birds and some SCGN amphibians, reptiles, and mammals through the [National Gap Analysis Program](#) effort to model the distributions of 2,000 U.S. species. In addition, regional efforts have created [habitat capability maps](#) for representative SCGN birds (wood thrush and Louisiana waterthrush) and one SCGN reptile (wood turtle), with more maps in process. Scientific names for SCGN are included in Appendices 1a, 1b, and 3j. Scientific names for other species are included in the text of the chapter.

Distribution of Maryland's Wildlife

Despite its small size, Maryland's wildlife is remarkably diverse- due, in large part, to the wide range of habitats that are found from the Atlantic Ocean in the east to the Allegheny Mountains in the west. Native fauna documented in the state include 96 mammals, 443 birds, 89 reptiles and amphibians, at least several hundred freshwater and marine fishes, and over 20,000 species of invertebrates (for further details see Table 3.4; sources of information are in Appendix 3d). A number of these species are rare, uncommon, or in serious decline.

The state's physiographic provinces and their associated habitats and climates have a profound influence on the distribution of wildlife species. While many wildlife species occur throughout the state, such as eastern box turtle and black-and-white warbler, others are restricted to a particular region, watershed, and/or habitat. For example, species like the seal salamander and nesting Canada warbler are limited to high elevation habitats in the far western part of the state, in the Appalachian Plateau physiographic region. The pearl dace and checkered sculpin, two fish species, are confined in Maryland to a handful of spring-fed coldwater streams in the Blue Ridge physiographic province. Other species, such as carpenter frog and nesting saltmarsh sparrow, occur only on Maryland's Eastern Shore. Some of the state's most imperiled species are confined to just a handful of sites and, in some cases, single locations. For example, the only remaining breeding areas in Maryland for the beach-nesting piping plover are on Assateague Island while several subterranean crustaceans are single site endemics, whose only known populations in the world are restricted to a single cave or



spring. Details on the associated habitat distributions of SGCN can be found in Chapter 4 and Appendix 4a.



Maryland includes a diverse array of habitats and species. Left, *Chesapeake Bay at Calvert Cliffs State Park* (Richard Orr); right, *blue crab (Callinectes sapidus) native to Chesapeake Bay estuary* (Rosedale Yannayon).

Conservation Status of Maryland’s Plants and Wildlife

MD DNR’s Natural Heritage Program (NHP), part of the Wildlife and Heritage Service, is one of the state’s lead programs for biodiversity conservation, including rare, threatened, and endangered species protection. NHP identifies, ranks, conserves, and conducts status assessments of all rare and endangered species and natural communities throughout the state. It currently monitors the status of over 1,100 native plants and animals. Species status assessments play a critical role by helping to set NHP and partner conservation priorities, supporting state and federal species listing decisions and related regulatory processes, and helping to inform the public of key conservation issues. In the sections that follow, the criteria used to select Maryland Species of Greatest Conservation Need (SGCN) are described. First, a summary of species that are currently either extinct or extirpated is presented, followed by an overview of state-listed species and non-listed but declining species. Conservation status rank (i.e., global [G1, G2, etc.] and state ranks [S1, S2, etc.]), legal protection status (Endangered, Threatened, In Need of Conservation), and other criteria used to select SGCN are then reviewed.

Maryland’s Extinct and Extirpated Wildlife Species

The U.S. Congress recognized human impacts on wildlife over 40 years ago in its preamble to the Endangered Species Act: “The Congress finds and declares that various species of fish, wildlife, and plants in the United States have been rendered extinct as a consequence of economic growth and development untempered by adequate concern and conservation” (USFWS 1973). Since European settlement, over 100 species of plants and animals have become extinct or extirpated from the state (i.e., no longer remaining in MD but still present elsewhere). Those species now gone entirely include the Carolina parakeet (*Conuropsis carolinensis*), passenger pigeon (*Ectopistes migratorius*), and heath hen (*Tympanuchus cupido cupido*). Habitat loss and overhunting were largely responsible for their demise and eventual extinction during the first half of the 20th century (Cornell Lab of Ornithology 2008).



Today an estimated 118 species (86 plants and 32 animals, Table 3.1) are state-listed as Endangered Extirpated. This legal status indicates that these species were once viable components of the state's flora and fauna but no longer occur in Maryland and, if rediscovered, would likely be afforded the legal status of Endangered. Six of the 32 animals listed as Endangered Extirpated are mammals.

These include gray wolves (*Canis lupus*), which historically occurred throughout the state but were eliminated by the late 1800's as a result

of indiscriminant hunting and trapping, habitat

loss, and increasingly scarce prey populations. American bison (*Bison bison*) and elk (*Cervus elaphus*) ranged throughout central and western Maryland when Europeans colonized the state. The last American bison was shot in 1775 in Garrett County (Paradiso 1969) and the last elk, also eliminated by overhunting, vanished around 1850 (Lee 1984). The American pine marten's (*Martes americana*) range included western Maryland until the early 1900s, as did the fisher (*Martes pennanti*), which was able to return to Maryland as a result of a release of 23 animals in West Virginia near the Maryland border in the winter of 1969. The snowshoe hare historically occurred in high elevation red spruce-dominated forests in western Maryland; there have been no reliable Maryland records in over 50 years (Paradiso 1969).



American bison (National Park Service)

As with some of the mammals mentioned above, habitat loss was the primary cause for the extirpation of a number of bird species that once nested in Maryland. The Swainson's thrush historically nested in high elevation red-spruce dominated forest (Robbins & Blom 1996) but was eliminated following extensive logging and the nearly complete loss of red spruce in the 19th and early 20th centuries. The Endangered Extirpated red-cockaded woodpecker disappeared due in large part to the loss of expansive tracts of old forest containing large pine trees that provided nest cavities (Robbins & Blom 1996; USFWS 2003). Bachman's sparrow (*Peucaea aestivalis*), a species that formerly nested in some of Maryland's open pine woodlands, is also extirpated in Maryland due in part to habitat loss. Habitat loss may also have been the main factor leading to the extirpation of these and several other species listed as Endangered Extirpated. These total to: 10 birds, 1 amphibian, 4 fishes, and 11 invertebrates (5 butterflies, 1 beetle, 3 dragonflies, 1 snail, 1 crustacean) (MD DNR 2010a).

Endangered, Threatened, and In Need of Conservation Species

More than 600 species and subspecies are listed in state regulations as Endangered, Threatened, or In Need of Conservation in Maryland (COMAR 08.03.08). Most of the species that are state-listed as Endangered are plants (263), and 96 are animals. An additional 70 plants and 20 animals are recognized as Threatened in the state. Thirty-five animal species are listed as In Need of Conservation in Maryland (Maryland Division of State Documents 2015b). A small fraction of plant and animal species (38) are also federally listed as Endangered or Threatened (Table 3.1), including 2 plant and 7 animal species considered to be extirpated in Maryland.



Six of Maryland's 12 mammals state-listed as Endangered are whales that occasionally or regularly migrate offshore in the state's coastal waters. These 6 species are also federally listed. The Delmarva fox squirrel, state-listed as In Need of Conservation, is endemic to the Delmarva Peninsula region. Reintroductions led by MD DNR along with other conservation measures have allowed populations to expand into parts of its former range on the Delmarva Peninsula (Therres & Willey 2002). These recovery efforts, in part, prompted its removal in November 2015 from the federal Endangered Species list (U.S. Fish and Wildlife Service 2014). More state-listed mammals are found in western Maryland compared to other parts of the state, including several species associated with rock outcrop habitats (e.g., Allegheny woodrat, southern rock vole, long-tailed shrew). Three of Maryland's listed species are bats, two of which are also federally listed.

Twenty bird species are state-listed as Threatened or Endangered, including the federally listed piping plover, whose only nesting area in Maryland is confined to Assateague Island. Twelve species are state-listed as In Need of Conservation, including American peregrine falcon. This species was reclassified in recent years from Endangered in the state as more pairs have adapted to nesting on tall buildings in urban areas as a substitute for traditional cliff nesting sites. Many of the state-listed birds are restricted to coastal marshes and islands (e.g., black rail, royal tern, gull-billed tern, black skimmer) or high elevation montane forests and wetlands (e.g., Nashville warbler, northern goshawk, and northern waterthrush). Others, like golden-winged warbler, an early successional habitat and high elevation wetland specialist, and Henslow's sparrow and upland sandpiper, both grassland species, are also in significant decline. Other state-listed birds include the elusive Swainson's warbler, a highly area-sensitive, forested wetland-nesting bird that breeds only in the Pocomoke River watershed on the lower Eastern Shore.

Five of the sixteen Threatened and Endangered reptiles and amphibians are federally listed sea turtles, which forage offshore or in Maryland's estuaries during warmer summer months. One of Maryland's Endangered frogs, the mountain chorus frog, is a species that breeds in high elevation temporary pools; the last known occurrence in Maryland was in 1986. The hellbender, an aquatic salamander state-listed as Endangered and North America's largest amphibian, is threatened by degraded water quality in its western Maryland riverine habitat. The Wehrle's salamander and eastern spiny softshell are also western Maryland species; these are the only reptiles and amphibians listed as In Need of Conservation.

There are 12 Threatened and Endangered fishes in Maryland, of which the shortnose sturgeon, Atlantic sturgeon, and Maryland darter are also federally listed. The blackbanded sunfish, a blackwater stream specialist state-listed as Endangered, has suffered severe declines primarily due to habitat loss and degradation (MD DNR 2010b). Competition and predation by introduced fish species, as well as illegal collecting for the pet trade, are also of concern. Other examples of Threatened and Endangered fishes include stripeback darter, Chesapeake logperch, and American brook lamprey. The Maryland darter, the State's only endemic vertebrate, may now be extinct although it is currently listed as Endangered. It was last reported in a single riffle of Deer Creek in Harford County in 1988 (Raesly 1992). This species has specialized habitat requirements and may have been impacted by changes in water quality due to development and pollution. The three In Need of Conservation fishes



include two Coastal Plain species, mud sunfish and swamp darter, and striped shiner, which is found in western Maryland streams and rivers.

Many of Maryland’s rarest and most imperiled wildlife species are invertebrates. Fifty-eight species are state-listed as Threatened or Endangered and 35 are listed as In Need of Conservation. Several of these species (e.g., Franz’s cave isopod, Shenandoah cave amphipod, Hoffmaster’s cave planarian) are highly specialized subterranean species found in springs, mines, and caves in Maryland’s mountains. Freshwater mussels are one of the most imperiled species groups in the U.S. and are a major conservation concern. The majority of the state’s 16 freshwater mussel species are rare, declining, or state listed. These include the Endangered dwarf wedgemussel whose Maryland range is confined to a handful of small streams on the Eastern Shore and in southern Maryland. Other state-listed invertebrates include 7 tiger beetle species (e.g., northeastern beach tiger beetle and Puritan tiger beetle, both federally listed as Threatened), 24 butterflies (e.g., bog copper, mottled duskywing, great purple hairstreak), 11 dragonflies (e.g., treetop emerald, elfin skimmer) and 3 snails (e.g., cherrypod snail, Blue Ridge spring snail).

Table 3.1 Summary of all federal and state-listed species in Maryland. Source: COMAR, MD Division of State Documents.

Federally Listed Species

Category	Plants	Animals
Endangered	5	21
Threatened	4	8
Total	9	29

State-listed Species*

Category	Plants	Animals
Endangered	263	96
Threatened	70	20
In Need of Conservation	n/a	35
Endangered Extirpated	86	32
Total	419	183

* Summary of state-listed species only includes species listed in COMAR 08.03.08.

Declining Species (and our opportunity to reverse that trend)

Although the state officially recognizes 183 animal species and 419 plant species in its protected species regulations, many other species are declining and may warrant listing in the next few decades. North America is home to more than a third of the world’s mussel species, but nearly 70% of North America’s 302 native mussel species are extinct or imperiled (USGS 2013). Approximately 20% of the 353 species of crayfish found in the United States are threatened (Helfrich & DiStefano 2009) and 39% of North America’s freshwater fish are imperiled (Jelks et al. 2011). In addition, a number of commercial fish species are considered as In Need of Conservation in terms of management concerns and harvest regulation needs (COMAR 8.02.12).



The 2015 list of SGCN includes 128 pollinator insect species. Pollinators are important players in ecosystems around the world, and carry out an essential process that drives agriculture and the agricultural economy. Of the 240,000 flowering plant species around the world, roughly 75% rely on pollinators in order to reproduce (National Resource Council 2007). In the U.S., the estimated commercial value of crops that rely on pollination to produce fruit was roughly \$15.1 billion in 2009, with nearly \$12 billion of that sum directly attributed to pollination from honey bees. In the natural system, contributions of pollinator species to the maintenance of plants ultimately contributes to ecosystem services such as carbon sequestration, water filtration, soil erosion control, and genetic diversity enhancement (Pollinator Health Task Force 2015). However, habitat loss and fragmentation, pesticide use, pathogens, invasive species, and lack of genetic diversity threaten pollinators in the U.S. and in much of the world. In addition, social pollinators such as honeybees are threatened by colony collapse disorder. Attributed to overuse of pesticides, malnutrition, disease, and stress, colony collapse disorder is causing unprecedented death rates in bee populations across the United States. In light of the importance of pollinators in natural communities and in activities of human interest, it is critical that conservation planners focus on the integral roles of pollinators in Maryland and across North America, and on the threats that affect these species today.

Amphibians are exhibiting alarming rates of decline, with one in three species globally threatened (IUCN 2015), and, in the U.S., declines are occurring at an annual rate of 3.7% (Adams et al. 2013). Reptiles are exhibiting dramatic declines similar to that of amphibians, with 19% of the world's reptiles estimated to be threatened with extinction (IUCN 2013). Habitat loss and degradation, environmental pollution, unsustainable use, diseases, introduced invasive species, and global climate change are the leading causes for declining reptile populations (Gibbons et al. 2000).

Numerous bird species are showing population declines nationally, regionally, and locally. Twenty-five of 59 shorebird species, subspecies, and populations assessed in the U.S. Shorebird Conservation Plan's 2014 Watch List Assessment met criteria as at-risk species (U.S. Shorebird Conservation Plan Partnership 2015). A recent assessment of U.S. bird populations has noted stabilizing grassland bird populations, although intensifying farming practices and overgrazing remain a major threat for many still-declining species within this category of birds (North American Bird Conservation Initiative 2014). In 2004, Partners in Flight (PIF) ranked 30 forest birds, 12 shrub/early successional birds, 10 grassland/agricultural birds, 7 wetland birds, and 1 urban/suburban bird (the chimney swift) as priority species for Maryland (Rosenberg 2004). Declining population trends remain a concern for most of these species today. Wetland bird populations have seen a gain of nearly 40% since 1968, but progress is hindered by continuing loss and degradation of wetlands, especially for southern species such as the king rail (North American Bird Conservation Initiative 2014).

Unlike birds, little is known about the population trends of many of Maryland's more secretive mammals. Recently, however, white-nose syndrome has devastated bat populations across eastern North America, and the combination of the many threats these species face has placed most bat species on the SGCN list. More information about white-nose syndrome and other threats to species can be found throughout Maryland's SWAP. The SWAP represents an opportunity to reverse these declining population trends for numerous species in greatest



need of conservation. By incorporating existing conservation ranks, population assessments and conservation plans into the development of the Maryland SWAP, MD DNR and its conservation partners have the opportunity to implement conservation actions that will have positive effects on species that truly have the greatest conservation need.

Species of Greatest Conservation Need (SGCN)

Maryland plant and wildlife species vary in their need and urgency for conservation. Some more obviously warrant conservation attention than others. State- and federally listed species are clearly high priorities but the Plan also provides the opportunity to consider species not currently listed but declining or at risk of decline. Specifically, in determining which species warrant SGCN status, Congress allows states to consider the “distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State’s wildlife,” (Element #1).

Rather than focusing on a certain group or category of wildlife, the effort to identify SGCN evaluated the status of over 2,000 known animal species and considered the countless additional invertebrate species yet unnamed and unstudied in Maryland. By considering all species and their requisite habitats in this assessment, the broader interrelationships of wildlife conservation can be addressed. Using national and regional guidance and the best scientific information available, each species status was assessed to determine those of greatest conservation need. The criteria that were used during the assessment process and to ultimately identify these species were adopted from national and regional guidelines developed by the Association of Fish and Wildlife Agencies and found in the *Best Practices for State Wildlife Action Plans* (AFWA 2012), U.S. Fish and Wildlife Service, and the Northeast Fish and Wildlife Diversity Technical Committee (NEFWDTC). Guidelines provided by the NEFWDTC were organized into the Northeast Lexicon document which is a set of common terminology developed by the Northeast states to facilitate interstate collaboration for all eight required elements in the SWAPs (Crisfield & NEWDTC 2013).

Fundamental considerations for assessing species conservation need and inclusion on/exclusion from the SGCN list include species abundance and trend; threat (number, immediacy, extent and/or reversibility of known threats to species populations); state responsibility (relative importance of the state to conservation of the species); habitat trend (changes in the extent or condition of habitat which may be closely related to threats); and information deficiency (lack of basic information needed to evaluate conservation status). In addition to these considerations and existing Maryland conservation status ranks, numerous state, regional, and national ranking systems that prioritize or rank species for each wildlife taxa group were used during this evaluation process. The criteria from all of these sources are included in Table 3.2 (for further details, see Appendix 3c).

Table 3.2 Categories considered for inclusion on Maryland's list of Species of Greatest Conservation Need (SGCN)

Special Conservation Status
Federally listed Threatened and Endangered plants and animals
State-listed Threatened and Endangered animals



Wildlife species listed as In Need of Conservation
Globally rare species ranked by NatureServe
MD DNR Natural Heritage Program tracked and watchlist animal species
IUCN Red List species
Northeast Regional Species of Greatest Conservation Need
Species recognized as endangered from international trade (CITES)
Recognized Bird Priority Status
Partners in Flight and all bird conservation plan priority species
US Fish & Wildlife Service’s migratory birds of conservation and management concern
Colonial waterbirds
Forest interior breeding birds
Shrubland successional breeding birds at risk
Grassland breeding birds at risk
Shorebirds with significant migratory concentrations and declining populations
Marshland breeding birds (e.g., rails, bitterns, sedge wren) at risk
Marine birds in decline
Other Terrestrial Conservation Status Priorities
Reptiles and amphibians at risk
Bats at risk
Small mammals at risk
Terrestrial invertebrates at risk
Aquatic Conservation Status Priorities
Aquatic invertebrates at risk
Freshwater fish at risk
American Fisheries Society’s species of concern
Depleted anadromous fish (e.g., shad spp., sturgeon)
Depleted marine invertebrates (e.g., horseshoe crab)
Sensitive aquatic species
Additional Selection Criteria
Endemic species
Disjunct species
Vulnerable species (to a variety of threats, particularly impacts from climate change and invasive species impacting host plant species)
Species with limited dispersal
Species with fragmented or isolated populations
Focal species (e.g., keystone species, species with specific needs)
Indicator species of high quality habitat
“Responsibility” species (i.e., species that have their center of range within Maryland)
Species that aggregate in concentration areas (e.g., migratory stopover sites, bat roosts/ maternity sites)



Identifying the SGCN in Maryland began with reviewing the previous 2005 SGCN list. Review of these species, using the guidance criteria explained above, provided an introductory understanding of species population changes over the last ten years. Decisions about which species to include on the draft 2015 SGCN list relied heavily on a review of the species current conservation status, based on both State and Global Conservation Ranks. The best available quantitative and qualitative data on status, abundance, distribution, and habitat associations for many species in the state were considered to confirm species conservation status and preliminary SGCN selection. Further justification for changes (additions and/or deletions) to the 2005 SGCN list, other than changes in conservation or legal status, included new discoveries and research findings since 2005; an increase (or decrease) of existing threats (e.g., illegal trade, spread of disease, increased loss of habitat); and new, emerging threats (e.g., white-nose syndrome, increase in operating wind turbines, hydrofracturing, loss of host species due to non-native pests). The overlap of priorities among groups, stakeholders, experts, agencies, and partner programs indicated significant agreement for criteria involved in the decision-making process and the species listings themselves. Species from the 2005 SGCN list that fell outside the review guidelines were removed, and new species that met the guidelines were added. This process resulted in 108 more animal species in the 2015 SGCN list compared to 2005, due to the addition of 202 additional species and removal of 94 species from the 2005 SGCN list (Table 3.3, Appendices 3e & 3f).

Table 3.3 Comparison of 2005 and 2015 Species of Greatest Conservation Need Lists

Taxa Group	2005 List	2015 List	Number Added	Number Deleted
Mammals	34	41	11	4
Birds	141	143	24	22
Reptiles	25	26	5	4
Amphibians	17	19	6	4
Fish	40	31	3	12
Beetles	23	22	7	8
Bees, Wasps and Ants	0	36	36	0
Butterflies and Moths	58	101	52	9
Dragonflies and Damselflies	100	93	15	22
Stoneflies, Mayflies and Caddisflies	1	14	14	1
Other Insects	4	6	3	1
<i>Total Insects</i>	186	272	127	41
Crustaceans and Allies	31	40	16	7
Snails	9	14	5	0
Freshwater Mussels	14	14	0	0
Flatworms	5	10	5	0
TOTALS	502	610	202	94



The final 2015 list of Maryland’s SGCN includes 610 animals species, with 260 vertebrates and 350 invertebrates. The list is comprised of 41 mammals, 143 birds, 26 reptiles, 19 amphibians, 31 fish, 272 insects, and 78 other invertebrates (Table 3.4). In addition, 750 plant species are included as SGCN (Table 3.19). These are species at risk of disappearing from Maryland in the foreseeable future if appropriate conservation actions (Chapter 7) are not implemented. Complete lists with status ranking information can be found in this Chapter under each taxonomic group. There are separate Appendices listing wildlife SGCN alphabetically by common name, and also by scientific name (Appendix 3a & 3b). All major animal taxonomic groups were considered for the SGCN screening process: mammals, birds, reptiles, amphibians, fishes, insects, freshwater mussels, and other invertebrate groups, such as snails and flatworms. The state and global conservation ranks presented in Table 3.4 are discussed in the next section, as they were used as initial criteria for inclusion on the SGCN list. In 2015, all plants with a status of rare, threatened, or endangered were included as SGCN.

Table 3.4 Wildlife diversity of Maryland

Taxa Group	Total*	SGCN	State-listed SGCN	Federally listed SGCN	S1 – S3 Ranked SGCN	G1 – G3 Ranked SGCN
VERTEBRATES		260	89	21	158	38
Mammals	97	41	19	8	20	17
Birds	443	143	34	3	94	5
Reptiles	47	26	11	6	12	8
Amphibians	42	19	8		11	2
Fish	> 300	31	17	4	24	6
SELECT INVERTEBRATES		350	76	3	207	103
INSECTS						
Beetles	> 15,000	22	9	2	16	10
Bees, Wasps and Ants	> 1,800	36			8	4
Butterflies and Moths	> 2,100	101	24		45	25
Dragonflies and Damselflies	170	93	11		85	8
Stoneflies, Mayflies and Caddisflies	> 290	14			1	14
Other Insects	-	6	1		2	1
OTHER INVERTEBRATES						
Crustaceans and Allies	-	40	20		28	20
Snails	> 150	14	3		7	10
Freshwater Mussels	18	14	6	1	11	7
Flatworms	> 40	10	2		5	4
TOTAL	Over 20,000	610	165	24	369	141

*Native species, including those that have become extirpated in the state. See Table 3.5 for an explanation of S and G ranks



SGCN Selection: Conservation Ranks

Table 3.4 summarizes the state, federal, and global listings and conservation ranks for Maryland’s wildlife species by taxa group. For additional regional, national, and international ranks, including for plants, see Appendices 3a, 3b, 3c, and 3j. The species ranks assigned and maintained by the Wildlife and Heritage Service’s Natural Heritage Program (NHP) are the most complete list and accounting of wildlife species conservation status in Maryland. Data maintained by NHP represents the best available summary of information on the abundance, distribution, threats, and conservation status of wildlife species for the state, and these data were reviewed as one of the initial steps to determine which species are of greatest conservation need.

Conservation status ranks (i.e., the global rank [G-rank] and state rank [S-rank]) are determined by state natural heritage programs and NatureServe in consultation with numerous biologists, taxonomic experts, and other members of the scientific community, as well as other state, federal and local agencies, and NGO’s. Definitions for these ranks can be found in Table 3.5. A variety of factors are considered when assessing a species conservation status rank. These factors fall into three groups - rarity, threats, and trends - which together provide a composite assessment of a species vulnerability to decline and extirpation (state ranks) or extinction (global ranks); see Appendix 3g for a more detailed explanation. These factors include:

- total number and condition/viability of occurrences (e.g., populations)
- population size
- range extent and area of occupancy
- short-term and long-term population trends
- scope, severity, and immediacy of threats
- intrinsic vulnerability
- environmental specificity

Most conservation status ranks follow a simple numerical scale of 1 - 5. When a species status assessment is completed, the most appropriate numeric rank is assigned from 1 (critically imperiled) to 5 (abundant, widespread, and/or demonstrably secure). Some additional non-numeric ranks may be most appropriate for a given species or subspecies, including “SH” for historically occurring species or “SX” for species thought to be extirpated with little, if any, hope of rediscovery within Maryland.

Table 3.5 Definitions of global (G) and state (S) conservation ranks and rank qualifiers

Rank	Definitions (Global / State)
GX or SX	Presumed Extirpated —Species believed to be extirpated from the jurisdiction (i.e. global, or state/province). Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
GH or SH	Historical (Possibly Extirpated) —Known only from historical records, but with still some hope of rediscovery. There is evidence that the species may no longer be present in the jurisdiction, (i.e. global, or state/province) but not enough to state this with certainty.



G1 or S1	Critically Imperiled/Highly State Rare —At very high risk of extinction or extirpation due to very restricted range, very few populations or occurrences, very steep declines, very severe threats, or other factors. Typically occurring in fewer than five populations.
G2 or S2	Imperiled/State Rare —At high risk of extinction or extirpation due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors. Typically occurring in 6-20 populations.
G3 or S3	Vulnerable/Watchlist —At moderate risk of extinction or extirpation due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors. Typically occurring in 21-80 populations.
G4 or S4	Apparently Secure —At fairly low risk of extinction or extirpation due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
G5 or S5	Demonstrably Secure —At very low risk of extinction or extirpation due to a very extensive range, abundant populations or occurrences, or little to no concern from declines or threats.
GU or SU	Status Uncertain —A numerical rank cannot be established with confidence for reasons including lack of historical records, low survey effort, cryptic nature of the species, or concerns that the species may not be native to the state. Uncertainty spans a range of 4- 5 ranks as defined above.
GNR or SNR	Not ranked —Conservation status has not yet been fully assessed.
SNA	Not a conservation target —Species is not a suitable target for most conservation actions because of its transient occurrence or other factors
Global Qualifiers	
Q	Questionable —Indicates that the taxon has questionable, controversial, or uncertain taxonomic standing (e.g., treated by some taxonomic authors as a species, whereas others treat it as a subspecies or variety or not at all).
T	Taxon —Indicates the rank of a subspecies or variety (i.e., an infraspecific taxon).
State Qualifiers	
?	Questionable —Indicating uncertainty that may span 2-3 numeric S-ranks, as defined above.
B	Breeding —Conservation status refers to Maryland’s breeding population of a migratory animal.
N	Nonbreeding —Conservation status refers to Maryland’s non-breeding population of a migratory animal.
M	Migrant —Migrant animal that occurs regularly during migration at particular staging areas or concentration spots where the species might warrant conservation attention. Conservation status refers to the aggregating migrant population of the species in the state.

Both global and state conservation ranks were very valuable in the process of selecting SGCN, as the factors used to calculate the ranks address several aspects of the SGCN definition. Table 3.6 describes the guidelines related to state and global ranks that were used in the initial steps of determining the SGCN list for Maryland. Consideration of other factors



in Table 3.2 and input from conservation partners and stakeholders, all in addition to this initial assessment, led to the final decisions as to what species are in greatest conservation need in the state. More information on the SGCN selection process, especially relating to working with our partners and stakeholders, can be found in Chapter 9.

Table 3.6 Cross-reference of Conservation Status Ranks and their use in SGCN listing

Ranking	Explanation for SGCN Listing
G1 & G2 species that occur in Maryland	All are included because of their global imperilment and Maryland’s responsibility in conserving the species.
G3 species that occur in Maryland	Many are included because of their global vulnerability and likelihood that they are of conservation value within the state due to their affinity with rare, declining, high quality or other significant habitats, or their importance as indicator species.
S1 and S2 species (either breeding or wintering for migrant species)	All are included because of their limited population size within Maryland and their elevated risk of loss from the state due to stochastic events or man-made habitat changes.
S3 species	Some are included based on limited or declining populations, or the threats they face are of sufficient scope, severity, or immediacy that their populations are likely to continue to decline without management or other intervention. Also, some S3 species may have been included due to their significance as indicator species within rare, high quality, or otherwise significant habitats even though they might not currently be facing severe or immediate threats.
S4 or S5 species	Some are included because of their importance as indicator or umbrella species of significant or high quality habitats, or because of known gradual, long-term population declines even though they are still considered relatively common within Maryland.
SH (historical)	Some are included because of their potential for rediscovery, albeit sometimes rather low. Most of these species have had insufficient survey work and additional surveys are needed to confirm their loss from Maryland. Some may be candidates for reintroduction efforts, as identified.
SX (extirpated)	A few are included if they have some reasonable potential for successful reintroduction efforts.
SU (uncertain)	Some are included if they have restricted distributions within Maryland and/or live in rare, declining, high quality, or otherwise significant habitats, even though insufficient information currently exists related to threats, statewide population size, or other primary factors that are needed to determine an accurate conservation status rank. These species are often good candidates for additional research into biological attributes that would enable more accurate priority ranks to be assigned.



SP (potential) or SR (reported)	A few are included when there is a high likelihood that the species could be located and documented within Maryland given sufficient survey efforts, and that the species would have relatively high conservation value due to their global rarity or their affinity with rare, declining, high quality or other significant habitats.
SZN (or SNA)	Because these are migrants or transitory species within Maryland, such that they could occur over a widespread area for relatively short periods during migration or the winter, the species are included primarily when there is regional or federal concern regarding their status.

Conservation Status Groups

As the factors and methods for determining species and natural community conservation status ranks have evolved over more than 30 years, the complexity of the ranking system has grown and the level of information contained within the ranks has increased. This is useful for conservation practitioners who understand the system's complexities, scientific rationale and intended applications. However, for the uninitiated and public at large, a simplified system in the form of a small matrix is provided in Figure 3.1.

SGCN Categorization Matrix¹

		STATE STATUS						
		S1	S2	S3	S4	S5	SNR / SU	SH
GLOBAL STATUS	G1	A					D	E
	G2	A	A				D	E
	G3	A	A	B			D	E
	G4	A	B	C	C		D	E
	G5	A	B	C	C	C	D	E
	GNR / GU	A	B				D	E

¹To apply the matrix, "range" status ranks were rounded upward in priority (e.g., S2S3 = S2); "range" ranks spanning 3 ranks were considered as the middle rank (e.g., S1S3 = S2); global status ranks for subspecies with T-ranks are treated as the "T" status (e.g., G5T3 = G3). Most "non-numeric" state status ranks are classified in Group D, the "Data Deficient" group (e.g., SU, SNR, SP, SR), except for SH.

Figure 3.1 Matrix used to categorize species into five conservation status categories. Global and state ranks are defined in Table 3.5. Conservation status categories are defined in Table 3.7.



Table 3.7 Definitions of the five conservation status categories from Figure 3.1 based on grouping global and state conservation status ranks.

Group	Definition
A	Highest conservation status
B	High conservation status
C	Moderate conservation status
D	Conservation status is uncertain; insufficient data to assign a state conservation status rank.
E	Historical status; ranked as “SH” and may no longer occur in Maryland, but with some potential for rediscovery in the foreseeable future.

This matrix was used to assign SGCN wildlife to conservation status groups to provide an overarching and less technical view of the state of Maryland’s wildlife species. Taking into account state and global ranks, this system especially highlights those species and taxonomic groups most in need of conservation (species in the A status group) and also those which are in danger due to lack of knowledge and research on these species (D status group). For a complete listing of wildlife SGCN organized by conservation status group, please see Appendix 3h. Figure 3.2 presents the percentages of SGCN in each taxonomic group classified into the five conservation status groups. Taxonomic groups with highest conservation status and at highest risk of elimination include beetles (59% classified as Status Group A), crustaceans and allies (55% classified as Status Group A), freshwater mussels (50% classified as Status Group A), fishes (45% classified as Status Group A), and dragonflies and damselflies (42% classified as Status Group A). Four of these five species groups live in aquatic habitats. Taxonomic groups with highest need of further inventory, research, and monitoring activities are largely concentrated in the invertebrate taxonomic groups, including stoneflies, mayflies, and caddisflies (93% classified as Status Group D), bees, wasps, and ants (67% classified as Status Group D), snails (50% classified as Status Group D), butterflies and moths (43% classified as Status Group D), and other insects, a taxonomic group which includes a collection of relatively unstudied insect species (67% classified as Status Group D). Forty-four percent of mammals are classified as Status Group D as well; this status was assigned mainly to bats and aquatic mammals, including whales and dolphins, whose migratory range in Maryland has not been fully investigated. Because they are relatively well studied, only eight percent of birds are categorized in Status Group D, in need of further research, monitoring, or inventory efforts.



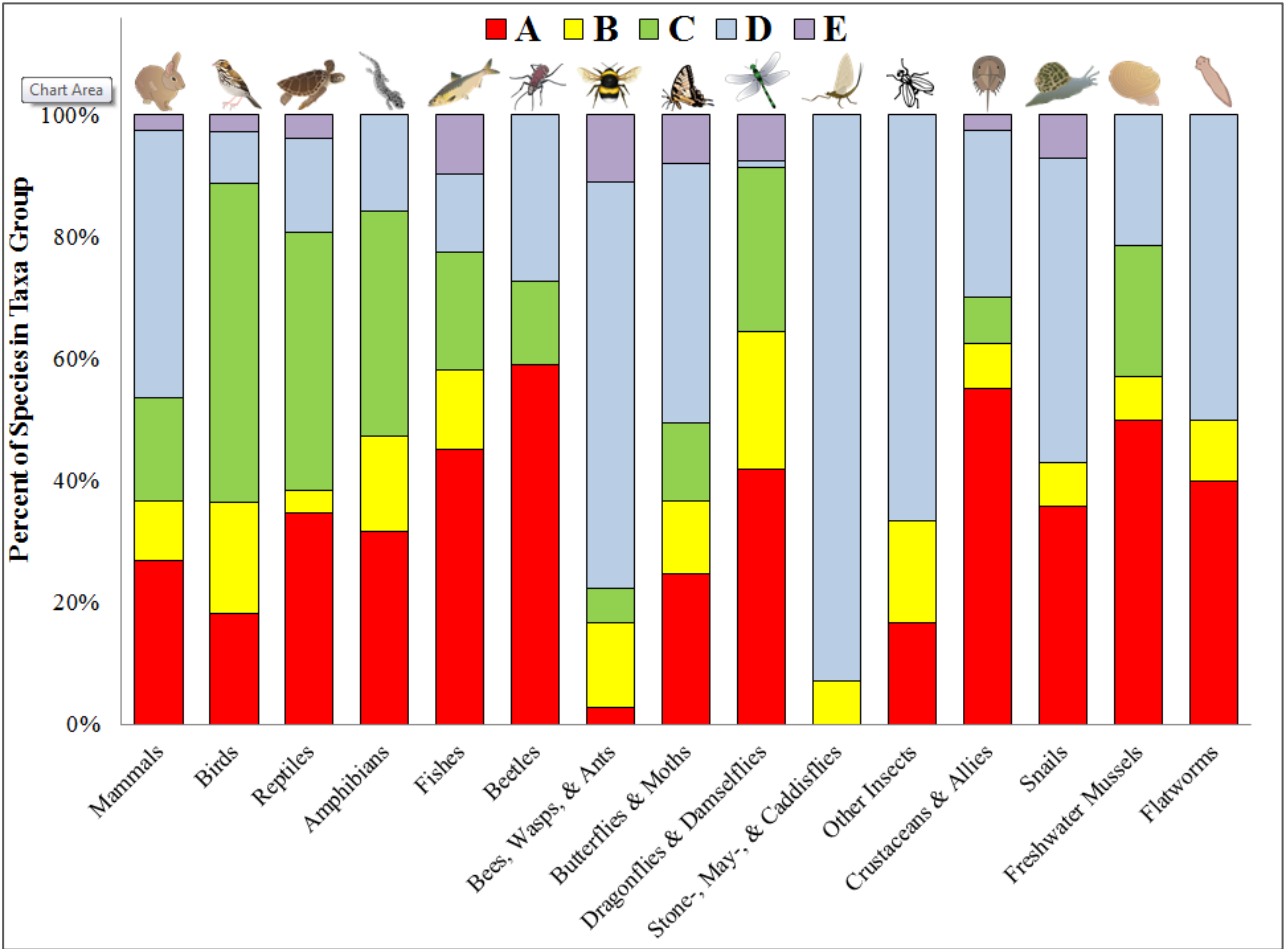


Figure 0.2 Percentages of species by taxa groups in each conservation status group. Conservation status groups are designated by letter as follows: A: highest; B: high; C: moderate; D: uncertain; E: historical.

Regional Context for Species of Greatest Conservation Need:

An Additional Factor for SGCN Selection

As states developed nongame and endangered species programs in the 1980s, their conservation efforts focused primarily on species that were state or federally listed. Although distribution and abundance data for taxonomic groups other than birds was limited, [the Northeast Fish and Wildlife Diversity Technical Committee](#) (NEFWDTC) applied this focus, along with additional priority setting methods, to nongame wildlife taxa in the Northeast region. Coordinated regional species lists were compiled beginning in the 1980s (French & Pence 2000) and led to the first region-wide list of species in need of conservation published by the Committee and subsequent species accounts (Terwilliger 2001). Hunt (2005) adapted the methodology to rank fish and wildlife species as Species of Greatest Conservation Need (SGCN) in the New Hampshire Wildlife Action Plan. This methodology was applied regionally in 2010 by the Northeast Partners in Amphibian and Reptile Conservation (NEPARC) to identify high priority species of northeast regional herpetofauna.



This evolving priority-setting process and Regional Species of Greatest Conservation Need (RSGCN) list is built upon the concept of review and re-evaluation by the NEFWDTC in order to maintain a current list of species that are of regional conservation interest. The most recent effort (2011-2013) highlights collaboration between the NEFWDTC and the North Atlantic Landscape Conservation Cooperative (NALCC) to improve and implement a screening of Northeast wildlife for conservation need and responsibility, and better capture and quantify species risk in the region. This effort resulted in 366 species or subspecies identified as RSGCN in the Northeast region (Appendix 3i), and Maryland has used this list as criteria in evaluating their 2015 SGCN list.

All major vertebrate taxonomic groups were considered for the RSGCN screening process: mammals (including marine mammals), birds, reptiles, amphibians, and freshwater and marine fish. Tiger beetles and freshwater mussels were also included. Due to insufficient information, many groups of invertebrates were not included. Instead, only the federally listed or candidate species were included until a more thorough review can be completed for these important taxa. Several invertebrate taxa groups (e.g., odonates and mussels) are the subject of current Regional Conservation Need project status reviews by experts in the region and will result in updated invertebrate lists.

The RSGCN screening criteria were applied to all 14 jurisdictions in the Northeast, with the intention that: 1) the list is available for voluntary adoption by states in their planning processes including Wildlife Action Plan revisions and, 2) the process and results satisfy certain Wildlife Action Plan requirements under Element 1. Additional factors such as emerging threats (e.g., diseases), changes in taxonomy, and other important updates are incorporated into the process as well.

Species on the RSGCN list are categorized according to “conservation need” (i.e., the percentage of Northeast states that list the species as SGCN in their 2005 SWAP) and “regional responsibility” (i.e., the percentage of the species North American range that occurs in the Northeast). This methodology was adapted from distribution and risk-based prioritizations used for birds (Carter et al. 2000; Wells et al. 2010), reptiles and amphibians (NEPARC 2010), and state agency endangered species lists (Hunt 1997, Joseph et. al. 2008, Wells et. al. 2010). Additional analyses were applied by the NALCC to a composite list of 2,398 species published in the 2005 Northeast SWAPs (Whitlock 2006) and applications will continue to be developed through collaboration with the Northeast states and NEFWDTC. Through this process, 366 species or subspecies have more than 50% of their North American range in the Northeast region or are identified by more than half of Northeast states as being species of greatest conservation need in 2005 State Wildlife Action Plans (Terwilliger & NEFWDTC 2013).

Major taxonomic groups of all species in the Northeast with the highest percentage of RSGCN include amphibians (40%), reptiles (39%), and tiger beetles (39%). Table 3.8 outlines the number of Northeast RSGCN by major taxonomic group. The large number of species included in these lists reflects the magnitude of the threats facing fish and wildlife species in the Northeast, as well as the commendable efforts of the individual Northeast states to ensure that their State Wildlife Action Plans were comprehensive in their coverage of species within these major taxonomic groups (Terwilliger & NEFWDTC 2013).



Table 3.8 RSGCN by major taxonomic group

Taxonomic Group	Number of RSGCN Species
Mammals	45
Birds	110
Reptiles	29
Amphibians	36
Fishes	101
Tiger Beetles ¹	11
Freshwater Mussels	23
Other Federally Listed Invertebrates	11
Total	366

¹ In Maryland’s SWAP, ‘Tiger Beetles’ fall under the category of ‘Beetles’ and are not counted separately
 Source: Terwilliger & NEFWDTDC 2013.

Mammals of Maryland

A total of 97 native mammal species have been documented in the state, including 28 marine mammals. The 69 land mammals are represented by 12 shrews and moles, 12 bats, 3 rabbits and hares, 22 rodents, 16 carnivores, 3 ungulates, and one marsupial, the Virginia opossum. Six non-native species have been introduced in Maryland, including Norway rat (*Rattus norvegicus*), house mouse (*Mus musculus*), sika deer (*Cervus nippon*), and nutria (*Myocastor coypus*). Most of Maryland’s native extant mammals have a statewide distribution. However, the Appalachian Plateau physiographic region, followed by the Ridge and Valley, support the highest diversity and the majority of the state's most imperiled mammals.

Twenty-one mammals in Maryland are game species with regulated hunting or trapping seasons. MD DNR’s Wildlife and Heritage Service maintains several programs that monitor the status of game mammal species, including the deer, bear, small game, and furbearer projects. The white-tailed deer (*Odocoileus virginianus*) management program monitors abundance and distribution in the state and regulates deer hunting seasons to maintain healthy deer populations within biological and cultural carrying capacities. A deer management plan (MD DNR 2008) was first developed by DNR in 1998 and is revised on a ten-year basis. Before implementation of this plan, which included creating one of the first ever urban/suburban deer management programs in the U.S., deer populations had drastically rebounded from historic lows. Populations doubled or more in most counties, increasing as much as 5-7 times (MD DNR 2008). Today, Maryland deer hunters enjoy very liberal deer seasons and bag limits, and, as a result, harvest more antlerless deer per square mile than any other state or province in North America. Deer population statistics have been on a declining trend since the deer population peaked in 2002 at nearly 295,000 deer. The 2014 white-tailed deer population was estimated at 227,000 (MD DNR 2015a).

Having reached historical lows in the mid-twentieth century, Maryland’s black bear (*Ursus americanus*) population has increased dramatically in western Maryland over the past few



decades. The first black bear management plan went into effect in 1992, and was followed by another 10-year management plan in 2004 (MD DNR 2004a). The bear population in Garrett and Allegany counties has increased 94% since 2005, with a tally of 701 bears in the two counties (MD DNR 2013).

The furbearer management program monitors and collects biological information on 14 mammal species that are legally harvested for their fur, either currently or historically. These species include gray fox (*Urocyon cinereoargenteus*), red fox (*Vulpes vulpes*), muskrat (*Ondatra zibethicus*), beaver (*Castor canadensis*), and raccoon (*Procyon lotor*). Over the past few decades, river otters (*Lontra canadensis*) and fishers have become re-established throughout most of their historical range in Maryland and coyotes are now present throughout the state. Trappers have taken an average of 258 otters and 52 fishers annually for the past 10 years. Fishers were extirpated from Maryland by the early 20th century, but have now expanded their range throughout western Maryland and into Frederick County from re-established populations in Pennsylvania and West Virginia.

Exotic species of mammals have become established in Maryland either through intentional or unintentional introductions. The house mouse and Norway rat arrived in Maryland with the earliest waves of Europeans to the Americas. Native to East Asia, sika deer were released in Maryland on James Island in 1916 and on Assateague Island around 1930. They have expanded their range in Maryland, now occupying five counties on Maryland's Eastern Shore (MD DNR 2015a). Nutria, a 15-20 lb rodent species of South American origin, has displaced the native muskrat in many coastal marsh regions and has impacted the marshes themselves. Able to breed throughout the year and sometimes "eating out" marsh vegetation, nutria greatly alter the marsh ecosystem and is a nuisance species. An aggressive nutria eradication program is currently underway throughout the Chesapeake and Delaware Bay regions; see Chapter 5 for more information.

SGCN Mammals of Maryland

Forty-one (42%) of the state's 97 native mammal species were identified as Species of Greatest Conservation Need (SGCN) (Table 3.10). Nineteen of these are state-listed, of which eight (3 bat species, 5 whale species; see Table 3.10) are also federally listed. The group also comprises 28 species of regional conservation concern in the northeastern U.S., 17 globally rare species, and six species that are otherwise declining, at risk, or of uncertain status and warrant conservation concern. The vast majority (81%, 33 species) are represented by three broad groups: bats, marine mammals, and species that are restricted, or mostly so, to montane habitats in western Maryland. These groups are described below. In addition, several small mammals occur in a wider variety of forested and open habitats, such as mink and least weasel. On Maryland's Eastern Shore, the Delmarva fox squirrel depends on forested habitats with at least some larger mast-producing trees, and least shrew can be found in coastal marshes (as well as in other habitats).

SGCN Montane Mammals

The state's greatest mammal diversity lies in the mountainous western region, which encompasses the Blue Ridge, Ridge and Valley and Appalachian Plateau physiographic provinces. Some 57 mammal species have been documented here, although eight are either



extirpated from the state (snowshoe hare [*Lepus americanus*], gray wolf [*Canis lupus*], American marten [*Martes americana*], elk [*Cervus elaphus*], American bison [*Bos bison*]), extinct (eastern cougar [*Felis concolor couguar*]) or their presence remains in question (eastern spotted skunk, Virginia northern flying squirrel). Of those still extant, approximately half (25 species) are species of greatest conservation need, including ten bat species (see subsequent section on SGCN bats) and nearly all of the state's most critically imperiled mammals. Twelve of these species occur only, or nearly so, in the western region with Garrett County supporting the greatest number of SGCN land mammals.

Many of western Maryland's SGCN mammals are associated with rare or uncommon montane habitats within large forested landscapes. Among the most specialized mammals is the southern water shrew, a globally rare species listed as Endangered in Maryland. Feeding primarily on aquatic insect larvae (e.g., mayflies, caddisflies, stoneflies), this small (~15 cm), uniquely adapted, semi-aquatic mammal is restricted to pristine, high elevation headwater streams in the central and southern Appalachians. The streams are typically bordered by bog wetlands and mature cool, moist forests dominated by northern hardwoods, hemlock, and/or red spruce, often with dense rhododendron thickets. In Maryland, small populations remain along just 6-7 streams, all in Garrett County. Another globally rare, Appalachian endemic with stringent habitat requirements is the southern rock vole (*Microtus chrotorrhinus carolinensis*). Known from just three Maryland sites, this Endangered mammal occurs in mesic, mature to old growth northern hardwood-hemlock forest with extensive, moss-covered boulderfields that often lay over springs.

At least eight SGCN mammals are associated with rock outcroppings and talus in western Maryland. These unique montane habitats are used seasonally or year-round as den sites, young-rearing areas, refugia, escape cover, and for foraging or hunting. SGCN mammals that use one or both of these habitats include eastern spotted skunk, bobcat, North American porcupine, and eastern small-footed myotis. Perhaps best exemplifying this habitat association is the Endangered Allegheny woodrat. An agile climber, it occurs almost exclusively in extensive rock outcroppings and talus slopes (and occasionally caves) surrounded by mast-bearing, mature to old growth forest (Thompson 1984, Feller 1994, Ford et al. 2006, Mengak et al. 2008). Although historically occurring as far east as the western edge of Washington DC, today its Maryland range is limited to a handful of widely scattered sites in the four westernmost counties, mostly along or near mountain ridge crests. Like many SGCN species, the Allegheny woodrat is sensitive to forest fragmentation, and maintaining adequate connectivity between sites to allow for dispersal and gene flow is key to the species survival.



Eastern spotted skunk (USFWS)

One species requiring montane talus habitat is the long-tailed shrew. It is limited to mesic forest containing large areas of loose talus where it preys primarily on small invertebrates



such as spiders, beetles and centipedes. Although found throughout the Appalachians, it occurs in highly localized, widely scattered locations and is rare to uncommon in parts of its range, including Maryland where it is state-listed as In Need of Conservation. Another montane habitat specialist is Appalachian cottontail. It is restricted, in part, to heavily forested, high elevation areas with extensive dense ericaceous vegetation (e.g., mountain laurel [*Kalmia latifolia*], great rhododendron [*Rhododendron maximum*]), especially along mountain ridgetops and slopes with extensive outcroppings and talus which provide thermal refugia and escape cover. It also occurs in natural shrubland and semi-open woodland habitats, such as shale barrens and sandstone glades. Appalachian cottontail is state-listed as In Need of Conservation and is a species of regional concern because of known or potential declines due to habitat loss, fragmentation, and competition with the ubiquitous eastern cottontail.

SGCN Bats

All 12 species of bats occurring in Maryland are considered to be SGCN. Unlike other mammals such as rabbits and mice, bats have a low reproduction rate, but make up for it by living long lives, provided they survive the many stressors and hazards in their environment. As a result of these threats, the Indiana bat and northern long-eared bat are federally listed, and the eastern small-footed myotis is state-listed as Endangered. Three more bat species are under review for possible state listing because of white-nose syndrome, a fungus that has killed millions of bats in the eastern United States (USGS 2015).



Indiana bat (Adam Mann, USFWS)

All bats in Maryland are insectivorous and use a highly sophisticated system of echolocation to find and catch insects in mid-air or glean from foliage. Bats are the primary predators of night flying insects, and can almost eat their weight in insects every night. Many of the insects eaten by bats are pests of gardens and farm crops (Webster et al. 1985).

Although bats in Maryland can be divided into groups based on life history strategies, in general they tend to select roosts near permanent water such as streams, rivers, ponds and lakes. Since insects are generally not active during winter, some of Maryland's bats migrate south and others fly to overwinter in hibernacula such as caves and abandoned sub-surface mines. Migratory bats include eastern red bats, hoary bats, silver-haired bats, and Seminole bats. Eastern red bats have been documented as occurring year-round in Maryland, although it is unknown if the bats that are present in the summer are the same as the individuals that overwinter. Red bats prefer mature deciduous trees to roost in during the summer (Limpert et al. 2007) and will overwinter under leaf litter in the fall and winter, while hoary bats prefer evergreen trees as summer roosts. Further south, Seminole bats prefer to roost in clumps of Spanish moss (*Tillandsia usneoides*), but not much is known about roost choices in Maryland since Spanish moss is no longer extant. Hoary bats are the largest bats in Maryland and occur throughout the state with a similar pattern to red bats. They prefer to roost in coniferous trees in clumps of foliage (Webster et al. 1985).



Silver-haired bats have not been documented as breeding in Maryland but have been documented during spring and fall migration periods. Silver-haired bats like to roost under bark crevices and in woodpecker holes, and occasionally are found in wood piles, open sheds, and rock crevices. Biologists think that silver-haired and hoary bats migrate south in the fall to areas where insects are active all year, however, much is still unknown about these species because they tend to roost singly or in family groups, are small in size, and are secretive in nature (Webster et al. 1985).

The remaining SGCN bats hibernate during the winter months when food is not available (little brown bat, big brown bat, northern long-eared bat, tricolored bat [formerly known as eastern pipistrelle], eastern small-footed myotis, and Indiana myotis). These species winter in caves, mines, and abandoned railroad tunnels in Maryland, although big brown bats will sometimes overwinter in buildings or bat boxes. Not much is known about where evening bats in Maryland spend the winter. Bats in this group may travel a hundred miles or more between their summer and winter roosts. Tricolored bats were once the most abundant wintering species in Maryland's caves, mines, and tunnels, but populations of this species, as well as little brown bats and northern long-eared bats, have been decimated by white-nose syndrome in addition to suffering other threats and stressors (D. Feller, unpublished data; MD DNR 2015b). During the summer breeding season, most of these species form loose colonies of females and pups (maternity colonies) in snags and hollow trees, under loose bark, in buildings, and in bat roosting boxes. Eastern small-footed bats differ in that they select rock outcrops for maternity sites. Males of these species tend to roost alone or in small bachelor colonies in similar habitats during the summer months.

SGCN Marine Mammals

Marine mammals encountered to date or are likely to occur in ocean waters off of Maryland and in the Chesapeake or Coastal Bays include 28 species: 23 cetaceans (whales, dolphins, porpoises), 4 pinnipeds (seals), and the West Indian manatee (Litwiler 2001). Of these 28, 10 cetaceans have been selected as SGCN mammals.

Cetaceans are divided into two groups, the baleen whales and the toothed whales. Baleen whales have large strips of whalebone or baleen instead of teeth which is used to filter water and food. Baleen whales do not echolocate but do use sound to communicate.

SGCN baleen whales include the sei, blue, fin, humpback, and North Atlantic right whale. All of these species with the exception of humpback whale are federally listed as Endangered and population stocks are classified as depleted by the Marine Mammal Protection Act (MMPA). The federal status of the humpback whale was under review for delisting in April 2015, which resulted in subdividing the global population into 14 distinct population segments. The population segment that encompasses Maryland was downlisted to "not at risk" status (NOAA 2015a). All baleen whales are state-listed as Endangered.



Bottlenose dolphin (George Jett)



Baleen whales in general spend the summer much further north of Maryland waters and migrate through to calving grounds much further south. Most sightings of baleen whales off the coast of Maryland occur in the fall, winter, and spring. The primary diet of these species includes krill, copepods, small fish in schools, and squid, which they can consume in vast quantities. Sei whales can be found in subtropical to subpolar oceans on the continental shelf edge and slope, often singly or in small groups of 2-5 individuals. Blue whales tend to be further offshore than other baleen whales (NOAA 2015c) and in general their movements are correlated with krill concentrations. Fin whales form social groups of 2-7 individuals but may feed with humpback whales, minke whales, and Atlantic white-sided dolphins (NOAA 2015d). Humpbacks engage in hunting techniques involving the creation of air bubbles to herd and trap fish. Bubble netting is unique to humpbacks and is a hunting strategy where individuals cooperate together to trap fish (NOAA 2015a). Right whales got their name because they have a layer of fat that floats them to the surface when dead. Early whalers referred to them as the “right” whales to hunt. Right whales are the rarest of baleen whales and among the rarest of marine mammals with only 450 individuals estimated in the North Atlantic. Their diet is primarily zooplankton but, unlike other baleen whales, they skim the water with their mouths open through a concentration of zooplankton. North Atlantic right whales occur in coastal or shelf waters (NOAA 2015e).

Species of toothed whales on Maryland’s SGCN list include the sperm whale, three beaked whales (Gervais’, True’s, and Cuvier’s) and one dolphin (bottlenose dolphin). The only species federally listed as Endangered, with stocks listed as depleted by the MMPA, is the sperm whale. The Western North Atlantic coastal stock of bottlenose dolphins is also listed as depleted by the MMPA. Only the sperm whale is state-listed as Endangered. Sperm whales can dive to 3,000 feet for an hour to feed on prey including large squid, sharks, skates, and fishes. Females form social bonds with other females and their young, and tend to stay in the same unit all their lives in tropical waters, whereas, young males form bachelor groups. As the young males age, they move polewards and become more solitary over time (NOAA 2015f).

Beaked whales are challenging to distinguish from one another and are very hard to observe. Cuvier’s beaked whales are deep divers and can dive 3,300 feet for 20-40 minutes going after squid and octopus, but will also eat fish and crustaceans. Gervais’ and True’s beaked whales are found alone or in small groups and their main prey are squid, shrimp, and fish. (NOAA 2015g; NOAA 2015h; NOAA 2015i). Bottlenose dolphins in the Mid-Atlantic are of two types, a coastal type which is the one designated as “depleted” by the MMPA and the offshore type. The coastal type is the one most likely to be found off the coast of Maryland. Similarly, Williams et al. (2015) found the coastal type most prevalent in the nearshore part of the study area in summer and remaining until fall, returning in the spring. Bottlenose dolphins were also the most abundant delphinid observed. Their diet consists of invertebrates, squids, and fish, and echolocation is used to find food; sometimes these dolphins employ a strategy known as “fish whacking” where they use their flukes to smack fish out of the water (NOAA 2015j).



Threats to SGCN Mammals

Threats to SGCN mammals are varied, reflecting the unique life histories and habitat requirements of this diverse group of species. Extensive forested, mountain ridgetop areas containing rock outcrops, talus slopes, and mature to old growth forest are among the most important SGCN mammal habitats in Maryland. These areas are threatened by energy development, especially wind power development and coal strip mining, as well as other forms of human disturbances, such as residential development and incompatible timber harvest practices. They provide critical habitat for Allegheny woodrat, long-tailed shrew, southern rock vole, and eastern small-footed myotis and can provide important habitat for other mammals, such as Appalachian cottontail, bobcat, and smoky shrew. The loss of high elevation red spruce and hemlock forest contributed to the extirpation of snowshoe hare and the decline of other mammals, including southern rock vole. This unique forest habitat and associated mammal fauna are likely to continue to be impacted by climate change, introduced species (e.g., hemlock wooly adelgid), and conversion to nonforested land uses. The southern water shrew, which requires high quality montane streams surrounded by old forest and high elevation wetlands, is vulnerable to a variety of land uses that could eliminate or degrade its requisite habitat. SGCN mammals in other parts of the state are similarly threatened by habitat loss and degradation.

Bats face particular threats to their food source through pesticide use and reduction of aquatic prey due to pollution, and are sensitive to disturbance during hibernation and while in maternity colonies located in tree cavities, rock outcrops (eastern small-footed myotis), and human structures. The removal of large tree snags and forest cover affects species such as Indiana myotis, northern long-eared bat, and red bat. At present, the greatest threat faced by a number of bat species is the recently introduced disease [white-nose syndrome](#) (WNS). Caused by a fungus (*Pseudogymnoascus destructans*), WNS was first detected in New York in the winter of 2006-2007 and has rapidly spread throughout the Eastern U.S., decimating bat populations in most states east of the Mississippi River (Turner et al. 2011). The eastern small-footed myotis may be the least common cave bat in the Northeast and is vulnerable to extirpation by chance events, like WNS, affecting isolated colonies concentrated in hibernacula. One of the biggest threats to migratory bat species is direct mortality from interactions with industrial wind turbines, which is estimated to kill as many as 888,000 migratory bats in North America per year (Smallwood 2013). In an effort to track effects of wind turbines on Endangered species, the U.S. Fish and Wildlife Service documents Indiana bat fatalities at wind energy facilities. Finally, urbanization has increased the level of competition and disease transmission between some SGCN and other species, such as raccoons, that adapt well to human-altered landscapes.

Marine mammals also face threats from pollutants and toxins dumped in the ocean, as well as entanglement in fishing gear, incidental take, and injuries from ship strikes. The coastal type of bottlenose dolphin has suffered viral outbreaks in recent times resulting in death and strandings. There is also growing concern about the effects of anthropogenic noise pollution on deep diving marine mammals. The possible effects of offshore wind turbine development on marine mammals and other marine taxa have been flagged for further study.



Conservation Actions and Information Needs for SGCN Mammals

Some of the conservation actions needed to address threats to specific SGCN are presented in recovery plans for federally listed species (e.g., Indiana myotis, certain whale species) (Table 3.9). For many SGCN mammals, the protection of critical forest, wetland, and rock outcrop habitat represents the most urgent and important conservation need. The best and, in some cases, only remaining habitat for some species is confined to MD DNR lands. For this reason, incorporating species and habitat conservation needs into public land management plans takes on an even greater importance. Landscape habitat models may help provide more effective conservation strategies for species with large home ranges (e.g., bobcat) or that occur as metapopulations and require large forested landscapes with minimal fragmentation (e.g., Allegheny woodrat). The restoration of high elevation red spruce-hemlock forest, along with efforts to minimize impacts from hemlock woolly adelgid, would provide important habitat for several SGCN mammals, as well as other SGCN taxa, and may provide opportunities for population reintroductions. Public education and working with mining, wind energy, and other industries that commonly cause disturbance in bat habitat could help to minimize bat mortality and deter the presence of invasive or pest species, such as domestic cats, near SGCN habitat.

To determine additional conservation measures, specific information or research is needed for some SGCN. The fossorial and nocturnal habits of many SGCN mammals make inventory, monitoring, and research on basic biology and habitat needs a particular challenge for this group. For wide-ranging species, understanding the landscape configuration needed to maintain metapopulations is of primary importance. Documenting the migratory flyways of bats and how to deter collisions with wind turbines are becoming more pressing issues as wind power development increases in the eastern U.S. Best management practices need to be developed to minimize the impacts of agricultural and timber harvest activities on forest and wetland mammals.

The Marine Mammal Protection Act (MMPA) of 1972 was monumental in that it provided ecosystem-level protection to all marine mammals in U.S. waters. Before the MMPA, marine mammals were protected by species on an as-needed basis to prevent total depletion of at-risk species, but the MMPA reaches across all marine mammal categories in its prohibition of take or harassment of marine mammals. The MMPA is carried out by the Secretary of the Interior through the U.S. Fish and Wildlife Service and by the Department of Commerce through the National Oceanic and Atmospheric Administration (NOAA). NOAA is responsible for managing pinnipeds, including cetaceans such as whale and dolphins.



Table 3.9 Existing federal recovery plans for SGCN mammal species.

Mammal Species	Federal Recovery Plan	Recent Action
Delmarva fox squirrel	USFWS 1993	2014: Draft post-delisting monitoring plan
Indiana myotis	USFWS 2007	2014: Initiation of 5-year review
Blue whale	NOAA Fisheries 1998	2012: Notice of intent to update recovery plan, request for more information
Fin whale	NOAA Fisheries 2010	2011: 5-year review, summary, & evaluation
Humpback whale	NOAA Fisheries 1991	2015: Status review completed
North Atlantic right whale	NOAA Fisheries 2004	2013: NOAA extends rule reducing risk of whale ship strikes along U.S. East Coast 2015: Proposed rule to expand critical habitat
Sei whale	NOAA Fisheries 2011	2012: 5-year review, summary, & evaluation
Sperm whale	NOAA Fisheries 2010	2015: 5-year review, summary, & evaluation

Table 3.10 Mammal Species of Greatest Conservation Need in Maryland

Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Allegheny woodrat	<i>Neotoma magister</i>	G3G4	S1	E		A
American mink	<i>Neovison vison</i>	G5	S4			C
Appalachian cottontail	<i>Sylvilagus obscurus</i>	G4	S1	I		A
Big brown bat	<i>Eptesicus fuscus</i>	G5	S5			C
Blue whale	<i>Balaenoptera musculus</i>	G3G4	SNA	E	E	D
Bobcat	<i>Lynx rufus</i>	G5	S3	I		C
Bottlenose dolphin	<i>Tursiops truncatus</i>	G5	SNR			D
Cuvier's beaked whale	<i>Ziphius cavirostris</i>	G4	SNR			D
Delmarva fox squirrel	<i>Sciurus niger cinereus</i>	G5T3	S1	I		A
Eastern harvest mouse	<i>Reithrodontomys humulis</i>	G5	SH	X		E
Eastern red bat	<i>Lasiurus borealis</i>	G4	SUB**, SUN**			D
Eastern small-footed myotis	<i>Myotis leibii</i>	G3G4	S1	E		A



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Eastern spotted skunk	<i>Spilogale putorius</i>	G4	S1			A
Evening bat	<i>Nycticeius humeralis</i>	G5	SUB**, SUN**			D
Fin whale	<i>Balaenoptera physalus</i>	G3G4	SNA	E	E	D
Gervais beaked whale	<i>Mesoplodon europaeus</i>	G3	SNR			D
Hoary bat	<i>Lasiurus cinereus</i>	G4	SUB**, SUN**			D
Humpback whale	<i>Megaptera novaeangliae</i>	G4	SNA	E	E	D
Indiana myotis	<i>Myotis sodalis</i>	G2	S1	E	E	A
Least shrew	<i>Cryptotis parva</i>	G5	S3S5			C
Least weasel	<i>Mustela nivalis</i>	G5	S2S3	I		B
Little brown myotis	<i>Myotis lucifugus</i>	G3G4	S1**			A
Long-tailed shrew	<i>Sorex dispar</i>	G4	S2	I		B
North American porcupine	<i>Erethizon dorsatum</i>	G5	S3S4			C
North Atlantic right whale	<i>Eubalaena glacialis</i>	G1	SNA	E	E	D
Northern long-eared bat	<i>Myotis septentrionalis</i>	G1G2	S1**	T	T	A
Sei whale	<i>Balaenoptera borealis</i>	G3	SNA	E	E	D
Seminole bat	<i>Lasiurus seminolus</i>	G5	SUB**, SUN**			D
Silver-haired bat	<i>Lasionycteris noctivagans</i>	G4	SUB**, SUN**			D
Smoky shrew	<i>Sorex fumeus</i>	G5	S2S3	I		B
Southeastern myotis	<i>Myotis austroriparius</i>	G3G4	SU**			D
Southeastern shrew	<i>Sorex longirostris</i>	G5	S3S4			C
Southeastern star-nosed mole	<i>Condylura cristata parva</i>	G5T4	SU			D
Southern bog lemming	<i>Synaptomys cooperi</i>	G5	S3			C
Southern pygmy shrew	<i>Sorex hoyi winnemana</i>	G5T4	S2			B
Southern rock vole	<i>Microtus chrotorrhinus carolinensis</i>	G4T3	S1	E		A



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Southern water shrew	<i>Sorex palustris punctulatus</i>	G5T3	S1	E		A
Sperm whale	<i>Physeter catodon</i>	G3G4	SNA	E	E	D
Tricolored bat	<i>Perimyotis subflavus</i>	G3G4	S1**			A
True's beaked whale	<i>Mesoplodon mirus</i>	G3	SNR			D
Virginia northern flying squirrel	<i>Glaucomys sabrinus fuscus</i>	G5T2	SP			D

¹ = See Table 3.5 for S-rank and G-rank definitions

² = T (Threatened); E (Endangered); I (In Need of Conservation); X (Endangered Extirpated)

³ = See Table 3.7 for Conservation Status definitions

* = a qualifier denoting the species is listed in a limited geographic area only

** = Proposed State Rank changes

Birds of Maryland

Birds are the most familiar and widely enjoyed wildlife in North America. As of 2015, 449 species of birds have been documented at least once in the state as represented in the “Official List of the Birds of Maryland” (Maryland Ornithological Society 2015). This list includes two species that have been extirpated from the state (trumpeter swan [*Cygnus buccinator*] and greater prairie chicken [*Tympanuchus cupido*]), two extinct species (passenger pigeon and Carolina parakeet), five introduced species that have become naturalized, and a large number of species that have made their way into Maryland only once or a few times since records were first kept in 1804.

Most Maryland birds are migratory and do not spend the entire year in the state, although some, such as the pileated woodpecker and northern bobwhite, are non-migratory and permanent year-round residents. Many species that breed in the state migrate to other areas outside of the breeding season. Some more northerly breeding species migrate south to Maryland and spend the winter here, while other species simply pass through the state during spring and fall migration periods. Less common are species like golden-crowned kinglet and dark-eyed junco that breed in western Maryland, but whose numbers increase when wintering individuals from the north occupy the entire state. Marine birds occur in the waters offshore with seasonally based abundance and distribution patterns, but their specific presence largely depends on the location of concentrations of their fish prey. Two-hundred and six species were documented as breeding in the state during data collection for the Second Breeding Bird Atlas from 2002 to 2006 (Ellison 2010). Although a number of other species only migrate through or overwinter in Maryland, their success while they are in the state can be critical to their continued survival.

Maryland’s importance to birds has been recognized by several organizations that have designated specific areas as particularly valuable to seabirds, wading birds, waterfowl, shorebirds and others. The Atlantic Coast Joint Venture (ACJV) designated much of Maryland’s coastal regions as Waterfowl Focus Areas in their [2005 ACJV Waterfowl Implementation Plan](#). Focus Areas include the Atlantic Coastal Bays, the Blackwater –



Nanticoke River region on the Delmarva Peninsula, the Chester River and Kent County Bayshore region, the Choptank River region, the Eastern Shore's Eastern Bay region, the Patuxent River region, the Tangier Sound and Bay islands, and the Tidal Potomac region (Atlantic Coast Joint Venture 2005). The Mid-Atlantic/New England Maritime Regional Working Group for Waterbirds (MANEM), a regional partnership working to conserve waterbirds in the Northeast, identified Important Waterbird Areas for breeding seabirds, wading birds, and marshbirds for 11 states and 4 provinces in the Northeast. [MANEM maps](#) for each of the mentioned groups of waterbirds are available for each state, including Maryland. Key areas for shorebird and marine bird conservation are under development by working groups for shorebirds (Atlantic Flyway Shorebird Business Strategy group) and marine birds (Northwest Atlantic Marine Bird Cooperative). Information from these and other efforts led to the creation of [focal area maps](#) for coastal areas in Maryland for shorebirds, waterbirds, landbirds, and waterfowl. In Maryland, concentrations of high priority landbirds, waterbirds, and/or shorebirds have led to the designation of 42 areas as [Important Bird Areas](#) (IBAs) by the National Audubon Society. Of the 42, six IBAs are of global significance, meaning that the IBA contains bird species of global conservation concern or the site meets other criteria based on the species limited range and high density in the IBA. IBAs are found in every region of Maryland, with the majority of higher ranked IBAs in coastal regions (National Audubon Society 2013). At regional and local scales, target areas in Maryland have been or are being identified for particular species (e.g., cerulean warbler, golden-winged warbler, rusty blackbird, and American woodcock) or groups of species (e.g., forest interior breeding birds, nightjars) based on habitat needs and known concentrations.

Maryland's landscape encompasses six physiographic regions, as described in Chapter 2: Lower Coastal Plain, Upper Coastal Plain, Piedmont, Ridge and Valley, Blue Ridge, and Appalachian Plateau. The diversity of habitats within these regions directly accounts for the diversity of birds found in the state. Because of this physiographic diversity, three Bird Conservation Regions (BCRs) occur in Maryland – [New England/Mid-Atlantic Coast](#), [Piedmont](#), and [Appalachian Mountains](#) (see Table 2.1). The Regions were designated by the North American Bird Conservation Initiative to represent ecologically distinct regions with similar bird communities, habitats, and resource management issues. Each BCR addresses different suites of species and issues, and some have designated priority areas for focal species. Additionally, numerous conservation plans address the unique guilds or groups of bird species that occur within BCRs and across the entire Atlantic Coast region.

SGCN Birds of Maryland

One hundred and forty-one species of birds have been listed by the SWAP process as species of greatest conservation need (SGCN) in Maryland (Table 3.12). Of these, 34 are state-listed, 18 of which are listed as Threatened or Endangered and 83 of which are of conservation concern in the Northeastern U.S. region (RSGCN). An additional 53 species were included because they are of national or international concern or the best available current scientific information indicates their populations are in decline or they require more specialized habitat types that are likely to be degraded (Appendix 3c). For example, regional rusty blackbird populations have declined steeply in recent years and Maryland has joined efforts to identify key wintering and migration wetland areas. Coordinated regional surveys are also underway



for nightjars (eastern whip-poor-will, common nighthawk, chuck-will's-widow) based on suspected declines and the difficulty of surveying nocturnal species. Birds federally listed as Endangered that formerly bred in Maryland include roseate tern and red-cockaded woodpecker. The bald eagle was removed from the federal list of Threatened and Endangered species in 2007, but the Atlantic coast breeding population of piping plovers is still federally listed as Threatened; both bird species are listed as MD SGCN. Fourteen species are considered by the MD DNR to be Endangered in the state: Wilson's plover, piping plover, upland sandpiper, black rail, common tern, gull-billed tern, royal tern, black skimmer, short-eared owl, sedge wren, loggerhead shrike, Swainson's warbler, mourning warbler, and northern goshawk. Species listed as Threatened in the state include the American bittern, the Nashville warbler, and the least tern. For additional regional, national, and international ranks see Appendices 3a, 3b, and 3c.

SGCN Montane Birds

Forests dominate the Blue Ridge, Ridge and Valley, and Appalachian Plateau provinces more so than any other part of the state and include mostly a mix of mature and younger sapling and pole stage forests with just scattered remnants of old-growth forest. Although most forests are dominated by hardwoods, more northern forest types with a conifer component are also present. Where they occur, old-growth forests in this region tend to support higher densities of several SGCN forest birds. In addition, bog and fen wetland complexes, cliff and rock outcrops, beaver-created wetlands, and large planted grasslands provide habitats for a great diversity of SGCN birds. Because some of these habitats occur nowhere else in the state, a number of bird species breed exclusively, or nearly so, in these regions, especially in the Appalachian Plateau. Some of these species are at or near the southern extent of their breeding ranges, such as Nashville warbler, mourning warbler, northern saw-whet owl, Canada warbler, and alder flycatcher. Eight state-listed species and an additional 11 SGCN birds breed only in western Maryland's montane region, including northern goshawk, pine siskin, winter wren, red-breasted nuthatch, and golden-winged warbler.



Northern saw-whet owl (George Jett)

Although historically a predominantly forested landscape, the Appalachian Plateau region includes extensive anthropogenic grasslands resulting from strip mine reclamation and agricultural practices (e.g., hayfields, pasture). These habitats provide some of the few remaining areas in Maryland where area-sensitive grassland nesting birds such as Henslow's sparrow, northern harrier, and upland sandpiper still regularly breed.

The mountain ridges of Maryland feature concentrations of migrating raptors by day and songbirds by night, where migrants also stop to feed and rest on their journeys. Recent satellite tracking studies on eastern golden eagles have reinforced hawk watch data showing



that the regional population concentrates along just a few mountain ridges as birds pass over Maryland (Katzner et al. 2012). In addition, ongoing studies at higher elevations in forested areas have shown that they are regularly used as wintering grounds by eastern golden eagles.

SGCN Birds of the Piedmont

The forests, riparian corridors, wetland habitats, and open areas of the Piedmont Bird Conservation Region support roughly 140 breeding bird species (Carter et al. 2000). Six bird species have a disproportionately large share of their global populations breeding within this area, which extends from southern Virginia to northern New Jersey (Kearney 2003; Watson 2014). These include four SGCN deciduous forest nesting species (wood thrush, Acadian flycatcher, scarlet tanager, Louisiana waterthrush) and one SGCN associated with early successional habitats (prairie warbler). The Piedmont is in the heart of these species geographic ranges and, therefore, forest conservation in this region could especially benefit and sustain their populations over the long term. In Maryland, willow flycatcher, American kestrel, and red-headed woodpecker breed more commonly in the Piedmont section of the state and their habitats deserve special attention. Regional planning efforts have also identified the importance for the Piedmont of protected or sheltered habitat corridors for forest and grassland species, maximizing opportunities to preserve habitats for breeding and migration for priority species in rapidly increasing urban and suburban areas, and preserving farmlands and associated habitats (Watson 2014).



Prairie warbler (George Jett)

Due to the concentration of human population growth, changes in farming practices, and alteration of natural fire frequencies, the Maryland Piedmont now forms a particularly fragmented mosaic of forest and mostly anthropogenic grassland, which limits the success of birds that depend on large blocks of these habitats. For example, broad-winged hawk, brown creeper, Kentucky warbler, and cerulean warbler have shown declines in the Piedmont, likely due to forest loss and fragmentation. In addition to forest-dependent species, Maryland's Piedmont habitats traditionally supported grassland species such as the vesper sparrow, grasshopper sparrow, and eastern meadowlark, which have decreased by an average of 10% per year and are among the most steeply declining birds in the mid-Atlantic Piedmont (Kearney 2003). Dickcissel, bobolink, barn owl, and upland sandpiper were once more common in the grassland habitats of this region of Maryland, and some of these species still occur there. Birds of shrublands and early successional habitats, such as the northern bobwhite, American woodcock, and yellow-breasted chat, have also seen large population declines as farming practices have changed and urbanization has increased in the Piedmont. Loss of habitat to development, changes in farming practices (lack of hedgerows), and other factors have also led to the loss of loggerhead shrike as a breeding bird in recent years in Maryland and surrounding states. The continued expansion of development in this area of the



state as well as in the region represents a particular challenge for bird conservation to the SGCN species that occur in Maryland's Piedmont.

SGCN Birds of the Coastal Plain

The avifauna of the Upper and Lower Coastal Plain is transitional and contains a mix of species mostly centered in southeastern North America, with some additional species coming into the area from more inland regions. Of the Coastal Plain breeders, many SGCN are associated with open water and wetland habitats, although some are associated with upland forests, shrublands, and grasslands. As would be expected, waterfowl, marsh birds, shorebirds, and colonial nesting waterbirds, are important components of this region's avifauna (Kushlan et al. 2002). Of the perching birds, Coastal Plain specialists include brown-headed nuthatch, marsh wren, Swainson's warbler, saltmarsh sparrow, seaside sparrow, Coastal Plain swamp sparrow, and boat-tailed grackle.

Chesapeake Bay is a major wintering area for waterfowl in the Atlantic Flyway including brant, redhead, canvasback, and long-tailed duck. Several SGCN also breed in the Chesapeake Bay region, including American black duck, blue-winged teal, and gadwall- all of which have declined in the state (Costanzo & Hindman 2007). The Bay is also very important for wintering and migrating red-throated loons and horned grebes; migrating northern gannets and saltmarsh sparrows; and breeding rails and sparrows, according to a recent analysis of the importance of the Chesapeake Bay to avian populations during different parts of their life cycle (Watts 2013). Overall, Chesapeake Bay supports 67 species of breeding waterbirds, 87 species of wintering waterbirds, and 138 species that stopover during migratory periods (Watts 2013), many of which are SGCN.

Efforts to assess Maryland's marsh bird populations began in the early 1990s (Brinker et al. 2001). Compared to most other groups of birds, many aspects of marshbird biology remain poorly known. Information is lacking or incomplete, for example, with regard to breeding and winter distribution, migration patterns, threats, and limiting factors (Watts 2013). Breeding marshbirds are included on the SGCN list due to documented declines in Maryland and in the region. Of great concern is the disappearance of Endangered black rails from many of their former locations, reflecting a region-wide decline estimated to be as high as 75% according to the Eastern Black Rail Conservation and Management Working Group. Marshes and wetlands of the Coastal Plain also provide important breeding habitat for other SGCN rails, ducks, shorebirds, raptors, wrens, and sparrows. A recent region-wide collaboration, the [Saltmarsh Habitat and Avian Research Program](#), will soon provide data on trends and productivity of a suite of SGCN marsh birds that are critical for effective conservation of these species.

Colonial waterbirds are particularly vulnerable to disturbance or loss of nesting areas since they concentrate during the nesting season into very limited areas. Since the mid-1980's, MD DNR has had an active colonial waterbird management program to assess and monitor these vulnerable populations. Regional management is coordinated through MANEM (2006) and the Colonial Waterbird and Shorebird Working Groups provide regional assessments of waterbird population status and trends. Recently, the [Integrated Waterbird Management and Monitoring Program](#), coordinated by the U.S. Fish and Wildlife Service, has worked to



provide breeding, wintering, and migration habitat for shorebirds, waterfowl, and wading birds as they occupy different areas throughout the year along the Atlantic Coast. Twenty-one species of colonial waterbirds nest currently or nested historically in Maryland. This group includes terns, gulls, herons, egrets, and ibises, along with black skimmer, double-crested cormorant and brown pelican. In Maryland, nesting black skimmers, common terns, and Forster's terns continue to experience significant declines, while double-crested cormorants (*Phalacrocorax auritus*) nesting on man-made structures like bridges have increased at a dramatic rate (Brinker et al. 2007). Many islands important to colonial waterbirds continue to shrink due to erosion and sea-level rise, and nests are increasingly vulnerable to overwash during high tides and storm events. Although the number of Chesapeake Bay colonies has increased for great blue heron and great egrets, decreases have been documented for other species (snowy egret, black-crowned night-heron) due to the loss of foraging and nesting habitats (Watts et al. 2007).

Maryland's Atlantic Coast and Coastal Bays provide the primary habitats where migrating shorebirds stop to feed and rest, where shorebirds spend the winter, and where rare piping plovers breed. Although a number of shorebird populations in North America have stabilized after large declines during the early 1980's and mid-1990's, several species that pass through (e.g., whimbrel, red knot, semipalmated sandpiper) or winter in Maryland (e.g., ruddy turnstone, lesser yellowlegs, sanderling) have continued to show significant population declines over the last 10 years (Andres et al. 2012). Shorebird populations are regularly monitored in Maryland only by the National Park Service (NPS) at Assateague Island National Seashore, although occasional Atlantic coast regional coordinated efforts have been carried out (Clark & Niles 2000; Hunter 2003). Conservation actions in North America are provided in the [U.S. Shorebird Conservation Plan](#) (Brown et al. 2001), and the U.S. Shorebird Conservation Partnership Council oversees the implementation of the regional, national, and international goals of the Plan.



Left: piping plover (Don Freiday, USFWS); **right:** protected sand dunes of Assateague Island, where the piping plover, endangered in Maryland, nests (Stephen Badger, MD DNR).

The piping plover, a federally listed as Threatened and state-listed as Endangered, is a tiny dune-nesting shorebird that nests on Maryland's Assateague Island and on other Atlantic



coastal beaches (USFWS 1996). The species is slowly recovering due to education of beach users, aided by signs and light fencing, the latter sometimes also being predator-resistant. The [Atlantic Flyway Shorebird Initiative: A Business Plan](#) (2015) presents an unprecedented approach to shorebird conservation. As a business strategy instead of a conservation plan, this strategy identifies the needs of species at greatest risk, examines necessary actions including funding, and presents those individuals and groups which are instrumental in the recovery process, along with analysis of possible outcomes. The goal of this conservation business strategy is to create a long-term platform for stability and recovery of focal species identified and to increase current shorebird population levels by 10-15 percent by 2020 (Manomet Center for Conservation Sciences and U.S. Fish and Wildlife Service 2015).

Remaining forested areas in the Upper and Lower Coastal Plain, especially those dominated by hardwoods, provide places for migrating songbirds to rest and refuel on their long journeys to the north or south of Maryland. Forested corridors along rivers, especially the Pocomoke River, have been shown to be particularly important to these migrants. Coastal Plain river corridors and Chesapeake Bay shorelines support the recovered bald eagle population at all times of the year (Watts et al. 2007). In larger forest blocks, breeding birds limited to the forest interior form a diverse, species-rich community that can include as many as 10 species of warblers and another 11 species that depend on this habitat. In Lower Coastal Plain uplands, a mosaic of anthropogenic grasslands (e.g., hayfields, wildlife habitat plantings), shrubs, and both young and older forest provides a landscape that supports species such as grasshopper sparrow, yellow-breasted chat, prairie warbler. This mosaic landscape is critical to maintain remaining northern bobwhite populations, whose range in Maryland has been largely reduced to the Lower Eastern Shore.

SGCN Marine Birds

The birds of Maryland's oceanic waters are the least understood and least studied group of birds in the state and in the region. To try to address information gaps, a recent collaboration, the [Northwest Atlantic Birds at Sea](#), is working to support surveys and research for marine birds. This group has also identified conservation target species for the region, most of which at least pass through offshore Maryland on a regular basis. Studies from the 1970's (Rowlett 1980) and 1980's (Powers 1983), compilations of data (O'Connell et al. 2009), as well as observations from pelagic boat trips for birdwatching have provided basic information on the presence and timing of the occurrence of over 20 marine bird species in the waters offshore of Maryland, not including gulls and terns. Although recent studies in advance of offshore wind development have provided additional information on deepwater marine birds, the distribution, seasonal movements, population status, and specific habitat preferences throughout the year remain poorly understood for many species. More information is available for birds using nearshore areas due to the ease of observation from



American oystercatcher (George Jett)



shore compared to areas that must be reached by boat or flown over with aircraft to document species presence and activity. Spring and fall migration periods bring the majority of marine birds to the state, although several species (loons, scoters, gannets) winter here in large numbers and some species (shearwaters, storm-petrels) can increase in abundance in the summer.

Marine birds in Maryland use pelagic habitats on the continental shelf that vary from shallow areas close to shore, to open waters beyond the 3-mile state boundary, to areas above deep canyons on the ocean floor miles from the coast. The presence and location of marine birds is very much influenced by the presence of their prey, which depends on temperature and salinity as dictated by oceanic currents and weather conditions, and which can also be influenced by ocean depth and underlying physical features of the ocean floor.

Concentrations of shellfish and other food sources around shoals and artificial reefs provide nearshore feeding grounds for wintering loons, grebes, and scoters. Migrating gannets move along the coast by the thousands, plunge diving on schooling fish, with a number of birds remaining to winter in Maryland waters. Further offshore, concentrations of pelagic birds can be found where fish and cephalopod prey are abundant, including near upwellings from deep canyons in the ocean floor at the outer edge of the continental shelf, where *Sargassum* mats are brought in by the Gulf Stream, and where fishing trawlers and processing vessels are dumping offal. In these situations, mixed groups of shearwaters and petrels, which can number in the hundreds, are often found where food is concentrated. Several terns, jaegers, alcids (puffins, murre, razorbills), storm-petrels, black-legged kittiwake, and two species of phalarope round out the diversity of marine birds occurring regularly offshore of Maryland. These species, especially storm-petrels and phalaropes, tend to aggregate where zooplankton, planktonic crustaceans, and small fish are concentrated at the surface. Although data to assess population trends for marine birds are limited, it has been estimated that loons, scoters, phalaropes, Audubon's shearwater, black-legged kittiwake, and Leach's storm-petrel are declining. Changes in food availability and challenges in breeding areas, such as habitat loss and contamination, are likely contributing to these declines.

Threats to SGCN Birds

Although SGCN birds are a diverse group, many of them (> 40 species) are highly area-sensitive and negatively affected by the fragmentation of their respective habitats. For example, forest nesting species, such as worm-eating warbler, cerulean warbler, and broad-winged hawk, typically only breed in large contiguous forest tracts and nest success tends to decline in increasingly fragmented areas. Area-sensitive grassland nesting birds such as Henslow's sparrow and short-eared owl, as well as some wetland species, like sedge wren and saltmarsh sparrow, show similar patterns. In addition to area sensitivity, some species require a mosaic of habitats at the landscape level to persist, such as northern bobwhite. Most fragmentation has resulted from residential and commercial development but agriculture and infrastructure such as roads and powerlines are also a major source. Of growing concern is forest loss and fragmentation from windpower developments on ridgetops and the potential for further fragmentation from hydrofracking. Conversion of native forest communities to commercial pine plantations alters the suitability of the habitat for most SGCN forest species, and some bird species, such as northern saw-whet owl and golden-crowned kinglet, are dependent on high elevation red spruce-hemlock habitats that have been greatly reduced in



size and impacted by climate change. Changes in forest composition and structure from altered fire regimes, invasive pests like hemlock wooly adelgid, overbrowsing by deer, and invasive plant species can all have serious impacts on critical habitat for forest nesting birds as well as some shrubland species. Grassland birds such as dickcissel and bobolink are further threatened by changes in agricultural practices such as early mowing. Wetlands birds are impacted by changes to their environment from invasive plant species (phragmites), contaminants, and lack of beaver-created wetlands.

Beach-nesting, migrating, and wintering shorebirds and colonial waterbirds face special challenges as they are concentrated in areas with increased recreational use, expanding gull populations, shoreline development, and alteration of natural shoreline processes. In addition, sea level rise has seriously impacted the availability of suitable nesting habitat for terns as islands in the Chesapeake and Coastal Bays have continued to disappear. Disturbance of colonial waterbird colonies is of special concern given the potential to negatively affect the breeding success of a large group of birds by impacting just one or a few areas. These colonies and beach-nesting shorebirds can also be seriously impacted by higher than normal predator populations favored by a variety of human activities.

The vast saltmarsh habitats of Maryland support the regional stronghold of rails and sparrows, such as black rail and Coastal Plain swamp sparrow. Contamination and drainage of these and other marsh habitats through development and mosquito control efforts can be a serious problem for marsh-nesting species. Climate change has also impacted coastal marsh habitats through sea level rise, combined with an increase in frequency and severity of storms and tidal surges in coastal areas during the nesting season. Marine birds can be impacted by overfishing, entanglement in fishing gear, contamination, and climate alterations that impact the presence and abundance of their food resources. The development of offshore wind energy facilities has the potential to impact marine birds, although the degree and severity of impacts can be difficult to predict.

Not including marine birds, 24 SGCN birds do not breed in Maryland, but overwinter or stop in Maryland during migration. Migratory stopover or wintering habitat is critical for these species, most of which are shorebirds or waterfowl. Disturbance of beach habitats, the absence of horseshoe crab eggs for shorebirds (especially red knot), and degradation of aquatic habitats for

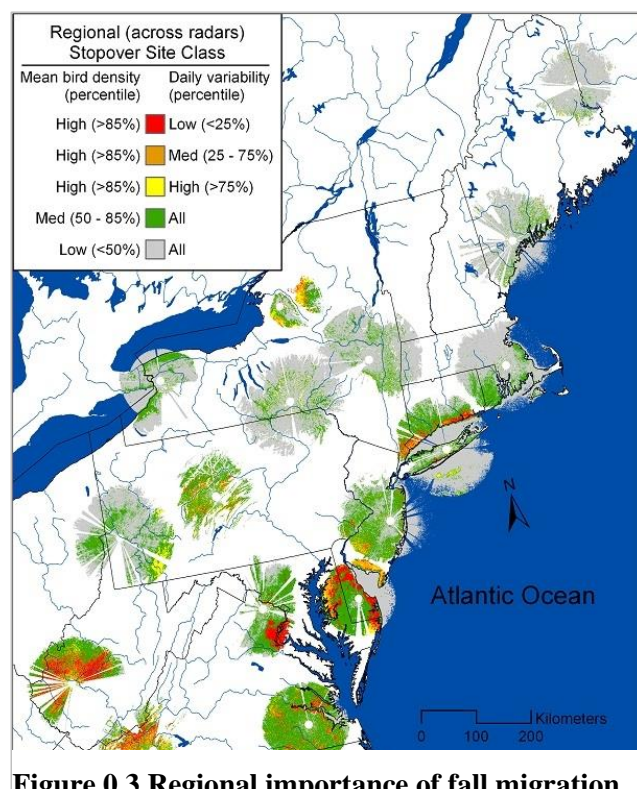


Figure 0.3 Regional importance of fall migration stopover sites for birds from the analysis of weather surveillance radar data. Source: Buler & Dawson 2014.



waterfowl threaten these species groups during winter and migration periods. In addition, studies show that migrating songbirds in the region regularly concentrate in certain areas of the state (Figure 3.3). Protection of migratory stopover habitat in these areas is critical to support regional populations. Several general threats to birds also affect SGCN to differing degrees. Collisions with towers, windows, cars, and other human structures kill many thousands of birds each year. SGCNs face competition for nest sites with introduced bird species, and free-ranging domestic cats are estimated to kill billions of birds annually in the U.S (Loss et al. 2013).

Conservation Actions and Information Needs for SGCN Birds

State and regional efforts to identify conservation actions and information needs for birds has been extensive, more so than for any other SGCN taxonomic group. For example, Partners in Flight has produced conservation plans that include Maryland SGCN, and Bird Conservation Region plans have been completed or species of concern have otherwise been identified for all of the regions in Maryland designated by the North American Bird Conservation Initiative. Recommendations for SGCN waterbirds, seabirds, shorebirds, and waterfowl are included in other regional plans. These plans help to provide population targets and landscape-level habitat information that can be used to identify priority areas for conservation through acquisition and easement and habitat restoration. In particular need are habitats for area sensitive and northern habitat species, and those species requiring a mosaic landscape of particular habitats. The recent designation of Important Bird Areas (IBA) by Audubon Maryland/DC will assist with this effort by identifying habitats supporting suites of SGCN and working to protect them. In addition, information needs and conservation actions for breeding federally listed species (piping plover) can be found in their respective recovery plans. Support for the recovery plans for federally listed Endangered and Threatened species is included in the implementation of the SWAP (Table 3.11). Partnerships, such as the newly formed Maryland Bird Conservation Initiative, are key to coordinating the efforts of local and regional groups for the most effective and efficient conservation of Maryland's SGCN birds and their habitats.

Given the mobility of birds, planning at the landscape level and considering species needs during their full life cycle is particularly important. Coordination of monitoring for birds and use of standardized protocols are likewise important to assess population status and trends across broad landscapes (Lambert et al. 2009). To address the special needs of SGCN birds, more information is particularly needed on migratory stopover and overwintering requirements; area sensitivity (forest, grassland, and marsh species); and inventory of nocturnal species and marine birds. Even for some more well-studied SGCN species, details of their habitat requirements and impacts of threats are not understood well enough for effective conservation. Building on information collected during the most recent Breeding Bird Atlas (Ellison 2010) could help to fill in information gaps for select species and also indicate where improvements in habitat conservation and restoration could be most beneficial for SGCN birds.

Fragmentation and habitat destruction for forest-interior as well as area-sensitive grassland species can be limited by protecting the remaining large blocks of unfragmented forests and grasslands, controlling urban sprawl through implementation of the state's smart growth



initiatives, smart siting of energy developments and transportation corridors, and limiting forest conversion to monotypic pine plantations. Work with the public can encourage the protection of SGCN at migratory stopover sites, beach-nesting sites, waterbird nesting colonies, and through control of predation by free-ranging cats. Programs that encourage private landowners to create or preserve habitat are key for several SGCN. Control of introduced and invasive bird species, predators, and deer populations continues to be needed to conserve some nesting bird species. Food resources of SGCN birds can be protected by limiting the use of pesticides and overharvest of horseshoe crabs and forage fish. Encouraging farming practices, utility right-of-way management, and reclaimed strip mine practices that favor grassland and shrub-scrub nesting species, such as late mowing, hedgerow establishment, and reduced pesticide use can benefit a number of SGCN grassland and early successional forest birds. Best Management Practices (BMPs), such as those created for Virginia Piedmont birds (Wolter et al. 2008) and golden-winged warbler habitats in the Appalachian region (Golden-winged Warbler Working Group 2013), can be good sources for conservation practices for SGCN birds; creation of additional BMPs would be beneficial, especially for work with private and public land managers. Working with a variety of partners will be critical to minimize mortality due to collisions.

Restoration of natural fire frequencies, shoreline processes, and beaver populations can create breeding habitat for certain SGCN. Creation of islands to replace those that have been lost could contribute greatly to the persistence of breeding colonial waterbirds. Retention and improvement of aquatic habitats for SGCN birds can be achieved by controlling common reed, restoring marshes, the enforcement of wetland protection laws, limiting excess nutrient and pollutant inputs, and the reduction of bycatch by commercial fisheries.

Table 3.11 Existing federal recovery plans for SGCN birds.

Bird Species	Federal Recovery Plan	Recent Action
Eskimo curlew	None	2011: 5-year review, summary, & evaluation
Ivory-billed woodpecker	USFWS 2010	2010: Final recovery plan
Piping plover	USFWS 1996	2014: Initiation of 5-year review
Red-cockaded woodpecker	USFWS 2003	2006: 5-year review, summary, & evaluation
Roseate tern	USFWS 1998	2010: 5-year review, summary, & evaluation

Table 3.12 Bird Species of Greatest Conservation Need in Maryland.

Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Acadian flycatcher	<i>Empidonax vireescens</i>	G5	S5B			C
Alder flycatcher	<i>Empidonax alnorum</i>	G5	S2B	I		B



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
American bittern	<i>Botaurus lentiginosus</i>	G4	S1B, SIN	T		A
American black duck	<i>Anas rubripes</i>	G5	S4B,S5N			C
American kestrel	<i>Falco sparverius</i>	G5	S4B,S3N			C
American oystercatcher	<i>Haematopus palliatus</i>	G5	S3B,S2N			C
American peregrine falcon	<i>Falco peregrinus anatum</i>	G4T4	S2	I		B
American redstart	<i>Setophaga ruticilla</i>	G5	S4B			C
American woodcock	<i>Scolopax minor</i>	G5	S4B,S4N			C
Audubon's shearwater	<i>Puffinus lherminieri</i>	G4G5	SNR			D
Bald eagle	<i>Haliaeetus leucocephalus</i>	G5	S4			C
Bank swallow	<i>Riparia riparia</i>	G5	S3B			C
Barn owl	<i>Tyto alba</i>	G5	S2	I		B
Bicknell's thrush	<i>Catharus bicknellii</i>	G4	SNA			D
Black rail	<i>Laterallus jamaicensis</i>	G3G4	S1	E		A
Black scoter	<i>Melanitta americana</i>	G5	S3N			C
Black skimmer	<i>Rynchops niger</i>	G5	S1B	E		A
Black-and-white warbler	<i>Mniotilta varia</i>	G5	S4B			C
Black-bellied plover	<i>Pluvialis squatarola</i>	G5	S3N			C
Blackburnian warbler	<i>Setophaga fusca</i>	G5	S3B			C
Black-crowned night-heron	<i>Nycticorax nycticorax</i>	G5	S3B,S2N			C
Black-legged kittiwake	<i>Rissa tridactyla</i>	G5	SNR			D
Black-throated blue warbler	<i>Setophaga caerulescens</i>	G5	S3S4B			C
Black-throated green warbler	<i>Setophaga virens</i>	G5	S4B			C
Blue-winged teal	<i>Anas discors</i>	G5	S2B,S3N			B



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Blue-winged warbler	<i>Vermivora cyanoptera</i>	G5	S4B			C
Boat-tailed grackle	<i>Quiscalus major</i>	G5	S4B,S3N			C
Bobolink	<i>Dolichonyx oryzivorus</i>	G5	S3S4B			C
Brant	<i>Branta bernicla</i>	G5	S4S3N			C
Broad-winged hawk	<i>Buteo platypterus</i>	G5	S3S4B			C
Brown creeper	<i>Certhia americana</i>	G5	S3B,S4N			C
Brown pelican	<i>Pelecanus occidentalis</i>	G4	S1B			A
Canada warbler	<i>Cardellina canadensis</i>	G5	S3B			C
Canvasback	<i>Aythya valisineria</i>	G5	S3S4N			C
Cerulean warbler	<i>Setophaga cerulea</i>	G4	S3B			C
Chimney swift	<i>Chaetura pelagica</i>	G5	S5B			C
Chuck-will's-widow	<i>Antrostomus carolinensis</i>	G5	S4B			C
Coastal Plain swamp sparrow	<i>Melospiza georgiana nigrescens</i>	G5T3	S2S3B,SUN	I		A
Common gallinule	<i>Gallinula galeata</i>	G5	S2S3B	I		B
Common loon	<i>Gavia immer</i>	G5	S4N			C
Common merganser	<i>Mergus merganser</i>	G5	S2B,S3S4N			B
Common nighthawk	<i>Chordeiles minor</i>	G5	S2S3B			B
Common tern	<i>Sterna hirundo</i>	G5	S1B	E		A
Cory's shearwater	<i>Calonectris diomedea</i>	G5	SNR			D
Dark-eyed junco	<i>Junco hyemalis</i>	G5	S3B,S5N			C
Dickcissel	<i>Spiza americana</i>	G5	S3B			C
Dunlin	<i>Calidris alpina</i>	G5	S3N			C



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Eastern meadowlark	<i>Sturnella magna</i>	G5	S5B,S3N			C
Eastern whip-poor-will	<i>Antrostomus vociferus</i>	G5	S3S4B			C
Forster's tern	<i>Sterna forsteri</i>	G5	S2B,S2N	I		B
Gadwall	<i>Anas strepera</i>	G5	S2B,S4N			B
Glossy ibis	<i>Plegadis falcinellus</i>	G5	S3B			C
Golden eagle	<i>Aquila chrysaetos</i>	G5	S2N			B
Golden-crowned kinglet	<i>Regulus satrapa</i>	G5	S3B,S4N			C
Golden-winged warbler	<i>Vermivora chrysoptera</i>	G4	S2B	I		B
Grasshopper sparrow	<i>Ammodramus savannarum</i>	G5	S5B			C
Great blue heron	<i>Ardea herodias</i>	G5	S5B, S3S4N			C
Great egret	<i>Ardea alba</i>	G5	S3S4B			C
Greater yellowlegs	<i>Tringa melanoleuca</i>	G5	S2S3N			B
Gull-billed tern	<i>Gelochelidon nilotica</i>	G5	S1B	E		A
Henslow's sparrow	<i>Ammodramus henslowii</i>	G4	S2B	I		B
Hooded warbler	<i>Setophaga citrina</i>	G5	S4B			C
Horned grebe	<i>Podiceps auritus</i>	G5	S4N			C
Kentucky warbler	<i>Geothlypis formosa</i>	G5	S4B			C
King rail	<i>Rallus elegans</i>	G4	S2B,S2N			B
Laughing gull	<i>Leucophaeus atricilla</i>	G5	S1B,S2N			A
Leach's storm-petrel	<i>Oceanodroma leucorhoa</i>	G5	SNR			D
Least bittern	<i>Ixobrychus exilis</i>	G5	S2S3B	I		B
Least flycatcher	<i>Empidonax minimus</i>	G5	S3S4B			C
Least tern	<i>Sternula antillarum</i>	G4	S2B	T		B
Lesser yellowlegs	<i>Tringa flavipes</i>	G5	S1N			A



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Little blue heron	<i>Egretta caerulea</i>	G5	S3B			C
Loggerhead shrike	<i>Lanius ludovicianus</i>	G4	S1B	E		A
Long-eared owl	<i>Asio otus</i>	G5	S1B, S1N			A
Long-tailed duck	<i>Clangula hyemalis</i>	G5	S4N			C
Louisiana waterthrush	<i>Parkesia motacilla</i>	G5	S5B			C
Magnolia warbler	<i>Setophaga magnolia</i>	G5	S3S4B			C
Marsh wren	<i>Cistothorus palustris</i>	G5	S4B,S2N			C
Mourning warbler	<i>Geothlypis philadelphia</i>	G5	S1B	E		A
Nashville warbler	<i>Oreothlypis ruficapilla</i>	G5	S1B	T		A
Nelson's sparrow	<i>Ammodramus nelsoni</i>	G5	S1N			A
Northern bobwhite	<i>Colinus virginianus</i>	G5	S4			C
Northern gannet	<i>Morus bassanus</i>	G5	S3N			C
Northern goshawk	<i>Accipiter gentilis</i>	G5	S1B, SAN	E*		A
Northern harrier	<i>Circus cyaneus</i>	G5	S2B,S4N	I		B
Northern parula	<i>Setophaga americana</i>	G5	S5B			C
Northern saw-whet owl	<i>Aegolius acadicus</i>	G5	S1B,S1N			A
Northern waterthrush	<i>Parkesia noveboracensis</i>	G5	S2B	I		B
Olive-sided flycatcher	<i>Contopus cooperi</i>	G4	SHB	X		E
Ovenbird	<i>Seiurus aurocapillus</i>	G5	S5B			C
Pied-billed grebe	<i>Podilymbus podiceps</i>	G5	S2S3B,S3N			B
Pine siskin	<i>Spinus pinus</i>	G5	S2B,S1S3N			B
Piping plover	<i>Charadrius melodus</i>	G3	S1B	E	T	A



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Prairie warbler	<i>Setophaga discolor</i>	G5	S4B			C
Prothonotary warbler	<i>Protonotaria citrea</i>	G5	S4B			C
Red knot	<i>Calidris canutus rufa</i>	G4T2	SNA	T	T	D
Red phalarope	<i>Phalaropus fulicarius</i>	G5	SNA			D
Red-breasted nuthatch	<i>Sitta canadensis</i>	G5	S3B,S3S4N			C
Red-cockaded woodpecker	<i>Picoides borealis</i>	G3	SHB	X	E	E
Redhead	<i>Aythya americana</i>	G5	S3S4N			C
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	G5	S4			C
Red-necked phalarope	<i>Phalaropus lobatus</i>	G4G5	SNA			D
Red-throated loon	<i>Gavia stellata</i>	G5	S3S4N			C
Roseate tern	<i>Sterna dougallii</i>	G4	SXB,S1N	X	E	E
Royal tern	<i>Thalasseus maximus</i>	G5	S1B	E		A
Ruddy duck	<i>Oxyura jamaicensis</i>	G5	S3N			C
Ruddy turnstone	<i>Arenaria interpres</i>	G5	S2N			B
Ruffed grouse	<i>Bonasa umbellus</i>	G5	S4			C
Rusty blackbird	<i>Euphagus carolinus</i>	G4	S2S3N			B
Saltmarsh sparrow	<i>Ammodramus caudacutus</i>	G4	S2B,S1N	I		B
Sanderling	<i>Calidris alba</i>	G5	S3N			C
Sandwich tern	<i>Thalasseus sandvicensis</i>	G5	S1B			A
Savannah sparrow	<i>Passerculus sandwichensis</i>	G5	S4B,S4N			C
Scarlet tanager	<i>Piranga olivacea</i>	G5	S5B			C
Seaside sparrow	<i>Ammodramus maritimus</i>	G4	S4B,S2N			C
Sedge wren	<i>Cistothorus platensis</i>	G5	S1B	E		A



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Semipalmated sandpiper	<i>Calidris pusilla</i>	G5	SNA			D
Sharp-shinned hawk	<i>Accipiter striatus</i>	G5	S2S3B,S4N			B
Short-billed dowitcher	<i>Limnodromus griseus</i>	G5	SNA			D
Short-eared owl	<i>Asio flammeus</i>	G5	S1B, S2N	E		A
Snowy egret	<i>Egretta thula</i>	G5	S3B			C
Sora	<i>Porzana carolina</i>	G5	S1B,S1N			A
Spotted sandpiper	<i>Actitis macularius</i>	G5	S3S4B			C
Surf scoter	<i>Melanitta perspicillata</i>	G5	S4N			C
Swainson's thrush	<i>Catharus ustulatus</i>	G5	SHB	X		E
Swainson's warbler	<i>Limnothlypis swainsonii</i>	G4	S1B	E		A
Tricolored heron	<i>Egretta tricolor</i>	G5	S3B			C
Upland sandpiper	<i>Bartramia longicauda</i>	G5	S1B	E		A
Veery	<i>Catharus fuscescens</i>	G5	S4B			C
Vesper sparrow	<i>Poocetes gramineus</i>	G5	S4B,S2N			C
Wayne's black-throated green warbler	<i>Setophaga virens waynei</i>	G5T3	SUB			D
Whimbrel	<i>Numenius phaeopus</i>	G5	SNA			D
White-winged scoter	<i>Melanitta fusca</i>	G5	S2S3N			B
Willet	<i>Tringa semipalmata</i>	G5	S4B,S2N			C
Willow flycatcher	<i>Empidonax traillii</i>	G5	S4B			C
Wilson's plover	<i>Charadrius wilsonia</i>	G5	S1B	E		A
Winter wren	<i>Troglodytes hiemalis</i>	G5	S2B,S3N			B
Wood thrush	<i>Hylocichla mustelina</i>	G5	S5B			C
Worm-eating warbler	<i>Helmitheros vermivorum</i>	G5	S4B			C



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	G5	S1B,S3S4 N			A
Yellow-breasted chat	<i>Icteria virens</i>	G5	S5B			C
Yellow-crowned night-heron	<i>Nyctanassa violacea</i>	G5	S3S4B			C
Yellow-throated vireo	<i>Vireo flavifrons</i>	G5	S4B			C

¹ = See Table 3.5 for S-rank and G-rank definitions

² = T (Threatened); E (Endangered); I (In Need of Conservation); X (Endangered Extirpated)

³ = See Table 3.7 for Conservation Status definitions

* = a qualifier denoting the species is listed in a limited geographic area only

Reptiles and Amphibians of Maryland

Maryland herpetofauna, also known as “herps,” includes 42 amphibian and 47 reptile species that are native inhabitants of the state. The most recent published complete account of Maryland herps (Harris 1975) is now out of date. However, MD DNR and the Natural History Society of Maryland recently concluded a five-year-long Maryland Amphibian and Reptile Atlas (MARA) project in 2015. A book will be published in 2017 documenting species accounts with life history information and distribution results of Maryland’s herpetofauna (see *Case Study* below for additional information on MARA). The Natural History Society of Maryland publishes local and statewide herp information in its bulletin and updates of information can be found in their newsletter and their [website](#).

Although reptiles and amphibians often are found together, moist-skinned amphibians are most abundant in the cool damp forests, such as those of the western counties, and in or near aquatic or wetland habitats throughout the state. By contrast, most reptiles (snakes, lizards, and some kinds of turtles) are more suited to warm and dry environments, where their dry and relatively impermeable skin conserves water. Amphibians generally are intolerant of even low concentrations of salt water, but the marine environment is not a barrier to a number of reptiles in Maryland, notably the sea turtles.

Reptiles

Native reptile species in Maryland include 17 turtles, 6 lizards, and 24 snakes. Maryland’s 17 turtles range from the highly aquatic eastern spiny softshell to the terrestrial eastern box turtle to the five sea turtles that visit offshore ocean waters, the Chesapeake Bay and Maryland’s coastal estuaries during the warmer months. Although most other turtles cannot tolerate brackish water, the northern diamond-backed terrapin lives primarily in this habitat, and a few primarily freshwater species, such as eastern snapping turtle and eastern mud turtle, sometimes venture into brackish habitats. Most of the other species are stream and pond inhabitants, such as the widespread painted turtle (*Chrysemys picta*) and northern red-bellied cooter (*Pseudemys rubriventris*).



Maryland's six lizards are small, four-legged, slender, and long-tailed reptiles. The common five-lined skink (*Plestiodon fasciatus*) and the eastern fence lizard (*Sceloporus undulatus*) are widespread and by inference tolerate a wide range of habitats. The little brown skink (*Scincella lateralis*), however, is restricted to the eastern half of the state; SGCN species also have restricted ranges. Lizards are frequently found in more open, sunny and drier habitats, including light gaps in forests or barren areas.

The 24 documented native snake species in Maryland range from the tiny, earthworm-like eastern wormsnake (*Carphophis amoenus amoenus*) to the thick-bodied, heavy, and venomous timber rattlesnake. About half of Maryland snakes lay eggs and the rest are live-bearers, with females retaining eggs during development. Maryland's snakes are carnivorous, eating a range of foods from invertebrates to small mammals.



Timber rattlesnake (Scott Smith, MD DNR)

Some have specialized diets like the Endangered rainbow snake that feeds primarily on eels; the rarely seen queensnake (*Regina septemvittata*), which feeds on recently molted (i.e., soft) crayfish; and that great actor, the eastern hog-nosed snake (*Heterodon platirhinos*), which focuses on toads. Most snakes are terrestrial or even arboreal, and a few, such as the watersnakes, are semiaquatic. Only two species in Maryland are venomous, the timber rattlesnake and copperhead (*Agkistrodon contortrix*).

Amphibians

Maryland's list of documented native amphibians includes 22 salamanders and 20 frogs and toads. Additional undetermined records are known for greater siren (Harris 1975) and a recently discovered siren population (species currently undetermined) in a lake near College Park.

Many amphibians require vernal or other fish-free ponds, slow-moving streams, springs or non-tidal wetlands for breeding. Nearly all of the 21 species of salamanders found in Maryland are associated with these freshwater aquatic environments, with a few notable exceptions such as the widespread and completely terrestrial eastern red-backed salamander (*Plethodon cinereus*). Many salamanders spend the winter hibernating underground and beneath



Northern slimy salamander (Bonnie Ott)

rocks and logs and then travel to seek traditional aquatic breeding sites shortly after emergence from hibernation in late winter or early spring. When habitats are fragmented, it often becomes difficult or impossible for these salamanders to reach breeding sites: desiccation occurs when formerly shaded forests dry out, predation increases when cover is



lost, and mortality ensues when adults try to cross roads. If their wetland breeding sites and surrounding upland buffers are altered or destroyed, then breeding may become impossible, unless alternative sites can be found (Semlitsch & Bodie 2003).

Most of Maryland's frogs and toads belong to three families (Bufonidae, toads; Hylidae, treefrogs and their allies; and Ranidae, true frogs) that are experiencing the sharpest declines worldwide (Stuart et al. 2004). Although all Maryland frog and toad species lay eggs in water, toads and some frogs are terrestrial as adults, the latter living in cool damp habitats where their moist skin does not readily desiccate. Each species of frog and toad has a distinctive mating call, usually made at night in spring and summer when most breeding activity occurs. After breeding, most frogs and toads go silent and then their presence is much harder to detect.

SGCN Reptiles and Amphibians of Maryland

Forty-five species of amphibians and reptiles have been identified by the SWAP process as species of greatest conservation need in Maryland (Table 3.14). Of these, 19 are amphibians and 26 are reptiles. Six reptiles are listed as federally Endangered or federally Threatened: bog turtle, green sea turtle, and loggerhead sea turtle are listed as Threatened, and the Kemp's ridley, Atlantic hawksbill, and leatherback sea turtles are listed as Endangered. Eight amphibians and 11 reptiles are state-listed, including 6 amphibians and 10 reptiles listed as Threatened or Endangered; 1 amphibian and 7 reptiles are of national or international concern, and 12 amphibians and 17 reptiles are of conservation concern in the Northeastern U.S. region (RSGCN). An additional 2 amphibians and 8 reptiles are included as SGCN due to concerns for declining populations or for other reasons. For more explanation and additional regional, national, and international ranks see Appendices 3a, 3b, and 3c.

SGCN Marine and Estuarine Reptiles

Maryland's five marine turtles are large to massive, have their forefeet modified as flippers, and have specialized salt glands to maintain proper water balance while living in the marine environment. Most observations of these turtles come from documentation of sea turtle strandings along Maryland's coastline and in the Chesapeake Bay, or capture in fishing nets and fish traps. However, the loggerhead sea turtle has successfully nested on the beaches of



Leatherback sea turtle (George Jett)

Assateague Island. The two most common species in Maryland are the loggerhead and Kemp's ridley sea turtles; the MARA project contains 43 atlas blocks for the former and 12 for the latter (MD DNR & NHSM, unpublished data). Leatherback and green sea turtles are reported less regularly and the Atlantic hawksbill has only been documented in the ocean off Maryland's coast. Most sea turtles in the Chesapeake and Coastal Bays are juveniles and non-breeding subadults, which use these estuaries to feed on various crabs, mollusks, and other invertebrates during the warmer summer months.



The only truly estuarine reptile in Maryland, the northern diamond-backed terrapin is designated as Maryland's state reptile and is one of the Chesapeake's iconic creatures. It lives in brackish waters and coastal marshes and lays its eggs from late May to early July on sandy beaches and bay islands. Historically, this turtle was a food source for Native Americans and early Colonists. Many thousands of pounds of terrapins were harvested and sold annually into the early 1900's. The market for this species was greatly reduced over the next half-century, but the high demand in Asian markets beginning in the 1990's added significant pressure on the population. Terrapins were commercially harvested until 2007 when the Maryland legislature enacted a ban on commercial take or possession.

SGCN Freshwater Reptiles and Amphibians

Most of Maryland's freshwater aquatic and wetland SGCN herpetofauna are amphibians, although some turtles and a few snakes also have aquatic affinities. The 19 SGCN amphibians exhibit a wide range of dependency on watery habitats during their lifetime.



Eastern hellbender (Lori Pruitt, USFWS)

At one extreme are the common mudpuppy and eastern hellbender, which are wholly aquatic and spend their entire lives submerged in boulder-strewn rivers in western Maryland. At the other extreme, species like Wehrle's salamander and green

salamander can live on mountain tops and in other drier habitats by finding cool, moist crevices in boulders and caves and moist soils under rocks and logs, as well as by foraging at night. Most of the 13 salamanders and 6 frogs and toads on the SGCN list require vernal pools, ponds, springs or streamside wetlands for reproduction. After mating and laying eggs, the adults usually remain nearby while the eggs develop into larval forms (tadpoles) before transforming into adults and leaving their watery habitats. Species particularly dependent on vernal pools and Delmarva bay habitats include barking treefrog, carpenter frog, eastern tiger salamander, Jefferson salamander, mountain chorus frog, and upland chorus frog.

Four of Maryland's amphibian species belong to the Ambystomatidae, the mole salamanders, a family in which the rate of population decline is greater than the average for all amphibians (Stuart et al. 2004). One of these, the eastern tiger salamander, is state-listed as Endangered in Maryland.

Two new native species have been identified in Maryland in recent years. The southern two-lined salamander was discovered as occurring in the state's southern Eastern Shore in 2008, and the Atlantic Coast leopard frog was first identified in 2012 and described in 2014 (Newman et al 2012; Feinberg et al 2014). Our knowledge of the Maryland distribution and life history of these two species is still limited and in need of additional research.



The SGCN reptiles that regularly live in or near freshwater habitats include five turtles and three snake species. Of the turtles, the eastern spiny softshell, state-listed as In Need of Conservation, and northern map turtle, state-listed as Endangered, spend much of their time submerged in larger rivers. Wood turtles are associated with streams and smaller rivers, but are more terrestrial than the other riverine turtles. The spotted turtle and especially the bog turtle inhabit freshwater wetlands. Wetland-dependent SGCN snakes include eastern ribbonsnake, plain-bellied watersnake (formerly known as red-bellied watersnake), and rainbow snake. Endangered in Maryland, the rainbow snake is limited to southern sections of the Potomac River and lives in tributary streams, marshes, and swamps as it hunts eels and other aquatic prey at night.

SGCN Reptiles of Upland Habitats

Most of the remaining SGCN reptiles (one turtle, two lizards, and nine snakes) are primarily associated with upland forests, rock outcrops, open fields, grassy glades, and other terrestrial habitats. The well known eastern box turtle lives in moist and dry forests throughout much of Maryland, but newly emerging diseases are taking a toll. A new population of the state-Endangered northern coal skink was recently discovered in western Maryland; however, the shale barren habitat where it was found is scarce and considered a rare habitat in the state. A number of the nine snakes associated with upland habitats are secretive, living underground or otherwise hidden, and are difficult to survey, such as the mole kingsnake. This snake and the smooth greensnake are found in meadows and open woods, with the latter species restricted to western Maryland. The mountain earthsnake and timber rattlesnake, one of two venomous snakes in Maryland, are also restricted to western Maryland today, although a timber rattlesnake population existed in Baltimore County in recent times.



Bog turtle (USFWS)

Threats to SGCN Reptiles and Amphibians

Almost all SGCN amphibians rely on freshwater streams, vernal pools, ponds, or other freshwater wetlands for all or some of their life stages. Threats such as pollution, acid mine drainage, and sedimentation due to erosion and run-off from impervious surfaces can seriously impact populations of these species by making water conditions unsuitable. The 21 species of salamanders found in Maryland are sensitive to human sprawl and associated habitat fragmentation. According to a survey conducted by the MD DNR, even the slightest bit of urbanization, less than 3%, has contributed to the reduction of three salamanders, namely mountain dusky (*Desmognathus ochrophaeus*), seal, and northern slimy salamanders (Boward et al. 1999). Watershed deforestation impacts include changes in water temperature, soil temperature, sedimentation, and a decrease in organic inputs that maintain a food base. These threats are especially of concern in western Maryland, where 8 of the 12 SGCN salamander species are found. In addition, Wehrle's and green salamanders rely on moist



rock crevices and are especially vulnerable to the destruction of rock outcrops and the removal of surrounding forest canopy that alters substrate moisture. Forest reptiles, including mountain earth snake and eastern box turtle are also threatened by deforestation and fragmentation due to timber harvests, habitat conversion, and road building. In some areas of the state, hydrological changes and groundwater withdrawal threaten the continued presence of critical water bodies for aquatic species. The loss of beaver impoundments, overgrazing, and ditching and draining of marshes and wetlands have further impacted populations of some amphibians and reptiles through the loss of habitat, including the federally listed bog turtle. Aquatic snakes (e.g., rainbow snake and plain-bellied watersnake) and turtles that rely on riverine and pool habitats (e.g., wood turtle, eastern spiny softshell, and map turtle) face threats similar to SGCN amphibians. In the marine environment, sea turtles are subject to boat collisions and ingestion of trash. Northern diamond-backed terrapin is also threatened as a non-target capture (bycatch) in commercial and recreational crab traps. In addition, shoreline development and structural stabilization often eliminates nesting areas for the terrapin.

Globally, widespread and largely unexplained declines in amphibians have been observed since 1980, and the need to identify the specific causes of these declines is urgent (Gibbons et al. 2000). Declines in some species may be due to over-exploitation for food and the pet trade; whereas, habitat loss also contributes to declines in some species (Stuart et al. 2004). The sharpest declines are enigmatic due to the lack of obvious causes, however, especially for stream-dwelling species in tropical locations, often in seemingly pristine conditions. For reasons that are unclear, the declines have been slower and fewer in number in North America, where the best information on populations exists. There is a recognized national and regional need for advocacy focused on conservation and the use of an ecosystem approach to incorporate protection of amphibian and reptilian species into existing management plans (SE PARC 2004; NE PARC 2010).

The use of different habitats at different times of the year for breeding, overwintering, and developing into adults further increases the vulnerability of SGCN amphibians and reptiles to landscape-level fragmentation and the loss of travel corridors. Movements between these habitats frequently result in road mortalities for frogs and toads, salamanders, turtles, and snakes. Unlike most other SGCN species, some reptiles and amphibians are increasingly threatened by illegal collection. Snakes in general and venomous snakes in particular are harassed and often killed when perceived to be a threat. The hibernacula of timber rattlesnakes are particularly vulnerable to harassment, destruction, and illegal collecting activities. Finally, amphibians are threatened by emerging diseases such as *Ranavirus* and chytridiomycosis. *Ranavirus*, which includes six species of viruses in the same genus, is known to affect over 100 reptile and amphibian species and subspecies. This disease is especially dangerous as relatively little information is known about the origin, extent, and frequency of the virus due to the disease's pattern of rapid onset and mortality. The virus can live for weeks outside the host in aquatic conditions, and is usually fatal to juvenile individuals, although adults can also be susceptible to or transmit *Ranavirus*. The disease spreads quickly through populations that tend to congregate in large groups, with some infected populations suffering 90% mortality (NE PARC 2014). Chytridiomycosis is an invasive contagious fungal disease causing amphibian die-offs in 40 countries worldwide,



including 36 states in the United States. The disease is caused by a chytrid fungus (*Batrachochytrium dendrobatidis* and *B. salamandrivorans*) that feeds on the skin of living vertebrates, interfering with amphibians' ability to take up water and air through their skin. Although the fungus has been present in the world since ancient times, scientists speculate that it is now becoming lethal to amphibians due to other stresses, such as climate change, pollution, and habitat destruction (Lips et al. 2006).

Conservation Actions and Information Needs for SGCN Reptiles and Amphibians

In order to better conserve SGCN reptiles and amphibians, seasonal movements and needs of different life stages should be investigated for a number of species. Understanding the impacts of roads, development, and forest harvest practices on SGCN species would also assist in their conservation. Direct inputs of contaminants to aquatic environments can be reduced through improved stormwater management practices, minimizing and mitigating acid mine drainage, controlling illegal dumping and wastewater inputs, minimizing the use of pesticides, and establishing adequate buffers of upland habitat. State and local wetland laws should be amended with larger buffers (life zones) as needed to protect significant habitats for SGCN amphibians and reptiles. Compatible management of the landscape in order to conserve aquatic habitats needs to include reduction of impervious surfaces, groundwater withdrawal, stream bank erosion, and watershed deforestation through better design and placement of developments, and improved timber harvest and agricultural practices. Restoration of key wetland habitats, such as beaver impoundments, and plugging ditches can help to address wetland losses. Road mortality may be minimized or mitigated through improved road design and placement, as well as installation of wildlife tunnels and causeways for safe passage corridors in key locations. For marine and estuarine turtles, collision injuries and impacts related to commercial harvest activities may be reduced by working with the fishing industry, recreational boaters, and crab harvesters. Enforcement of existing state regulations on possession and trade of amphibians and reptiles and revision of those regulations for further protection are critical. In addition, education and outreach are needed to reduce illegal collecting and killing of reptiles and amphibians.

Other inventory and research needs, and actions for conservation, are included in sea turtle recovery plans, the bog turtle recovery plan, and the regional plan for the northern diamond-backed terrapin. Recently, Partners for Amphibian and Reptile Conservation has used the Important Bird Areas program as a model for herpetofauna habitat conservation. The 2012 Priority Amphibian and Reptile Conservation Areas Report identifies valuable habitat for priority amphibians and reptiles based on designations of species rarity and richness, local and regional implementation responsibility, and landscape integrity (PARC 2012). To improve the population status regionally, the USFWS, NMFS, and other partners coordinate the actions identified by the Federal Recovery Plans for these species (NMFS and USFWS 1991, 1992, 1993, 2009; NMFS et al. 2011) (Table 3.13). A new revision of the Virginia and Maryland Sea Turtle Conservation Plan provides updated research about distribution and abundance of sea turtles in the Chesapeake and Atlantic waters of Maryland and Virginia. The plan discusses greatest threats and conservation strategies for the loggerhead and Kemp's ridley sea turtles, the most common sea turtle species in the region (Virginia Aquarium & MD DNR 2015). There is also a [state-specific plan](#) to conserve these sea turtles along with other marine animals in Maryland (Litwiler 2001). A recovery plan for the federally listed bog turtle (USFWS 2001) is being implemented in Maryland. These plans



contain detailed status and distribution information, as well as prioritized conservation actions, based on surveys and other research results.

Case Study: Maryland Amphibian and Reptile Atlas (MARA)

Grid-based atlas projects began over 50 years ago with the Atlas of the British Flora (Perring & Walters 1962), in which 1,500 botanists mapped the distribution of 2,000 plant species to a 10-km (6.2 mi) grid. Since then, hundreds of similar atlases, many of which mapped bird distributions, have been conducted in numerous countries. Maryland has been fortunate to have completed two breeding bird atlas projects, the first in 1983 – 1987 (Blom & Robbins 1996) and the second about 20 years later in 2002 – 2006 (Ellison 2010). Conclusions about changes in species distributions over those 20 years were able to be documented throughout Maryland because of the standard data gathering methods used for both atlases. This information is an essential part of assessing and documenting the conservation status of our biodiversity.

The abundance and distribution of a number of Maryland’s amphibians and reptiles, also known as herpetofauna or “herps”, were thought to be in decline for many years. The increasing challenges that amphibians and reptiles face – primarily resulting from human-induced causes such as habitat loss, pollution, introduced diseases, and over-harvesting or collecting – raise concerns for their continued success and even survival. Unfortunately, sufficient data were lacking to have a good handle on the status of many herps in Maryland. Observed declines, based on anecdotal evidence, highlighted the need for more rigorous and complete documenting of current amphibian and reptile populations.

In the 1930s and 1940s, the Natural History Society of Maryland (NHSM) published distributional surveys of Maryland’s reptile species, including *The Reptiles of Maryland and the District of Columbia* (McCauley 1945). Fifteen years later, the curator of the Department of Herpetology at the NHSM, John E. Cooper, published a paper on the distribution of amphibians and reptiles for the state (Cooper 1960). In 1969, Herbert S. Harris, Jr. published the first distributional survey of every amphibian and reptile known to occur in Maryland, and he updated the publication in 1975. No updated, complete survey of reptile and amphibian distributions has been published since then. Although distributional data have been collected dating back to the 1930s, no systematic and replicable survey of all herpetofauna had ever been conducted in Maryland.



To fill this need, the NHSM and the Maryland Department of Natural Resources (DNR) completed the Maryland Amphibian and Reptile Atlas (MARA) project, using State Wildlife Grant funding and thousands of hours of volunteer effort. The project’s goal was to map the current distribution of all 89 native species of amphibians and reptiles within the state in a manner that is repeatable; thus establishing a baseline and aiding species conservation status assessments both now and in the future. Understanding patterns of change at county and statewide scales is necessary for land managers, regulators, and citizens to make better decisions to conserve the herpetofauna of Maryland.



MARA began in 2009 with a one-year pilot project to iron out logistics. However, the bulk of the fieldwork was conducted in a 5-year window starting January 2010. With the help of social media outlets, including Facebook and Meetup, MARA also became an important educational tool, as hundreds of people across Maryland spent roughly 30,000 hours searching for herps and reported nearly 35,000 herp sightings. The results, both in map and tabular formats, are available through MD DNR's online database website (<https://webapps02.dnr.state.md.us/mara/default.aspx>). Similar to the breeding bird atlas projects, a book with species accounts, life history information, and distribution results will be written by various people involved with MARA and is expected to be published in 2017. Providing project results both online and in traditional published format will hopefully reach the widest possible audience. Figure 3.3 shows a comparison of a MARA distribution map and a Harris distribution map.

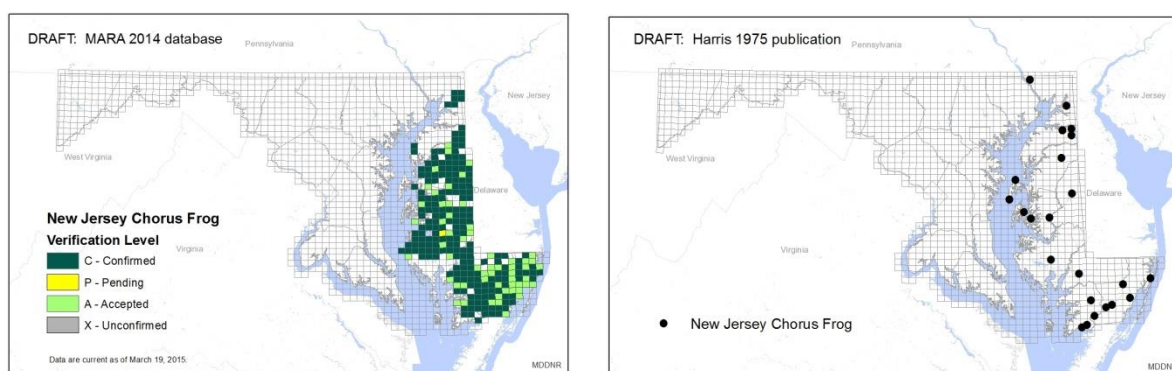


Figure 0.4 New Jersey chorus frog distribution map comparison: MARA 2014 (left) and Harris 1975 (right). Sources: MD DNR, Harris 1975.

Although surveys in Garrett County in far western Maryland were still being conducted in 2015, the project was complete enough to provide valuable data to inform the development of the updated list of Species of Greatest Conservation Need. Some species, such as upland chorus frog, Eastern six-lined racerunner, mole kingsnake, and Coastal Plain milksnake were added because their ranges have been reduced since Harris's 1975 publication. On the other hand, a number of species were removed from the SGCN list because they do not appear to have range restrictions in the past 40 years and the more active volunteer atlasers agreed that these species did not seem to be in decline, including Allegheny mountain dusky salamander (*Desmognathus ochrophaeus*), New Jersey chorus frog (*Pseudacris kalmi*), Eastern spadefoot (*Scaphiopus holbrookii*), Northern red-bellied cooter (*Pseudemys rubriventris*), Eastern hognose snake (*Heterodon platirhinos*), and queen snake (*Regina septemvittata*). An undetermined species of siren was discovered in Maryland during the MARA project, and about 25 introduced, non-native species were documented during the MARA project. Some of these include Florida softshell turtle (*Apalone ferox*), Mississippi map turtle (*Graptemys pseudogeographica kohnii*), yellow-bellied slider (*Trachemys scripta scripta*), savannah monitor (*Varanus exanthematicus*), green anole (*Anolis carolinensis*), American alligator (*Alligator mississippiensis*), red-tailed boa (*Boa constrictor*), Burmese python (*Python bivittatus*), Cuban treefrog (*Osteopilus septentrionalis*), and Northwestern salamander



(*Ambystoma gracile*), which was found hitchhiking on a Christmas tree from the Pacific Northwest.

Table 3.13 Existing federal recovery plans for SGCN reptiles.

Reptile Species	Federal Recovery Plan	Recent Action
Atlantic hawksbill sea turtle	NOAA Fisheries and USFWS 1993	2013: 5-year review, summary, & evaluation
Bog turtle	USFWS 2001	2011: Initiation of 5-year review
Green sea turtle	NOAA Fisheries and USFWS 1991	2015: 12-month findings and proposed rule to list 11 Distinct Population Segments (DPS) of green sea turtles as threatened or endangered under the ESA
Kemp’s Ridley sea turtle	NOAA Fisheries and USFWS 2011	2015: 5-year review, summary, & evaluation
Leatherback sea turtle	NOAA Fisheries and USFWS 1992	2013: 5-year review, summary, & evaluation
Loggerhead sea turtle	NOAA Fisheries and USFWS 2009	2011: Final rule to list 9 distinct DPS of loggerhead sea turtles under the ESA 2014: Designation of critical habitat

Table 3.14 Reptile and Amphibian Species of Greatest Conservation Need in Maryland.

Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Amphibians						
Atlantic Coast leopard frog	<i>Lithobates kauffeldi</i>	GNR	SNR			D
Barking treefrog	<i>Hyla gratiosa</i>	G5	S1	E		A
Carpenter frog	<i>Lithobates virgatipes</i>	G4	S3			C
Common mudpuppy	<i>Necturus maculosus</i>	G5	S1	X		A
Eastern hellbender	<i>Cryptobranchus alleganiensis</i>	G3G4	S1	E		A
Eastern mud salamander	<i>Pseudotriton montanus</i>	G5	S2			B
Eastern narrow-mouthed toad	<i>Gastrophryne carolinensis</i>	G5	S1S2	E		A
Eastern tiger salamander	<i>Ambystoma tigrinum</i>	G5	S2	E		B
Green salamander	<i>Aneides aeneus</i>	G3G4	S2	E		A
Jefferson salamander	<i>Ambystoma jeffersonianum</i>	G4	S3			C
Mountain chorus frog	<i>Pseudacris brachyphona</i>	G5	S1	E		A



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Northern red salamander	<i>Pseudotriton ruber</i>	G5	S5			C
Northern spring salamander	<i>Gyrinophilus porphyriticus</i>	G5	S4			C
Seal salamander	<i>Desmognathus monticola</i>	G5	S5			C
Southern two-lined salamander	<i>Eurycea cirrigera</i>	G5	SNR			D
Undetermined siren	<i>Siren sp. 1</i>	GNR	SNR			D
Upland chorus frog	<i>Pseudacris feriarum</i>	G5	S5**			C
Valley and Ridge salamander	<i>Plethodon hoffmani</i>	G5	S5			C
Wehrle's salamander	<i>Plethodon wehrlei</i>	G4	S2	I		B
Reptiles						
Atlantic hawksbill sea turtle	<i>Eretmochelys imbricata</i>	G3	SNR	E	E	D
Bog turtle	<i>Glyptemys muhlenbergii</i>	G3	S2	T	T	A
Coastal Plain milksnake	<i>Lampropeltis triangulum elapsoides X triangulum</i>	GNR	SNR			D
Common ribbonsnake	<i>Thamnophis sauritus</i>	G5	S5			C
Eastern box turtle	<i>Terrapene carolina</i>	G5	S5			C
Eastern kingsnake	<i>Lampropeltis getula</i>	G5	S5			C
Eastern six-lined racerunner	<i>Aspidoscelis sexlineata</i>	G5	S4			C
Eastern spiny softshell	<i>Apalone spinifera</i>	G5	S1	I		A
Green sea turtle	<i>Chelonia mydas</i>	G3	SNA	T	T	D
Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>	G1	S1N	E	E	A
Leatherback sea turtle	<i>Dermochelys coriacea</i>	G2	SNA	E	E	D
Loggerhead sea turtle	<i>Caretta caretta</i>	G3	S1B,S1N	T	T	A



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Mole kingsnake	<i>Lampropeltis calligaster rhombomaculata</i>	G5T5	S4			C
Mountain earthsnake	<i>Virginia valeriae pulchra</i>	G5T3T4	S1S2	E		A
Northern coal skink	<i>Plestiodon anthracinus</i>	G5	S1	E		A
Northern diamond-backed terrapin	<i>Malaclemys terrapin terrapin</i>	G4T4Q	S4			C
Northern map turtle	<i>Graptemys geographica</i>	G5	S1	E*		A
Northern pinesnake	<i>Pituophis melanoleucus</i>	G4	SH			E
Northern scarletsnake	<i>Cemophora coccinea</i>	G5	S3			C
Plain-bellied watersnake	<i>Nerodia erythrogaster</i>	G5	S2S3			B
Rainbow snake	<i>Farancia erytrogramma</i>	G4	S1	E		A
Red cornsnake	<i>Pantherophis guttatus</i>	G5	S4			C
Smooth greensnake	<i>Opheodrys vernalis</i>	G5	S5**			C
Spotted turtle	<i>Clemmys guttata</i>	G5	S5**			C
Timber rattlesnake	<i>Crotalus horridus</i>	G4	S3			C
Wood turtle	<i>Glyptemys insculpta</i>	G3	S2S3**			A

¹ = See Table 3.5 for S-rank and G-rank definitions

² = T (Threatened); E (Endangered); I (In Need of Conservation); X (Endangered Extirpated)

³ = See Table 3.7 for Conservation Status definitions

* = a qualifier denoting the species is listed in a limited geographic area only

** = Proposed State Rank changes

Fishes of Maryland

The Chesapeake Bay, Coastal Bays, Atlantic Ocean, and Maryland’s rivers, streams, lakes, and ponds are home to many types of freshwater and saltwater fishes. Some of the state’s fish species are freshwater residents, such as brook trout and mud sunfish. Some fishes are residents of the estuaries, including hogchoker (*Trinectes maculatus*) and northern pipefish (*Syngnathus fuscus*). Scup (*Stenotomus chrysops*) and bluefin tuna (*Thunnus thynnus*) are among the fish species that live in marine waters, and several species of shark are highly



migratory, traveling long distances. Anadromous fish species that utilize Maryland's freshwater rivers for spawning include striped bass (*Morone saxatilis*), shad, and herring. Some species (e.g., red drum (*Sciaenops ocellatus*), tautog (*Tautoga onitis*), Atlantic croaker [*Micropogonias undulates*]) spawn in marine waters but rely upon estuaries for juvenile development, while other marine species spawn in estuaries (e.g., weakfish [*Cynoscion regalis*]) or use them as foraging habitat (e.g., black drum [*Pogonias cromis*]).

Maryland waters support a number of game fish. For example, trout are found in the streams of the mountains to the Piedmont, striped bass occur in the Chesapeake Bay, and marlin and tuna inhabit the open waters of the Atlantic. Numerous species have been stocked in Maryland's streams over the past 135 years, including largemouth bass (*Micropterus salmoides*), brown (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*) and common carp (*Cyprinus carpio*) (Boward et al. 1999). MD DNR Fisheries Service currently stocks a number of ponds, lakes and streams with warm-water and cold-water species every year; in the spring of 2015, a total of 337,400 trout were released (MD DNR 2015c).

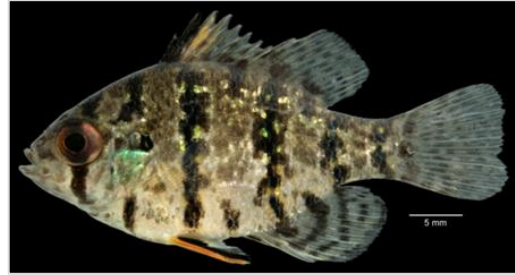
The Fishery Management Plan (FMP) Workgroup of the Chesapeake Bay Program (CBP) led the development of some of the first Chesapeake Bay-specific fish management plans guiding conservation of the major commercial, recreational and ecologically valuable fish species in the Bay, including shad and herring (CBP 1989a), striped bass (CBP 1989b), and summer flounder (*Paralichthys dentatus*) (CBP 1991a). The latest full Fishery Management Plan includes updates for fifteen FMPs encompassing 21 species (MD DNR 2014). Fisheries management expanded to the ecosystem level when representatives from a number of organizations focused on the health of the Chesapeake Bay came together to develop a Fisheries Ecosystem Plan (Chesapeake Bay Fisheries Ecosystem Advisory Panel 2006). This Ecosystem Plan describes the structure and function of the Chesapeake Bay ecosystem, focusing on the interactions between key fisheries species in an effort to move beyond traditional fisheries management tools like controlling harvest limits. Based on this foundational plan, detailed ecosystem-based reports were developed for fisheries species and species groups including alosines (MDSG 2011), striped bass (MDSG 2009a), and menhaden (*Brevoortia tyrannus*) (MDSG 2009b).

The [Atlantic States Marine Fisheries Commission \(ASMFC\)](#), Mid-Atlantic Fishery Management Council (MAFMC) and National Marine Fisheries Service (NMFS) have also developed FMPs for numerous fish species that are found in the state's Atlantic waters. These plans, regular revisions, and updates to the plans promote habitat management and protection to achieve interstate conservation goals. The Chesapeake Bay Program website hosts a detailed [field guide](#) featuring residential and migratory fish of the Chesapeake Bay watershed.



Freshwater Fishes

MD DNR's Maryland Biological Stream Survey (MBSS) has sampled over 4,000 sites since 1995, compiling a robust inventory of the status and distribution of the nearly 100 freshwater fish species found in the state (Versar, Inc. 2011). The survey sampled streams representing the four ecological stream types: Highlands Warmwater, Highlands Coldwater, East Piedmont, and Coastal Plain. Eighteen species of freshwater fish were found to occur in all geographic regions. Coastal Plain streams had the most fish species (60), followed closely by East Piedmont streams (55 species). The most common fishes in Maryland's streams include the blacknose dace, creek chub (*Semotilus atromaculatus*), American eel (*Anguilla rostrata*), tessellated darter (*Etheostoma olmstedi*), and bluegill (*Lepomis macrochirus*). MBSS continues to maintain the best available scientific information regarding population status, abundance, and distribution of nongame freshwater fishes in the state.



Blackbanded sunfish (Dave Neely, MD DNR)

Non-native fishes have been widely introduced in Maryland dating as far back as 1854 (Smith & Bean 1899). Many introductions were made to establish and maintain recreational fisheries, while others resulted from the illegal release of unused bait, unwanted aquarium pets, or of fishes purchased from live seafood markets. At least 20-25 introduced fishes now inhabit Maryland's waters, and some have acclimated very well, like the popular largemouth bass and the not-so-popular common carp. Some introduced fishes have proven to be invasive. For example, the northern snakehead (*Channa argus*), an illegally introduced predatory fish from Asia, was first established in the Potomac River and has since spread to other river basins like the Patuxent and Nanticoke. MD DNR is now working to prevent further spread of snakehead and to control established populations. In order to control the abundance of this species in invaded waters, anglers in Maryland and Virginia are required to kill any snakeheads that they catch.

Marine and Estuarine Fishes

Maryland's marine and estuarine waters host a diverse array of fishes, with the Chesapeake Bay hosting 350 fish species, the Coastal Bays more than 140 species of fish, and the Atlantic Ocean being home to hundreds more (MD DNR 2004b; Pyzik et al. 2004). The 2001 commercial landings of fish and shellfish from Chesapeake Bay were worth \$239 million (NMFS 2013); which is a \$64 million increase in worth since 2004. A number of Maryland's marine and estuarine fish species have been overfished or show serious population declines, leading to the adoption of fishery management plans to conserve many individual species.



Although many marine species have existing Fishery Management Plans to guide their conservation (e.g., striped bass, spiny dogfish [*Squalus acanthias*], goosefish [*Lophius americanus*]) scup), harvest pressure coupled with impaired habitat has resulted in population declines and many questions on the status of forage species, trophic interactions, and the loss of critical spawning and nursery habitat remain unanswered. Sharks, marlin and tuna are highly migratory species that move over large areas of the ocean and are not permanent residents of the state’s marine waters. As a result, their management requires regional, national and sometimes international partnerships. The National Marine Fisheries Service monitors the status of highly migratory species and has developed a fishery management plan (NMFS 2006) outlining conservation efforts for sharks, tuna and swordfish (*Xiphias gladius*). This plan continues to be amended regularly.



Atlantic sturgeon (MD DNR)

SGCN Fishes of Maryland

Thirty-one fishes have been identified by the SWAP process as species of greatest conservation need (SGCN) in Maryland (Table 3.16). Three fishes are federally listed as Endangered including Maryland darter, Atlantic sturgeon, and shortnose sturgeon; the thorny skate is federally listed as a Special Concern species. Seventeen SGCN fish species are state-listed, 12 of which are listed as Threatened or Endangered, 6 are of national or international concern, 6 are of conservation concern in the Northeastern U.S. region (RSGCN), and an additional 5 species are included due to concerns about declining populations or for other reasons. For additional regional, national, and international ranks see Appendices 3a, 3b, and 3c.

Maryland’s Atlantic coastal waters support three SGCN fishes – the thorny skate, barndoor skate, and smooth skate – that are of regional conservation concern and are considered vulnerable or Endangered by the IUCN. The status of these fishes in Maryland waters is largely unknown and requires additional survey efforts and research. Coastal waters also serve as important habitat to Atlantic sturgeon and shortnose sturgeon. These fishes also frequent the Chesapeake Bay estuary and its tidal tributaries. These tidal waters are an important habitat for these species, utilized as adult spawning grounds and as juvenile nurseries. A fall spawning population of the Atlantic sturgeon was recently discovered in Marshyhope Creek in the Nanticoke River basin, providing promising news for the conservation of this prehistoric-looking species. This fall-spawning life history strategy was previously unrecognized – most populations of Atlantic sturgeon spawn during spring. Spotfin killifish, another SGCN, is a species of the tidal estuary that is found within the intertidal shallows along brackish marshes. It is often found in shallow pools no more than an inch deep and can tolerate sudden shifts in temperature and oxygen concentrations. Spotfin killifish often becomes stranded in standing intertidal pools among marsh grasses where it awaits the next incoming tide.

Coastal Plain streams and rivers support a variety of SGCN fishes. Bowfin and white catfish are predators of Maryland’s highly productive large Coastal Plain rivers. Upstream in smaller



Coastal Plain streams, the solitary, secretive mud sunfish lurks in slow water, hidden among soft substrate and submerged vegetation. Two additional SGCN fishes, blackbanded sunfish and banded sunfish, are perfectly adapted to the naturally low oxygen, acidic blackwater swamps that characterize forested lowlands of the Eastern Shore. Ironcolor shiner and swamp darter can also be found in these dystrophic habitats.

Two SGCN fishes in Maryland have restricted ranges that straddle the Fall Line separating the Coastal Plain and Piedmont physiographic provinces. One of these is the federally Endangered Maryland darter. The state's only endemic vertebrate, the Maryland darter is one of the world's rarest fish species and may now be extinct. Known historically from only three streams in Harford County, it was last observed in a single riffle of Deer Creek in 1988 (Raesly 1992). Intensive survey efforts over the past 25 years have failed to find Maryland's namesake fish (Kilian & Raesly 2012). The Maryland darter is subject to the same stressors as other freshwater fishes; however, due to its restricted distribution, it is especially vulnerable. The Chesapeake logperch, a species described in 2008 (Near 2008), is another resident of Deer Creek and nearby tributaries. This species is a habitat generalist – equally at home in fast-flowing, cobble strewn riffles in Piedmont streams as it is in slow, vegetated habitats common within the Coastal Plain. Although once known from the Potomac River, the distribution of the Chesapeake logperch now includes only the waters of the Upper Chesapeake Bay and the Lower Susquehanna River in Maryland and southeastern Pennsylvania.

Congregating in large schools during the early months of spring, hickory shad and American shad are SGCN fishes that migrate long distances from the sea to spawn in freshwater. These anadromous species utilize spawning habitats in both Coastal Plain and Piedmont streams of Maryland. Although populations of these species remain depleted from historical levels due to a combination of dams, overfishing, and pollution, extensive restoration efforts including hatchery propagation and the removal of stream blockages (e.g., dams, culverts) have been largely successful at increasing their abundance in bay tributaries – especially that of hickory shad.

From the Piedmont province and west, Maryland's SGCN fishes are associated with higher gradient streams with an abundance of cobble, gravel, and other coarse substrates. For example, the stonecat is a small, nocturnal catfish that seeks shelter during daylight hours under large submerged boulders. It is a species that was eliminated from a large portion of its historical range in western Maryland as a result of poor coal mining practices. Several SGCN fishes in this region are restricted to clean, coldwater habitats. For example, the mottled sculpin is a small, bottom dwelling insectivorous fish found in high gradient, coldwater streams of the Youghiogheny River basin. As a species that requires clean coarse substrate to spawn, the mottled sculpin tends to be especially susceptible to sedimentation. The longnose sucker, a species that is likely extirpated, was once also a coldwater Youghiogheny River dweller. Brook trout, a coldwater specialist that ranges from the Appalachian Plateau to the eastern Piedmont, prefers stream temperatures below 20°C year round to survive. SGCN fishes of western Maryland also include checkered sculpin and pearl dace – two limestone stream specialists restricted to spring-fed streams flowing through the karst terrain of the Great Valley of Maryland near Hagerstown.



Threats to SGCN Fishes

The dependence of SGCN fish species on aquatic environments makes them vulnerable to negative inputs to streams, rivers, and estuaries. For example, run-off from roads, impervious surfaces, and farm fields can directly contaminate SGCN habitats through inputs of road salt, oil, pesticides, herbicides, nutrients, and excessive fine sediments. All flowing water bodies are influenced by upstream inputs, and accumulations of toxins, sediments, and nutrients can be particularly acute in large rivers and estuaries. Removal of trees from a watershed in general and especially from riparian areas can reduce the quality and quantity of fish habitat by increasing stream temperature, stream bank erosion, and decreasing instream woody debris, rootwads, and leaf litter. The influx of silt that often accompanies deforestation can bury important spawning and feeding habitats negatively affecting SGCN like stripeback darter and mottled sculpin. Any changes in pH, temperature, and turbidity from acid mine drainage, livestock grazing, urbanization, and other sources can make habitats unsuitable for SGCN fishes. For example, brook trout, the only trout species native to Maryland, are particularly sensitive to temperature changes that occur when forest cover is removed. This species has suffered drastic population declines. Once likely found in the millions, the population of brook trout has decreased to just under 200,000 statewide (Dew-Baxter & Southerland 2013). Brook trout are now extirpated from 62% of historically occupied subwatersheds in Maryland, a 5% increase since the initial assessment (57%) completed in 2005 (MD DNR 2006). As a species that thrives in cold water, their population decline is attributed to hot water runoff from roofs, roadsides, and other impervious surfaces, loss of trees along streams, and climate change.

Human activities in or near aquatic environments can adversely affect SGCN and their habitats. Bridge construction and demolition, dredging, and vessel strikes, have adversely affected SGCN of large rivers such as the shortnose and Atlantic sturgeons (Litwiler 2001). Similarly, the practice of stream ditching and channelization, common on Delmarva Peninsula, can adversely impact SGCN including mud sunfish. Surface and groundwater withdrawals for drinking water and irrigation are an increasing threat to stream and river habitats, especially in rapidly urbanizing areas. Dams and other barriers to fish passage, such as road culverts, isolate populations and disrupt the habitat connectivity that many resident and migratory fishes require to remain a viable part of Maryland's fauna. These barriers prevent the upstream and downstream movement of fishes in response to stressors and may hinder their ability to adapt to altered flow and temperature regimes expected with climate change. Pesticide applications, such as those for mosquito control, can reduce aquatic prey species important to many SGCN fishes. Overharvest has particularly affected sturgeon and shad. Species introduced for sport, mosquito control, or other means (e.g., bait bucket introductions, released pets) can impact SGCN fishes through direct competition and predation. Other non-native, invasive species like the zebra mussel (*Dreissena polymorpha*) have the capacity to alter the structure and function of aquatic food webs directly and indirectly, affecting SGCN fishes and their habitats. Aquatic invasive species are an increasing threat to SGCN fishes, especially with forecasted increases in the global trade of live organisms (Levine & D'Antonio 2003; Padilla & Williams 2004).



Conservation Actions and Information Needs for SGCN Fishes

For the effective conservation of SGCN fishes, threats to aquatic habitats must be addressed at both local and landscape scales, from headwaters to large rivers and the Chesapeake Bay. Minimizing or eliminating stressors that affect key components of streams, rivers, and estuaries are possible through better land use planning, improved stormwater management, reduction of impervious surfaces, mitigation of acid mine drainage, improved wastewater treatment, improved agricultural and forestry practices, reduction of pesticide use, and maintaining and improving riparian buffers. Careful planning to limit the location and extent of deforestation, urbanization, and nutrient inputs is needed to conserve functioning watersheds. The ecological impacts of surface and groundwater withdrawals should be better assessed and research should be conducted to quantify the minimum flow requirements of each SGCN fish species. Maps of groundwater and hydrological systems could assist with determining potential impacts and planning restoration activities. Dams should continue to be removed wherever possible. When removal is not an option, fish passage should be improved with ladders or other techniques. Coordination and planning with state and county highway departments should be increased to replace undersized or faulty road culverts and encourage state-of-the-art stream crossing designs that reduce stream alterations and improve connectivity of SGCN habitats.

More information on the seasonal movements and spatial life history requirements of SGCN, including anadromous fishes, is needed to determine habitat requirements. Recreational management plans are important tools for conservation for some species, such as the brook trout management plan. Regulatory controls are needed to limit the establishment of non-natives and minimize their impact. Research on the impacts of competition between native and non-native species is also needed. Continued regulation is critical for the recovery of SGCN shad and sturgeon populations. Reintroduction after habitat restoration has the potential to increase populations of some SGCN species.

To restore Atlantic sturgeon, American shad, and hickory shad in the Chesapeake Bay, MD DNR's Fisheries Service uses a combination of closed fishery, removal of barriers to spawning grounds, water quality improvements, and hatchery-produced fish. Information regarding threats and conservation actions for these fishes can be found in the Fishery Management Plan for Atlantic Sturgeon by the Atlantic States Marine Fisheries Commission (ASMFC 1998) and subsequent addenda, and Maryland's regional American Shad Habitat Plan (Capossela 2014), in addition to the original Interstate Fishery Management Plan for American Shad and River Herring and associated amendments which include compliance and monitoring requirements for states (ASMFC 1985, 1999). Federal recovery plans exist for Atlantic sturgeon, shortnose sturgeon, and Maryland darter (Table 3.15).

New to the 2015 SGCN fishes list are the barndoor, smooth, and thorny skates. The thorny skate is a federal species of concern, but all three skates have seen heavy declines in the Atlantic Coast fishery, which includes seven species in the Northeast Skate Complex. The barndoor and thorny skate species are overfished, and restrictions on possession of these species are in place. The barndoor, smooth, and thorny skate species are managed by NOAA Fisheries, which in conjunction with the New England Fishery Management Council, implemented the Northeast Skate Complex Fishery Management Plan in 2003 (New England



Fishery Management Council 2003). A team is working to reassess the status of all seven species in the fishery and revise the plan with recent research (Cavanagh & Damon-Randall 2009).

Table 3.15 Existing federal recovery plans for SGCN fishes.

Fish Species	Federal Recovery Plan	Recent Action
Atlantic sturgeon	In progress	2012: Final listing rule for Gulf of Maine, New York Bight, and Chesapeake Bay DPS of Atlantic Sturgeon in the Northeast Region
Maryland darter	USFWS 1985	2012: Initiation of 5-year review
Shortnose sturgeon	NOAA Fisheries 1998	2010: Biological assessment

Table 3.16 Fish Species of Greatest Conservation Need in Maryland.

Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
American brook lamprey	<i>Lethenteron appendix</i>	G4	S1S2	T		A
American shad	<i>Alosa sapidissima</i>	G5	S3			C
Atlantic sturgeon	<i>Acipenser oxyrinchus</i>	G3	S1	E	E	A
Banded sunfish	<i>Enneacanthus obesus</i>	G5	S2			B
Barndoor skate	<i>Dipturus laevis</i>	G3	SNR			D
Blackbanded sunfish	<i>Enneacanthus chaetodon</i>	G3G4	S1	E		A
Bowfin	<i>Amia calva</i>	G5	S1			A
Bridle shiner	<i>Notropis bifrenatus</i>	G3	SH	X		E
Brook trout	<i>Salvelinus fontinalis</i>	G5	S3S4			C
Checkered sculpin	<i>Cottus sp 7</i>	G4Q	S1S2			A
Chesapeake logperch	<i>Percina bimaculata</i>	G1G2	S1S2	T		A
Comely shiner	<i>Notropis amoenus</i>	G5	S3			C
Flier	<i>Centrarchus macropterus</i>	G5	S1S2	T		A
Glassy darter	<i>Etheostoma vitreum</i>	G4G5	S1S2	T		A
Hickory shad	<i>Alosa mediocris</i>	G4	S3			C



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Ironcolor shiner	<i>Notropis chalybaeus</i>	G4	S1	E		A
Johnny darter	<i>Etheostoma nigrum</i>	G5	S3			C
Longnose sucker	<i>Catostomus catostomus</i>	G5	SH	X		E
Maryland darter	<i>Etheostoma sellare</i>	GH	SH	E	E	E
Mottled sculpin	<i>Cottus bairdi</i>	G5	S3S4			C
Mud sunfish	<i>Acantharchus pomotis</i>	G4G5	S2	I		B
Pearl dace	<i>Margariscus margarita</i>	G4	S1S2	T		A
Shortnose sturgeon	<i>Acipenser brevirostrum</i>	G3	S1	E	E	A
Smooth skate	<i>Malacoraja senta</i>	GNR	SNR			D
Spotfin killifish	<i>Fundulus luciae</i>	G4	S2			B
Stonecat	<i>Noturus flavus</i>	G5	S1	E		A
Stripeback darter	<i>Percina notogramma</i>	G4	S1	E		A
Striped shiner	<i>Luxilus chrysocephalus</i>	G5	S1S2	I		A
Swamp darter	<i>Etheostoma fusiforme</i>	G5	S2	I		B
Thorny skate	<i>Amblyraja radiata</i>	GNR	SNR		SC	D
White catfish	<i>Ameiurus catus</i>	G5	SU			D

¹ = See Table 3.5 for S-rank and G-rank definitions

² = T (Threatened); E (Endangered); I (In Need of Conservation); X (Endangered Extirpated)

³ = See Table 3.7 for Conservation Status definitions

Invertebrates of Maryland

As a group, Maryland's invertebrates are not nearly as well studied as vertebrates. Historically, and to varying degrees persisting today, there has been greater public interest and focus on more "charismatic megafauna." This also is true at both the regional and national scale due largely to the overwhelming number of invertebrate species, limited number of taxonomic specialists, and the complexities of the ecological communities of which they are an integral part. Because Maryland has marine, estuarine, freshwater and terrestrial environments, the invertebrate fauna of Maryland are diverse and include many



thousands of species representing a wide variety of taxonomic groups, such as flatworms; freshwater mussels and other molluscs; crustaceans; spiders; and numerous insect groups, including dragonflies and damselflies, moths and butterflies, and many more.

Most species require further study while others have received significant attention and are known to be Endangered, Threatened, or In Need of Conservation in the state. Fairly well-researched taxa groups include butterflies, dragonflies and damselflies (odonates), and freshwater mussels, a small percentage of the total number. Others, such as bees and moths, are known well enough to be recognized as species or taxonomic groups of conservation concern that merit further study and focus by academia, natural resource agencies, and the broader conservation community.

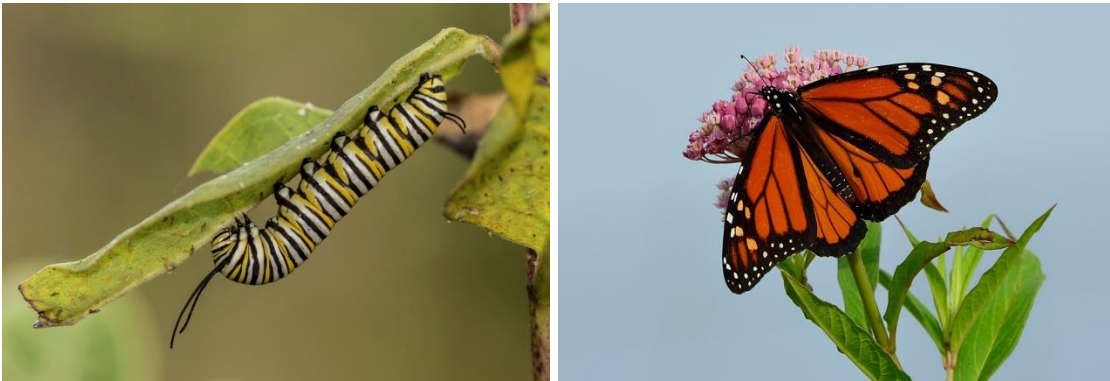
Many invertebrate species serve as excellent indicators of biotic integrity and environmental health. More than 500 genera of benthic macroinvertebrates are found in Maryland streams, allowing MD DNR to utilize an Index of Biotic Integrity for benthic macroinvertebrate species (plus another for fish) to assess the health of stream communities (Versar, Inc. 2011). The number of pollution-sensitive benthic macroinvertebrate taxa is another measure that MD DNR uses to assess stream health. Several mayflies, stoneflies and caddisflies, collectively called EPT for their taxonomic orders (Ephemeroptera, Plecoptera, and Trichoptera), are monitored to indicate water quality and/or physical habitat degradation of Maryland's streams (Boward et al. 1999). The benthic communities of the Coastal Bays and their associated tidal streams similarly have served as biological indicators for the health of those estuaries (DNR 2004d).

Several species of aquatic invertebrates are of high economic importance, either as commercially valuable species or because they are pest species. Commercially important species include the blue crab, several species of clams and the eastern oyster (*Crassostrea virginica*), all of which are managed by MD DNR's Fisheries Service with the goal of attaining healthy, sustainable populations. Although declining and a Species of Greatest Conservation Need, horseshoe crabs are commercially valuable, with Maryland catches making up 23-78% of the northeast region's landings along the Atlantic Coast since 1980 (CBP 1994). Horseshoe crabs are valuable as bait and for use in the biomedical industry. Approximately 255,000 horseshoe crabs are fished annually from Maryland waters – roughly 32% of the total harvest occurring along the Atlantic Coast (Sweka et al. 2013). The state's populations of horseshoe crab, blue crab (*Callinectes sapidus*) and eastern oysters have existing fishery management plans that are reviewed annually (ASMFC 1998; CBP 1998, 2004b).

The vast majority of invertebrates, however, are clearly understudied and data deficient. Some species remain sparsely documented while many are yet to be discovered and described. The paucity of available invertebrate information is an important limitation to our ability to fully represent wildlife and broader biodiversity conservation needs in Maryland's State Wildlife Action Plan. Although the population statuses for several invertebrate taxa groups and for some rare species are fairly well known, little is known for the vast majority of the thousands of invertebrates in Maryland. For this reason, this Plan takes a coarse-filter approach to invertebrate conservation, using available data on the quality and distribution of



natural vegetative communities and key wildlife habitats as surrogates for species lacking status information. For example, many butterflies require one or a few species of food plants in order to complete their life cycles. To take a well-known example, the Monarch butterfly lays its eggs on milkweeds in the genus *Asclepias*. Preserve habitats with milkweeds and this part of the butterfly's life cycle will be secure. For many odonates (dragonflies and damselflies), part of their life cycle is completed in the clean waters of flowing streams. Maintaining clean and free-flowing waters will enhance odonate populations. This more holistic approach of focusing on habitats and natural communities will proactively provide conservation to these SGCN, as well as to the entire spectrum of wildlife from rare to abundant.



Left, a monarch caterpillar on a milkweed plant (Richard Orr); right, a monarch butterfly (Orr)

SGCN Insects of Maryland

MD DNR lists 272 insects as Species of Greatest Conservation Need (SGCN). This list (Table 3.18) includes the following insect orders: Collembola (1 species), Coleoptera (22), Diptera (3), Ephemeroptera (1), Hemiptera (2), Hymenoptera (36), Lepidoptera (101), Odonata (93), Plecoptera (6), and Trichoptera (7). Most of these species are so poorly known that they cannot be classified as Endangered or Threatened, only in need of further study (i.e., data deficient), but about ten percent of the insects have been studied well enough to warrant a particular conservation status.

The SGCN insect list includes 45 state-listed species, of which 35 are listed as Threatened or Endangered. Sixty-two species are of national or international concern. The puritan tiger beetle and the northeastern beach tiger beetle are federally listed as Threatened and state-listed as Endangered. For additional regional, national, and international ranks see Appendices 3a, 3b, and 3c.



SGCN Aquatic Insects (Odonates and Ephemeroptera, Plecoptera, Trichoptera)

Aquatic insects are an extremely diverse group, spanning some 13 orders of insects from springtails (Order Collembola) to caddisflies (Order Trichoptera) and containing thousands of species, some assuredly still undiscovered and unknown to science. They are a dominant part of most freshwater aquatic food webs, play critical roles in nutrient cycling, and serve as excellent indicators of aquatic habitat condition and biotic integrity. Still, for most aquatic insect groups, their study and identification, especially to species level, require specialized taxonomic skills and training, which can pose formidable challenges to documenting species presence, distribution, ecological requirements, threats and conservation needs. Certain taxa, however, such as stoneflies (Order Plecoptera), mayflies (Order Ephemeroptera), caddisflies (Order Trichoptera) and especially odonates (dragonflies and damselflies, Order Odonata), are relatively well known. Members of the first three of these orders, often referred to as “EPT”, serve as important biological indicators for water quality.



Banded pennant (Kerry Wixted, MD DNR)

In the case of odonates, considerable progress has been made over the past few decades in determining their status, distribution, and habitat associations. This is due, in large part, to the recent publication of excellent field guides and a surge in interest among amateur naturalists, professional entomologists, state and federal conservation agencies, and NGO's. Many years of concerted and often collaborative survey efforts by odonate experts, naturalists, and DNR-NHP biologists led to a recent, comprehensive statewide status assessment of dragonflies and damselflies. Today, a total of 182 odonate taxa have been recorded in Maryland. Over half (93 of 182 species) have been identified as SGCN. Many have highly restricted ranges and stringent habitat requirements, and some are associated with rare, unique and/or high quality aquatic habitats, such as pristine headwater streams, forested seepage wetlands, montane rivers, and Carolina bays. The state's SGCN odonates include 9 globally rare species, 85 state rare species, 7 species that occurred here historically and may have been extirpated, and 11 species that are state-listed. As a group, few other animal taxa have such a high proportion of species warranting conservation attention, perhaps reflecting, in part, the degraded condition of their freshwater habitats.

The SGCN list also includes 6 stonefly species, 7 caddisflies, and one mayfly. All are globally rare but, as with most members of these three species groups, detailed information is lacking about their Maryland status, distribution, and ecological requirements. To date, a total of 89 stoneflies, 106 caddisflies, and 57 mayfly species have been recorded in Maryland, and surveys are likely to reveal additional species, many of which may be state or globally rare given the numerous threats to their habitats.

Case Study: SGCN Pollinators



The Importance of Pollinators

The 2015 SGCN contains 128 pollinator species, comprised of 101 species of butterflies and moths, 26 species of bees, and the six-banded longhorn beetle. Some of these pollinator species were included in the 2005 SWAP as SGCN, but were not identified as such, nor were pollinators the subject of any unique conservation actions. However, in light of the importance of pollinators in natural communities and in activities of human interest, it is critical that conservation planners focus on the integral roles of pollinators in Maryland and across North America, and on the threats that affect these species today.



Pearly-banded bee
(Sam Droege)

Pollination, the act of fertilizing a plant by transferring pollen from anther to stigma, forms a mutually beneficial relationship between plants and the pollinators who rely on plants for sustenance and shelter. Of the 240,000 flowering plant species around the world, roughly 75% rely on pollinators in order to reproduce (National Resource Council 2007). Included within this group are many types of plant species upon which large grazing animals rely for sustenance, as well as plant species that produce seeds and fruits which support birds and small mammals. Within the United States alone, 130 of the agricultural crops grown rely on animal and insect pollinators to enable plant reproduction and the production of fruits and seeds (The Heinz Center 2013).

The estimated commercial value of crops that rely on pollination to produce fruit was roughly \$15.1 billion in 2009, with nearly \$12 billion of that sum directly attributed to pollination from honey bees (Pollinator Health Task Force 2015). It is difficult to calculate the exact economic value of pollinators in the environment because there are a variety of ecosystem services provided by a multitude of pollinating species. In natural systems, pollinator species contributions to the maintenance of plants contributes to ecosystem services such as carbon sequestration, water filtration, soil erosion control, and genetic diversity enhancement (Pollinator Health Task Force 2015).

Threats to Pollinators

Habitat Loss and Fragmentation: Advancement of farming techniques has led to increasingly intensive use of agricultural land. Plowing, mowing, and other agriculture-related ground disturbances can destroy nesting and overwintering sites. Conversion of diverse grassland habitat to monocultured landscapes reduces foraging grounds (Hatfield et al. 2012). Social bees and wasps face the additional threat of colony isolation as a result of fragmentation. Isolated colonies may be more vulnerable to random severe weather events and disease outbreaks. The impacts of deer browse, predation, and parasitism might also be exacerbated in small, isolated colonies.

Pesticide Use and Toxins: Insecticides, designed to kill insects, and herbicides, which kill undesirable plants, are used widely in both agricultural and urban landscapes. Pesticides can have direct toxic and lethal effects on species, and may also reduce floral diversity, eliminating food sources and habitat area. These effects are exacerbated when combined with other stressors, such as climate change and the spread of invasive species (Pollinator Health Task Force 2015). Pesticides are often not adequately regulated and pose threats to



pollinators when users are not educated about the extensive effects of these chemicals (Hatfield et al. 2012).

Pathogens and Pests: Pollinators and their habitats may be harmed by invasive mites, larger predator animals, and pathogens including bacteria, viruses, and fungi. The effects of pest animals and pathogens can become more severe when combined with lack of forage material and exposure to pesticides (Pollinator Health Task Force 2015). Due to global distribution of bees for commercial means, introduced pathogens have become a major threat to both kept and wild bee populations. Recent bumble bee declines have been partly attributed to the transmission of *Nosema bombi*, a parasitic fungus that was introduced to American bees from imported European bumble bees. This fungus has been shown to reduce colony size by affecting survival rates and sperm counts of adult bees (Hatfield et al. 2012).

Genetic Diversity: A lack of genetic diversity, known as inbreeding depression, is a problem for many species of pollinators including butterflies and bees. Most affected are species with populations living in small patch habitats within a fragmented landscape that are incapable of long-distance dispersal. These limitations prevent gene flow between isolated populations, causing the expression of adverse characteristics in inbred offspring.

Conservation Actions for Pollinators

Because pollinating species are such integral players in their ecosystems and are significant to human well-being, immediate conservation action is crucial to restore the health of these species and their habitats. Conservation actions range from increasing public knowledge of pollinating species and their roles to creating more numerous and healthier habitats for these species. Roads and utility right-of-ways are ideal potential habitats for pollinators, especially when native plants are allowed to grow in these areas. To take advantage of this opportunity, conservation actions such as reworking mowing regimes along roadsides, medians, storm management facilities, and powerline right-of-ways and developing and providing seed mixes that utility companies can plant in their work areas can assist in expanding pollinator habitat. Croplands and personal yards can also become pollinator habitat with the planting of native flowering plants. MD DNR and other conservation advocates can assist by developing lists of pollinator-friendly plants, educating the public about the benefits of pollinator species and the harmful effects of pesticide sprays, and encouraging the planting of native species for bee refugia around croplands.

Social pollinators such as honeybees are threatened by colony collapse disorder (CCD), which is causing unprecedented death rates in bee populations across the United States. CCD is attributed primarily to parasitic mites and the diseases they transmit, in addition to overuse of pesticides, malnutrition, and stress. Limiting pesticide use and planting native plants supports colonial bees as well as solitary species of bees and other insects. As research continues on pollinator health, population declines, and CCD, citizen science is a major source of information on status of pollinator species. [Bumblebee Watch](#) and the [Great Sunflower Project](#) are two citizen science projects that encourage the public to submit pollinator sightings.



Other SGCN Invertebrates of Maryland

MD DNR lists 78 other invertebrates as Species of Greatest Conservation Need (SGCN). This list (Table 3.18) includes 10 species of flatworm, 14 freshwater mussels, 14 land snails, 34 freshwater crustaceans, 1 marine arthropod, and 5 spiders. The list of other SGCN invertebrates includes 31 state-listed species, of which 23 are listed as Threatened or Endangered; 41 are of national or international concern; and 5 are of conservation concern in the Northeastern U.S. region (RSGCN). The dwarf wedgemussel is federally listed as an Endangered species. For additional regional, national, and international ranks, see Appendix 3a and 3b.

Even nationally, endangered species of invertebrates are disproportionately underrepresented in species conservation efforts. As a result, many scientists call for an ecosystem-level approach to provide conservation for endangered invertebrates, while collecting needed information about the diversity, abundance and distribution of these species. Eventually population data will allow species-based actions to be incorporated into management plans to protect specific endangered invertebrate species (Black et al. 2001).

SGCN Subterranean and Groundwater Species

This highly diverse group comprises 43 Species of Greatest Conservation Need (SGCN). All are obligate subterranean species that are restricted to cave habitats and/or shallow groundwater springs and seeps (hypotelminorheic habitats). It includes many of the state's rarest, most imperiled species, including at least eight Maryland endemics, five of which occur at just a single site. The group is represented by 27 crustaceans (19 amphipods, 8 isopods), 10 flatworms or planarians, 2 spiders, 2 aquatic snails, a beetle and a springtail. Of the 43 species, 25 are globally rare, 34 are state rare and 22 are state-listed: 19 as Endangered, 2 as In Need of Conservation, and 1 species as Endangered Extirpated. Most species are aquatic, occurring in cave drip pools, phreatic (groundwater) pools, subterranean streams, shallow groundwater aquifers and associated spring and seep emergences. Their greatest diversity lies in karst-dominated areas in western Maryland, followed by the Piedmont and near the Fall Line where the Piedmont abruptly transitions into the Upper Coastal Plain. Most are troglomorphic, exhibiting physical adaptations to subterranean life, such as reduced eyes and pigment. Caves and other subterranean habitats are extremely fragile and subject to numerous threats that could permanently alter or eliminate them.



Franz's cave amphipod (Dan Feller, MD DNR)

SGCN Freshwater Mussels

Freshwater mussels belong to the order Unionoida, a subgroup of bivalves (animals with a single pair of hinged shells or valves) comprising 840 species worldwide. They are distinguished from all other bivalves by a unique shell structure, pearly nacre on the inside of the shells, lack of byssal threads (fibrous strands used by some bivalves like the zebra mussel



to permanently attach themselves to substrates), and unique life histories that require host fish to reproduce successfully. The U.S. supports the greatest number of freshwater mussels with approximately 300 species. Most of this diversity lies in the southeastern U.S., a region with unrivaled mussel diversity and among the world's great centers of freshwater biodiversity. Maryland is positioned near the northeastern edge of this global mussel biodiversity hotspot with 16 species.

Freshwater mussels, distant cousins to the beleaguered eastern oyster, play a critical role in freshwater ecosystems, one that is intricately tied to the health of our watersheds. They have unique life cycles, behavioral adaptations, and evolutionary histories. In addition to having a major role in aquatic food webs and serving as prey for numerous aquatic and terrestrial species, they perform essential nutrient cycling and have enormous filtering capacity. Healthy mussel beds also provide habitat for many other aquatic species.



Triangle floater
(James McCann, MD DNR)

Recent studies and status assessments have also revealed alarming declines in freshwater mussels. In the United States, over 70% of the approximately 300 species are declining, endangered, or extinct. A similar pattern holds in Maryland where 14 of the state's 16 native species have been identified as SGCN. These include seven globally rare species and six state-listed species. At both the state and national level, freshwater mussels represent one of the most endangered groups of species and their decline is an indication of the degraded condition of many of our streams and rivers.

Since 1990, MD DNR-NHP (and more recently in collaboration with MD DNR-MBSS) has conducted nearly 1,500 freshwater mussel surveys in streams, rivers, and impoundments throughout the state. These data, along with intensive population monitoring for some high priority species, have provided essential information for conducting species status assessments, identifying important mussel habitat, and prioritizing conservation actions. Presently, four species are state-listed as Endangered, including the dwarf wedgemussel, which is also federally listed as Endangered. Two other species, the Atlantic spike and creeper, are state-listed as In Need of Conservation. Among the most imperiled species are brook floater and green floater, both state-listed as Endangered. Although once fairly widespread in the Piedmont and Ridge and Valley physiographic regions, only a few small populations of each species remain and similar declines have occurred in surrounding states.



SGCN Land Snails

The 2015 SGCN list includes 14 land snail species. Seven are state rare, ten are globally rare, and three are state-listed: the Blue Ridge springsnail (Endangered), cherrystone drop (In Need of Conservation) and Maryland glyph (Endangered Extirpated). In Maryland, SGCN land snails occur statewide in a variety of terrestrial habitats and along the edges and drier portions of freshwater wetlands. Land snail communities tend to be especially rich in calcareous forests, woodlands, glades, and fens. In western Maryland, other important habitats include montane peatlands, algific (cold producing) talus slopes, and rich mature to old-growth forest. On the Coastal Plain, rich old forests and calcareous woodlands overlying ancient shell middens can support a diverse land snail fauna including several SGCN's. Land snails as a group have been identified as warranting conservation attention, primarily because of the high potential for other state and globally rare species occurring in the state; their habitat specificity and utility as indicators of unique, rare and/or pristine natural habitats; their limited mobility; and vulnerability to decline and extirpation from a wide range of threats. Also, the group as a whole is not well studied and better information is needed on their status, distribution, and conservation needs.



Cherrystone drop (Timothy Pierce, Carnegie Museum of Natural History)

Other SGCN Invertebrates, Including Other Insects

In addition to the groups above, another 48 invertebrates have been identified as Species of Greatest Conservation Need. These include 37 insects and 11 crustaceans. Among the insects are 22 beetles, of which 11 are tiger beetles. This relatively well known beetle group includes seven globally rare and seven state-listed taxa, of which two (Puritan tiger beetle, northeastern tiger beetle) are also federally listed. Tiger beetles as a group occur in a variety of habitats, but each of the rare species is highly habitat specific, requiring highly dynamic habitats whose existence depends on natural disturbance regimes, such as naturally eroding earthen cliffs along the Chesapeake Bay, pristine coastal beaches, and fire dependent sandy pine-oak woodlands. Other beetles represented include the Seth Forest water scavenger beetle, an Endangered vernal pool obligate known from just two Eastern Shore sites, and two Endangered darkling beetles (family Tenebrionidae; *Helops cisteloides*, *Schoenicus puberulus*) that are restricted to inland sand ridge oak-pine woodlands on the lower Eastern Shore.





Rock crayfish
(Casey Swecker, MD DNR)

Other SGCN invertebrates include 13 species that are found only on native ash (*Fraxinus* sp.) trees. These species along with their host trees are threatened by the emerald ash borer (*Agrilus planipennis*), an introduced Asian species that is decimating millions of ash trees throughout most of the state and in 24 other states in the Midwest and Northeastern U.S. The SGCN list also includes four crayfish that are being impacted by stream degradation and expanding populations of two highly invasive, nonnative crayfish, the virile crayfish (*Orconectes virilis*), and rusty crayfish (*Orconectes rusticus*). The horseshoe crab is also included because of historical severe declines from overharvesting. These

declines, in turn, have contributed to major declines in the red knot, a federally listed migratory shorebird dependant during migration on horseshoe crab eggs that are a rich food source.

Threats to SGCN Invertebrates

Maryland's SGCN invertebrates are impacted by a wide range of threats that affect a variety of both aquatic and terrestrial microhabitats. Freshwater mussels, crustaceans, odonates, aquatic macroinvertebrates, and spring amphipods are especially sensitive to contamination of water sources through acid mine drainage and from sedimentation and water chemistry alteration resulting from development, agriculture, or forest cover removal. Pesticides used for mosquito and gypsy moth control can also negatively impact SGCN invertebrates. The dependence of some SGCN mussels on specific fish hosts to complete their life cycles exacerbates the threats to these species, as both mussels and their host fish are sensitive to the threats affecting aquatic environments. Introduction of non-native, invasive species can often displace native invertebrates. This threat is especially high for Maryland's SGCN crayfishes. Overfishing is an additional concern for horseshoe crabs.

The greatest threat to Maryland's freshwater mussels is the loss and degradation of their stream and river habitats due to suburban sprawl and poor farming practices. Non-native species can also impact mussels through competition, predation, and by altering aquatic communities. Of particular concern are recent invaders like the zebra mussel, Asiatic clam, and rusty crayfish. Dams, too, can have a profound impact on mussels and have led to the extinction of some species in southeastern states. Dams not only inundate stream and river habitat but also block host fish movement, particularly those of migratory host fish, such as shad, herring, and eels. Poorly designed or eroded out stream culverts can have a similar effect on fish movement. Climate change poses yet another threat. In particular, as the lower nontidal sections of coastal streams, some of which support rare and endangered mussel species, become increasingly saline due to sea level rise, freshwater mussel populations will decline and eventually disappear in these areas.

Vernal pools, the only habitat for several SGCN beetles including the recently described Seth Forest water scavenger beetle, may be drained or degraded through development, timber harvest activities, and pesticide contamination. The loss of beaver impoundments, threats



from overgrazing, and the ditching and draining of marshes and wetlands for agriculture, mosquito control, and development impact SGCN dragonflies and damselflies, as well as other invertebrates that depend on wetlands to complete their life cycle.

The cave and groundwater habitats of a number of SGCN are exceptionally fragile with very limited potential for restoration if disturbed. Many isopods and amphipods are affected by groundwater pollution and hydrologic disturbances that are often associated with agriculture and development. These and other cave organisms (spiders, springtails, and flatworms) are also affected by direct disturbance from spelunkers by trash, change in air pressure and temperature, and damage to the cave itself (National Speleological Society 2009).

Terrestrial insects, including moths, butterflies, bees, and forest beetles, may be impacted by the incompatible or excessive use of insecticides to control pest species, such as gypsy moths and crop pests. SGCN tiger beetles' dependence on open, sandy areas makes them vulnerable to a disruption of natural processes, such as shoreline cliff erosion, and to disturbance by recreational uses, development, and the use of heavy equipment and site preparation for logging. SGCN land snails have very limited mobility and dispersal capabilities along with, apparently, stringent soil chemistry, moisture, and habitat requirements. These attributes make them particularly vulnerable to habitat loss, degradation, and fragmentation. For similar reasons, they are sensitive to air pollution, acid rain, and climate change. Invasive plants, via allelopathy and perhaps through changes in microhabitat conditions, may also impact land snails. The dependence of SGCN butterfly and moth larvae on specific host plants makes them vulnerable to plant loss through extensive deer browsing, displacement of native species by exotic invasives, and incompatible mowing regimes along roadsides and powerlines. Overcollection is a particular concern for some butterfly species.

Conservation Actions and Information Needs for SGCN Invertebrates

Of all the taxonomic groups that comprise Maryland's wildlife, the invertebrate group includes the most species for which basic biological information is needed. Information on host plant preferences and impacts of invasive plants on butterflies and moths, fish hosts for mussels, microhabitat preferences and tolerances, and the impacts of pest control on non-target species are especially needed to determine effective conservation actions.

Recovery plans for several federally listed species, such as dwarf wedgemussel (USFWS 1993a) and northeastern beach and puritan tiger beetles (USFWS 1993b, 1994) (Table 3.17), and a [regional conservation strategy for horseshoe crab](#) can assist in determining conservation actions for these species in Maryland.

In the last ten years, several projects, some of which are ongoing, have assessed the status and distribution of under-represented or poorly understood invertebrates. The U.S. Geological Survey Bee Inventory and Monitoring Lab has been leading the effort to determine the status and distribution of bee species throughout Maryland. In addition to coordinating survey efforts in all regions of the state, the Bee Lab has been instrumental in creating and updating species keys, creating manuals to assist both professional and citizen scientists, and promoting bee conservation. Efforts such as this one help to gather information on groups that have historically been under-represented on the MD NHP list of



Rare, Threatened, and Endangered Animals. SWG-funded projects have complimented this statewide bee survey effort by targeting bees and other Hymenopterans (i.e., ants) in rare key wildlife habitats, specifically inland sand and dune ridge woodlands. A more recent effort to determine the status and distribution of moths in rare ecological communities across the state is also underway. This is a joint effort involving NHP, the Smithsonian National Museum of Natural History’s Entomology Department and private citizens. The moth project will primarily target moth species inhabiting rare ecological communities, including cypress swamps, barrens and glades, and inland sand dunes. Projects such as these will identify which species occur in Maryland and will also help determine which species may be rare or restricted to specific habitats.

Aquatic habitats for SGCN invertebrates require protection through a reduction or mitigation of acid mine drainage, impervious surfaces, deforestation, and inputs of nutrients, pesticides, and herbicides near water bodies. Introductions of non-native species should be prevented. When prevention efforts fail, efforts should be focused on controlling invasive species populations and limiting their dispersal when possible. Pest control strategies that are incompatible with SGCN species should be avoided. Human disturbance of open sand habitats, vernal pools, and cave environments, as well as overcollection, can be limited by education and exclusion from certain sensitive areas. Restoration of open and early successional habitats and of natural processes, such as fire frequency and cliff erosion, is needed to maintain and recover SGCN invertebrates that are limited to such habitats. Degradation of forested habitats can be minimized by limiting forest fragmentation, buffering vernal pools, controlling deer populations and invasive plants, and maintaining critical microhabitats. State and local wetland laws should be appended as needed for greater protection, and the restoration of wetland habitats through beaver impoundments and plugging ditches can help to address wetland losses.

Nationally and regionally, many freshwater mussel species are in danger of extinction (Williams et. al. 1993). Five of Maryland’s 16 native freshwater mussel species are state-listed due to their rarity. Additional surveys for and long-term monitoring of freshwater mussels are needed to fully determine the distribution and abundance of these species. Baseline population status and life history information is needed to establish effective conservation actions.

Table 3.17 Existing federal recovery plans for SGCN invertebrates.

Invertebrate Species	Federal Recovery Plan	Recent Action
Insect Species		
Northeastern beach tiger beetle	USFWS 1994	2009: 5-year review, summary, & evaluation
Puritan tiger beetle	USFWS 1993b	2011: Initiation of 5-year review
Other Invertebrate Species		



Dwarf wedgemussel	USFWS 1993a	2011: Initiation of 5-year review
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Table 3.18 Invertebrate Species of Greatest Conservation Need in Maryland.

INSECTS						
Common Name	Scientific Name	S-Rank ¹	G-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Beetles						
Appalachian tiger beetle	<i>Cicindela ancocisconensis</i>	G3	S1	E		A
Ash seed weevil	<i>Thysanocnemis bischoffi</i>	GNR	SNR			D
Bethany Beach firefly	<i>Photuris bethaniensis</i>	G1Q	SP			D
Cow path tiger beetle	<i>Cicindela purpurea</i>	G5	S3			C
Eastern ash bark beetle	<i>Hylesinus aculeatus</i>	GNR	SNR			D
Eastern pinebarrens tiger beetle	<i>Cicindela abdominalis</i>	G3G4	S1	E		A
Festive tiger beetle	<i>Cicindela scutellaris</i>	G5	S3			C
Ghost tiger beetle	<i>Cicindela lepida</i>	G3G4	S1	E		A
Northeastern beach tiger beetle	<i>Cicindela dorsalis dorsalis</i>	G3G4T 2	S1	E	T	A
Northern ash bark beetle	<i>Hylesinus criddlei</i>	GNR	SNR			D
Northern barrens tiger beetle	<i>Cicindela patruela</i>	G3	S1	E		A
One-spotted tiger beetle	<i>Cicindela unipunctata</i>	G4G5	S3			C
Puritan tiger beetle	<i>Cicindela puritana</i>	G1G2	S1S2	E	T	A
Seth forest water scavenger beetle	<i>Hydrochus spangleri</i>	G1	S1	E		A
Six-banded longhorn beetle	<i>Dryobius sexnotatus</i>	GNR	S1	E		A
Splendid tiger beetle	<i>Cicindela splendida</i>	G5	S1			A
White tiger beetle	<i>Cicindela dorsalis media</i>	G3G4T 3T4	S1	E		A
White-banded ash bark beetle	<i>Hylesinus fasciatus</i>	GNR	SNR			D
A cave beetle	<i>Pseudanophthalmus sp 15</i>	G1	S1			A



INSECTS						
Common Name	Scientific Name	S-Rank ¹	G-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
A tenebrionid beetle	<i>Helops cisteloides</i>	GNR	S1			A
A tenebrionid beetle	<i>Schoenicus puberulus</i>	GNR	S1			A
A weevil	<i>Apion porosicolle</i>	GNR	SNR			D
Bees, Wasps, and Ants						
American bumble bee	<i>Bombus pensylvanicus</i>	G3G4	SNR			D
Ashton's cuckoo bumble bee	<i>Bombus ashtoni</i>	GH	SNR			D
Black and gold bumble bee	<i>Bombus auricomus</i>	G4G5	SU			D
Blackheaded ash sawfly	<i>Tethida barda</i>	GNR	SNR			D
Brownheaded ash sawfly	<i>Tomostethus multicinctus</i>	GNR	SNR			D
Half-black bumble bee	<i>Bombus vagans</i>	G4	S3			C
Lemon cuckoo bumble bee	<i>Bombus citrinus</i>	G4G5	SNR			D
Macropis cuckoo bee	<i>Epeoloides pilosula</i>	G1	SH			E
Oak-grove ant	<i>Formica querquetulana</i>	GNR	SNR			D
Pearly-banded bee	<i>Nomia manei</i>	GNR	S1S3			B
Rusty-patch bumble bee	<i>Bombus affinis</i>	G1	SNR			D
Sanderson's bumble bee	<i>Bombus sandersoni</i>	G4G5	S3			C
Texas temnothorax ant	<i>Temnothorax texanus</i>	GNR	SNR			D
Variable cuckoo bumble bee	<i>Bombus variabilis</i>	GU	SH			E
Yellowbanded bumble bee	<i>Bombus terricola</i>	G2G4	SNR			D
A cellophane bee	<i>Colletes aestivalis</i>	GNR	SH			E
A cuckoo bee	<i>Nomada rubicunda</i>	GNR	S1S3			B
A dolichoderine ant	<i>Dolichoderus taschenbergi</i>	GNR	SNR			D



INSECTS						
Common Name	Scientific Name	S-Rank ¹	G-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
A formicine ant	<i>Camponotus impressus</i>	GNR	SNR			D
A fungus-growing ant	<i>Trachymyrmex septentrionalis</i>	GNR	SNR			D
A hairy-tongue bee	<i>Lasioglossum arantium</i>	GNR	S2S3			B
A hairy-tongue bee	<i>Lasioglossum georgeickworti</i>	GNR	SNR			D
A hairy-tongue bee	<i>Lasioglossum marinum</i>	GNR	SU			D
A hairy-tongue bee	<i>Lasioglossum nymphale</i>	GNR	S2S3			B
A hairy-tongue bee	<i>Lasioglossum rahleighense</i>	GNR	SU			D
A mason bee	<i>Osmia chalybea</i>	G4	S1S3			B
A mining bee	<i>Andrena braccata</i>	GNR	SU			D
A mining bee	<i>Andrena fulvipennis</i>	GNR	SU			D
A mining bee	<i>Protandrena abdominalis</i>	GNR	SU			D
A myrmicine ant	<i>Leptothorax muscorum</i>	GNR	SNR			D
A myrmicine ant	<i>Myrmica pinetorum</i>	GNR	SNR			D
A sweat bee	<i>Dieunomia heteropoda</i>	GNR	SU			D
A sweat bee	<i>Dieunomia nevadensis</i>	GNR	SU			D
A temnothorax ant	<i>Temnothorax pergandei</i>	GNR	SNR			D
An oil-collecting bee	<i>Macropis ciliata</i>	GNR	S1			A
An oil-collecting bee	<i>Macropis patellata</i>	GNR	SH			E
Butterflies and Moths						
American chestnut nepticulid moth	<i>Ectoedemia castaneae</i>	GH	SH			E
Angle winged emerald moth	<i>Chloropteryx tepperaria</i>	G4	SNR			D
Appalachian blue	<i>Celastrina neglectamajor</i>	G4	S3S4			C



INSECTS						
Common Name	Scientific Name	S-Rank ¹	G-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Aralia shoot borer moth	<i>Papaipema araliae</i>	G3G4	SNR			D
Ash pyralid	<i>Palpita magniferalis</i>	GNR	SNR			D
Atlantis fritillary	<i>Speyeria atlantis</i>	G5	S1	T		A
Aureolaria seed borer moth	<i>Pyrrhia aurantiago</i>	G3G4	SNR			D
Baltimore checkerspot	<i>Euphydryas phaeton</i>	G4	S2			B
Black dash	<i>Euphyes conspicua</i>	G4	S4			C
Bog copper	<i>Lycaena epixanthe</i>	G4G5	S1	E		A
Bold-based zale moth	<i>Zale lunifera</i>	G3G4	SNR			D
Broad-lined catopyrrha	<i>Erastria coloraria</i>	G3G4	SH			E
Bronze copper	<i>Lycaena hyllus</i>	G5	S4			C
Buffalo moth	<i>Parapamea buffaloensis</i>	G4	SNR			D
Carolina satyr	<i>Hermeuptychia sosybius</i>	G5	S1S3			B
Chain fern borer moth	<i>Papaipema stenocelis</i>	G4	SNR			D
Chermock's mulberry wing	<i>Poanes massasoit chermocki</i>	G4T1	S1	E		A
Cobweb skipper	<i>Hesperia metea</i>	G4	S3			C
Compton tortoiseshell	<i>Nymphalis vaualbum</i>	G5	S1B	E		A
Curved halter moth	<i>Capis curvata</i>	G4	S1S2			A
Cypress sphinx moth	<i>Isoparce cupressi</i>	G4	S1S2			A
Delaware skipper	<i>Atrytone logan</i>	G5	S3			C
Dion skipper	<i>Euphyes dion</i>	G4	S3			C
Doris' tiger moth	<i>Grammia doris</i>	G4	SNR			D
Dusted Skipper	<i>Atrytonopsis hianna</i>	G4G5	S4**			C
Early hairstreak	<i>Erora laeta</i>	GU	S1	E		A
Edwards' hairstreak	<i>Satyrrium edwardsii</i>	G4	S1	E		A



INSECTS						
Common Name	Scientific Name	S-Rank ¹	G-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Fingered lemmeria	<i>Lemmeria digitalis</i>	G4	SNR			D
Franck's sphinx	<i>Sphinx franckii</i>	G4	S1S2			A
Fringed dart	<i>Eucoptocnemis fimbriaris</i>	G4	SNR			D
Frosted elfin	<i>Callophryss irus</i>	G3	S1	E		A
George's midget moth	<i>Elaphria georgei</i>	G4	SU			D
Giant swallowtail	<i>Papilio cressphontes</i>	G5	S2	I		B
Graceful clearwing	<i>Hemaris gracilis</i>	G3G4	SNR			D
Gray comma	<i>Polygonia progne</i>	G4G5	S3			C
Great purple hairstreak	<i>Atlides halesus</i>	G4G5	S1S2	T		A
Grote's sallow	<i>Copivaleria grotei</i>	G5	SNR			D
Harris's checkerspot	<i>Chlosyne harrisii</i>	G4	S2	T		B
Hessel's hairstreak	<i>Mitoura hesseli</i>	G3G4	SH	X		E
Hickory hairstreak	<i>Satyrium caryaevorum</i>	G4	S1	E		A
Hoary elfin	<i>Callophrys polios</i>	G5	S1	E		A
Hydrangea sphinx	<i>Darapsa versicolor</i>	G4	SNR			D
Indian skipper	<i>Hesperia sassacus</i>	G4G5	S3			C
King's hairstreak	<i>Satyrium kingi</i>	G3G4	S1	E		A
Lemmer's noctuid moth	<i>Lithophane lemmeri</i>	G3G4	SNR			D
Leonard's skipper	<i>Hesperia leonardus</i>	G4	S2			B
Little beggar	<i>Eubaphe meridiana</i>	G4	SNR			D
Long dash	<i>Polites mystic</i>	G5	S3			C
Louisiana owlet moth	<i>Macrochilo louisiana</i>	G4	SNR			D
Marbled underwing	<i>Catocala marmorata</i>	G3G4	SH			E



INSECTS						
Common Name	Scientific Name	S-Rank ¹	G-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Melsheimer's sack-bearer	<i>Cicinnus melsheimeri</i>	G4	SNR			D
Mixed dart	<i>Euxoa immixta</i>	G4	SNR			D
Monarch	<i>Danaus plexippus</i>	G4	S5			C
Mottled duskywing	<i>Erynnis martialis</i>	G3	S1	E		A
Mulberry wing	<i>Poanes massasoit massasoit</i>	G4	S4			C
Newman's brocade	<i>Meropleon ambifusca</i>	G3G4	SNR			D
Northern crescent	<i>Phyciodes cocyta</i>	G5	SP			D
Northern hairstreak	<i>Satyrium favonius ontario</i>	G4T4	S1S2	E		A
Northern metalmark	<i>Calephelis borealis</i>	G3G4	S2	T		A
Olympia marble	<i>Euchloe olympia</i>	G4G5	S2	I		B
Palamedes swallowtail	<i>Papilio palamedes</i>	G4	S1	E		A
Pepper and salt skipper	<i>Amblyscirtes hegon</i>	G5	S2	I		B
Phleophagan chestnut nepticulid moth	<i>Ectoedemia phleophaga</i>	GH	SH			E
Phyllira tiger moth	<i>Grammia phyllira</i>	G4	SNR			D
Pine barrens zanclognatha	<i>Zanclognatha martha</i>	G4	S1S3			B
Pink sallow	<i>Psectraglaea carnosae</i>	G3	SNR			D
Pink-edged sulphur	<i>Colias interior</i>	G5	S1			A
Pitcher plant borer moth	<i>Papaipema appassionate</i>	G4	SNR			D
Plain schizura	<i>Schizura apicalis</i>	G3G4	SNR			D
Polymnia stalk borer moth	<i>Papaipema polymniae</i>	G4	SH			E



INSECTS						
Common Name	Scientific Name	S-Rank ¹	G-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Precious underwing	<i>Catocala pretiosa pretiosa</i>	G4T2	SH			E
Purple plagodis	<i>Plagodis kuetzingi</i>	G5	SNR			D
Rare skipper	<i>Problema bulenta</i>	G2G3	S1	T		A
Seaside goldenrod stem borer	<i>Papaipema duovata</i>	G4	SU			D
Silver-bordered fritillary	<i>Boloria selene</i>	G5	S3			C
Silvery blue	<i>Glaucopsyche lygdamus</i>	G5	S2	I		B
Sinuuous lytrosis	<i>Lytrosis sinuosa</i>	G4	S1S3			B
Southern grizzled skipper	<i>Pyrgus wyandot</i>	G1G2Q	S1	E		A
Southern ptichodis moth	<i>Ptichodis bistrigata</i>	G3	SNR			D
Speyer's hooded owlet	<i>Cucullia speyeri</i>	G4	SNR			D
Three-horned moth	<i>Pachypolia atricornis</i>	G3G4	SH			E
Tuscarora emerald	<i>Nemoria tuscarora</i>	GU	SNR			D
Two-spotted skipper	<i>Euphyes bimacula</i>	G4	S1	E		A
Unexpected cyncia	<i>Cyncia inopinatus</i>	G4	SNR			D
Venus flytrap cutworm	<i>Hemipachnobia subporphyrea</i>	G1	SNR			D
Violet dart	<i>Euxoa violaris</i>	G4	SNR			D
West Virginia white	<i>Pieris virginianensis</i>	G3	S1S2			A
White-tailed diver moth	<i>Bellura gortynoides</i>	G4	SNR			D
A crambid snout moth	<i>Undulambia striatalis</i>	GNR	SNR			D
A geometrid moth	<i>Apodrepanulatr ix liberaria</i>	G3	SU			D
A geometrid moth	<i>Cyclophora nanaria</i>	G5	SU			D



INSECTS						
Common Name	Scientific Name	S-Rank ¹	G-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
A geometrid moth	<i>Euchlaena milnei</i>	G2G4	SNR			D
A lymantriid moth	<i>Dasychira atrivenosa</i>	G4	SU			D
A noctuid moth	<i>Amolita roseola</i>	G5	SNR			D
A noctuid moth	<i>Chytonix sensilis</i>	G4	SNR			D
A noctuid moth	<i>Hadena ectypa</i>	G3G4	SU			D
A noctuid moth	<i>Melanapamea mixta</i>	GU	S1			A
A noctuid moth	<i>Meropleon cosmion</i>	G4	SNR			D
A noctuid moth	<i>Meropleon titan</i>	G2G4	S2S4			B
A noctuid moth	<i>Zale curema</i>	G4	S1			A
A noctuid moth	<i>Zale submediana</i>	G4	S1S3			B
Dragonflies and Damselflies						
Allegheny river cruiser	<i>Macromia alleghaniensis</i>	G4	S2			B
Amber-winged spreadwing	<i>Lestes eurinus</i>	G4	S3			C
American emerald	<i>Cordulia shurtleffii</i>	G5	S3			C
Appalachian jewelwing	<i>Calopteryx angustipennis</i>	G4	S1S2			A
Appalachian snaketail	<i>Ophiogomphus incurvatus incurvatus</i>	G3T2T3	S1			A
Arrowhead spiketail	<i>Cordulegaster obliqua</i>	G4	S2			B
Atlantic bluet	<i>Enallagma doubledayi</i>	G5	S1			A
Attenuated bluet	<i>Enallagma daeckii</i>	G4	S3			C
Banded pennant	<i>Celithemis fasciata</i>	G5	S3			C
Banded spiketail	<i>Cordulegaster obliqua fasciata</i>	G4T3Q	S1			A
Bar-winged skimmer	<i>Libellula axilena</i>	G5	S3			C



INSECTS						
Common Name	Scientific Name	S-Rank ¹	G-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Beaverpond baskettail	<i>Epitheca canis</i>	G5	S3			C
Black-tipped darner	<i>Aeshna tuberculifera</i>	G4	S2			B
Blackwater bluet	<i>Enallagma weewa</i>	G5	S2			B
Brown spiketail	<i>Cordulegaster bilineata</i>	G5	S3			C
Brush-tipped emerald	<i>Somatochlora walshii</i>	G5	S1			A
Burgundy bluet	<i>Enallagma dubium</i>	G5	S1			A
Canada darner	<i>Aeshna canadensis</i>	G5	S2			B
Chalk-fronted skimmer	<i>Ladona julia</i>	G5	S3			C
Chesapeake snaketail	<i>Ophiogomphus sp 1</i>	G1	S1			A
Comet darner	<i>Anax longipes</i>	G5	S3			C
Common sanddragon	<i>Progomphus obscurus</i>	G5	S3			C
Coppery emerald	<i>Somatochlora georgiana</i>	G3G4	S1			A
Crimson-ringed whiteface	<i>Leucorrhinia glacialis</i>	G5	S1			A
Delta-spotted spiketail	<i>Cordulegaster diastatops</i>	G5	S3S4			C
Dot-tailed whiteface	<i>Leucorrhinia intacta</i>	G5	S3			C
Double-ringed pennant	<i>Celithemis verna</i>	G5	S2			B
Duckweed firetail	<i>Telebasis byersi</i>	G5	S1			A
Dusky clubtail	<i>Gomphus spicatus</i>	G5	S1			A
Eastern ringtail	<i>Erpetogomphus designatus</i>	G5	S2			B
Elfin skimmer	<i>Nannothemis bella</i>	G4	S1	E		A
Faded pennant	<i>Celithemis ornata</i>	G5	SH			E



INSECTS						
Common Name	Scientific Name	S-Rank ¹	G-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Fine-lined emerald	<i>Somatochlora filosa</i>	G5	S2			B
Four-spotted pennant	<i>Brachymesia gravida</i>	G5	S3S4			C
Frosted whiteface	<i>Leucorrhinia frigida</i>	G5	S1			A
Furtive forktail	<i>Ischnura prognata</i>	G4	S1			A
Golden-winged skimmer	<i>Libellula auripennis</i>	G5	S3			C
Gray petaltail	<i>Tachopteryx thoreyi</i>	G4	S3			C
Green-faced clubtail	<i>Gomphus viridifrons</i>	G3G4	S1			A
Green-striped darner	<i>Aeshna verticalis</i>	G5	S2			B
Harlequin darner	<i>Gomphaeschna furcillata</i>	G5	S3S4			C
Harpoon clubtail	<i>Gomphus desertus</i>	G4	S1S2			A
Hudsonian whiteface	<i>Leucorrhinia hudsonica</i>	G5	S1			A
Laura's clubtail	<i>Stylurus laurae</i>	G4	S2S3			B
Little blue dragonlet	<i>Erythrodiplax minuscula</i>	G5	S1			A
Maine snaketail	<i>Ophiogomphus mainensis fastigiatus</i>	G4TU	S1			A
Mantled baskettail	<i>Epithea semiaquea</i>	G5	SH			E
Martha's pennant	<i>Celithemis martha</i>	G4	S1			A
Midland clubtail	<i>Gomphus fraternus</i>	G5	S2			B
Mocha emerald	<i>Somatochlora linearis</i>	G5	S3S4			C
Mustached clubtail	<i>Gomphus adelphus</i>	G4	S1			A
Northern bluet	<i>Enallagma annexum</i>	G5	S1			A
Northern pygmy clubtail	<i>Lanthus parvulus</i>	G4	S2			B



INSECTS						
Common Name	Scientific Name	S-Rank ¹	G-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Ocellated darner	<i>Boyeria grafiana</i>	G5	S1			A
Pale bluet	<i>Enallagma pallidum</i>	G4	S1			A
Petite emerald	<i>Dorocordulia lepida</i>	G5	SH			E
Piedmont clubtail	<i>Gomphus parvidens</i>	G4	SH	X		E
Pygmy snaketail	<i>Ophiogomphus howei</i>	G3	S1			A
Rainbow bluet	<i>Enallagma antennatum</i>	G5	S1			A
Rapids clubtail	<i>Gomphus quadricolor</i>	G3G4	S2	I		A
Red-veined pennant	<i>Celithemis bertha</i>	G5	S1			A
River jewelwing	<i>Calopteryx aequabilis</i>	G5	SR			D
Riverine clubtail	<i>Stylurus amnicola</i>	G4	SH	X		E
Robust baskettail	<i>Epithea spinosa</i>	G4	S1S2			A
Royal river cruiser	<i>Macromia taeniolata</i>	G5	S3			C
Rusty snaketail	<i>Ophiogomphus rupinsulensis</i>	G5	S2			B
Sable clubtail	<i>Gomphus rogersi</i>	G4	S2	I		B
Seepage dancer	<i>Argia bipunctulata</i>	G4	S3			C
Selys' sundragon	<i>Helocordulia selysii</i>	G4	S2	T		B
Skillet clubtail	<i>Gomphus ventricosus</i>	G3	SH	X		E
Ski-tailed emerald	<i>Somatochlora elongata</i>	G5	S2			B
Smoky rubyspot	<i>Hetaerina titia</i>	G5	SH			E
Southern pygmy clubtail	<i>Lanthus vernalis</i>	G4	S2			B
Southern sprite	<i>Nehalennia integricollis</i>	G5	S1S2			A
Sparkling jewelwing	<i>Calopteryx dimidiata</i>	G5	S2			B



INSECTS						
Common Name	Scientific Name	S-Rank ¹	G-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Sphagnum sprite	<i>Nehalennia gracilis</i>	G5	S2			B
Spine-crowned clubtail	<i>Gomphus abbreviatus</i>	G4	S1			A
Splendid clubtail	<i>Gomphus lineatifrons</i>	G4	S1			A
Spotted spreadwing	<i>Lestes congener</i>	G5	S3			C
Spring blue darner	<i>Rhionaeschna mutata</i>	G4	S1	E		A
Stripe-winged baskettail	<i>Epiheca costalis</i>	G5	S1			A
Stygian shadowdragon	<i>Neurocordulia yamaskanensis</i>	G5	S3			C
Superb jewelwing	<i>Calopteryx amata</i>	G4	S1S2	T		A
Sweetflag spreadwing	<i>Lestes forcipatus</i>	G5	S3			C
Taper-tailed darner	<i>Gomphaeschna antilope</i>	G4	S2			B
Tiger spiketail	<i>Cordulegaster erronea</i>	G4	S3			C
Treetop emerald	<i>Somatochlora provocans</i>	G4	S1	E		A
Tule bluet	<i>Enallagma carunculatum</i>	G5	S1			A
Uhler's sundragon	<i>Helocordulia uhleri</i>	G5	S3			C
White corporal	<i>Ladona exusta</i>	G4	S1	E		A
White-faced meadowhawk	<i>Sympetrum obtrusum</i>	G5	S3			C
Yellow-sided skimmer	<i>Libellula flavida</i>	G5	S2S3			B
Zebra clubtail	<i>Stylurus scudderi</i>	G4	S1			A
Stoneflies, Mayflies, and Caddisflies						
Aracoma sallfly	<i>Alloperla aracoma</i>	G3	SNR			D
Dusky sallfly	<i>Alloperla biserrata</i>	G3	SNR			D



INSECTS						
Common Name	Scientific Name	S-Rank ¹	G-Rank ¹	State-listed ²	Federally listed ²	Conservation status group ³
Gaspe sallfly	<i>Utaperla gaspesiana</i>	G3	SNR			D
Pocahontas sallfly	<i>Sweltsa pocahontas</i>	G2	SNR			D
Shenandoah needlefly	<i>Megaleuctra flinti</i>	G2	SNR			D
Shenandoah sallfly	<i>Sweltsa palearata</i>	G2G3	SNR			D
Speith's great speckled olive mayfly	<i>Siphloplecton costalense</i>	G2G4	SNR			B
A caddisfly	<i>Ceraclea spongillovorax</i>	G3G4	SNR			D
A caddisfly	<i>Ceraclea uvalo</i>	G2G4	SNR			D
A caddisfly	<i>Cernotina pallida</i>	G3G4	SNR			D
A caddisfly	<i>Cheumatopsyche parentum</i>	G3	SNR			D
A caddisfly	<i>Hydropsyche hoffmani</i>	G3G4	SNR			D
A caddisfly	<i>Protoptila georgiana</i>	G3G4	SNR			D
A Scalaris trichopteran	<i>Hydropsyche brunneipennis</i>	G3G4	S3			D
Other Insects						
Ash bullet gall midge	<i>Dasineura pellex</i>	GNR	SNR			D
Ash midrib gall midge	<i>Continaria canadensis</i>	GNR	SNR			D
Ash plant bug	<i>Tropidosteptes amoenus</i>	GNR	SNR			D
Crabtree cave springtail	<i>Arrhopalites sp 1</i>	GNR	SU			D
Eastern sedge barrens leafhopper	<i>Limotettix minuendus</i>	G1	S1	E		A
Pitcher-plant mosquito	<i>Wyeomyia smithii</i>	G5	S2			B

OTHER INVERTEBRATES						
Common Name	Scientific Name	S-Rank	G-Rank	State-listed	Federally listed	Conservation status group
Crustaceans and Allies						



OTHER INVERTEBRATES						
Common Name	Scientific Name	S-Rank	G-Rank	State-listed	Federally listed	Conservation status group
Acuminate crayfish	<i>Cambarus acuminatus</i>	G4Q	S2	I		B
Allegheny cave amphipod	<i>Stygobromus allegheniensis</i>	G5	S2S3	I		B
Allegheny crayfish	<i>Orconectes obscurus</i>	G5	S3			C
Allegheny spring isopod	<i>Caecidotea alleghenyensis</i>	GNR	S1	E		A
Appalachian cave spider	<i>Porhomma cavernicola</i>	G5	S2			B
Ash flowergall mite	<i>Aceria fraxiniflora</i>	GNR	SNR			D
Ash key gall mite	<i>Aceria fraxinivorus</i>	GNR	SNR			D
Ashleaf gall mite	<i>Aceria chondriphora</i>	GNR	SNR			D
Barrelville amphipod	<i>Stygobromus sp 5</i>	GNR	S1			A
Biggers' cave amphipod	<i>Stygobromus biggersi</i>	G2G4	S1	E		A
Capital Area groundwater amphipod	<i>Stygobromus sextarius</i>	G1	S1	E		A
Cecil groundwater amphipod	<i>Stygobromus caecilius</i>	G1	S1	E		A
Devils Hole cave amphipod	<i>Stygobromus sp 6</i>	GNR	S1			A
Digger crayfish	<i>Fallicambarus fodiens</i>	G5	SNR			D
Feller's groundwater amphipod	<i>Stygobromus felleri</i>	G1	S1	E		A
Franz's cave amphipod	<i>Stygobromus franzi</i>	G3G4	S2S3	I		A
Franz's cave isopod	<i>Caecidotea franzi</i>	G2G4	S1	E		A
Friendly cave amphipod	<i>Stygobromus amicus</i>	G1	S1	E		A
Greenbrier cave amphipod	<i>Stygobromus emarginatus</i>	G3	S1	E		A
Holsinger's cave isopod	<i>Caecidotea holsingeri</i>	G5	S1	E		A
Horseshoe crab	<i>Limulus polyphemus</i>	G5	SNR			D



OTHER INVERTEBRATES						
Common Name	Scientific Name	S-Rank	G-Rank	State-listed	Federally listed	Conservation status group
Maus' cave isopod	<i>Caecidotea mausi</i>	G2	S1	E		A
Norden's groundwater isopod	<i>Caecidotea nordeni</i>	GH	SH	X		E
Pennsylvania cave crangonyctid	<i>Crangonyx dearolfi</i>	G2	S1	E		A
Pizzini's amphipod	<i>Stygobromus pizzinii</i>	G3G4	S1			A
Potomac amphipod	<i>Stygobromus tenuis potomacus</i>	G4T4	S3			C
Prettyboy groundwater amphipod	<i>Stygobromus paxillus</i>	G1	S1	E		A
Price's cave isopod	<i>Caecidotea pricei</i>	G5	S3			C
Rappahannock spring amphipod	<i>Stygobromus foliatus</i>	G2	S1	E		A
Rock crawfish	<i>Cambarus carinirostris</i>	G5	SNR			D
Rock Creek groundwater amphipod	<i>Stygobromus kenki</i>	G2	S1	E		A
Roundtop amphipod	<i>Stygobromus sp 14</i>	GNR	S1			A
Shenandoah Valley cave amphipod	<i>Stygobromus gracilipes</i>	G3G4	S1	E		A
Snivelys cave spider	<i>Oreonetides sp 1</i>	GNR	SU			D
Tenuis amphipod	<i>Stygobromus tenuis tenuis</i>	G4T4	SU			D
Tidewater amphipod	<i>Stygobromus indentatus</i>	G3	S1			A
Vandel's cave isopod	<i>Caecidotea vandeli</i>	G3G4	S1	E		A
A copepod	<i>Acanthocyclops columbiensis</i>	G1	SNR			D
An amphipod	<i>Crangonyx stagnicolous</i>	G2	SNR			D
An ostracod	<i>Donnaldsoncythere donnaldsonensis</i>	G3	SNR			D



OTHER INVERTEBRATES						
Common Name	Scientific Name	S-Rank	G-Rank	State-listed	Federally listed	Conservation status group
Snails						
Angular disc	<i>Discus catskillensis</i>	G5	S1			A
Appalachian springsnail	<i>Fontigens bottimeri</i>	G2G3	S2			A
Bear creek slitmouth	<i>Stenotrema simile</i>	G2	SU			D
Blue Ridge springsnail	<i>Fontigens orolibas</i>	G3	S1	E		A
Cherrystone drop	<i>Hendersonia occulta</i>	G4	S2	I		B
Chesapeake ambersnail	<i>Oxyloma subeffusum</i>	G3	SNR			D
Coastal-plain ambersnail	<i>Oxyloma effusum</i>	G3	SNR			D
Cylindrically-ornate wood snail	<i>Vertigo ventricosa</i>	G5	SU			D
Maryland glyph	<i>Glyphyalinia raderi</i>	G2	SH	X		E
Natural Bridge supercoil	<i>Paravitrea pontis</i>	G3	SNR			D
Rust glyph	<i>Glyphyalinia picea</i>	G3	SNR			D
Snowhill ambersnail	<i>Catinella hubrichti</i>	G3	SNR			D
Spruce knob threetooth	<i>Triodopsis picea</i>	G3	S1			A
Striped whitelip	<i>Webbhelix multilineata</i>	G5	S1			A
Freshwater Mussels						
Alewife floater	<i>Anodonta implicata</i>	G5	S3			C
Atlantic spike	<i>Elliptio producta</i>	G3Q	S2	I		A
Brook floater	<i>Alasmidonta varicosa</i>	G3	S1	E		A
Creeper	<i>Strophitus undulatus</i>	G5	S2	I		B
Dwarf wedgemussel	<i>Alasmidonta heterodon</i>	G1G2	S1	E	E	A
Eastern lampmussel	<i>Lampsilis radiata</i>	G5	SU			D
Eastern pondmussel	<i>Ligumia nasuta</i>	G4	S1S2			A



OTHER INVERTEBRATES						
Common Name	Scientific Name	S-Rank	G-Rank	State-listed	Federally listed	Conservation status group
Green floater	<i>Lasmigona subviridis</i>	G3	S1	E		A
Northern lance	<i>Elliptio fisheriana</i>	G4	S3			C
Paper pondshell	<i>Utterbackia imbecillis</i>	G5	S3			C
Tidewater mucket	<i>Leptodea ochracea</i>	G3G4	S1S2			A
Triangle floater	<i>Alasmidonta undulata</i>	G4	S1	E		A
Yellow lampmussel	<i>Lampsilis cariosa</i>	G3G4	SU			D
Yellow lance	<i>Elliptio lanceolata</i>	G2G3	SU			D
Flatworms						
Hoffmaster's cave planarian	<i>Sphalloplana hoffmasteri</i>	G3G4	S1	E		A
A planarian	<i>Paraplanaria dactyligera</i>	GNR	S2			B
A planarian	<i>Phagocata dissimilis sp. nov.</i>	GNR	SNR			D
A planarian	<i>Phagocata projecta sp. nov.</i>	GNR	SNR			D
A planarian	<i>Phagocata virilis</i>	GNR	S1			A
A planarian	<i>Procotyla typhlops</i>	G1G2	S1	E		A
A planarian	<i>Sphalloplana buchanani</i>	G1G2	SNR			D
A planarian	<i>Sphalloplana cava sp. nov.</i>	GNR	SNR			D
A planarian	<i>Sphalloplana pricei</i>	G2G3	SNR			D
A planarian	<i>Sphalloplana sp 1</i>	GNR	S1S2			A

¹ = See Table 3.5 for S-rank and G-rank definitions

² = T (Threatened); E (Endangered); I (In Need of Conservation); X (Endangered Extirpated)

³ = See Table 3.7 for Conservation Status definitions

* = a qualifier denoting the species is listed in a limited geographic area only

** = Proposed State Rank changes

Maryland's Plants

While the development of Maryland's SWAP is focused primarily around SGCN wildlife and their key wildlife habitats, plants form the basis of nearly every ecosystem, provide essential habitat and/or food for most faunal life forms and, of course, are intricately linked, whether directly or indirectly, to the survival of all SGCN. Plants are useful to conservationists in that they are faithful indicators of specific site conditions and typically reflect biological and ecological patterns across a landscape. Plants are more readily



measurable than other biota or environmental conditions. Most U.S. states did not include plants in their discussion of Species of Greatest Conservation Need in 2005; however, the development and revision of SWAPs provides an excellent opportunity for states to advance the conservation of declining, rare, threatened, and endangered plant species (NatureServe 2010). Recognizing this opportunity, MD DNR's Wildlife and Heritage Service has developed a list of SGCN plants (Table 3.19) for inclusion in the 2015 SWAP revision. Plant species have also been incorporated in Chapter 4 and throughout the Plan to characterize key wildlife habitats, which are based on the Northeast Terrestrial Habitat Classification System (NETHCS) (see Appendix 4d).

The state's diverse hydrology and geology support plant life from western Maryland's mountaintops to low-lying beaches on the Coastal Plain (Maryland Botanical Heritage Workgroup 2014). The Maryland Flora includes about 3,085 plant species, of which 2,239 are native (Knapp & Naczi in prep.). Efforts to understand the specific distribution of all of these plant species are in their infancy, but this is the goal of the [Maryland Plant Atlas](#) (Maryland Plant Atlas Work Group 2015).



Canby's dropwort (Dave Suiter, USFWS)

The Maryland Plant Atlas aims to provide distribution maps for all native and naturalized plants in Maryland based on the most recent and accurate data, to provide information about Maryland's plants to the public, and to promote conservation by increasing public awareness of plants. Because plants support other organisms through photosynthesis, the remarkable process by which plants convert sunlight to carbon-based fuel, plants are the foundation sustaining other life forms in systems that providing habitat for rare animals and that maintain healthy water quality in Maryland's streams. Native plants are also important economically, as they support pollinators necessary for agricultural production. Furthermore, plant diversity is becoming especially important as ecosystems are pressured by the effects of climate change (Boesch 2008).

Threats to plants are similar to threats faced by Maryland's animal species with one added source of risk: plants cannot physically move away from danger. Limitations in the colonizing ability of many plant species pose major obstacles to restoration of plant communities. The alteration of historical ecosystem processes, such as fire, and changes in the spatial arrangement of habitats via habitat destruction and fragmentation are key threats largely because plants are non-motile. Further, even if ecosystem processes are reinstated, many previously occupied habitat patches may remain unoccupied and the linkages between habitat patches will remain fragmented due to insurmountable barriers to gene flow via seed and pollen. Loss of historical disturbance regimes, intensive urbanization, and human-mediated manipulation of species composition have led to homogenization of plant species and loss of diversity over large areas. This, coupled with a limited capacity of the seed bank to aid recovery, have led to a rapid decline in both species diversity and composition of plant communities. Finally, the overabundance of white-tailed deer has been directly implicated in the altered species richness and abundance of Maryland orchids (Knapp & Wiegand 2014)



and other rare species (Maryland Botanical Heritage Workgroup 2014). Other major threats include the widespread infestation of invasive species, the emergence of new diseases, and pervasive shifts in climactic patterns (Stein et al. 2000).

Conservation efforts for plants are a relatively recent trend in conservation planning. While the U.S. Endangered Species Act was established in 1970, it was not until 1977 that the first plant species were federally listed. Inequality still exists between federally listed animals and plants: under law, Threatened and Endangered animals cannot be captured or killed anywhere in the U.S., but the taking of Threatened and Endangered plants is prohibited only on federal or state-owned lands (USFWS 1973). The U.S. Fish and Wildlife Service lists five Maryland plants as Endangered and four as Threatened (Table 3.19). In Maryland regulations, 263 plants are listed as Endangered and 70 as Threatened. Outreach and conservation remain as important steps in advancing the conservation of rare plants. To this end, MD DNR provides information to assist with identifying and maintaining habitat for Maryland’s [Endangered plant species](#). In addition to this formal listing, MD DNR maintains a list of 750 plant species that are either rare, Threatened, Endangered, or Endangered Extirpated in the state (see Appendix 3j), the result of a thorough review process by state botanists and other plant experts.

Rare plants take on the role of “canary in the coal mine” for Maryland’s habitats, signaling through their decline that the system is unhealthy. Plants factor into many conservation decisions in Maryland, such as invasive plant management and prescribed burn programs. By working plants into the SWAP through habitat classifications and SGCN plant list, the Plan highlights the importance of conserving plant life along with wildlife.

Table 3.19 Plant Species of Greatest Conservation Need in Maryland.

Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Balsam Fir	<i>Abies balsamea</i>	G5	S1		
Blue Monkshood	<i>Aconitum uncinatum</i>	G4	S1	E	
American Bugbane	<i>Actaea podocarpa</i>	G4	S2		
Climbing Fumitory	<i>Adlumia fungosa</i>	G4	S2	T	
Sensitive Joint-vetch	<i>Aeschynomene virginica</i>	G2	S1	E	LT
Sandplain Gerardia	<i>Agalinis acuta</i>	G1	S1	E	LE
Earleaf False Foxglove	<i>Agalinis auriculata</i>	G3	S1	E	
Ten-lobed False Foxglove	<i>Agalinis obtusifolia</i>	G4G5Q	SH	X	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Threadleaf Gerardia	<i>Agalinis setacea</i>	G5?	S2	E	
Pale False Foxglove	<i>Agalinis skinneriana</i>	G3G4	S1	E	
Purple Giant-hyssop	<i>Agastache scrophulariifolia</i>	G4	S1S2	T	
Small-fruited Agrimony	<i>Agrimonia microcarpa</i>	G5	S1?		
Woodland Agrimony	<i>Agrimonia striata</i>	G5	S1	E	
Golden Colicroot	<i>Aletris aurea</i>	G5	SH	X	
Seaside Alder	<i>Alnus maritima</i>	G3	S3.1		
Seabeach Amaranth	<i>Amaranthus pumilus</i>	G2	S1	E	LT
Running Shadbush	<i>Amelanchier humilis</i>	G5	S1	T	
Nantucket Shadbush	<i>Amelanchier nantucketensis</i>	G3Q	S1	T	
Roundleaf Serviceberry	<i>Amelanchier sanguinea</i>	G5	S1	E	
Running Serviceberry	<i>Amelanchier spicata</i>	G5	S2		
Fly-poison	<i>Amianthium muscitoxicum</i>	G4G5	S2		
Koehne Ammannia	<i>Ammannia latifolia</i>	G5	S2		
Blue Maidencane	<i>Amphicarpum amphicarpon</i>	G4	S3		
Chaffweed	<i>Anagallis minima</i>	G5	SU	X	
Pearly Everlasting	<i>Anaphalis margaritacea</i>	G5	S3		
Canada Anemone	<i>Anemone canadensis</i>	G5	SH	X	
Mountain Thimbleweed	<i>Anemone lancifolia</i>	G5	S1?		
Great Angelica	<i>Angelica atropurpurea</i>	G5	SH	X	
Filmy Angelica	<i>Angelica triquinata</i>	G4	S1	E	
Single-head Pussytoes	<i>Antennaria solitaria</i>	G5	S2	T	
Vanilla Grass, Holy Grass	<i>Anthoxanthum hirtum</i>	G4G5	S1	E	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Spreading Rockcress	<i>Arabis patens</i>	G3	S3		
Hairy Rockcress	<i>Arabis pycnocarpa</i> var. <i>adpressipilis</i>	G5T4Q	S1S2		
Western Hairy Rockcress	<i>Arabis pycnocarpa</i> var. <i>pycnocarpa</i>	G5T5	S1		
Bristly Sarsaparilla	<i>Aralia hispida</i>	G5	S1	E	
American Spikenard	<i>Aralia racemosa</i>	G4G5	S2S4		
Bearberry	<i>Arctostaphylos uva-ursi</i>	G5	S1	E	
Dragon's Mouth Orchid	<i>Arethusa bulbosa</i>	G4	SH	X	
Woolly Three-awn	<i>Aristida lanosa</i>	G5	S1	E	
Seabeach Needlegrass	<i>Aristida tuberculosa</i>	G5	S3		
Wand-like Three-awn Grass	<i>Aristida virgata</i>	G5	S1S2	E	
Lake-cress	<i>Armoracia lacustris</i>	G4?	S1	E	
Leopard's-bane	<i>Arnica acaulis</i>	G4	S1	E	
Great Indian-plantain	<i>Arnoglossum reniforme</i>	G4	SH	X	
Purple Chokeberry	<i>Aronia prunifolia</i>	G4G5Q	S3		
Switch Cane	<i>Arundinaria tecta</i>	G5	S2		
Smooth Orange Milkweed	<i>Asclepias lanceolata</i>	G5	S1		
Purple Milkweed	<i>Asclepias purpurascens</i>	G5	S2		
Red Milkweed	<i>Asclepias rubra</i>	G4G5	S1	E	
Whorled Milkweed	<i>Asclepias verticillata</i>	G5	S3		
Bradley's Spleenwort	<i>Asplenium bradleyi</i>	G4	SH	X	
Lobed Spleenwort	<i>Asplenium pinnatifidum</i>	G4	S1	E	
Black-stem Spleenwort	<i>Asplenium resilens</i>	G5	S1	E	
Wallrue Spleenwort	<i>Asplenium ruta-muraria</i>	G5	S3		



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Canadian Milkvetch	<i>Astragalus canadensis</i>	G5T5	S1	E	
Ozark Milkvetch	<i>Astragalus distortus</i>	G5	S2	T	
Seabeach Orach/Crested Saltbush	<i>Atriplex mucronata</i>	G5	S1S2		
Smooth Yellow False Foxglove	<i>Aureolaria flava</i>	G5	S3		
Downy Yellow Foxglove	<i>Aureolaria laevigata</i>	G5	SU		
Big Carpetgrass	<i>Axonopus furcatus</i>	G5	S2?		
Tropical Water-hyssop	<i>Bacopa innominata</i>	G3G5	SH	X	
Blue Wild Indigo	<i>Baptisia australis</i>	G5	S2	T	
Twining Screwstem	<i>Bartonia paniculata</i>	G5T5	S3		
Gray Birch	<i>Betula populifolia</i>	G5	S1?		
Maryland Bur-marigold	<i>Bidens bidentoides</i>	G3G4	S3.1		
Small-fruit Beggarsticks	<i>Bidens mitis</i>	G4?	S1	E	
Tickseed Sunflower	<i>Bidens trichosperma</i>	G5	S2S3		
Downy Woodmint	<i>Blephilia ciliata</i>	G5	S3S4		
Hairy Woodmint	<i>Blephilia hirsuta</i>	G5	SH		
Susquehanna Doll's-daisy	<i>Boltonia asteroides</i> var. <i>asteroides</i>	GNRTNR	SH		
White Doll's-daisy	<i>Boltonia asteroides</i> var. <i>glastifolia</i>	G5TNR	S1	E	
Short's Rockcress	<i>Borodinia dentata</i>	G5	S3		
Missouri Rockcress	<i>Borodinia missouriensis</i>	G5	S1	E	
Sea Oxeye	<i>Borrchia frutescens</i>	G5	SH	X	
Lanceleaf Grapefern	<i>Botrychium lanceolatum</i> var. <i>angustisegmentum</i>	G5T4	S1	X	
Chamomile Grapefern	<i>Botrychium matricariifolium</i>	G5	S1?		



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Least Grapefern	<i>Botrychium simplex</i>	G5	SH	X	
Side-oats Grama	<i>Bouteloua curtipendula</i>	G5	S2		
Fringed Brome	<i>Bromus ciliatus</i>	G5	SH		
Wild Chess	<i>Bromus kalmii</i>	G5	SH	X	
Broad-glumed Brome	<i>Bromus latiglumis</i>	G5	S2	E	
Nottoway Brome	<i>Bromus nottowayanus</i>	G3G5	S3S4		
Bluehearts	<i>Buchnera americana</i>	G5?	SH	X	
Porter's Reedgrass	<i>Calamagrostis porteri</i>	G4T4	S3		
Wild Calla	<i>Calla palustris</i>	G5	S1	E	
French Mulberry	<i>Callicarpa americana</i>	G5	SH	X	
Tuberous Grass-pink	<i>Calopogon tuberosus</i>	G5	S1	E	
Low Bindweed	<i>Calystegia spithamea ssp. spithamea</i>	G5T4T5	S2		
Southern Harebell	<i>Campanula divaricata</i>	G4	SH	X	
American Harebell	<i>Campanula rotundifolia</i>	G5	S2		
Pale Corydalis	<i>Capnoides sempervirens</i>	G5	S3		
Purple Cress	<i>Cardamine douglassii</i>	G5	S3		
Long's Bittercress	<i>Cardamine longii</i>	G3?	S2	E	
American Bittercress	<i>Cardamine rotundifolia</i>	G4	S3		
Summer Sedge	<i>Carex aestivalis</i>	G4	S1	E	
White Bear Sedge	<i>Carex albursina</i>	G5	S3		
Appalachian Sedge	<i>Carex appalachica</i>	G4	S1?		
Water Sedge	<i>Carex aquatilis</i>	G5	S1		
Hay Sedge	<i>Carex argyrantha</i>	G5	S3		
Barratt's Sedge	<i>Carex barrattii</i>	G4	S3		
Brownish Sedge	<i>Carex brunnescens</i>	G5T5	S3		
Button Sedge	<i>Carex bullata</i>	G5	S3		



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Buxbaum's Sedge	<i>Carex buxbaumii</i>	G5	S2	T	
Carey's Sedge	<i>Carex careyana</i>	G4G5	S1	E	
Thin-leaved Sedge	<i>Carex cephaloidea</i>	G5	SH		
Field Sedge	<i>Carex conoidea</i>	G5	S1	E	
Crested Sedge	<i>Carex cristatella</i>	G5	S1?		
Davis' Sedge	<i>Carex davisii</i>	G4	S1	E	
Cypress-knee Sedge	<i>Carex decomposita</i>	G3	S1	E	
Lesser Panicked Sedge	<i>Carex diandra</i>	G5	S1	E	
Southern Slender Woodland Sedge	<i>Carex digitalis</i> <i>var. macropoda</i>	G5	S1?		
Ebony Sedge	<i>Carex eburnea</i>	G5	S1	E	
Prickly Sedge	<i>Carex echinata</i>	G5	S3		
Emory's Sedge	<i>Carex emoryi</i>	G5	S3		
Coast Sedge	<i>Carex exilis</i>	G5	S1	E	
Fraser's Sedge	<i>Carex fraseriana</i>	G4	S1	E	
Giant Sedge	<i>Carex gigantea</i>	G4	S3		
Southern Waxy Sedge	<i>Carex glaucescens</i>	G4	S1	E	
Cloud Sedge	<i>Carex haydenii</i>	G5	S1	E	
Pubescent Sedge	<i>Carex hirtaefolia</i>	G5	S3		
Hitchcock's Sedge	<i>Carex hitchcockiana</i>	G5	S1	E	
Shoreline Sedge	<i>Carex hyalinolepis</i>	G4G5	S2S3		
Porcupine Sedge	<i>Carex hystericina</i>	G5	S1	E	
Inland Sedge	<i>Carex interior</i>	G5	S1		
Joor's Sedge	<i>Carex jorii</i>	G4G5	S3		
Lake-bank Sedge	<i>Carex lacustris</i>	G5	S2		
Slender Sedge	<i>Carex lasiocarpa</i>	G5	S1	E	
Coupled Sedge	<i>Carex laxiculmis</i> <i>var. copulata</i>	G5T3T5	S1?		
Louisiana Sedge	<i>Carex louisianica</i>	G5	S3		
Blue Ridge Sedge	<i>Carex lucorum</i>	G4T4	S1		
False Hop Sedge	<i>Carex lupuliformis</i>	G4	S2		
Mead's Sedge	<i>Carex meadii</i>	G4	S1	E	
Andre Michaux's Sedge	<i>Carex michauxiana</i>	G5	SH		



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Mitchell's Sedge	<i>Carex mitchelliana</i>	G4	S2		
Sharpscale Sedge	<i>Carex oxylepis</i>	G5?TNR	S1?		
Long-stalked sedge	<i>Carex pedunculata</i>	G5	S1	E	
Woolly Sedge	<i>Carex pellita</i>	G5	S2?		
Flat-spiked Sedge	<i>Carex planispicata</i>	G4	S1S2		
Plantain-leaved Sedge	<i>Carex plantaginea</i>	G5	S1?		
Variable Sedge	<i>Carex polymorpha</i>	G3	SH	X	
Necklace Sedge	<i>Carex projecta</i>	G5	S2		
Richardson's Sedge	<i>Carex richardsonii</i>	G4	S1	E	
Sartwell's Sedge	<i>Carex sartwellii</i>	G4G5	SH		
Short's Sedge	<i>Carex shortiana</i>	G5	S2	T	
Seabeach Sedge	<i>Carex silicea</i>	G5	S1	E	
Bur-reed Sedge	<i>Carex sparganioides</i>	G5	S1S2		
Eastern Straw Sedge	<i>Carex straminea</i>	G5	S1S2		
Lined Sedge	<i>Carex striatula</i>	G5	S3		
Slender Sedge	<i>Carex tenera</i>	G5	SH	X	
Rigid Sedge	<i>Carex tetanica</i>	G4G5	S1	E	
Hairy-fruited Sedge	<i>Carex trichocarpa</i>	G4	S2		
Tuckerman's Sedge	<i>Carex tuckermanii</i>	G4	S1	E	
Dark Green Sedge	<i>Carex venusta</i>	G4T4	S3		
Inflated Sedge	<i>Carex vesicaria</i>	G5	S1	T	
Velvety Sedge	<i>Carex vestita</i>	G5	S2	T	
Big Shellbark Hickory	<i>Carya laciniosa</i>	G5	S1	E	
American Chestnut	<i>Castanea dentata</i>	G4	S2S3		
Scarlet Indian-paintbrush	<i>Castilleja coccinea</i>	G5	S1	E	
Erect Coinleaf	<i>Centella erecta</i>	G5	S3		
Coastal Butterfly Pea	<i>Centrosema virginianum</i>	G5	S3		
Octoraro Creek Chickweed	<i>Cerastium velutinum var. villosissimum</i>	G5T1	S1		



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Prickly Hornwort	<i>Ceratophyllum echinatum</i>	G4?	S1	E	
Partridge Pea	<i>Chamaecrista fasciculata</i> var. <i>macrosperma</i>	G5T3	S1	E	
Leatherleaf	<i>Chamaedapne calyculata</i>	G5	S1	E	
Devil's-bit	<i>Chamaelirium luteum</i>	G5	S2		
Red Turtlehead	<i>Chelone obliqua</i>	G5	S2	T	
Giant-seed Goosefoot	<i>Chenopodium simplex</i>	G5	S2	E	
Standley's Goosefoot	<i>Chenopodium standleyanum</i>	G5	S2	E	
Common Wintergreen	<i>Chimaphila umbellata</i>	G5T5	S3		
Green-and-gold	<i>Chrysogonum virginianum</i>	G5T5?	S3		
Bulb-bearing Water-hemlock	<i>Cicuta bulbifera</i>	G5	S1	E	
Slender Wood Reedgrass	<i>Cinna latifolia</i>	G5	S3		
Yellow Thistle	<i>Cirsium horridulum</i>	G5	S3		
Swamp Thistle	<i>Cirsium muticum</i>	G5	S3		
Carolina Springbeauty	<i>Claytonia caroliniana</i>	G5	S3		
Spreading Pogonia	<i>Cleistosiopsis divaricata</i>	G4	S1	E	
Purple Clematis	<i>Clematis occidentalis</i>	G5T5	S1	E	
Curly-heads	<i>Clematis ochroleuca</i>	G4	SH	X	
Vase-vine Leatherflower	<i>Clematis viorna</i>	G5	S3		
Harned's Clintonia	<i>Clintonia allegheniensis</i>	G1Q	S1		
Clinton Lily	<i>Clintonia borealis</i>	G5	S2	T	
Long-bract Green Orchis	<i>Coeloglossum viride</i>	G5T5	S1	E	
Wrinkled Jointgrass	<i>Coelorachis rugosa</i>	G5	S1	E	
Erect Dayflower	<i>Commelina erecta</i>	G5	S3		
Goldthread	<i>Coptis trifolia</i>	G5T5	S1	E	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Early Coralroot	<i>Corallorhiza trifida</i>	G5	S1	E	
Spring Coralroot	<i>Corallorhiza wisteriana</i>	G5	S1	E	
Rose Coreopsis	<i>Coreopsis rosea</i>	G3	S1	E	
Tall Tickseed	<i>Coreopsis tripteris</i>	G5	S1	E	
Whorled Coreopsis	<i>Coreopsis verticillata</i>	G5	S3		
Bunchberry	<i>Cornus canadensis</i>	G5	S1	E	
Roundleaf Dogwood	<i>Cornus rugosa</i>	G5	S1	E	
Beaked Hazelnut	<i>Corylus cornuta</i>	G5	S3		
Water Pygmyweed	<i>Crassula aquatica</i>	G5	SH	X	
Plains Frostweed	<i>Crocanthemum bicknellii</i>	G5	S1	E	
Hazel Dodder	<i>Cuscuta coryli</i>	G5?	SH	X	
Bigseed Dodder	<i>Cuscuta indecora</i>	G5T5	S2?		
Smartweed Dodder	<i>Cuscuta polygonorum</i>	G5	S1	E	
Beaked Dodder	<i>Cuscuta rostrata</i>	G4	S1	E	
Toothed Sedge	<i>Cyperus dentatus</i>	G4	SH	X	
Umbrella Flatsedge	<i>Cyperus diandrus</i>	G5	SU		
Sheathed Flatsedge	<i>Cyperus haspan</i>	G5	S1?		
Houghton's Umbrella-sedge	<i>Cyperus houghtonii</i>	G4?	S1		
Flatsedge	<i>Cyperus hystericinus</i>	G4	S2		
Many-flowered Umbrella-sedge	<i>Cyperus lancastriensis</i>	G5	SU		
Plukenet's Flatsedge	<i>Cyperus plukenetii</i>	G5	SH	X	
Reflexed Flatsedge	<i>Cyperus refractus</i>	G5	S2?		
Rough Flatsedge	<i>Cyperus retrofractus</i>	G5	S2		
Small White Lady's-slipper	<i>Cypripedium candidum</i>	G4	S1	E	
Large Yellow Lady's-slipper	<i>Cypripedium parviflorum var. pubescens</i>	G5T5	S3		



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Showy Lady's-slipper	<i>Cypripedium reginae</i>	G4	SH	X	
Bulblet Fern	<i>Cystopteris bulbifera</i>	G5	S3		
Tennessee Bladderfern	<i>Cystopteris tennesseensis</i>	G5	S1		
Tall Larkspur	<i>Delphinium exaltatum</i>	G3	S1	E	
Dwarf Larkspur	<i>Delphinium tricorne</i>	G5	S3		
Tufted Hairgrass	<i>Deschampsia cespitosa</i>	G5	S1	E	
Showy Tick-trefoil	<i>Desmodium canadense</i>	G5	SH		
Toothed Tick-trefoil	<i>Desmodium cuspidatum</i>	G5T5?	S1		
Fernald's Tick-trefoil	<i>Desmodium fernaldii</i>	G4	S1		
Trailing Tick-trefoil	<i>Desmodium humifusum</i>	G1G2Q	SH	X	
Smooth Tick-trefoil	<i>Desmodium laevigatum</i>	G5	S3		
Sand Tick-trefoil	<i>Desmodium lineatum</i>	G5	SH	X	
Nuttall's Tick-trefoil	<i>Desmodium nuttallii</i>	G5	S1?		
Stiff Tick-trefoil	<i>Desmodium obtusum</i>	G4G5	S1	E	
Cream Tick-trefoil	<i>Desmodium ochroleucum</i>	G1G2	S1	E	
Sessile-leaf Tick-trefoil	<i>Desmodium sessilifolium</i>	G5	SH	X	
Pineland Tick-trefoil	<i>Desmodium strictum</i>	G4	S1	E	
Wild Bleedinghearts	<i>Dicentra eximia</i>	G4	S2	T	
Needle Witchgrass	<i>Dichanthelium aciculare</i>	G5	S2?		
Ringed Witchgrass	<i>Dichanthelium annulum</i>	GNR	SH		
Northern Witchgrass	<i>Dichanthelium boreale</i>	G5	SU	X	
Open-flower Witchgrass	<i>Dichanthelium laxiflorum</i>	G5	S1?		
Roughish Witchgrass	<i>Dichanthelium leucothrix</i>	G4?Q	SU		



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Few-flowered Witchgrass	<i>Dichanthelium oligosanthes</i> var. <i>oligosanthes</i>	G5T5?	S2S3?		
Scribner's Witchgrass	<i>Dichanthelium oligosanthes</i> var. <i>scribnerianum</i>	G5T5	S2		
Ravenel's Witchgrass	<i>Dichanthelium ravenelii</i>	G5	SH		
Tall Swamp Witchgrass	<i>Dichanthelium scabriusculum</i>	G4	S1	E	
Wright's Witchgrass	<i>Dichanthelium wrightianum</i>	G4	S1	E	
Shaggy Crabgrass	<i>Digitaria villosa</i>	G5	SU	X	
Deep-root Clubmoss	<i>Diphasiastrum tristachyum</i>	G5	S3		
Eastern Leatherwood	<i>Dirca palustris</i>	G4	S2	T	
Cornel-leaf Aster	<i>Doellingeria infirma</i>	G5	S3		
Pink Sundew	<i>Drosera capillaris</i>	G5	S1	E	
Roundleaf Sundew	<i>Drosera rotundifolia</i>	G5	S3		
Mountain Woodfern	<i>Dryopteris campyloptera</i>	G5	S1	E	
Log Fern	<i>Dryopteris celsa</i>	G4	S3		
Clinton's Woodfern	<i>Dryopteris clintoniana</i>	G5	S1	E	
Goldie's Fern	<i>Dryopteris goldiana</i>	G4G5	S2		
Creeping Burhead	<i>Echinodorus cordifolius</i>	G5	S1	E	
American Waterwort	<i>Elatine americana</i>	G4	S3		
Small Waterwort	<i>Elatine minima</i>	G5	S1	E	
White Spikerush	<i>Eleocharis albida</i>	G4G5	S2S3		
Flat-stem Spikerush	<i>Eleocharis compressa</i>	G4	S1	E	
Engelmann's Spikerush	<i>Eleocharis engelmannii</i>	G4G5	S3		
Horsetail Spikerush	<i>Eleocharis equisetoides</i>	G4	S1	E	
Bald Spikerush	<i>Eleocharis erythropoda</i>	G5	SU		



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Saltmarsh Spikerush	<i>Eleocharis halophila</i>	G4	S1	E	
Matted Spikerush	<i>Eleocharis intermedia</i>	G5	S1	E	
Black-fruit Spikerush	<i>Eleocharis melanocarpa</i>	G4	S1	E	
Robbins' Spikerush	<i>Eleocharis robbinsii</i>	G4G5	S1	E	
Beaked Spikerush	<i>Eleocharis rostellata</i>	G5	S2?		
Twisted Spikerush	<i>Eleocharis tortilis</i>	G5	S3		
Three-angle Spikerush	<i>Eleocharis tricostata</i>	G4	S1	E	
Tobaccoweed	<i>Elephantopus tomentosus</i>	G5	S1	E	
Hairy Willowherb	<i>Epilobium ciliatum</i>	G5	S1	E	
Linear-leaf Willowherb	<i>Epilobium leptophyllum</i>	G5	S2S3		
Downy Willowherb	<i>Epilobium strictum</i>	G5?	S1	E	
Water Horsetail	<i>Equisetum fluviatile</i>	G5	S1	E	
Woodland Horsetail	<i>Equisetum sylvaticum</i>	G5	S1	E	
Meadow Lovegrass	<i>Eragrostis refracta</i>	G5	S3S4		
Harbinger-of-Spring	<i>Erigenia bulbosa</i>	G5	S3		
Braun's Robin's-plantain	<i>Erigeron pulchellus var. brauniae</i>	G5T4	S1		
Seven-angle Pipewort	<i>Eriocaulon aquaticum</i>	G5	S1	E	
Flattened Pipewort	<i>Eriocaulon compressum</i>	G5	S2		
Ten-angle Pipewort	<i>Eriocaulon decangulare</i>	G5T5?	S1		
Parker's Pipewort	<i>Eriocaulon parkeri</i>	G3	S2	T	
Slender Cottongrass	<i>Eriophorum gracile</i>	G5	S1	E	
Tawny Cottongrass	<i>Eriophorum virginicum</i>	G5	S3		



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Rattlesnake-master	<i>Eryngium yuccifolium</i>	G5	SH	X	
White Trout Lily	<i>Erythronium albidum</i>	G5	S2	T	
Tall Boneset	<i>Eupatorium altissimum</i>	G5	S3		
White-bracted Boneset	<i>Eupatorium leucolepis</i>	G5	S2S3	T	
Southeastern Flowering Spurge	<i>Euphorbia pubentissima</i>	G5	SU		
Glade Spurge/Darlington's Spurge	<i>Euphorbia purpurea</i>	G3	S1	E	
Warty Spurge	<i>Euphorbia spathulata</i>	G5	S1	E	
Low Rough Aster	<i>Eurybia radula</i>	G5	S1	E	
Low Showy Aster	<i>Eurybia spectabilis</i>	G5	S1	E	
Spotted Joe-pye Weed	<i>Eutrochium maculatum</i>	G5	SU	X	
Fringed Blackbindweed	<i>Fallopia cilinodis</i>	G5	S3		
Cluster Fescue	<i>Festuca paradoxa</i>	G5	S1?		
Queen-of-the-Prairie	<i>Filipendula rubra</i>	G4G5	S1	E	
Annual Fimbry	<i>Fimbristylis annua</i>	G5	S3		
Carolina Fimbry	<i>Fimbristylis caroliniana</i>	G4	S1S2		
Harper's Fimbristylis	<i>Fimbristylis perpusilla</i>	G2	S2	E	
Hairy Fimbristylis	<i>Fimbristylis puberula</i>	G5	SU		
Carolina Ash	<i>Fraxinus caroliniana</i>	G4G5	S2		
Black Ash	<i>Fraxinus nigra</i>	G5	S3		
Dwarf Umbrella-sedge	<i>Fuirena pumila</i>	G4	S2S3		
Downy Milkpea	<i>Galactia volubilis</i>	G5	S3		
Northern Bedstraw	<i>Galium boreale</i>	G5	S1	E	
Coast Bedstraw	<i>Galium hispidulum</i>	G5	S1	E	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Purple Bedstraw	<i>Galium latifolium</i>	G5	S3		
Creeping Snowberry	<i>Gaultheria hispidula</i>	G5	S1	E	
Box Huckleberry	<i>Gaylussacia brachycera</i>	G3	S1	E	
Dwarf Huckleberry	<i>Gaylussacia dumosa</i>	G5	S1	E	
Fringe-top Bottle Gentian	<i>Gentiana andrewsii</i>	G5?	S2	T	
Narrowleaf Gentian	<i>Gentiana linearis</i>	G4G5	S3		
Downy Gentian	<i>Gentiana puberulenta</i>	G4G5	SH	X	
Striped Gentian	<i>Gentiana villosa</i>	G4	S1	E	
Stiff Gentian	<i>Gentianella quinquefolia</i>	G5	S1	E	
Fringed Gentian	<i>Gentianopsis crinita</i>	G5	S1	E	
Herb-Robert	<i>Geranium robertianum</i>	G5	S1		
Yellow Avens	<i>Geum aleppicum</i>	G5	S1	E	
Rough Avens	<i>Geum laciniatum</i>	G5	S3		
Sharp-scaled Mannagrass	<i>Glyceria acutiflora</i>	G5	S1	E	
American Mannagrass	<i>Glyceria grandis</i>	G5	S1	E	
Angular-fruit Milkvine	<i>Gonolobus suberosus</i> var. <i>suberosus</i>	G5	S2		
Dwarf Rattlesnake-plantain	<i>Goodyera repens</i>	G5	SH	X	
Checkered Rattlesnake-plantain	<i>Goodyera tessellata</i>	G5	SH	X	
Branched Hedge-hyssop	<i>Gratiola ramosa</i>	G4G5	SH	X	
Short's Hedge-hyssop	<i>Gratiola viscidula</i>	G4G5	S1	E	
Northern Oak Fern	<i>Gymnocarpium dryopteris</i>	G5	S1	E	
Kentucky Coffeetree	<i>Gymnocladus dioicus</i>	G5	S1		
Shortleaf Beardgrass	<i>Gymnopogon brevifolius</i>	G5	S1	E	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Harperella	<i>Ptilimnium nodosum</i> [1]	G2	S1	E	LE
Stiff-hair Sunflower	<i>Helianthus hirsutus</i>	G5	S1		
Smooth Sunflower/Shale Barren Sunflower	<i>Helianthus laevigatus</i>	G4	S1	E	
McDowell's Sunflower	<i>Helianthus occidentalis</i>	G5T5	S1	T	
Swamp Pink	<i>Helonias bullata</i>	G3	S2	E	LT
Nuttall's Micranthemum	<i>Hemianthus micranthemoides</i>	GH	SH	X	
Cow-parsnip	<i>Heracleum maximum</i>	G5	S3		
Downy Alumroot	<i>Heuchera pubescens</i>	G4?	S3		
Hairy Alumroot	<i>Heuchera villosa</i>	G5	SH	X	
Crested Coralroot	<i>Hexalectris spicata</i>	G5	SH	X	
Virginia Heartleaf	<i>Hexastylis virginica</i>	G4	S1	E	
Halberd-leaf Rosemallow	<i>Hibiscus laevis</i>	G5	S3		
Glade Fern	<i>Homalosorus pycnocarpos</i>	G5	S2	T	
Sea Chickweed	<i>Honckenya peploides</i>	G5T4	S1	E	
Featherfoil	<i>Hottonia inflata</i>	G4	S1	E	
Michaux's Bluet	<i>Houstonia serpyllifolia</i>	G4?	S3		
Slender-leaved Bluets	<i>Houstonia tenuifolia</i>	GNR	S1		
Golden Heather	<i>Hudsonia ericoides</i>	G4	S1	E	
Rock Clubmoss	<i>Huperzia porophila</i>	G4	SX		
Green Violet	<i>Hybanthus concolor</i>	G5	S3		
Golden-seal	<i>Hydrastis canadensis</i>	G4	S2	T	
Large-leaf Waterleaf	<i>Hydrophyllum macrophyllum</i>	G5	S2	T	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Few-flower Tick-trefoil	<i>Hylodesmum pauciflorum</i>	G5	S2	E	
Creeping St. John's-wort	<i>Hypericum adpressum</i>	G3	S1	E	
Coppery St. John's-wort	<i>Hypericum denticulatum</i>	G5	S2	T	
Drummond's St. John's-wort	<i>Hypericum drummondii</i>	G5	SH	X	
Pale St. John's-wort	<i>Hypericum ellipticum</i>	G5	SU		
Clasping-leaf St. John's-wort	<i>Hypericum gymnanthum</i>	G5	S3		
Sharpleaf St. John's-wort	<i>Hypericum virgatum</i>	G4?	SH		
Deciduous Holly	<i>Ilex decidua</i>	G5	S2		
Mountain Holly	<i>Ilex mucronata</i>	G5	S3		
Eastern Bloodleaf	<i>Iresine rhizomatosa</i>	G5	S1	E	
Dwarf Crested Iris	<i>Iris cristata</i>	G5	S1	E	
Slender Blueflag	<i>Iris prismatica</i>	G4G5	S2	E	
Dwarf Iris	<i>Iris verna</i>	G5T3T5	S1	E	
Virginia Blueflag	<i>Iris virginica</i>	G5	S3		
Engelmann's Quillwort	<i>Isoetes engelmannii</i>	G5	S3		
Riverbank Quillwort	<i>Isoetes riparia</i>	G5?	SU		
Pipevine, Dutchman's Pipe	<i>Isotrema macrophyllum</i>	G5	S2	T	
Small Whorled Pogonia	<i>Isotria medeoloides</i>	G2	SH	X	LT
Butternut	<i>Juglans cinerea</i>	G4	S2S3		
Jointed Rush	<i>Juncus articulatus</i>	G5	S1		
Baltic Rush	<i>Juncus balticus</i>	G5T5	SH	X	
Small-head Rush	<i>Juncus brachycephalus</i>	G5	SH	X	
Narrow-panicle Rush	<i>Juncus brevicaudatus</i>	G5	S2		
New Jersey Rush	<i>Juncus caesariensis</i>	G2G3	S1	E	
Elliott's Rush	<i>Juncus elliotii</i>	G4G5	S1		
Long's Rush	<i>Juncus longii</i>	G3Q	S1	E	
Big-head Rush	<i>Juncus megacephalus</i>	G4G5	S1		



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Bayonet Rush	<i>Juncus militaris</i>	G5	SH	X	
Brown-fruit rush	<i>Juncus pelocarpus</i>	G5	S1	E	
Torrey's Rush	<i>Juncus torreyi</i>	G5	S1	E	
Highland Rush	<i>Juncus trifidus</i>	G5	S1	E	
Dwarf Juniper	<i>Juniperus communis</i>	G5	SH	X	
Sheep Laurel	<i>Kalmia angustifolia</i>	G5	S3S4		
Potato Dwarf-dandelion	<i>Krigia dandelion</i>	G5	S2S3		
Red Root	<i>Lachnanthes caroliniana</i>	G4	S1	E	
Hairy Lettuce	<i>Lactuca hirsuta</i>	G5	SH	X	
American Larch	<i>Larix laricina</i>	G5	S1	E	
Vetchling Peavine	<i>Lathyrus palustris</i>	G5	S1	E	
Virginian Beach Pinweed	<i>Lechea maritima</i>	G5T3Q	S3		
Slender Pinweed	<i>Lechea tenuifolia</i>	G5	SH	X	
Club-head Cutgrass	<i>Leersia hexandra</i>	G5	S1	E	
Catchfly Cutgrass	<i>Leersia lenticularis</i>	G5	S1	E	
Star Duckweed	<i>Lemna trisulca</i>	G5	S1	E	
Violet Lespedeza	<i>Lespedeza frutescens</i>	G5	S3		
Silky Lespedeza	<i>Lespedeza stuevei</i>	G5	S3		
Heller's Blazing Star/Shale-barren Blazing Star	<i>Liatris helleri</i>	G3	SH	X	
Prairie Blazing Star	<i>Liatris spicata</i>	G5	S1		
Scaly Gayfeather	<i>Liatris squarrosa</i>	G5T5	S1	E	
American Lovage	<i>Ligusticum canadense</i>	G4	SH	X	
Wood Lily	<i>Lilium philadelphicum</i>	G5	SH	X	
American Frog's-bit	<i>Limnobium spongia</i>	G4	S1	E	
Mudwort	<i>Limosella australis</i>	G4G5	S2	E	
Sandplain Flax	<i>Linum intercursum</i>	G4	S2	T	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Grooved Yellow Flax	<i>Linum sulcatum</i>	G5	S1	E	
Large Twayblade	<i>Liparis liliifolia</i>	G5	S2S3		
Loesel's Twayblade	<i>Liparis loeselii</i>	G5	S1S2		
Dwarf Bulrush	<i>Lipocarpha micrantha</i>	G5	S1	E	
Southern Twayblade	<i>Listera australis</i>	G4	S3		
Heartleaf Twayblade	<i>Listera cordata</i>	G5T5	SH	X	
Kidneyleaf Twayblade	<i>Listera smallii</i>	G4	S1	E	
American Gromwell	<i>Lithospermum latifolium</i>	G4	S1	E	
Hairy False Gromwell	<i>Lithospermum parviflorum</i>	G4G5	S1	E	
Virginia False Gromwell	<i>Lithospermum virginianum</i>	G4	S1	E	
Pondspice	<i>Litsea aestivalis</i>	G3	S1	E	
Canby's Lobelia	<i>Lobelia canbyi</i>	G4	S2	E	
Elongated Lobelia	<i>Lobelia elongata</i>	G4G5	S3		
American Fly Honeysuckle	<i>Lonicera canadensis</i>	G5	S1	E	
Primrose-willow	<i>Ludwigia decurrens</i>	G5	S2S3		
Cylindric-fruit Seedbox	<i>Ludwigia glandulosa</i>	G5T5	S1	E	
Hairy Ludwigia	<i>Ludwigia hirtella</i>	G5	S1	E	
Sundial Lupine	<i>Lupinus perennis</i>	G5	S2	T	
Bog Clubmoss	<i>Lycopodiella inundata</i>	G5	S2		
Sessile-leaf Bugleweed	<i>Lycopus amplexans</i>	G5	S1	E	
Climbing Fern	<i>Lygodium palmatum</i>	G4	S2	T	
Lowland Loosestrife	<i>Lysimachia hybrida</i>	G5	S2	T	
Lanceleaf Loosestrife	<i>Lysimachia lanceolata</i>	G5	S3		
Sea Milkwort	<i>Lysimachia maritima</i>	G5	SH	X	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Water Loosestrife	<i>Lysimachia thyrsiflora</i>	G5	S1	E	
Winged Loosestrife	<i>Lythrum alatum</i>	G5	S1	E	
Umbrella Magnolia	<i>Magnolia tripetala</i>	G5	S3		
Starflower Solomon's-plume	<i>Maianthemum stellatum</i>	G5	S2	E	
Green Adders-mouth Orchid	<i>Malaxis unifolia</i>	G5	S1S3		
Southern Crabapple	<i>Malus angustifolia</i>	G5	S3		
Carolina Anglepod	<i>Matelea caroliniensis</i>	G4	S2	E	
Climbing Milkweed	<i>Matelea obliqua</i>	G4?	S1S2	E	
Ostrich Fern	<i>Matteuccia struthiopteris</i>	G5	S2S3		
Purple Mecardonia	<i>Mecardonia acuminata</i>	G5T5	S2	E	
Narrow Melicgrass	<i>Melica mutica</i>	G5	S3		
Three-flower Melicgrass	<i>Melica nitens</i>	G5	S2	T	
Guadeloupe Cucumber	<i>Melothria pendula</i>	G5?T5?	S2	E	
Bog Buckbean	<i>Menyanthes trifoliata</i>	G5	S1	E	
Lettuceleaf Saxifrage	<i>Micranthus micranthidifolia</i>	G5	S3		
Carolina Sandwort	<i>Minuartia caroliniana</i>	G5	S1	E	
Appalachian Sandwort	<i>Minuartia glabra</i>	G4	S1	E	
Michaux's Stitchwort	<i>Minuartia michauxii</i>	G5T5	S2	T	
Grove Sandwort	<i>Moehringia lateriflora</i>	G5	S1	E	
Basil Beebalm	<i>Monarda clinopodia</i>	G5	S3S4		
Purple Bergamot	<i>Monarda media</i>	G4?	SH		
Sweet Pinesap	<i>Monotropsis odorata</i>	G3	S1	E	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Evergreen Bayberry	<i>Morella caroliniensis</i>	G5	S1	E	
Hair-awn Muhly	<i>Muhlenbergia capillaris</i>	G5	S1	E	
Hairgrass	<i>Muhlenbergia glabriflora</i>	G4?	SH		
Marsh Muhly	<i>Muhlenbergia glomerata</i>	G5	SH		
Woodland Muhly	<i>Muhlenbergia sylvatica</i>	G5	S3		
Torrey's Dropseed	<i>Muhlenbergia torreyana</i>	G3	S1	E	
Large-seed Forget-me-not	<i>Myosotis macrosperma</i>	G5	S3S4		
Spring Forget-me-not	<i>Myosotis verna</i>	G5	S3		
Broadleaf Water-milfoil	<i>Myriophyllum heterophyllum</i>	G5	S1		
Slender Water-milfoil	<i>Myriophyllum tenellum</i>	G5	SH	X	
Whorled Water-milfoil	<i>Myriophyllum verticillatum</i>	G5	SU		
Slender Rattlesnake-root	<i>Nabalus autumnalis</i>	G4G5	S1	E	
Slender Naiad	<i>Najas flexilis</i>	G5	S3		
Thread-like Naiad	<i>Najas gracillima</i>	G5?	SU	X	
Southern Naiad	<i>Najas guadalupensis</i>	G5	S3		
Glade Mallow	<i>Napaea dioica</i>	G4	S1	E	
Small-flower Baby-blue-eyes	<i>Nemophila aphylla</i>	G5	S2		
Big Floatingheart	<i>Nymphoides aquatica</i>	G5	S1	E	
Little Floatingheart	<i>Nymphoides cordata</i>	G5	S1	E	
Shale Barren Evening-primrose	<i>Oenothera argillicola</i>	G3G4	S3		
Clustered Bluets	<i>Oldenlandia uniflora</i>	G5	S3		
False Scurfpea	<i>Orbexilum pedunculatum</i>	G5T4	SX		
One-side Wintergreen	<i>Orthilia secunda</i>	G5	SH	X	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Mountain-ricegrass	<i>Oryzopsis asperifolia</i>	G5	S2	T	
Sourwood	<i>Oxydendrum aboreum</i>	G5	S1	E	
Shale-barren Ragwort/Cat's-paw Ragwort	<i>Packera antennariifolia</i>	G4	S3		
Balsam Ragwort	<i>Packera paupercula</i>	G5	S3		
American Ginseng	<i>Panax quinquefolius</i>	G3G4	S2S3		
Wiry Witch Grass	<i>Panicum flexile</i>	G5	S1	E	
Maidencane	<i>Panicum hemitomon</i>	G5	S3		
Philadelphia Panicgrass	<i>Panicum philadelphicum</i>	G5	SU		
Kidneyleaf Grass-of-parnassus	<i>Parnassia asarifolia</i>	G4	S1	E	
Yellow Nailwort/Virginia Whitlow-wort	<i>Paronychia virginica</i>	G4	S1	E	
Wild Quinine	<i>Parthenium integrifolium</i>	G5T5	S1	E	
Walter's Paspalum	<i>Paspalum dissectum</i>	G4?	S2	T	
Horse-tail Paspalum	<i>Paspalum fluitans</i>	G5	S1	E	
Mountain-ricegrass	<i>Patis racemosa</i>	G5	S2	T	
Canby's Mountain-lover	<i>Paxistima canbyi</i>	G2	S1	E	
Swamp Lousewort	<i>Pedicularis lanceolata</i>	G5	S1	E	
Smooth Cliffbrake	<i>Pellaea glabella</i>	G5T5	S1	E	
Smooth Beardtongue	<i>Penstemon laevigatus</i>	G5	S3		
Red Bay	<i>Persea palustris</i>	G5	S1	E	
Stout Smartweed	<i>Persicaria robustior</i>	G4G5	SU	X	
Swamp Smartweed	<i>Persicaria setacea</i>	G5	SU		
Coville's Phacelia	<i>Phacelia covillei</i>	G3	S2	E	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Miami-mist	<i>Phacelia purshii</i>	G5	S3		
Wild Kidney Bean	<i>Phaseolus polystachios</i>	G5	S3		
Northern Beechfern	<i>Phegopteris connectilis</i>	G5	S2		
Roundleaf Fameflower	<i>Phemeranthus teretifolius</i>	G4	S2	T	
Smooth Phlox	<i>Phlox glaberrima</i>	G5	S1	E	
Mountain Phlox	<i>Phlox ovata</i>	G4	SH	X	
Downy Phlox	<i>Phlox pilosa</i>	G5	S1	E	
Carolina Leaf-flower	<i>Phyllanthus caroliniensis</i>	G5T5?	S3		
Virginia Ground-cherry	<i>Physalis virginiana</i>	G5	S3		
Red Spruce	<i>Picea rubens</i>	G5	S3		
Springs Clearweed	<i>Pilea fontana</i>	G5	S3		
Heartleaf Plantain	<i>Plantago cordata</i>	G4	SH	X	
White Fringed Orchid	<i>Platanthera blephariglottis</i> var. <i>blephariglottis</i>	G4G5	S2	T	
Yellow Fringed Orchid	<i>Platanthera ciliaris</i>	G5	S2	T	
Crested Yellow Orchid	<i>Platanthera cristata</i>	G5	S3		
Pale Green Orchid	<i>Platanthera flava</i>	G4	S2		
Large Purple Fringed Orchid	<i>Platanthera grandiflora</i>	G5	S2	T	
Purple Fringeless Orchid	<i>Platanthera peramoena</i>	G5	S1S2	T	
Small Purple Fringed Orchid	<i>Platanthera psychodes</i>	G5	SH	X	
Shriver's Frilly Orchis	<i>Platanthera shriveri</i>	GNR	S1		
Resurrection Fern	<i>Pleopeltis polypodioides</i> var. <i>michauxiana</i>	G5T5	S3		
Marsh Fleabane	<i>Pluchea camphorata</i>	G5	S1	E	
Fowl Bluegrass	<i>Poa palustris</i>	G5	SH		
Dropping Bluegrass	<i>Poa saltuensis</i>	G5	S1	E	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Threadfoot	<i>Podostemum ceratophyllum</i>	G5	S3		
Rose Pogonia	<i>Pogonia ophioglossoides</i>	G5	S3		
Common Clammyweed	<i>Polanisia dodecandra</i>	G5T5	S1	E	
Bog Jacob's Ladder	<i>Polemonium vanbruntiae</i>	G3G4	S2	T	
Crossleaf Milkwort	<i>Polygala cruciata</i>	G5	S2	T	
Pink Milkwort	<i>Polygala incarnata</i>	G5	S2S3		
Racemed Milkwort	<i>Polygala polygama</i>	G5	S1	T	
Seneca Snakeroot	<i>Polygala senega</i>	G4G5	S2	T	
Seaside Knotweed	<i>Polygonum glaucum</i>	G3	S1	E	
Bushy Knotweed	<i>Polygonum ramosissimum</i>	G5	SH	X	
Largeleaf Pondweed	<i>Potamogeton amplifolius</i> [2]	G5	S1S2		
Leafy Pondweed	<i>Potamogeton foliosus</i>	G5	S1	E	
Illinois Pondweed	<i>Potamogeton illinoensis</i> 2	G5	S2		
Claspingleaf Pondweed	<i>Potamogeton perfoliatus</i>	G5	S2		
Slender Pondweed	<i>Potamogeton pusillus</i>	G5	S1		
Richardson's Pondweed	<i>Potamogeton richardsonii</i>	G5	SH	X	
Flatleaf Pondweed	<i>Potamogeton robbinsii</i>	G5	SH	X	
Spiral Pondweed	<i>Potamogeton spirillus</i>	G5	S1		
Flatstem Pondweed	<i>Potamogeton zosteriformis</i>	G5	S1	E	
Tall Cinquefoil	<i>Potentilla arguta</i>	G5	SH		
Common Shootingstar	<i>Primula meadia</i>	G5	S3		
Allegheny Plum	<i>Prunus alleghaniensis</i>	G4	S2	T	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Beach Plum	<i>Prunus maritima</i>	G4	S1	E	
Susquehanna Sandcherry	<i>Prunus susquehanae</i>	G4	SH		
Carolina Clubmoss	<i>Pseudolycopodiella caroliniana</i>	G5	S1	E	
Common Hoptree	<i>Ptelea trifoliata</i>	G5	S3		
Basil Mountainmint	<i>Pycnanthemum clinopodioides</i>	G1G2	SH		
Southern Mountainmint	<i>Pycnanthemum pycnanthemoides</i>	G5	SH	X	
Torrey's Mountainmint	<i>Pycnanthemum torreyi</i>	G2	S1	E	
Whorled Mountainmint	<i>Pycnanthemum verticillatum</i>	G5	S1	E	
Virginia Mountainmint	<i>Pycnanthemum virginianum</i>	G5	S2		
Green-flower Wintergreen	<i>Pyrola chlorantha</i>	G5	SH	X	
Bur Oak, Mossycup Oak	<i>Quercus macrocarpa</i>	G5	S1		
Shumard Oak	<i>Quercus shumardii</i>	G5	S2	T	
Allegheny Mountains Buttercup	<i>Ranunculus allegheniensis</i>	G4G5	S3		
Water-plantain Spearwort	<i>Ranunculus ambiguus</i>	G4	S1	X	
Hispid Buttercup/Carolina Buttercup	<i>Ranunculus carolinianus</i>	G5	SU	X	
Early Buttercup	<i>Ranunculus fascicularis</i>	G5	S1	E	
Yellow Water-crowfoot	<i>Ranunculus flabellaris</i>	G5	S1	E	
Long-stalked Crowfoot	<i>Ranunculus hederaceus</i>	G5	S1	E	
Mississippi Buttercup	<i>Ranunculus laxicaulis</i>	G5?	S1		
Bristly Crowfoot	<i>Ranunculus pennsylvanicus</i>	G5	SH	X	
Pursh's Buttercup	<i>Ranunculus pusillus</i>	G5	SU		
Threadleaf Water Crowfoot	<i>Ranunculus trichophyllus</i>	G5T5	S1	E	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Alderleaf Buckthorn	<i>Rhamnus alnifolia</i>	G5	S1		
Smooth Azalea	<i>Rhododendron arborescens</i>	G4G5	S3		
Flame Azalea	<i>Rhododendron calendulaceum</i>	G5	S1		
Hairy Snoutbean	<i>Rhynchosia tomentosa</i>	G5	S2	T	
White Beakrush	<i>Rhynchospora alba</i>	G5	S3		
Capitate Beakrush	<i>Rhynchospora cephalantha</i>	G5	S1	E	
Globe Beakrush	<i>Rhynchospora globularis</i>	G5?T5?	S1	E	
Clustered Beakrush	<i>Rhynchospora glomerata</i>	G5T5?	S3		
Harper's Beakrush	<i>Rhynchospora harperi</i>	G4?	S1	E	
Drowned Hornrush	<i>Rhynchospora inundata</i>	G4?	S1	E	
Small-headed Beakrush	<i>Rhynchospora microcephala</i>	G5	S2		
Short-beaked Baldrush	<i>Rhynchospora nitens</i>	G4?	S1	E	
Feather-bristle Beaksedge	<i>Rhynchospora oligantha</i>	G4	SH	X	
Pale Beakrush	<i>Rhynchospora pallida</i>	G3	SH	X	
Few-flowered Beakrush	<i>Rhynchospora rariflora</i>	G5	SU	X	
Cymose Beakrush	<i>Rhynchospora recognita</i>	G5?	S2		
Long-beaked Baldrush	<i>Rhynchospora scirpoides</i>	G4	S2	T	
Torrey's Beakrush	<i>Rhynchospora torreyana</i>	G4	S2	T	
Wild Black Currant	<i>Ribes americanum</i>	G5	SH	X	
Prickly Gooseberry	<i>Ribes cynosbati</i>	G5	S3		
Skunk Currant	<i>Ribes glandulosum</i>	G5	S3		
Smooth Rose	<i>Rosa blanda</i>	G5	S1	E	
Orange Coneflower	<i>Rudbeckia fulgida</i>	G5	S3		



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Brown-eyed Susan	<i>Rudbeckia triloba</i>	G5T4T5	S3		
Hairy Wild Petunia	<i>Ruellia humilis</i>	G5	S1	E	
Pursh's Wild Petunia	<i>Ruellia purshiana</i>	G3	S1	E	
Limestone Wild Petunia	<i>Ruellia strepens</i>	G4G5	S2S3		
Tall Dock	<i>Rumex altissimus</i>	G5	S1	E	
Slender Marsh Pink	<i>Sabatia campanulata</i>	G5	S1	E	
Two-formed Pink	<i>Sabatia difformis</i>	G4G5	S1	E	
Large Marsh Pink	<i>Sabatia dodecandra</i>	G5?	S3		
Silver Plume Grass	<i>Saccharum alopecuroides</i>	G5	S1?		
Slender Plume Grass	<i>Saccharum baldwinii</i>	G5	S1	E	
Bent-awn Plume Grass	<i>Saccharum contortum</i>	G5	S3S4		
Gibbous Panic-grass	<i>Sacciolepis striata</i>	G5	S1	E	
Engelmann's Arrowhead	<i>Sagittaria engelmanniana</i>	G5?	S2	T	
Grassleaf Arrowhead	<i>Sagittaria graminea</i>	G5	SU		
Sessile-fruit Arrowhead	<i>Sagittaria rigida</i>	G5	S1	E	
Spongy Arrowhead	<i>Sagittaria spatulata</i>	G5	S2		
Strap-leaf Arrowhead	<i>Sagittaria subulata</i>	G4	SU		
Bebb's Willow	<i>Salix bebbiana</i>	G5	SH	X	
Carolina Willow	<i>Salix caroliniana</i>	G5	S3		
Pussy Willow	<i>Salix discolor</i>	G5	SH		
Narrowleaf Willow	<i>Salix exigua</i>	G5	S1	E	
Shining Willow	<i>Salix lucida</i>	G5	SH	X	
Dwarf Prairie Willow	<i>Salix occidentalis</i>	G5	S2		
Nettleleaf Sage	<i>Salvia urticifolia</i>	G5	SX	X	
Canada Burnet	<i>Sanguisorba canadensis</i>	G5	S2	T	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Maryland Black-snakeroot	<i>Sanicula marilandica</i>	G5	S3		
Large-fruited Sanicle	<i>Sanicula trifoliata</i>	G4	S3		
Northern Pitcherplant	<i>Sarracenia purpurea</i>	G5	S2	T	
Leathery Grapefern	<i>Sceptridium multifidum</i>	G5	SH	X	
Blunt-lobe Grapefern	<i>Sceptridium oneidense</i>	G4	S1	E	
Purple Oat	<i>Schizachne purpurascens</i>	G5	S1	E	
Canby's Bulrush	<i>Schoenoplectus etuberculatus</i>	G3G4	SH	X	
Salt-marsh Bulrush	<i>Schoenoplectus novae-angliae</i>	G5	S2		
Smith's Bulrush	<i>Schoenoplectus smithii</i>	G5?	SH	X	
Water Bulrush	<i>Schoenoplectus subterminalis</i>	G4G5	S1	E	
Torrey's Bulrush	<i>Schoenoplectus torreyi</i>	G5	S1		
Chaffseed	<i>Schwalbea americana</i>	G2G3	SH	X	LE
Northeastern Bulrush	<i>Scirpus ancistrochaetus</i>	G3	S1	E	LE
Woodland Bulrush	<i>Scirpus expansus</i>	G4	S3		
Mosquito Bulrush	<i>Scirpus hattorianus</i>	G5	SU		
Slender Nutrush	<i>Scleria minor</i>	G4	S1	E	
Muehlenberg's Nutrush	<i>Scleria muehlenbergii</i>	G5	S1S2		
Shining Nutrush	<i>Scleria nitida</i>	GNR	S1	E	
Little-head Nutrush	<i>Scleria oligantha</i>	G5	S1		
Reticulated Nutrush	<i>Scleria reticularis</i>	G4	S2S3		
Whip Nutrush	<i>Scleria triglomerata</i>	G5	S3		
Low Nutrush	<i>Scleria verticillata</i>	G5	S1	E	
One-flower Sclerolepis	<i>Sclerolepis uniflora</i>	G4	S2	T	
Hare Figwort	<i>Scrophularia lanceolata</i>	G5	S3		



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Hooded Skullcap	<i>Scutellaria galericulata</i>	G5	S2		
Hoary Skullcap	<i>Scutellaria incana</i>	G5T5	S3		
Leonard's Skullcap	<i>Scutellaria leonardii</i>	G4	S2	T	
Veined Skullcap	<i>Scutellaria nervosa</i>	G5	S1S2	E	
Heartleaf Skullcap	<i>Scutellaria ovata</i>	G5TNR	S3		
Rock Skullcap	<i>Scutellaria saxatilis</i>	G3	S1	E	
Showy Skullcap	<i>Scutellaria serrata</i>	G4G5	S3		
Cliff Stonecrop	<i>Sedum glaucophyllum</i>	G4	S2	T	
Sweet-scented Indian-plantain	<i>Senecio suaveolens</i>	G4	S1	E	
Maryland Wild Senna	<i>Senna marilandica</i>	G5	S3		
Puerto Rico Sea-Purslane	<i>Sesuvium maritimum</i>	G5	S1	E	
Virginia Mallow	<i>Sida hermaphrodita</i>	G3	S1	E	
Snowy Campion	<i>Silene nivea</i>	G4?	S1	E	
Threeleaf Rosinweed	<i>Silphium astericus Linneaus var. trifoliatum</i>	G4?T4?	S3		
Sandplains Blue-eyed Grass	<i>Sisyrinchium arenicola</i>	GNR	S1	E	
Saw Greenbrier	<i>Smilax bona-nox</i>	G5	S3		
Upright Greenbrier	<i>Smilax ecirrata</i>	G5?	S1S3		
Long-stalk Greenbrier	<i>Smilax pseudochina</i>	G4G5	S2	T	
Late Goldenrod	<i>Solidago arguta var. arguta</i>	G5T4T5	S1?		
Shale barren Goldenrod	<i>Solidago arguta var. harrisii</i>	G5T4	S3		
Hairy Goldenrod	<i>Solidago hispida</i>	G5	S3		
Elliott's Goldenrod	<i>Solidago latissimifolia</i>	G5	S3		
Sharp-leaved Goldenrod	<i>Solidago patula</i>	G5T5	S3		
Racemose Goldenrod	<i>Solidago racemosa</i>	G5T3	S1	T	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Prairie Goldenrod	<i>Solidago rigida</i>	G5	S1	X	
Roan Mountain Goldenrod	<i>Solidago roanensis</i>	G4G5	S1?	X	
Rock Goldenrod	<i>Solidago rupestris</i>	G4	SH	X	
Showy Goldenrod	<i>Solidago speciosa</i>	G5T5?	S2	T	
Coastal Goldenrod	<i>Solidago tarda</i>	G4?	S1		
Bog Goldenrod	<i>Solidago uliginosa</i>	G4G5	S3		
American Mountain Ash	<i>Sorbus americana</i>	G5	S3		
Long-bristle Indian Grass	<i>Sorghastrum elliottii</i>	G5	S1	E	
Branching Bur-reed	<i>Sparganium androcladum</i>	G4G5	SU		
Greenfruit Bur-reed	<i>Sparganium emersum</i>	G5	S3		
Giant Bur-reed	<i>Sparganium eurycarpum</i>	G5	S3		
Smooth Buttonweed	<i>Spermacoce glabra</i>	G4G5	S1	E	
Swamp Oats	<i>Sphenopholis pennsylvanica</i>	G4	S2	T	
Large Yellow Lady's-slipper	<i>Spiraea betulifolia Pallas var. corymbosa</i>	G5T5	S3		
Shining Ladies'-tresses	<i>Spiranthes lucida</i>	G5	S1	E	
Yellow Ladies'-tresses	<i>Spiranthes ochroleuca</i>	G4	S1	E	
Fragrant Ladies'-tresses	<i>Spiranthes odorata</i>	G5	SH	X	
Grass-leaved Ladies'-tresses	<i>Spiranthes praecox</i>	G5	SH		
Little Ladies'-tresses	<i>Spiranthes tuberosa</i>	G5	S1?		
Rough Dropseed	<i>Sporobolus clandestinus</i>	G5	S2		
Northern Dropseed	<i>Sporobolus heterolepis</i>	G5	S1	E	
Gritty Hedge-nettle	<i>Stachys aspera</i>	G4?	S1	E	
Hyssopleaf Hedge-nettle	<i>Stachys hyssopifolia</i>	G4G5	S1		



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Nuttall's Hedge-nettle	<i>Stachys nuttallii</i>	G4G5	SH		
Trailing Stitchwort	<i>Stellaria alsine</i>	G5	S1	E	
Eastern Featherbells	<i>Stenanthium gramineum</i>	G4G5T3T5	S1	T	
Pine Barren Deathcamas	<i>Stenanthium leimanthoides</i>	G4Q	S1	E	
Rosy Twisted-stalk	<i>Streptopus lanceolatus</i>	G5	S1S2	T	
Narrowleaf Seepweed	<i>Suaeda linearis</i>	G5	S3		
Common Snowberry	<i>Symphoricarpos albus</i>	G5T5	S1	T	
Eastern Silvery Aster	<i>Symphyotrichum concolor</i>	G5	S1	E	
Serpentine Aster	<i>Symphyotrichum depauperatum</i>	G2	S1	E	
Drummond's Aster	<i>Symphyotrichum drummondii</i>	G4G5T4T5	S1		
Smooth Blue Aster	<i>Symphyotrichum laeve</i> var. <i>concinnum</i>	G5T4	S1?	X	
Willow Aster	<i>Symphyotrichum praealtum</i>	G5	S1		
Short's Aster	<i>Symphyotrichum shortii</i>	G5	S3S4		
Horsesugar	<i>Symplocos tinctoria</i>	G5	S3		
Mountain Parsley	<i>Taenidia montana</i>	G3	S2	T	
Canada Yew	<i>Taxus canadensis</i>	G5	S2	T	
Spiked Hoary-pea	<i>Tephrosia spicata</i>	G4G5	S1S2	E	
Purple Meadow-parsnip	<i>Thaspium trifoliatum</i>	G5	S1	E	
Bog Fern	<i>Thelypteris simulata</i>	G4	S2	T	
Climbing Dogbane	<i>Thrysanthella difformis</i>	G5	S1	E	
American Arborvitae	<i>Thuja occidentalis</i>	G5	S1	T	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Canby's Dropwort	<i>Oxypolis canbyi</i> [3]	G2	S1	E	LE
Spanish Moss	<i>Tillandsia usneoides</i>	G5	SX		
Fernald's Mannagrass	<i>Torreyochloa pallida</i> var. <i>fernaldii</i>	G5	S1		
Pale Mannagrass	<i>Torreyochloa pallida</i> var. <i>pallida</i>	G5	S3		
Tassel-rue	<i>Trautvettaria caroliniensis</i>	G5	S3		
Coastal False Asphodel	<i>Triantha racemosum</i>	G5	SX		
Bashful Sedge	<i>Trichophorum planifolium</i>	G5	S2		
Glade Bluecurls	<i>Trichostema brachiatum</i>	G5	S3		
Narrowleaf Bluecurls	<i>Trichostema setaceum</i>	G5	S1		
Chapman's Redtop	<i>Tridens chapmanii</i>	G3	S1		
Buffalo Clover	<i>Trifolium reflexum</i>	G3G4	SH	X	
Kate's Mountain Clover	<i>Trifolium virginicum</i>	G3	S2S3	T	
Three-ribbed Arrow-grass	<i>Triglochin striata</i>	G5	S1	E	
Northern Nodding Trillium	<i>Trillium cernuum</i>	G5	S3		
Nodding Trillium	<i>Trillium flexipes</i>	G5	S1	E	
Snow Trillium	<i>Trillium nivale</i>	G4	S1	E	
Virginia Least Trillium	<i>Trillium pusillum</i> var. <i>virginianum</i>	G3T2	S2	T	
Yellowleaf Tinker's-weed	<i>Triosteum angustifolium</i>	G5	S1	E	
Nodding Pogonia	<i>Triphora trianthophora</i>	G3G4	S1	E	
Southern Cattail	<i>Typha domingensis</i>	G4G5	S3		
Horned Bladderwort	<i>Utricularia cornuta</i>	G5	S1		



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Swollen Bladderwort	<i>Utricularia inflata</i>	G5	S1	E	
Flatleaf Bladderwort	<i>Utricularia intermedia</i>	G5	S1		
Purple Bladderwort	<i>Utricularia purpurea</i>	G5	S1	T	
Northeastern Bladderwort	<i>Utricularia resupinata</i>	G4	S1	E	
Fibrous Bladderwort	<i>Utricularia striata</i>	G4G5	S1	E	
Zigzag Bladderwort	<i>Utricularia subulata</i>	G5	S3		
Large-flower Bellwort	<i>Uvularia grandiflora</i>	G5	S1	E	
Large Cranberry	<i>Vaccinium macrocarpon</i>	G4	S3		
Velvetleaf Blueberry	<i>Vaccinium myrtilloides</i>	G5	S3		
Small Cranberry	<i>Vaccinium oxycoccos</i>	G5	S2	T	
Valerian	<i>Valeriana pauciflora</i>	G4	S1	E	
Goosefoot Cornsalad	<i>Valerianella chenopodiifolia</i>	G5	S1	E	
Navel-shaped Cornsalad	<i>Valerianella umbilicata</i>	G3G5	SH	X	
Broadleaf Bunchflower	<i>Veratrum hybridum</i>	G5	S1	E	
Virginia Bunchflower	<i>Veratrum virginicum</i>	G5	S3		
Giant Ironweed	<i>Vernonia gigantea</i>	G5	SU		
Marsh Speedwell	<i>Veronica scutellata</i>	G5	S1	E	
Nannyberry	<i>Viburnum lentago</i>	G5	S1		
American Purple Vetch	<i>Vicia americana</i>	G5T5	SH	X	
Appalachian Blue Violet	<i>Viola appalachiensis</i>	G4	S3		
Salad Violet	<i>Viola esculenta</i>	G4G5	S2		
Long-spur Violet	<i>Viola rostrata</i>	G5	S3		
Rock Grape	<i>Vitis rupestris</i>	G3	S1		
Sword Bogmat	<i>Wolffiella gladiata</i>	G5	SH	X	
Rusty Woodsia	<i>Woodsia ilvensis</i>	G5	S2	T	
Fringed Yellow-eyed-grass	<i>Xyris fimbriata</i>	G5	S1	E	



Common Name	Scientific Name	G-Rank ¹	S-Rank ¹	State-listed ²	Federally listed ²
Small's Yellow-eyed-grass	<i>Xyris smalliana</i>	G5	S1	E	
Northern Prickly-ash	<i>Zanthoxylum americanum</i>	G5	S1S2	E	
Atamasco Lily	<i>Zephyranthes atamasca</i>	G4G5	S1	E	
Southern Wild Rice	<i>Zizaniopsis miliacea</i>	G5	S1	E	
Golden Alexanders	<i>Zizia aurea</i>	G5	S3		

¹ = See Table 3.5 for S-rank and G-rank definitions

² = T (Threatened); E (Endangered); I (In Need of Conservation); X (Endangered Extirpated)

Using the best available current information, this chapter summarized the full array of wildlife found in Maryland and identified Species of Greatest Conservation Need in each taxonomic group (addressing **Element #1**). The next chapter will provide detailed information about the distribution and condition of the identified key wildlife habitats, including their SGCN, signature plants, and natural communities.

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