

Species of Greatest Conservation Need



REQUIRED ELEMENT 1

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SPECIES OF GREATEST CONSERVATION NEED

Chapter Recap

- ✓ The Pennsylvania Game Commission (PGC), Pennsylvania Fish and Boat Commission (PFBC), and taxonomic experts from Pennsylvania Biological Survey (PABS) used best available data to update 2,137 Pennsylvania native species conservation statuses within bird, mammal, fish, amphibian, reptiles, and aquatic and terrestrial invertebrate taxonomic groups.
- ✓ PGC and PFBC used a data-driven, transparent, and repeatable Species of Greatest Conservation Need (SGCN) selection process like the 2015-25 Pennsylvania Wildlife Action Plan SGCN, with minor modifications.
- ✓ The 2025-35 Pennsylvania Wildlife Action Plan (PA WAP) includes **858 SGCN**, a 30% increase from the 2015-25 iteration, primarily terrestrial invertebrates, and **604 Data Deficient** species.

Process Changes and Similarities Since 2015

Approach and Selection Criteria

Employing explicit and transparent Species of Greatest Conservation Need (SGCN) selection criteria is a [State Wildlife Action Plan Best Practice](#) for clarity and replication (AFWA 2012). The 2015-25 Pennsylvania Wildlife Action Plan (PA WAP) improved the 2005-15 expert-opinion based method by using objective, data-driven considerations to the greatest extent practicable, illustrated by a flowchart (Fig. 1.2 in PGC-PFBC 2015). The 2025-35 PA WAP animal SGCN selection process builds upon the 2015-25 approach with minor adjustments to flowchart decision nodes (Fig. 1.2). These subtle changes provide efficiencies, emphasize empirical species data, and employ the “precautionary principle,” whereby species are included as SGCN despite data deficiencies (e.g., unknown short-term population trend) if active conservation measures to lessen individual threat impacts are known (Appendix 1.1, SGCN flowchart guidance).

New for this PA WAP iteration, the Pennsylvania Game Commission (PGC) worked with several Pennsylvania Biological Survey (PABS) Ornithological Technical Committee (OTC) members to develop specific migration and wintering season bird SGCN criteria (see *Special Cases* below; Fig. 1.2, Step 1A). Full life cycle conservation is imperative for migratory species, particularly birds. These criteria reflect U.S. and Canadian concern as well as northeastern U.S. regional and state-level imperilment. Though conservation status assessment is challenging for these two seasons due to data scarcity and lack of uniformity, we emphasize as Pennsylvania SGCN migratory birds of conservation concern in eastern North America that use the Pennsylvania landscape in significant abundance to affect positive conservation outcomes if included. We also include as wintering bird SGCN year-round bird species (e.g.,



Red-headed Woodpecker, Ruffed Grouse) because meeting habitat requirements during non-breeding times of the year is necessary for their survival and future population growth.

These modifications accounted for most additions to and deletions from the 2015-25 SGCN list. However, in some cases new survey data indicated populations are more abundant than previously realized (e.g., fishes) or an agency removed species from threatened or endangered status (i.e., delisted) due to population recovery (e.g., Bald Eagle, Osprey), resulting in removal as an animal SGCN. Peregrine Falcon, though delisted, remains SGCN for continued close population monitoring.

Finally, a major addition to the 2025-35 PA WAP, the PGC and Pennsylvania Fish and Boat Commission (PFBC) adapted the animal SGCN flowchart for future plant SGCN selection when dedicated plant conservation federal funding becomes available. Currently, annually appropriated U.S. Department of Interior State and Tribal Wildlife Grants (SWG) program funding is unable to be used toward plant conservation without an animal SGCN connection. PGC and PFBC leadership required an animal SGCN dependency for selecting plant SGCN; in other words, a plant SGCN must support a component of an animal SGCN's life history (e.g., specific host plant for an insect SGCN). The plant SGCN selection criteria highlight a plant's ecological role in supporting several animal SGCN (Fig. 1.2, Step 2). Pennsylvania Department of Conservation and Natural Resources (PA DCNR), Pennsylvania Natural Heritage Program (PNHP), and PABS Vascular Plant Technical Committee staff and members reviewed the method to verify criteria.

Standard Terminology

Nationally, species identified in Element 1 of State Wildlife Action Plans are referred to as “*Species of Greatest Conservation Need*,” abbreviated as, and commonly referred to as, “SGCN.” We continue this nomenclature in the 2025-35 PA WAP for species meeting defined criteria (see Fig. 1.2; Appendix 1.2) and for which conservation actions can be assigned. Species lacking sufficient information to evaluate Pennsylvania extirpation risk are referred to as “Data Deficient” species and priorities for further investigation. Data Deficient species are exclusive from “SGCN,” thus enumerated separately.

Species of Greatest Conservation Need
Defined by each state fish or wildlife agency in its Wildlife Action Plan, typically a native species with declining populations, or vulnerabilities expected to benefit from strategic conservation action.

-Crisfield and the Northeast Fish and Wildlife Diversity Technical Committee (2022)

Introduction

Aligning with Congressional intent of the SWG program to prevent further federal endangered species listings, we give special attention in the 2025-35 PA WAP to native species approaching the point of federal listing or are experiencing significant declines and/or impacted by pervasive and severe threats. Working with partner organizations through the SWG program, the PGC and PFBC strive to intervene in fish and wildlife conservation and management at the state level before imperiled species require protection under the federal Endangered Species Act. Congress investing in SWG funding now to protect



or restore wildlife populations within a state is far more effective and cost efficient than waiting until populations reach critically low levels and require expensive critical recovery efforts at the federal level.

However, limiting PA WAP scope to rapidly declining or imperiled species would continue the inefficient pattern of “reactive” rather than “proactive” management. SWG program funding and the PA WAP provide PGC, PFBC, and conservation partners an opportunity to focus beyond imperiled species, to keep common native species common. Since 2005, an overarching PA WAP goal has been to move toward proactive management of species and habitats for which Pennsylvania has an outsized role in regional, national, or global population securement. Shifting from reactive to proactive management increases on-the-ground conservation success and promotes efficient use of limited staff and financial resources.

Notably, Wildlife Action Plan development by all U.S. states and territories has spurred staff to consider fish and wildlife conservation beyond state boundaries (AFWA 2018, 2021; Mawdsley et al. 2020). This PA WAP iteration continues to emphasize Pennsylvania’s unique role, and regional U.S. responsibility, in conserving SGCN at a landscape-scale. A 2025-35 PA WAP objective is to reach beyond rarity – which often forces managers to simply document the declines of a species – so we may achieve comprehensive, proactive management.

This chapter describes considerations, methods, and results for Pennsylvania’s **858 2025-2035 SGCN** and **604 Data Deficient** species. Appendix 1.4-Species Accounts describe conservation status, habitat associations, threats, prioritized conservation actions, and research and survey needs for each SGCN.

Species of Greatest Conservation Need Selection

Regional and State Species Conservation Status Assessments

Regional Species of Greatest Conservation Need (RSGCN)

Adapted from Terwilliger Consulting, Inc. and the Northeast Fish and Wildlife Diversity Technical Committee (2023).

Since 1999, northeast U.S. states (Maine to Virginia) and the District of Columbia have collaborated, through the Northeast Association of Fish and Wildlife Agencies Fish and Wildlife Diversity Technical Committee (NEFWDTTC), to prioritize Regional Species of Greatest Conservation Need (RSGCN) for shared conservation and management. This regional effort maintains a non-regulatory RSGCN list to provide landscape-scale focus, resources, and collaboration to conserve these species of mutual conservation concern (and their habitats) for current and future generations (see AFWA 2018, 2021; Mawdsley et al. 2020).

RSGCN assessment methods have matured to be more analytical and inclusive. Initially focused on threatened and endangered species, the dawn of State Wildlife Action Plans in 2005 allowed the NEFWDTTC to consider proactive collaborative measures to avert declines and expanded the RSGCN list to consider state SGCN. The 4th iteration of the RSGCN list, conducted 2022-23, expands this further to pre-screen all species in the Northeast, not just state SGCN, for potential RSGCN designation. Due to several Northeast 2015-25 SWAPs including plant SGCN, the NEFWDTTC included plant species screening in the 2023 assessment, despite plant project ineligibility for State and Tribal Wildlife Grants funding.



Reference [Terwilliger Consulting Inc. and NEFWDC](#) (2023) and Starking et al. (2026) for extensive Northeast RSGCN methods documentation.

In total, Terwilliger Consulting Inc. and NEFWDC (2023) evaluated and prescreened, using NEAFWA RSGCN selection criteria, 7,270 of 17,916 (41%) species estimated to occur in the northeastern U.S. Of these, they identified 382 RSGCN (56% invertebrates; 44% vertebrates) (Fig. 1.1; see Fig. 1.3.3 in Terwilliger Consulting Inc. and NEFWDC 2023). Additionally, they noted “proposed RSGCN” and “watchlist” species to indicate priorities for further assessment and evaluation prior to the next RSGCN list update (anticipated 2028); “proposed RSGCN” and “watchlist” species are not yet “RSGCN.”

The PGC and PFBC considered Northeast RSGCN eligible for Pennsylvania SGCN if the species is native to and regularly occurs in the Commonwealth.

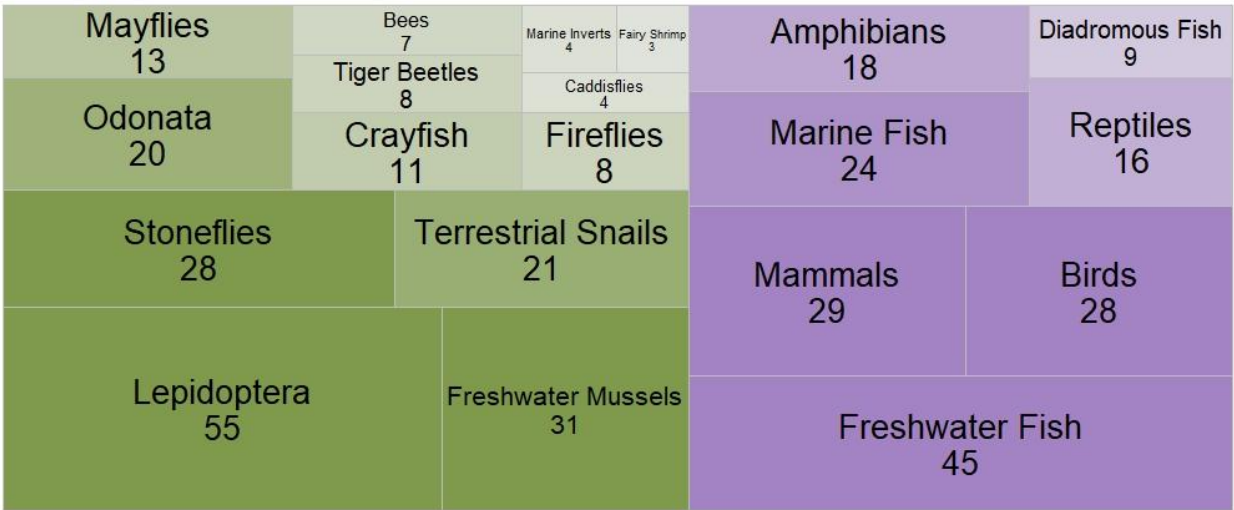


Fig. 1.1. 2023 Northeast U.S. Regional Species of Greatest Conservation Need Box Score (Terwilliger Consulting, Inc. and the Northeast Fish and Wildlife Diversity Technical Committee 2023).

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Pennsylvania Conservation Status Assessments

For consistency in status assessments across taxonomic groups and to implement a national best practice for State Wildlife Action Plans (AFWA 2012), PGC and PFBC staff and contractors with specific taxonomic expertise updated state-level conservation status ranks (i.e., S-ranks) using the NatureServe® Rank Calculator Version 3.2 (hereafter Rank Calculator; NatureServe 2020). This method provides an objective conservation status assessment based on population rarity, trends, and threats (see Faber-Langendoen et al. 2012). Taxonomic experts used best available data to evaluate population size, distribution, threats, and trends (Table 1.1). Threats assessments used a standard threats classification system developed by Salafsky et al. (2008) and adopted by the International Union for Conservation of Nature in 2012, later revised (version 3.3, IUCN 2022). This threats classification also has been adopted by the northeastern U.S. states (Maine to Virginia) and the District of Columbia to facilitate consistency between State Wildlife Action Plans (Crisfield and the Northeast Fish and Wildlife Diversity Technical Committee [NEFWDTCT] 2022). Conservation status assessment reports can be found in Appendix 1.1, which each include a description of the rank calculation process.

We assessed conservation status for 2,137 native vertebrate and invertebrate species. We evaluated 638 vertebrate species including native freshwater and marine fishes, birds (breeding, migration, and wintering seasons), mammals (breeding and wintering seasons), reptiles, and amphibians (Table 1.2). Pennsylvania aquatic and terrestrial invertebrate species abundance (estimated to be over 11,000 (Rawlins and Bier 1998; Rawlins 2007) precluded our temporal and financial feasibility to evaluate the conservation status of all invertebrates. Thus, invertebrate conservation status assessments included 450 2015-25 Pennsylvania Wildlife Action Plan invertebrate SGCN (PGC-PFBC 2015 Appendix 1.2) and select terrestrial and other aquatic invertebrate orders which PNHP taxonomic experts considered important for review. In total, PNHP assessed 1,499 terrestrial and freshwater invertebrate species for this revision (see [Special Cases – marine species](#)). PGC assessed species occurring in the state during various life stages (e.g., migratory and wintering birds, migratory bats) separately for each occurrence period (see [Special Cases – passage migrant and wintering birds](#)). PABS taxonomic technical committees reviewed Rank Calculator data and resulting S-ranks prior to PGC (birds, mammals, terrestrial invertebrates) or PFBC (fishes, amphibians, reptiles, and aquatic and terrestrial invertebrates) finalization. PNHP will share updated S-ranks with NatureServe for inclusion in NatureServe Explorer.

Table 1.2. Number of regularly occurring Pennsylvania native species assessed for inclusion as Species of Greatest Conservation Need in the 2025-2035 Pennsylvania Wildlife Action Plan. Bird species include breeding and nonbreeding seasons; Mammals include bat breeding and wintering seasons.

Taxonomic Group	Number of Native Species Assessed*
Invertebrates [aquatic & terrestrial]	1,499
Fishes	246
Birds	218
Mammals	89
Reptiles	44
Amphibians	41

*Extirpated native species included in assessment.



Table 1.1 Reference data for comprehensive, state-level conservation status assessments (i.e., S-ranks) using the NatureServe® Rank Calculator version 3.1 (Master et al. 2012). Complete references are provided in respective status assessment reports (Appendix 1.1).

Taxonomic Group	Status Assessment Reference Data
BIRDS	
<i>Breeding</i>	Biotics (PNHP 2023); Breeding Bird Survey (BBS; Ziolkowski 2023); eBird (Sullivan et al. 2009); eBird Status and Trends (Fink et al. 2023); Pennsylvania Game Commission annual reports for colonial waterbirds, wetland nesting birds, waterfowl, Peregrine Falcon, American Barn Owl, Bald Eagle, Osprey, and shorebirds (Barber 2022; Barber and Murphy 2022; Huck 2023; McMorris et al. 2022; Mummert et al. 2022; Murphy 2022a,b; Barber and Haffner 2023); Pennsylvania Wildlife Action Plan Conservation Opportunity Area Tool (PGC-PFBC 2023); Partners in Flight Population Estimates Database (Partners in Flight 2020); Second Atlas of Breeding Birds in Pennsylvania (safe dates only; Wilson et al. 2012)
<i>Passage migrants</i>	Biotics (PNHP 2023); eBird (Sullivan et al. 2009); Pennsylvania Wildlife Action Plan Conservation Opportunity Area Tool (PGC-PFBC 2023); Raptor Population Index (Oleyar et al. 2021)
<i>Wintering</i>	Biotics (PNHP 2023); Christmas Bird Count (National Audubon Society 2022); eBird (Sullivan et al. 2009); Pennsylvania Wildlife Action Plan Conservation Opportunity Area Tool (PGC-PFBC 2023); Raptor Population Index (Oleyar et al. 2021)
MAMMALS	Biotics (PNHP 2023); Guide to the Mammals of Pennsylvania (Merritt 1987); Mammals of the Eastern United States (Whitaker and Hamilton 1998); Pennsylvania Game Commission annual reports for snowshoe hare, cottontails, bats, Allegheny woodrat (Boyd 2022; Nolder et al. 2022; Scafani 2022a,b); Pennsylvania Game Commission elk management plan (Banfield and Rosenberry 2020); Pennsylvania Game Commission Game Take and Furtaker surveys (Johnson 2022); Pennsylvania Game Commission terrestrial mammal database (Scafani and Turner 2022); Terrestrial Vertebrates of Pennsylvania (Steele et al. 2010); Turner et al. 2011
FISHES	Pennsylvania Fish and Boat Commission and Penn State University (unpublished data); Stauffer et al. 2016; taxonomic experts
AMPHIBIANS & REPTILES	Pennsylvania Natural Diversity Inventory element occurrences (PNHP 2024); Pennsylvania Amphibian and Reptile Survey (unpublished data); taxonomic experts
INVERTEBRATES	See pages 32-36 in Leppo et al. 2025, Appendix 1.1



Pennsylvania Species of Greatest Conservation Need Selection Criteria

Determining SGCN through a clear and repeatable process is paramount for effective conservation planning (AFWA 2012; also see Groves 2003). The 2025-35 PA WAP SGCN selection method builds upon that of the 2015-25 PA WAP. During 2015-25 PA WAP development, we finalized SGCN criteria after several iterations over the course of a year with input from the PA WAP Steering and Advisory Committees, PABS technical committee members, and agency staff (Fig. 1.2). Thus, for this 2025-35 revision, we reviewed criteria and node placement to ensure accuracy and completeness, making subtle adjustments for clarity, and edited the accompanying guidance document accordingly (Appendix 1.2). Any native fish, amphibian, reptile, assessed aquatic or terrestrial invertebrate, bird, or mammal known to occur regularly (i.e., not vagrants) in Pennsylvania for any part of its life cycle was eligible for review against flowchart criteria, with some exceptions.

Considerations in the Pennsylvania SGCN flowchart included:

- | | |
|---|---------------------------------------|
| 1. <i>Pennsylvania native</i> | 6. <i>State imperilment</i> |
| 2. <i>Data deficiency (global, regional or state)</i> | 7. <i>Pennsylvania responsibility</i> |
| 3. <i>Global imperilment</i> | 8. <i>Declining population</i> |
| 4. <i>Federal imperilment</i> | 9. <i>Significant threats</i> |
| 5. <i>Northeast U.S. regional concern</i> | |

“Data Deficient” species were those with undocumented abundance and/or distribution data and, therefore, unreliable for making an informed assessment of the extirpation risk to a species with a level of certainty (i.e., insufficient data to calculate a G-rank (GU), IUCN Red List category (DD) or S-rank (SU)) (Appendix 1.2). This category also includes species with published taxonomic uncertainties that precluded our ability to assess its conservation status. Though not considered “Pennsylvania SGCN,” we include a separate “Data Deficient” species list to highlight the need for more information on these species (Appendix 1.3).

Exceptions to SGCN consideration: The PGC, with concurrence from the PABS Ornithological Technical Committee, continued for the 2025-2035 assessment several species that did not warrant SGCN evaluation in the 2015-2025 PA WAP. These were Trumpeter Swan (*Cygnus buccinator*), Double-crested Cormorant (*Nannopterum auritum*), American Herring Gull (*Larus smithsonianus*), Great Black-backed Gull (*Larus marinus*), Sandhill Crane (*Antigone canadensis*), Merlin (*Falco columbarius*), Clay-colored Sparrow (*Spizella pallida*), House Finch (*Haemorhous mexicanus*), Black Vulture (*Coragyps atratus*) and Blue Grosbeak (*Passerina caerulea*). Omitted species are either not a conservation priority (e.g., House Finch) or are experiencing a recent range expansion without a history (since ~1900) of nesting in the state (e.g., Merlin). They also tend to have few threats and adapt well to anthropogenic landscapes.

Special cases

Passage migrant and wintering birds

To embrace full life-cycle stewardship of bird species (e.g., Berlanga et al. 2010), we represent passage migrant and wintering birds within the SGCN list. Determining selection criteria for these annual stages necessitated distinctive approaches due to unique evaluation challenges. First, Pennsylvania is a thoroughfare for hundreds of migratory bird species (Rodewald and Brittingham 2004, 2007; Leppold



and Mulvihill 2011; Dennhardt et al. 2015). We aimed to include as Pennsylvania SGCN those species occurring in substantial numbers such that conservation actions taken in Pennsylvania will be meaningful to an imperiled population. Specifically, we avoided including “incidental” or “vagrant” species, which occur in the state sporadically and, typically, for very brief periods. Second, data for the winter season are not as robust as those for the breeding season. Therefore, we filtered all regularly occurring migratory and wintering birds for species of concern in the northern range (e.g., Canada, northern Bird Conservation Regions), nationally (i.e., USFWS threatened or endangered), regionally (Northeast Regional Species of Greatest Conservation Need, or in the state (i.e., threatened, endangered, year-round 2025-35 breeding SGCN [wintering only]) (Table 1.3; see Murphy et al. 2026, Appendix 1.1). The PABS OTC reviewed the resulting species list prior to PGC evaluating all seasons in which they occur in Pennsylvania. We thank several PABS OTC members (Acknowledgements) for their assistance in developing a refined method that enhances the 2015-25 PA WAP approach.

To elucidate *migratory* bird species for which Pennsylvania plays an outsized role among surrounding states of similar latitude in Mississippi and Atlantic Flyways (Flyways), PGC evaluated passage migrant bird relative abundance among New Jersey, Pennsylvania, Ohio, Indiana, Illinois, and Iowa that pass-through Pennsylvania at the peak of spring and fall migration seasons. To identify species for which Pennsylvania is particularly important as a migration corridor, we compared the estimated proportion of migrants occurring within Pennsylvania to the proportion expected based on state area alone. Pennsylvania is 18.4% (119,279 km²) of the area of the two Flyways, hence, if we estimate that >36.8% of the population passes through Pennsylvania, we thereby assess that the species is a Pennsylvania priority migrant. A full description of methods is provided in Appendix 1.1 (Murphy et al. 2026). We evaluated these results in the context of conservation priority in the Eastern U.S. and other factors (Fig. 1.2B).

Selection criteria for *wintering* bird SGCN similarly started with species of high conservation concern in Canada, federally protected, regional concern or state listed or vulnerable (i.e., S3N). We then considered relative abundance of individuals in Pennsylvania compared to New Jersey, Ohio, Indiana, Illinois, and Iowa during the wintering period. Finally, we included as Pennsylvania wintering bird SGCN any breeding season SGCN that are year-round residents (e.g., Red-headed Woodpecker, Ruffed Grouse) (Fig. 1.2B).

Table 1.3. Conservation status lists referenced during the Pennsylvania migratory and wintering bird 2025-35 Species of Greatest Conservation Need evaluation process (see Murphy et al. 2026, Appendix 1.1, for full citations).

Conservation Status List	Threshold Criteria	Link or Reference
U.S. Endangered Species Act	Threatened or endangered	http://www.fws.gov/endangered/
Pennsylvania Game and Wildlife Code	Threatened or endangered	58 Pa. Code Subchapter B. Birds
2015-25 Pennsylvania Wildlife Action Plan	Species of Greatest Conservation Need	PGC-PFBC 2015



Canada Species at Risk Act	Special concern, threatened, or endangered	S.C. 2002, c 29; https://laws-lois.justice.gc.ca/eng/acts/s-15.3/page-10.html#h-435647
Northeast U.S. Regional Species of Greatest Conservation Need (2023)	Regional Species of Greatest Conservation Need	https://northeastwildlifediversity.org/rsgcn
Tipping Point Species	Any species regularly occurring in Pennsylvania	https://r2rbirds.org/tipping-point-species/
Raptors at Risk	High- or moderate-risk	Oleyar et al. 2025
North Atlantic-Appalachian Region At-Risk Species	"Conservation species"	U.S. Fish and Wildlife Service 2021
Birds of Conservation Concern	"Highest" or "High" within Bird Conservation Regions 3, 13, 14, or at the continental scale	U.S. Fish and Wildlife Service 2021

Marine species

For marine or estuarine invertebrates, we evaluated the blue crab (*Callinectes sapidus*) because the Pennsylvania Fish and Boat Commission regulates harvest of this species. The review resulted in assessing the species as "Data Deficient." In the mid-1980s, young blue crabs (15-20 mm) were collected in Pennsylvania waters, but it was uncertain if these were spawned in Pennsylvania or moved into the area collected from downstream (Mike Kaufmann, PFBC Fisheries Biologist, personal communication). Further, Kaufmann notes reliable incidental reports of blue crabs in all major tidal tributaries. However, the frequency of occurrence is unknown. Occurrence also may be influenced by climatic factors that affect salinity, location of the salt wedge, and temperature.

No exclusively marine or estuarine fishes were found to be SGCN. Marine or estuarine fishes found in Pennsylvania waters are either considered occasional/accidental or, if they regularly occurred, are not a suitable species for conservation in Pennsylvania.

Vascular plants

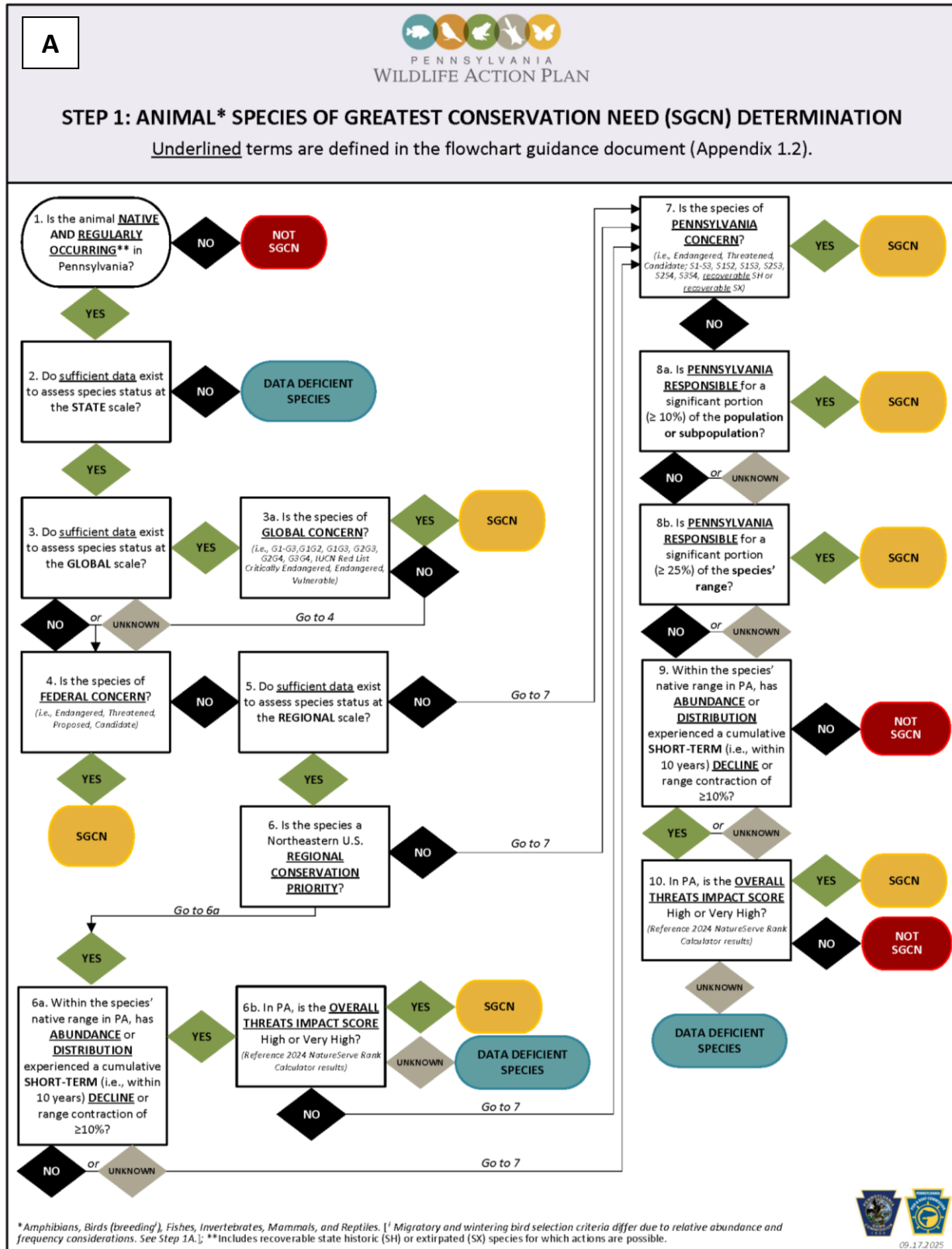
Wildlife is generally defined as species in the kingdom Animalia (animals), thus individual vascular plants (e.g., herbaceous and woody species) have not been evaluated to date for inclusion in a Pennsylvania wildlife-focused plan. Moreover, specific plant projects are ineligible for SWG program funding unless the plant is vital to animal SGCN survival. Thus, since 2005, the PA WAP has viewed plant conservation through a healthy habitat lens. However, the proposed federal Recovering America's Act (RAWA) of 2022 ([H.R. 2773](#), [S. 2372](#)), legislation dedicating \$1.4 billion nationally for SWAP implementation per year, provided an additional 5% to states that include plant SGCN. Though RAWA passed the U.S. House, it was never placed on the Senate schedule for consideration.

The prospect of additional funding for plant conservation spurred Pennsylvania to consider plant SGCN criteria to prepare for a time when dedicated plant funds may be available. PGC and PFBC Executive Directors, agencies that co-administer the SWG program and PA WAP, required plant SGCN to support



animal SGCN recovery. The PGC and PFBC, in consultation with PA DCNR and the PABS Vascular Plant Technical Committee, developed a plant SGCN selection flowchart based upon the directive to support animal SGCN (Fig. 1.2C). PGC and PFBC will consider adding plant SGCN to the PA WAP once dedicated federal funding for plant SGCN becomes available. Regardless of plant SGCN identification, beneficial habitat management practices and collaborations will continue to support native plants and ecosystems upon which animal SGCN depend.

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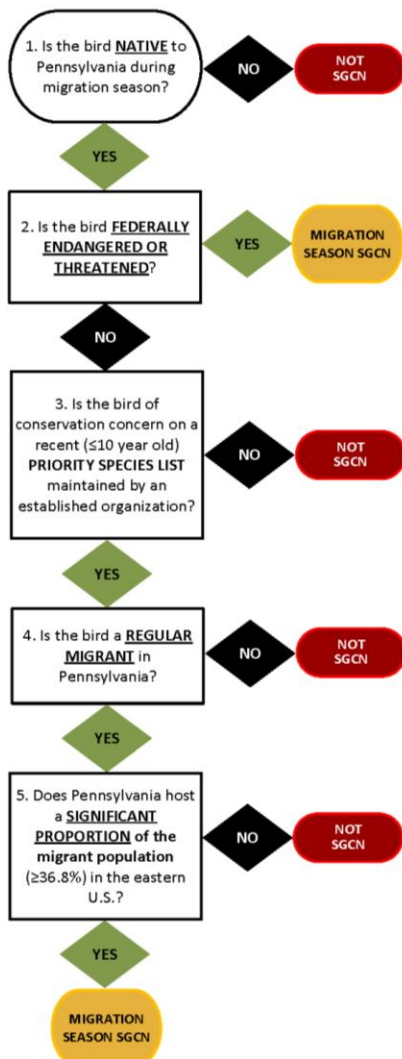
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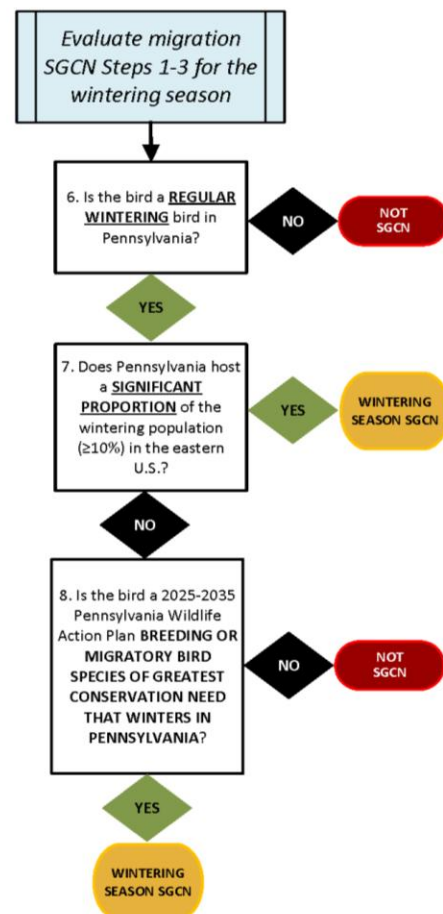
STEP 1A: MIGRATION & WINTERING SEASON BIRD SPECIES OF GREATEST CONSERVATION NEED (SGCN) DETERMINATION

Underlined terms are defined in the flowchart guidance document (Appendix 1.2).

MIGRATION SEASON SGCN DETERMINATION



WINTERING SEASON SGCN DETERMINATION



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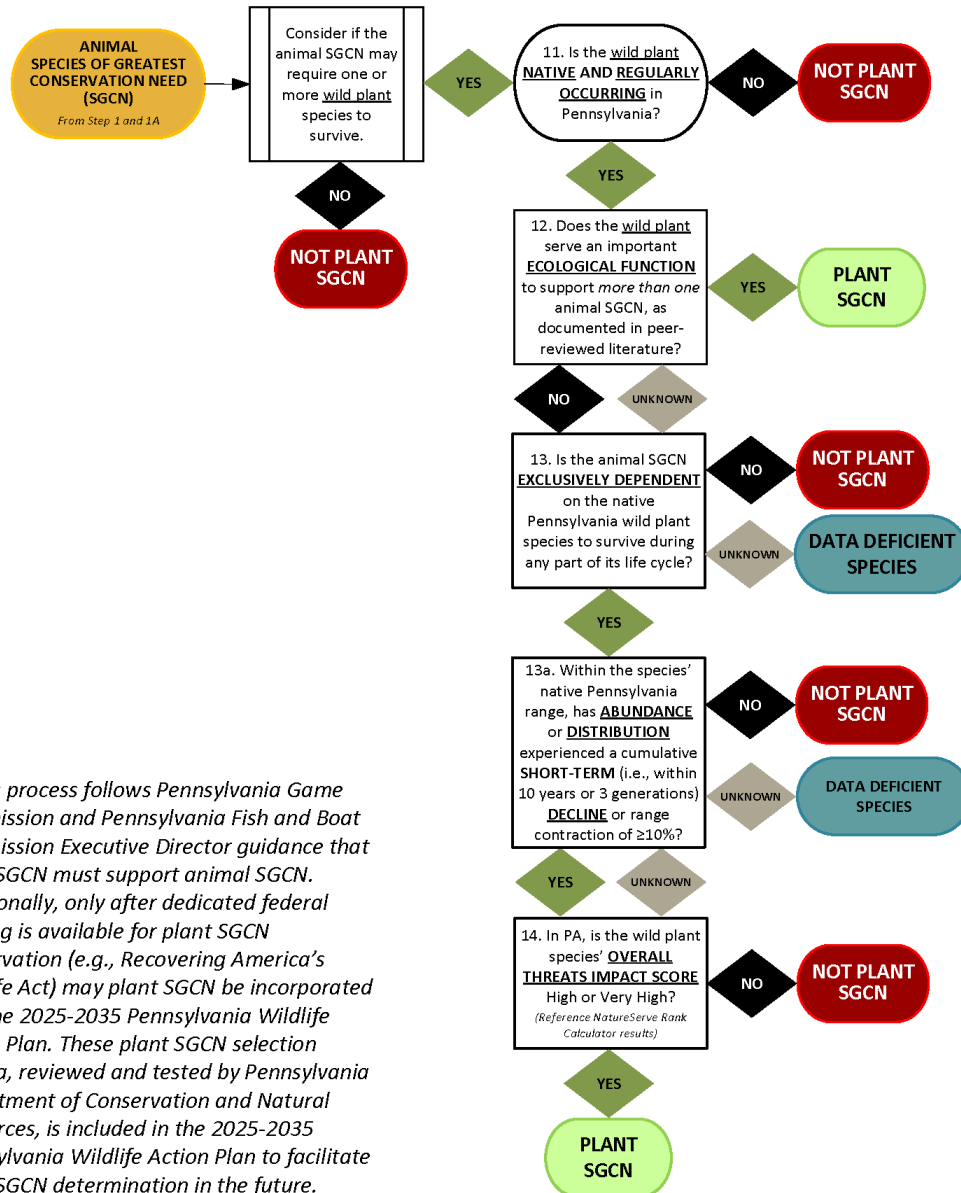


C



STEP 2: PLANT SPECIES OF GREATEST CONSERVATION NEED (SGCN) DETERMINATION**

Underlined terms are defined in the flowchart guidance document (Appendix 1.2).



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Fig. 1.2. Decision models for 2025-2035 Pennsylvania Wildlife Action Plan (PA WAP) animal Species of Greatest Conservation Need (SGCN) and data deficient species selection (panels A and B). Eligible species included native Pennsylvania fishes, amphibians, reptiles, terrestrial and aquatic invertebrates, birds or mammals occurring regularly (i.e., not vagrants) in any part of their life cycle. “Data deficient” species are priorities for information gathering, thus not “SGCN”. Passage migrant and wintering bird SGCN selection used modified flowchart criteria (panel B). Plant SGCN must support more than one animal SGCN and may be incorporated in a future PA WAP using criteria specified in Step 2 (panel C).

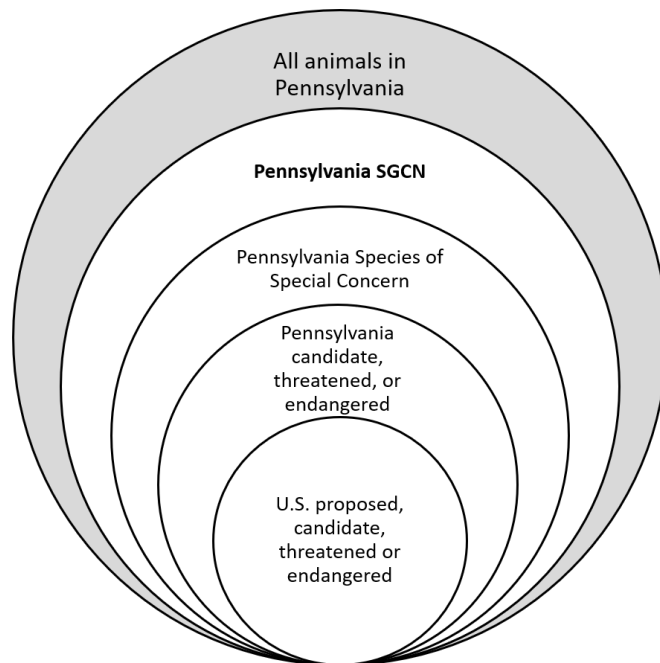
Status Definitions

Many terms are used to describe Pennsylvania species’ statuses, which often causes confusion. Some of these terms refer to legal protection (e.g., state threatened) while others indicate the general species conservation status within the Commonwealth relative to all species in the state (e.g., Species of Special Concern, Species of Greatest Conservation Need). Neither Species of Special Concern nor Species of Greatest Conservation Need carry legal protection simply by having these designations, though species protected through statute are typically included in these lists (Fig. 1.3).

Species of Greatest Conservation Need:

The most inclusive of the four lists, this term refers to species identified within this Pennsylvania Wildlife Action Plan. These represent fish and wildlife species conservation priorities for targeted conservation action, 2025-2035. All birds, mammals, fish, reptiles, amphibians and aquatic invertebrates are considered “protected” in the Commonwealth, meaning that it is unlawful to harm or harass these species outside of legal hunting/fishing seasons or without proper permits or licenses from the PGC, PFBC, and/or U.S. Fish and Wildlife Service. Terrestrial invertebrates currently are not protected under statute; however, the Department of Conservation and Natural Resources Natural Heritage Program provides voluntary conservation measures for priority terrestrial invertebrates during project environmental reviews.

Fig. 1.3. Relationship of Pennsylvania Species of Greatest Conservation Need (SGCN) to other species lists in the state. United States proposed, candidate, threatened, or endangered and Pennsylvania candidate (PFBC only), threatened, or endangered are protected through statute.



Pennsylvania Species of Special Concern: Often used generically to describe at-risk species in the state, this term represents the lists maintained by the taxonomic technical committees of the [Pennsylvania](#)



Biological Survey. These include endangered, threatened and common, but declining, species. The list of Species of Greatest Conservation Need is inclusive of these special concern species.

Pennsylvania candidate (PFBC only), threatened, endangered: A legal designation within Pennsylvania, “state listed” species are protected under the Pennsylvania Code Title 58, Chapter 75 (relating to PFBC) & Chapter 133 (relating to PGC).

United States proposed, candidate, threatened, or endangered: Referring to species receiving, or deemed eligible to receive, federal protection under the Endangered Species Act of 1973, as amended. These include proposed, candidate, threatened, or endangered fish, amphibian, reptile, terrestrial and aquatic invertebrate, bird or mammal species known to occur in Pennsylvania during any stage of its life cycle. The [U.S. Fish and Wildlife Service](#) provides definitions for these categories.

Pennsylvania Species of Greatest Conservation Need

Of the 2,137 species assessed, using SGCN flowchart criteria, we identified **859 Species of Greatest Conservation Need** fish, reptile, amphibian, bird, mammal and invertebrate (aquatic and terrestrial) species on which to focus conservation actions over the next 10 years (Table 1.4). This represents approximately 40% of species assessed. We maintained 518 SGCN from 2015 because their conservation status had not improved sufficiently to warrant removal from the list (Table 1.5). Recovering populations is a significant undertaking that can require decades of dedicated attention. However, significant gains have been made since 2015, with support SWG program funding and other sources that, in part, enabled 104 SGCN to be removed as SGCN since the 2015-25 PA WAP (e.g., Hickorynut [mussel species]), Eastern Fence Lizard, big brown bat) and, in some cases, the state threatened and endangered species list (Bald Eagle, Osprey, Eastern Mudminnow, Central Mudminnow).

Table 1.4. 2025-2035 Pennsylvania Species of Greatest Conservation Need (SGCN) Box Score. 2015-25 SGCN totals are provided for reference; however, changes between decades do not necessarily reflect changes in conservation status due to enhanced data acquisition, taxonomic changes, or SGCN selection criteria adjustments between terms.

	2025-35 SGCN Totals	U.S. Threatened or Endangered	U.S. Proposed Threatened or Endangered	U.S. Under Review for Endangered Species Act Protection	Pennsylvania Threatened, Endangered, or Candidate ^a	Pennsylvania Recovered ^b (2015-2025)	2015-25 SGCN Totals
Birds[†]	86	3	0	1	21	3	90
Mammals[†]	21	2	1	1	9	0	19
Fishes[†]	47	2	0	0	29	2	65
Amphibians[‡]	19	0	0	0	8	0	18
Reptiles[‡]	18	2	0	0	8	0	22
Invertebrates[°]	667	11	2	0	13	0	450
Grand Total	858	20	11	2	88	5	664

^a Includes currently extirpated species. Candidate category – Pennsylvania Fish and Boat Commission only;

^b Delisted from state threatened or endangered species lists due to reaching recovery goals; ^{†,‡,°} State legal authority: [†]Pennsylvania Game Commission; [‡]Pennsylvania Fish and Boat Commission; [°]Aquatic invertebrates - Pennsylvania Fish and Boat Commission, Terrestrial invertebrates - None.



Table 1.5. Counts of species maintained or removed from the 2015-2025 Pennsylvania Species of Greatest Conservation Need list and new Species of Greatest Conservation Need in 2025.

	Total SGCN	Maintained from 2015	Removed since 2015	New in 2025
Birds[†]	86	74	16	12
Mammals[†]	21	18	1	3
Fishes[‡]	47	42	18	6
Amphibians[‡]	19	17	1	2
Reptiles[‡]	18	21	1	0
Invertebrates[°]	668	346	67	325
Grand Total	860	518	104	345

^{†,‡,°} State legal authority: [†]Pennsylvania Game Commission; [‡]Pennsylvania Fish and Boat Commission; [°] Aquatic - Pennsylvania Fish and Boat Commission, Terrestrial - None.

Not surprisingly, aquatic and terrestrial invertebrates comprise the largest proportion (78%) of the total SGCN list due to their incredible species' diversity (Fig. 1.4). Rawlins (2007) and PABS estimate Pennsylvania supports at least 11,000 invertebrate species, over twice the diversity of all plants and animals under current state jurisdiction (B. Leppo, personal communication). Despite their ubiquity and foundational importance to food webs, the vast majority Pennsylvania invertebrates remain extremely understudied; 576 of 1,499 (38%) assessed invertebrates are Data Deficient.

Forty-four percent (44%) of Pennsylvania's 195 vertebrate SGCN are avifauna, primarily landbirds (e.g., swallows, warblers). Birds are particularly good indicators of environmental conditions due to their relative ease of detection, fecundity, and, in some cases, habitat specificity. For these reasons, they are the most studied taxonomic group in the world. Thus, bird SGCN serve as totems for the condition of habitats on which they depend, reflecting concerns for forest fragmentation and lack of structural diversity; wetland quantity and quality loss to development and invasive species; and natural succession of grassland habitats within Pennsylvania (see Chapter 2-Habitats). Similarly, in the aquatic realm, fishes and herptiles (amphibians and reptiles) are harbingers of environmental condition and change, comprising approximately 25% and 19% of the vertebrate SGCN list, respectively. Point and non-point source pollutants, habitat loss to development and energy infrastructure, illegal harvest, and impacts from climate change are significant threats facing aquatic species. 11% of the vertebrate SGCN list includes Pennsylvania mammals; however, these mammal SGCN represent 32% of the state's 66 native mammal species. 38% of 21 mammal SGCN are bat species, illustrating continued emphasis on cave hibernating bat recovery from white-nose syndrome (Chapter 3-Threats) and increased concern for migratory tree bats.

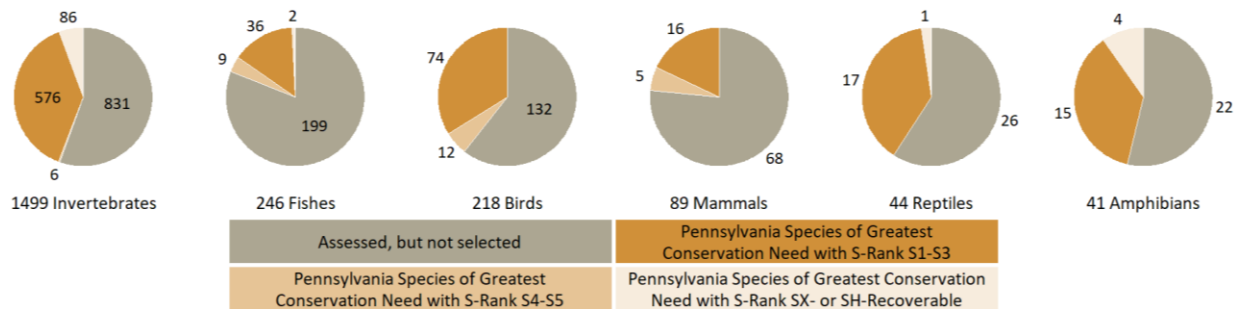


Fig. 1.4. Total number of Pennsylvania native species assessed during the Species of Greatest Conservation Need (SGCN) selection process, number of species not selected as SGCN (gray), number of species selected as SGCN that are S1 (critically imperiled), S2 (imperiled), or S3 (vulnerable) (darker orange), number of SGCN that are S4 (apparently secure) or S5 (secure) (lighter orange), and the proportion of SGCN that are SX (extirpated) or SH (historic) but thought to be recoverable (very light orange).

Pennsylvania Data Deficient Animals

Despite animals (Kingdom Animalia) being the most studied group of organisms, they are affected by data insufficiencies. Knowledge gaps range from populations size or distribution (e.g., Western Banded Killifish) to species identification (e.g., Lee Cave amphipod). During the species assessment process, we identified 604 species requiring more information to evaluate SGCN status; 515 (85%) of which are insects (class Insecta) (Table 1.6). Butterflies and moths (order Lepidoptera) and flies (order Diptera) comprise the majority, suggesting these as priorities for further investigation. Though invertebrates comprise most data deficiencies, we found 21 fish, 4 reptiles, and 1 amphibian require more information to assess conservation status.

Table 1.6. Counts of Data Deficient species by subtaxonomic grouping in the 2025-2035 Pennsylvania Wildlife Action Plan, sorted from greatest to least number of species. See Appendix 1.3 for the species list.

Subtaxonomic Group	Species Count
Insect: Lepidoptera	224
Insect: Diptera	101
Insect: EPT	62
Insect: Hymenoptera	61
Mollusc	49
Insect: Coleoptera	33
Insect: Other	33
Fish	22
Terrestrial Invertebrate	8
Crustacean	4
Reptile	4
Amphibian	1
Insect:Odonata	1
Marine Invertebrate	1
Grand Total	604

Species of Greatest Conservation Need Prioritization

Prioritization is inherent to being identified as SGCN; these 863 Pennsylvania animals are priorities for active conservation attention in the next decade over all others. Though not a federal requirement, the 2005 and 2015 PA WAPs incorporated differing SGCN prioritization schemes in attempts to highlight the



highest priority species within the SGCN list (see PGC-PFBC 2005, PGC-PFBC 2015). The 2005 PA WAP focused on rarity and responsibility (e.g., immediate concern, high-level concern, maintenance categories) whereas the 2015 PA WAP defined priority criteria for four categories, focusing on why species were a priority (e.g., contribute to the conservation of globally or regionally important species). However, each prioritization approach had its drawbacks, and neither prioritization approach was broadly adopted during implementation. Thus, we do not present prioritization methods in this 2025-35 PA WAP iteration.

We intend to develop a new method, with diverse stakeholder input, during the early implementation phases that may prioritize species and actions by geographic boundary, such as physiographic province, section, or watershed. SGCN distributions follow habitat distributions, which reflect geology and other non-living influences (e.g., microclimate), which vary greatly from Philadelphia to Erie counties. Regional prioritization will focus critical attention for SGCN where the most benefit can be gained. Analyses will be facilitated by the Wildlife Action Plan SQL database and Wildlife Action Map (WAM; <https://wildlifeactionmap.pa.gov>) SGCN occurrence database. The WAM also provides established infrastructure for conservation delivery.

Until a new species prioritization framework is established, federal and state endangered, threatened, candidate, and proposed conservation statuses will remain the highest priority and should be a primary focus if found in your area of interest. However, due to rarity, regulatory status, and highly specific needs, these species often require conservation professionals to address recovery actions. More broadly, considering species-habitat associations can focus attention. Supporting native wildflowers, shrubs, trees, and other vegetation – from potted plants to hundreds of acres – will foster SGCN and other native animals. All SGCN require conservation action to recover or be sustained in the Commonwealth thus, despite a specific prioritization hierarchy, assisting any SGCN will be beneficial. The WAM is the best place to start (see Chapter 4-Conservation Action for more information or visit <https://wildlifeactionmap.pa.gov>).

Threats to Species of Greatest Conservation Need

Chapter 3-Threats provides fuller descriptions of threat categories included below. Here, we summarize threats to vertebrate and invertebrate SGCN found during the comprehensive threats assessment updates for all native, regularly occurring animals in Pennsylvania.

Taxonomic experts identified at least one direct threat to species during the conservation status ranking process (Fig. 1.5, Table 1.7). Impactful specific threats for which at least one action to each SGCN could be defined are found in individual species accounts (Appendix 1.4). Threat descriptors, such as scope (i.e., the percentage of the species range in Pennsylvania potentially impacted by the threat) and severity (i.e., within the threat scope, the degree to which the population is affected), accompanied each threat category within the NatureServe® threat assessment to determine an overall ‘threat impact score,’ ranging from low to very high (Faber-Langendoen et al. 2012). Additionally, species account authors further described each threat characteristic as specified in the Northeast Lexicon (Crisfield and the Northeast Fish and Wildlife Agencies 2022), including immediacy, reversibility, certainty, and likelihood of the threat (see Chapter 3-Threats). The combination of all, or several, threat descriptors



highlight the relative impact of a threat to a species (e.g., Table 1.8) and, thus, inform conservation action prioritization.

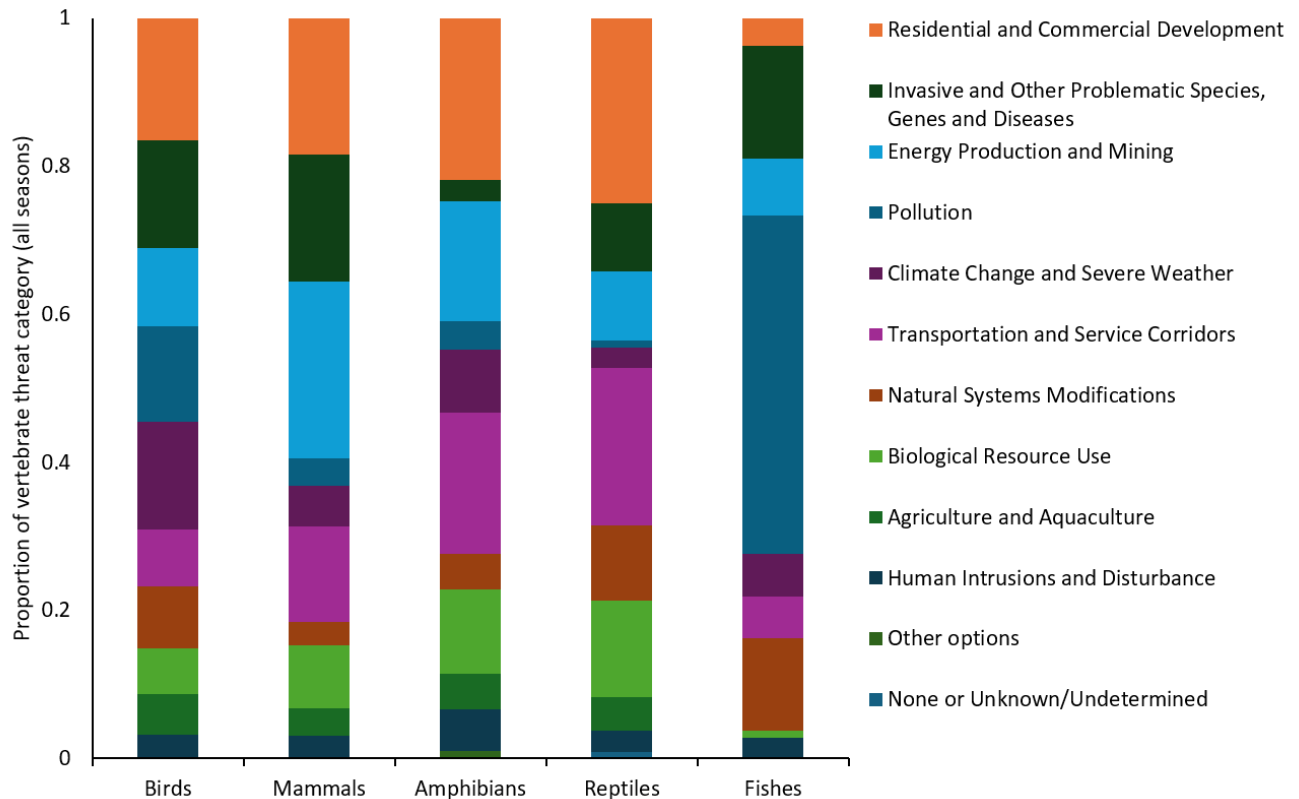


Fig. 1.5. Proportion of threat categories identified for vertebrate Species of Greatest Conservation Need identified during species conservation status assessments, by taxonomic group. Threat categories are from Salafsky et al. 2008.

Aquatic and Terrestrial Vertebrate Threats

Consistent with the 2014 threat assessment (PGC-PFBC 2015), 57% of threats identified for birds, mammals, amphibians, reptiles, and fishes belonged to four threat categories:

1. **Residential and Commercial Development** (17%)
2. **Invasive and Other Problematic Species, Genes and Diseases** (14%)
3. **Energy Production and Mining** (13%) and **Pollution** (13%)

Major threat categories differed among taxonomic groups, as expected (Fig. 1.5, Table 1.7). For example, *Energy Production and Mining* accounted for 24% of mammal threats among all seasons. Direct bat mortality from wind turbines and mining or quarrying as well as small mammal impacts from energy infrastructure are primary concerns. *Pollution* accounts for nearly half (45%) of all fish threats, primarily *Agricultural and Forestry Effluents* (26%), followed by *Industrial and Military Effluents* (11%). Water quality is degraded by various point and non-point sources of pollution to waterways, such as sedimentation and nutrient loading and run-off from poorly maintained agricultural fields and logging operations. Bird, amphibian, and reptile primary threats are related to the *Residential and Commercial Development* threat category (16%, 22%, and 25% respectively), similar to ten years ago. Specific



concerns include permanent conversion to non-habitat or degradation or fragmentation of existing habitat, improper habitat management/manipulation in recreational areas and privately owned forests, hydrologic disruption, and, more prominent in this iteration, bird-window collisions and lack of chimney availability (for Chimney Swifts). Further details can be found in the individual species accounts (Appendix 1.4).

To discern highest risk threats to vertebrate SGCN, we filtered for continuing threats that received a very high or high individual threat score, are estimated to impact over 30% of the species' statewide distribution and contribute to population declines (Table 1.8). Once again, *Invasive and Other Problematic Species, Genes and Diseases*, specifically *Invasive Non-native/Alien Species/Diseases*, were dominant within these criteria, highlighting the persistent conservation priority to promote native vegetation, enhance genetic diversity of native populations, and proactively address fish and wildlife health needs (see Chapter 3-Threats, fish and wildlife health assessment).

Table 1.7. Primary threats affecting vertebrate Species of Greatest Conservation Need. International Union for the Conservation of Nature (IUCN) Level 1 threat categories (Salafsky et al. 2008) accounting for over 50% of all threat categories identified within each taxonomic group.

Taxonomic Group	IUCN Level 1 Threat Category	Percent of Threats for Group
Birds	Residential and Commercial Development	16%
	Invasive and Other Problematic Species, Genes and Diseases	15%
	Climate Change and Severe Weather	15%
	Pollution	13%
Mammals	Energy Production and Mining	24%
	Residential and Commercial Development	18%
	Invasive and Other Problematic Species, Genes and Diseases	17%
Amphibians	Residential and Commercial Development	22%
	Transportation and Service Corridors	19%
	Energy Production and Mining	16%



Reptiles	Residential and Commercial Development	25%
	Transportation and Service Corridors	21%
	Biological Resource Use	13%
Fish	Pollution	45%
	Invasive and Other Problematic Species, Genes and Diseases	16%

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Table 1.8. High risk threats to vertebrate Species of Greatest Conservation Need, identified during the species conservation status assessment process. Results are organized by International Union for Conservation of Nature (IUCN) Level 1 threat category (Salafsky et al. 2008) and include Level 2 threat categories to clarify specific threats. Bird threats are restricted to the breeding season. High risk threats are defined as continually occurring with a pervasive or large scope, extreme severity, and a very high or high individual threat impact score (Master et al. 2012). Note: No Energy Production and Mining threats achieved this threshold.

IUCN Level 1 Threat Category	Common Name	Scientific Name	IUCN Level 2 Threat Category
Residential and Commercial Development	New Jersey Chorus Frog	<i>Pseudacris kalmi</i>	Housing and Urban Areas
	Western Chorus Frog	<i>Pseudacris triseriata</i>	Housing and Urban Areas
	Eastern Tiger Salamander	<i>Ambystoma tigrinum</i>	Housing and Urban Areas
	Blanding's Turtle	<i>Emydoidea blandingii</i>	Tourism and Recreational Areas
Agriculture and Aquaculture	Sedge Wren	<i>Cistothorus stellaris</i>	Annual and Perennial Non-timber Crops
	Blue-spotted Salamander	<i>Ambystoma laterale</i>	Annual and Perennial Non-timber Crops
Transportation and Service Corridors	Eastern Cricket Frog	<i>Acris crepitans</i>	Roads and Railroads
	Blue-spotted Salamander	<i>Ambystoma laterale</i>	Roads and Railroads
	Eastern Smooth Earthsnake	<i>Virginia valeriae valeriae</i>	Roads and Railroads
	Blanding's Turtle	<i>Emydoidea blandingii</i>	Roads and Railroads
Biological Resource Use	Great Blue Heron	<i>Ardea herodias</i>	Hunting and Collecting Terrestrial Animals
	Eastern Smooth Earthsnake	<i>Virginia valeriae valeriae</i>	Logging and Wood Harvesting
Human Intrusions and Disturbance	Northern Brook Lamprey	<i>Ichthyomyzon fossor</i>	Work and Other Activities
Natural Systems Modifications	Golden-winged warbler	<i>Vermivora chrysoptera</i>	Other Ecosystem Modifications
	Loggerhead Shrike	<i>Lanius ludovicianus</i>	Other Ecosystem Modifications



	Black Tern	<i>Chlidonias niger</i>	Dams and Water Management/Use
	King Rail	<i>Rallus elegans</i>	Dams and Water Management/Use
	Upland Chorus Frog	<i>Pseudacris feriarum</i>	Other Ecosystem Modifications
	Eastern Massasauga	<i>Sistrurus catenatus</i>	Other Ecosystem Modifications
	Eastern Smooth Earthsnake	<i>Virginia valeriae valeriae</i>	Fire and Fire Suppression
	Northern Rough Greensnake	<i>Opheodrys aestivus</i>	Fire and Fire Suppression
	Bog Turtle	<i>Glyptemys muhlenbergii</i>	Other Ecosystem Modifications
Invasive and Other Problematic Species, Genes and Diseases	Piping Plover	<i>Charadrius melodus</i>	Problematic Native Species/Diseases
	Sedge Wren	<i>Cistothorus stellaris</i>	Invasive Non-native/Alien Species/Diseases
	Black Tern	<i>Chlidonias niger</i>	Invasive Non-native/Alien Species/Diseases
	Eastern Smooth Earthsnake	<i>Virginia valeriae valeriae</i>	Logging and Wood Harvesting
Pollution	Sedge Wren	<i>Cistothorus stellaris</i>	Agricultural and Forestry Effluents
	Black Tern	<i>Chlidonias niger</i>	Domestic and Urban Waste Water; Agricultural and Forestry Effluents
Climate Change and Severe Weather	American Goshawk	<i>Astur atricapillus</i>	Temperature Extremes
	Black Tern	<i>Chlidonias niger</i>	Habitat Shifting or Alteration
	Coastal Plains Leopard Frog	<i>Lithobates sphenoccephalus utricularius</i>	Storms and Flooding
	Eastern Mud Salamander	<i>Pseudotriton montanus montanus</i>	Droughts; Storms and Flooding



Aquatic and Terrestrial Invertebrate Threats

Consistent with vertebrate assessments, PFBC and the Western Pennsylvania Conservancy completed aquatic and terrestrial invertebrate conservation statuses, including individual species threats assessments, using the NatureServe Rank Calculator Version 3.2 (NatureServe 2020) (see Appendix 1.1). This approach was more inclusive than in 2015, when experts assigned IUCN threat categories by informal taxonomic group to 375 invertebrate SGCN. Thus, resulting primary threats shifted slightly between PA WAP iterations, likely the 2024 assessment accommodating individual threats for all species.

As with terrestrial vertebrates, primary threats varied among invertebrate SGCN taxonomic groups (Fig. 1.6). *Residential and Commercial Development* (20%), *Agriculture and Aquaculture* (16%), *Pollution* (14%), and *Climate Change and Severe Weather* (14%) accounted for sixty-four percent (64%) of all threats to 671 SGCN invertebrates. Specific threats within the respective categories included habitat loss to residential, commercial and tourism development, point and non-point source pollution such as sewage, wastewater, agricultural run-off and air pollution, conversion of natural lands to cropland, ranchland and plantations, and climatic instability causing droughts, temperature extremes, storms and flooding, and species' range shifts.

Reference Appendix 1.1-conservation status assessments and Appendix 1.4-invertebrate species accounts for detailed information.

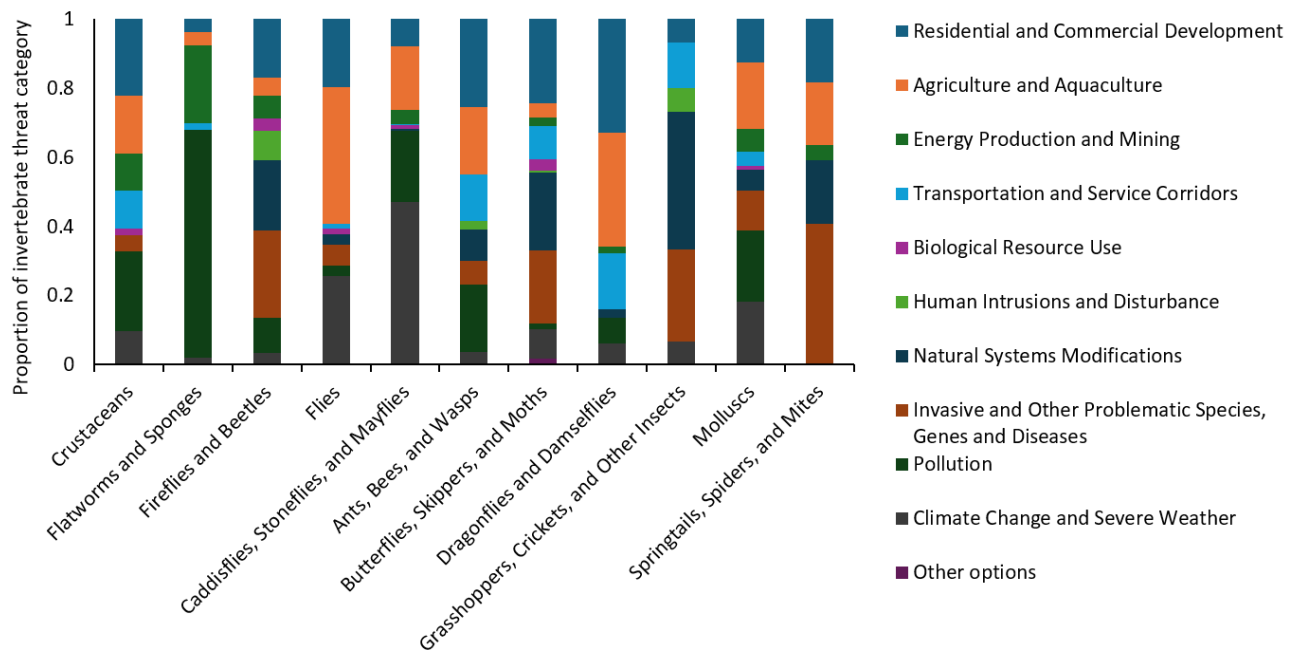


Fig. 1.6. Proportion of International Union for Conservation of Nature (IUCN) threat categories (Salafsky et al. 2008) identified for 671 invertebrate Species of Greatest Conservation Need during species conservation status assessments (see Leppo et al. 2025, Appendix 1.4).



Species Conservation Actions

All SGCN have associated species accounts (see Appendix 1.4), facilitated by a new SQL database developed by the PGC Bureau of Automated Technology Services.

While writing species accounts, taxonomic experts used the Northeast Lexicon (Crisfield and the NEFWDC 2022) to identify general groupings for specific actions. These groupings are based on the Conservation Measures Partnership (CMP) with enhancements developed by the Quebec Ministry of Forests, Wildlife, and Parks and Canadian Wildlife Service (hereafter modified CMP action lexicon). The new system is completely revised from the 2015-25 PA WAP, which used U.S. Fish and Wildlife Service's (USFWS) Wildlife Tracking and Reporting Actions for the Conservation of Species (TRACS) categories.

The modified CMP action lexicon includes three hierarchical tiers with increasing detail. Level 0, the broadest tier, included *“Active restoration and stress reduction measures”*, *“Create favorable conditions for conservation”*, and *“Encourage beneficial human behavior”*, each with two to five Level 1 sub-tiers. We encouraged taxonomic experts to note Level 2 conservation action categorization within Level 1 tiers to provide even more specificity. For example, within *Active restoration and stress reduction measures (Level 0)* and *Direct habitat management (Level 1)*, the author could specify one of several Level 3 categories including *“Manage non-living habitat components,” “Manage plants, animals, fungi, or bacteria,”* or *“Mitigate human environmental impact”* to categorize the specific action needed for SGCN conservation. Each conservation action addresses a specific threat. Species account authors prioritized actions for a species, with “1” representing the highest priority action (i.e., the lower the number, the higher the priority). In some cases, concurrent actions are needed; however, authors were required to assign unique prioritizations for each action.

Modified CMP conservation action category descriptions, as they apply to Pennsylvania, can be found in Chapter 4-Conservation Actions. Prioritized specific conservation actions and details for each SGCN can be found in individual species accounts (Appendix 1.4). In this section we summarize conservation actions at the coarsest scale (i.e., Level 1) for vertebrate and invertebrate SGCN, respectively.

Aquatic and Terrestrial Vertebrate Conservation Actions

Taxonomic experts assigned nearly eighty percent (80%) of all vertebrate conservation actions into three Level 1 categories (Fig. 1.7):

- **Design and Plan Conservation** (34%)
- **Direct Habitat Management** (30%)
- **Outreach** (15%)

Every vertebrate taxonomic group included *Design and Plan Conservation* actions to some degree, with amphibians (53% of actions), reptiles (43% of actions), and fishes (70% of actions) using it most frequently. It was the second most frequently used category for birds (22% of actions) (Table 1.9). Action types within this category are *“Complementary or alternative conservation measures,” “Conservation planning,” “Conserve land or seascapes,” “Conserve via zoning or informal designations,”* or *“Protect resources with site infrastructure”* with specific actions focused on avoiding and minimizing impacts to



SGCN in development activities (e.g., environmental review¹, local zoning), creating species and habitat conservation plans, protecting sensitive habitats (e.g., wetlands, boreal conifer forests), and mitigating impacts from barriers to population movement (e.g., fish passage structures).

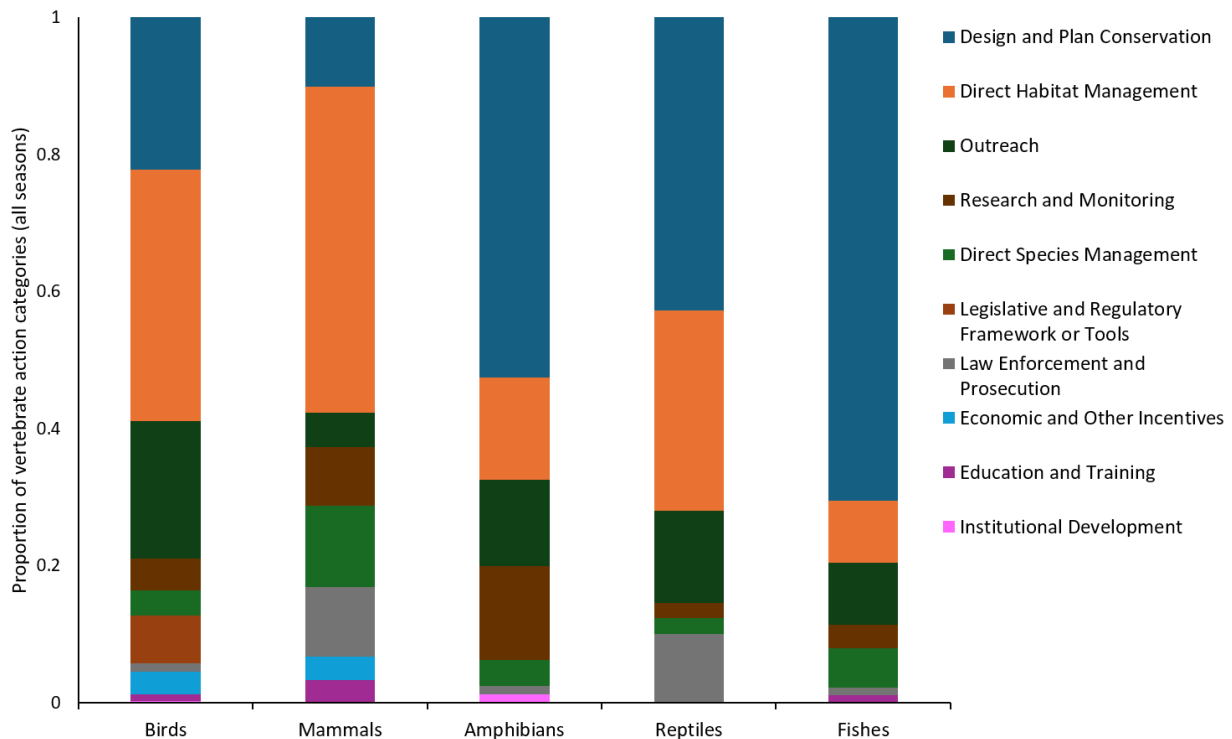


Fig. 1.7. Proportion of Conservation Measures Partnership action categories (Crisfield and the Northeast Fish and Wildlife Diversity Technical Committee 2022) identified for vertebrate Species of Greatest Conservation Need, by taxonomic group. See Appendix 1.4-Species Accounts.

“Direct habitat management,” under *“Active restoration and stress reduction measures,”* was overwhelmingly most common for mammal conservation actions (47% of actions), followed by birds (37% of actions) and reptiles (29% of actions). Within this action type, specific actions could be classified as *“Manage non-living habitat components,”* *“Manage plants, animals, fungi, or bacteria,”* or *“Mitigate human environmental impact.”* The prevalence of this category for mammals is explained by mammal recovery activities being largely focused on alleviating bat stress during hibernation to reduce fatalities

¹ Environmental review includes a regulatory framework through which project permits are issued to minimize potential impacts on federal or state listed species. The PGC (for birds and mammals) and PFBC (for amphibians, reptiles, fish, and aquatic invertebrates) review projects for potential impacts to state threatened or endangered species and their habitats, deferring to USFWS for federally listed species, and describe the surveys and/or avoidance and minimization measures to protect species or habitat from harm. These recommendations are provided to the Pennsylvania Department of Environmental Protection, the permitting agency in the state. More information on the Pennsylvania Natural Diversity Inventory Environmental Review tool is available on the [Pennsylvania Conservation Explorer](#) website and through the [PABS Handbook](#).



from white-nose syndrome (*Pseudogymnoascus destructans*), a non-native fungal disease. To do this, PGC biologists, habitat managers, and partners manipulate mine temperature (i.e., non-living habitat components), spray polyethylene glycol to control fungal spread (i.e., manage fungi), and install bat-friendly gates in caves and decommissioned mine openings (i.e., mitigate human environmental impact).

This action category was also used most often for birds, highlighting issues such as fire suppression, invasive plant impacts on habitats, controlling water levels in impoundments appropriately to maximize SGCN benefit, and managing forests for structural and species diversity. Reptile conservation actions noted the need for manmade (anthropogenic) infrastructure impact mitigation, such as wildlife passage (e.g., road underpasses) projects to prevent road mortality. Reducing habitat succession and invasive plants will also support reptile SGCN.

“Outreach” actions to “Encourage beneficial human behavior” ranked highly for birds, reptiles, and fishes out of all actions identified for those taxonomic groups. Topics and audiences for this outreach range widely, from homeowners and farmers to habitat managers and boaters. There is growing need for bird-safe glass installations to reduce bird fatalities from window collisions, to increase awareness of proper bird feeder hygiene to prevent pathogen transmission between birds, and to keep domestic cats indoors (or on leash when outside) to reduce bird predation. Enhancing awareness of private property owners, farmers, and habitat managers about reducing pesticide use and using sustainable forestry practices, including the importance of retaining snags, can benefit a variety of SGCN. Boaters must learn how do their part to prevent aquatic invasive species transfer between water bodies.

Table 1.9. Top three modified Conservation Measures Partnership conservation action categories (Crisfield and the Northeast Fish and Wildlife Diversity Technical Committee 2022) identified for each vertebrate Species of Greatest Conservation Need taxonomic group. See Appendix 1.4 for specific actions.

Taxonomic Group	Action Category (Level 1)	Percent of Actions in Category
Birds	Direct Habitat Management	37%
	Design and Plan Conservation	22%
	Outreach	20%
Mammals	Direct Habitat Management	47%
	Direct Species Management	12%
	Design and Plan Conservation	10%
	Law Enforcement and Prosecution	10%
Amphibians	Design and Plan Conservation	53%
	Direct Habitat Management	15%
	Research and Monitoring	14%
Reptiles	Design and Plan Conservation	43%
	Direct Habitat Management	29%



	Outreach	13%
Fishes	Design and Plan Conservation	70%
	Direct Habitat Management	9%
	Outreach	9%

Aquatic and Terrestrial Invertebrate Conservation Actions

Aquatic and terrestrial invertebrate (hereafter invertebrate, unless otherwise noted) conservation actions aligned with vertebrate action categories, though habitat management actions are more prominent (Fig. 1.8):

- **Direct Habitat Management (55%)**
- **Design and Plan Conservation (25%)**
- **Outreach (16%)**

Leppo et al. (2025; Appendix 1.1) and individual species accounts (Appendix 1.4) provide details for each action. Note that no Commonwealth agency has legal oversight of *terrestrial* invertebrates in Pennsylvania, though these species are voluntarily considered in state land planning. Continuing a

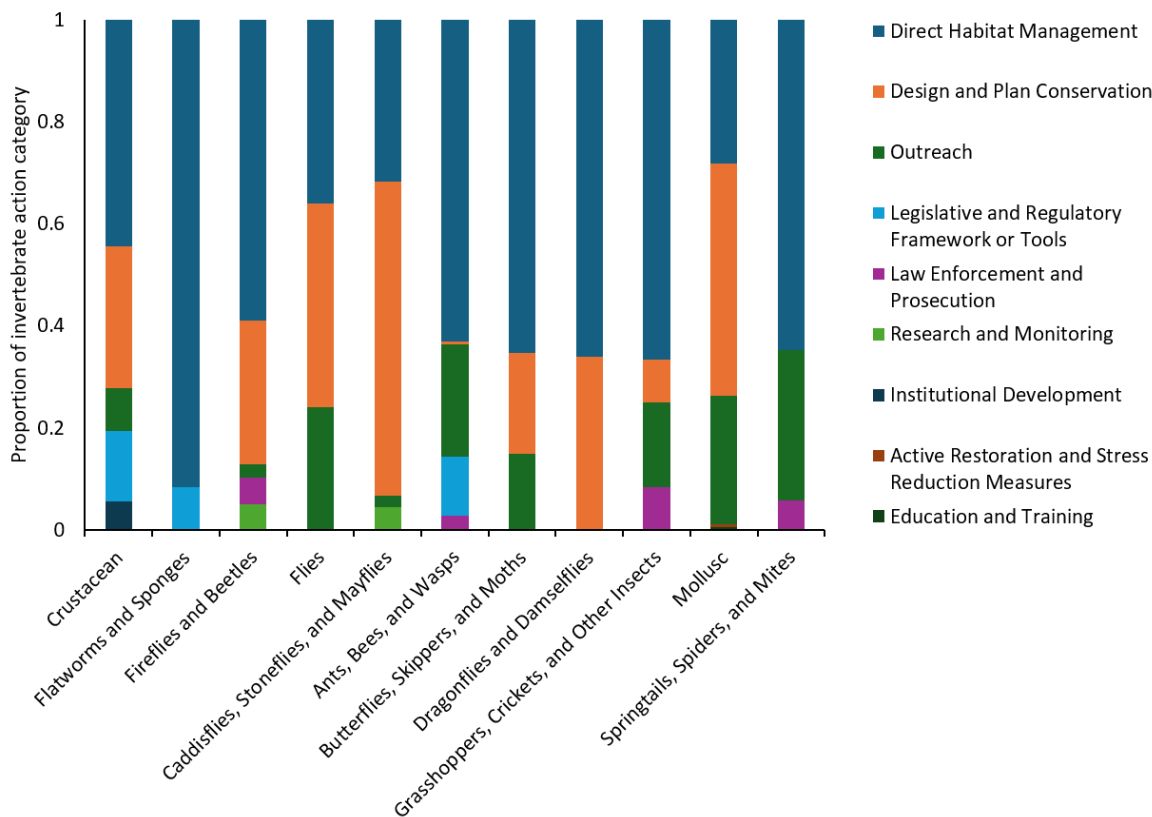


Fig. 1.8. Proportion of modified Conservation Measures Partnership conservation action categories (Crisfield and the Northeast Fish and Wildlife Diversity Technical Committee 2022) identified for invertebrate Species of Greatest Conservation Need, by taxonomic group. See Appendix 1.4, Leppo et al. 2025.



collaborative approach among state agencies and with non-government organizations will remain paramount to addressing actions for these species.

“Direct Habitat Management” is, overwhelmingly, the top conservation action across invertebrate taxonomic groups (Table 1.10). *“Manage plants, animals, fungi, or bacteria”* (Level 2 category) accounted for 67% of these habitat management actions, primarily reflected in pollinating insect - butterflies, skippers, and moths (i.e., Lepidoptera) and ants, bumble bees, sawflies, horntails, and allies, and solitary bees (i.e., Hymenoptera) - species accounts. These insect orders comprise over half (51%) of all invertebrate SGCN, and species ranges often overlap vertebrate SGCN (e.g., grassland birds). Similar needed actions, such as controlling non-native vegetation, non-native insects, and reducing deer browse, provide synergistic approaches for multispecies benefit in these shared habitats, particularly barrens. For aquatic invertebrate SGCN, habitat management to enhance vegetated riparian corridors, removing barriers to mussel host fish passage, stabilizing stream banks to reduce erosion and sedimentation, restricting livestock from streams, managing water flows, and remediating acid mine drainage are primary activities.

Fifty-five percent (55%) of *“Design and Plan Conservation”* actions involved *“conservation planning”* for across most taxonomic groups. Environmental review will remain critically important to conserve mussel species in a rapidly changing environment. Additionally, species experts often used *“Produce conservation plan for taxonomic groups or species,”* specifically to incorporate invertebrates into climate adaptation planning for wildlife. Conserving specific land to protect bogs, rare cave invertebrates, and fairy shrimp should be explored. With growing concern over declining insect populations and insect biomass, all Pennsylvania residents, agencies, and non-profit organizations should consider invertebrate SGCN recovery in land use planning and implementation decisions.

Nearly all invertebrate orders incorporated *“Outreach”* actions to *“Encourage beneficial human behavior”*, with *“Outreach, communication and distribution”* commonly used to classify the specific need. *“Targeted communications,” “public information and outreach,”* and *“assistance to public inquiry”* are sorely needed to support invertebrate SGCN recovery. Integrated pest management awareness and use is noted for nearly all solitary bee SGCN; media campaigns to reduce invasive crayfish range expansion will support native crayfish; and limiting invasive earthworms to new sites will assist land snails. Other actions are tailored specific groups for explicit items such as protecting precise host plants for two lace bug SGCN. Sharing knowledge and expertise for diverse invertebrate SGCN recovery will provide the best chance for their securement.

“Legislative and Regulatory Framework or Tools” was not used frequently among taxonomic groups, but the specific actions are notable. Species experts suggest that several globally vulnerable amphipods, crayfishes, and one planarian should be evaluated for state listing (PFBC jurisdiction). Additionally, bumble bee and solitary bee populations would be aided by neonicotinoid pesticide use in residential and agricultural settings.



Table 1.10. Top three modified Conservation Measures Partnership conservation action categories (Crisfield and the Northeast Fish and Wildlife Diversity Technical Committee 2022) identified for each aquatic and terrestrial invertebrate Species of Greatest Conservation Need. See Appendix 1.4 for specific actions.

Taxonomic Group	Action Category (Level 1)	Percent of Actions in Category
Crustacean	Direct Habitat Management	44%
	Design and Plan Conservation	28%
	Legislative and Regulatory Framework or Tools	14%
Flatworms and Sponges	Direct Habitat Management	92%
	Legislative and Regulatory Framework or Tools	8%
Fireflies and Beetles	Direct Habitat Management	59%
	Design and Plan Conservation	28%
	Law Enforcement and Prosecution	5%
	Research and Monitoring	5%
Flies	Direct Habitat Management	36%
	Design and Plan Conservation	40%
	Outreach	24%
Caddisflies, Stoneflies, and Mayflies	Design and Plan Conservation	61%
	Direct Habitat Management	32%
	Research and Monitoring	5%
Ants, Bees, and Wasps	Direct Habitat Management	63%
	Outreach	22%
	Legislative and Regulatory Framework or Tools	12%
Butterflies, Skippers, and Moths	Direct Habitat Management	65%
	Design and Plan Conservation	20%
	Outreach	15%
Dragonflies and Damselflies	Direct Habitat Management	66%
	Design and Plan Conservation	34%
Grasshoppers, Crickets, and Other Insects	Direct Habitat Management	67%
	Outreach	17%
	Design and Plan Conservation	8%
	Law Enforcement and Prosecution	8%
Molluscs	Design and Plan Conservation	45%
	Direct Habitat Management	28%
	Outreach	25%



Springtails, Spiders, and Mites	Direct Habitat Management	65%
	Outreach	29%
	Law Enforcement and Prosecution	6%

Research, Survey and Monitoring Needs

Chapter 5-Monitoring provides an overview of an adaptive management framework embraced by the PGC and PFBC, and hopefully conservation partners, over the next 10 years. This section highlights emerging themes for research, survey and monitoring needs, by taxonomic group, in the species accounts. Summary information below is not meant to be comprehensive; readers should reference individual species accounts (Appendix 1.4) for specifics.

Definition of terms

Research in this document refers to enhancing knowledge related to a species abundance, distribution, or life history (e.g., habitat use) for the purpose of fish and wildlife management decision-making. Species account authors were encouraged to identify applied research questions for each SGCN, though this was not required.

Survey is used to address data gaps for a species. This represents new information gathered spatially for a SGCN. A survey would be needed if no data exist in a particular location or for a particular species.

Monitoring is distinguished from a survey by inclusion of a temporal component. Monitoring applies when an observer makes repeated observations at the same, or similar, location to track changes in occupancy and/or abundance over time. In addition to population monitoring, however, is monitoring effectiveness of a conservation action. For each action specified in a species account, information on effectiveness measures is provided.

Fishes

Research: Effects of dredging projects; causes of populations declines; immigration/emigration of anadromous fish; reintroduction potential

Survey: Species distribution and status assessments; acoustic tagging of Shortnose Sturgeon (*Acipenser brevirostrum*); expansion of existing surveys into additional drainage basins

Monitoring: Development of standardized monitoring protocols and programs where they currently do not exist; continuation of annual surveys to track population trends

Amphibians and Reptiles

Research: Evaluate effectiveness of reintroduction and augmentation initiatives; developing reintroduction and augmentation protocols where needed; assess genetic population structure; population response to fire; illegal collection repatriation disease risk and efficacy

Survey: Expand searches to new sites; pre-and post-treatment surveys; surveys of historic sites



Monitoring: Development of standardized monitoring protocols and long-term monitoring programs where they currently do not exist; establish databases for long-term monitoring; continue long-term surveys at established sites

Mammals

Research: Hybridization extent and impact; effects of habitat fragmentation and human disturbance on populations; population responses to habitat manipulations; life history and genetic studies of lesser known species; home range, habitat use and dispersal; effects of energy development on bat populations and best deterrent techniques; white nose syndrome survivorship and recovery action efficacy; effects of forest management on habitats and populations

Survey: Abundance and distribution surveys; core activity area delineation

Monitoring: Continuation of summer roost and winter hibernaculum bat surveys; annual live-trapping and nest box surveys for northern flying squirrel; lagomorph pellet collection

Birds

Research: Effects of pesticides on aerial insectivore populations; forest structure and bird breeding densities; habitat use and site fidelity; development of best-management practices; exposure to wildlife disease and contaminants; linkage between breeding and migratory populations; home range, habitat use and dispersal; effects of habitat fragmentation and degradation on bird populations; effects of forest management on habitats and populations

Survey: Off-road point count surveys and spot-mapping for forest interior birds; autonomous recording unit remote surveys pre- and post-habitat treatment; habitat use and occupancy; initiation of statewide surveys where they do not exist; develop a volunteer network for surveying urban bird SGCN (e.g., Chimney Swift)

Monitoring: Use existing databases (e.g., eBird) to monitor population trends; invasive plant species impacts; population responses to habitat manipulations and disease outbreaks; participation in existing coordinated bird monitoring programs (e.g., North American Breeding Bird Survey, Golden-winged Warbler Conservation Initiative); continuation of long-term statewide monitoring programs (e.g., colonial waterbirds, osprey, marshbirds); participation in international bird monitoring programs

Invertebrates

Source: Leppo et al. 2015

Many taxonomic groups have not been studied enough to develop a basic understanding of their life history, habitat requirements, number of occurrences, or distribution. With limited exceptions, species level information for most invertebrates is still rare and based on a single-collection event at a particular site. Some sites have been visited repeatedly, but too infrequently or inconsistently with respect to time of year, species habits and behaviors, local weather and environmental conditions, or sampling methodology, to be considered monitoring. The cost and logistics involved with routinely surveying for species that must be sampled with special equipment, occupy habitats that are difficult to access, or are very rare or difficult to find may be prohibitive for monitoring efforts. More efficient ways of detecting



rare and/or difficult-to-find species are needed, as are better methods for monitoring species of sensitive habitats that may be degraded or destroyed by repeated surveys.

Future monitoring efforts can build upon the occurrence information compiled for this assessment. Monitoring programs may become more feasible with increased use of technologies such as genetic barcoding to identify species, environmental DNA testing that can detect the presence of aquatic species within a water body, and miniature electronic tags that allow for the tracking of very small animals.

Adequate funding for invertebrate monitoring is necessary to develop and implement systematic, successful statewide monitoring programs. There is a great need for experts and funding to support the training of new taxonomists. Species level identification of most invertebrate species requires extensive training, a well-maintained reference collection, lab equipment, and a library of reference texts. Many invertebrate species simply have few or no experts that specialize in their taxonomy and systematics.

Special case – Recoverable Extirpated Species

Species no longer occurring regularly in Pennsylvania but extant in other parts of their range (i.e., extirpated species) were considered for inclusion as a SGCN if there was a reasonable expectation (e.g., available habitat, nearby source population) that the species could return to Pennsylvania with modest assistance (i.e., recoverable) and their recolonization is expected to be supported by the public. Currently extirpated species have not received as much attention and require further study. Many of these species were included in the Data Deficient category and, thus, documenting species' presence is a priority over monitoring activities. Monitoring programs will be developed once comprehensive recovery assessments are completed.

Summary

Pennsylvania's fish and wildlife remain in dire need of conservation attention. Species status assessments identified gains made for a few species that received dedicated focus for decades (e.g., bald eagle) but also highlighted new threats and recent declines (e.g., insectivorous birds, Evening Grosbeak, snowshoe hare). Thus, the SGCN list did not change substantially between PA WAP periods, with 79% of vertebrate SGCN and 77% of invertebrate SGCN maintained from 2015 (Table 1.5). Some changes can be attributed to SGCN selection procedures (e.g., migratory and wintering birds) or better information (e.g., several fishes removed as SGCN). New invertebrate SGCN comprise the largest proportion increase, nearly 50% over 2015, demonstrating enhanced concern and active recovery needs for these species.

The individual Species Accounts (Appendix 1.4) for each SGCN, again, provide a firm foundation for the 2025-35 PA WAP. Each account includes a photo; conservation profile; habitat association and specific habitat requirements; threats, actions, and action location; measure for action; research and survey needs; and monitoring programs for long-term population tracking. We summarized information contained in these accounts within this chapter, but readers are encouraged to reference the individual accounts, and associated [Wildlife Action Map](#) tool, frequently during their planning processes.



Species of Greatest Conservation Need continue to face existing and emerging challenges across the state, yet with these challenges come opportunities. For example, treatments for white nose syndrome have demonstrated encouraging preliminary results. Hundreds of local watershed associations and County Conservation Districts are remediating acid mine drainage and breathing new life into these impaired streams. Non-governmental partners, with cooperation from industry, are taking stock of energy development impacts and crafting best practices to minimize impacts. Through research to understand the problem, species requirements, and responses, systematic conservation planning to expertly illustrate solutions, and proper execution through direct management, we are optimistic for the future of the Species of Greatest Conservation Need over the next 10 years.

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