CHAPTER 1: REGIONAL SPECIES OF GREATEST CONSERVATION NEED IN THE NORTHEAST

SWAP Element 1

Information on 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.

A. The Strategy indicates sources of information (e.g., literature, databases, agencies, individuals) on wildlife abundance and distribution consulted during the planning process.
B. The Strategy includes information about both abundance and distribution for species in all major groups to the extent that data are available. There are plans for acquiring information about species for which adequate abundance and/or distribution information is unavailable.
C. The Strategy identifies low and declining populations to the extent data are available.
D. All major wildlife groups have been considered or an explanation is provided as to why they were not (e.g., including reference to implemented marine fisheries management plans). The State may indicate whether these groups are to be included in a future Strategy revision.
E. The Strategy describes the process used to select the species in greatest need of conservation. The quantity of information in the Strategy is determined by the State with input from its partners, based on what is available to the State.

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HOW TO USE THIS CHAPTER:

Chapter 1 provides a summary of the overall region, methods, and approach to developing the RSGCN list and presents a summary of the new 2023 list and all the taxonomic groups.

- Section 1.1 describes the purpose and need for RSGCN.
- Section 1.2 discusses the method updates and RSGCN process.
- Section 1.3 describes the RSGCN 2023, each of the 20 taxonomic groups broken-down by SGCN, RSGCN, conservation highlights, RSGCN categories, each with habitats and threats per taxa, and regional conservation work by partners (if applicable).
    - Each RSGCN and Proposed RSGCN were assigned to all suitable habitats and threats, meaning each species, population, or entity can have more than one habitat or threat and are summarized as such. More detailed information on habitats and threats can be found in *Chapter 2* and *Chapter 3*, respectively.
- Section 1.4 of *Chapter 1* has available links to taxon partners, *Chapter 7* describes partners in greater detail.
- This Chapter ends, Section 1.5, with an overall discussion of the RSGCN list and categories, process advancements, and recommendations.
- Appendices for this and all chapters can be found in the Appendices PDF, separate from the chapters. *Chapter 1 Appendix 1A* covers the methods of the RSGCN process in more detail.
- Supplemental Information, such as full species lists for all RSGCN categories and the state breakdown of RSGCN per state, can be found in the Excel workbook with *Supplemental Information 1A-1E* for *Chapter 1*.

1.0 REGIONAL OVERVIEW

1.1 PURPOSE AND BACKGROUND OF IDENTIFYING REGIONAL SPECIES OF GREATEST CONSERVATION NEED

The states of the Northeast region and the District of Columbia have collaborated to prioritize Regional Species of Greatest Conservation Need (RSGCN) for shared conservation and management since 1999. This regional effort aims to maintain a non-regulatory list of RSGCN to provide focus, resources, and collaboration to conserve these species of mutual conservation concern (and their habitats) for current and future generations in the Northeast[1].

Northeast RSGCN species for which the region has stewardship responsibility due to high conservation concerns and/or populations centralized within the Northeast Region. The list includes 20 vertebrate and invertebrate taxa groups of Species of Greatest Conservation Need (SGCN) from State Wildlife Action Plans (SWAPs) in the Northeast Association of Fish and Wildlife Agencies (NEAFWA) planning geography (Maine to Virginia, including the District of Columbia). The list promotes focused action on high-priority Northeast species by the Northeast Fish and Wildlife Diversity Technical Committee (NEFWDTC) in developing SWAPS and conservation planning and implementation by state fish and wildlife agencies and their partners.

NEAFWA's NEFWDTC updates the Regional Species of Greatest Conservation Need list every five years using the following criteria: Regional stewardship responsibility (proportion of the species range in the Northeast region) and Conservation concern status (imperilment). To meet these objectives and fulfill the purposes and goals of RSGCN, the five-year update during 2021-2023 has undergone significant updates in methodology. This report outlines those updates and summarizes the results leading toward greater regional conservation efforts in the Northeast. This 2023 update is the 4th revision of the Regional Species of Greatest Conservation Need List developed by the Northeast Fish and Wildlife Diversity Technical Committee of the Northeast Association of Fish and Wildlife Agencies. The original list was published in 1999 (Therres 1999), and sequential updates in 2013 and 2018 followed (Terwilliger Consulting Inc. 2013, 2018).

RSGCN provides an effective, collaborative conservation focus, which facilitates regional watershed and landscape approaches for fish and wildlife diversity conservation in the Northeast. The current RSGCN list and supportive information on status updates demonstrate how the Northeast continues to lead the RSGCN concept nationally by implementing NEAFWA's conservation planning model through its Regional

Conservation Needs Program and committee charges. This effort informs all Northeast state fish and wildlife agencies, their SWAPs, and partners about these priority species, habitats, threats, and actions. The NEFWDTC then develops and implements research, surveys and monitoring, and conservation on the ground through the Regional Conservation Needs (RCN) program to fund conservation at the regional scale. Additional information can be found in the Northeast RSGCN Database (Terwilliger Consulting Inc. and Northeast Fish and Wildlife Diversity Technical Committee 2023).

To meet these objectives and fulfill the purposes and goals of RSGCN, the 2021-2023 update has undergone significant changes in methodology. The method advancements have come from numerous iterations of this process across multiple regions (Terwilliger Consulting Inc. 2019, 2021), including greater consistency between regions and adding a "Proposed" category to include non-SGCN species. This report outlines these changes and summarizes the results leading towards greater regional conservation efforts and actions herein.

This 4th revision of the RSGCN list resulted in 382 RSGCN. Again, updated method and selection criteria were used to prescreen and evaluate all species known to occur in the NEAFWA region (Table 1.1.1). The update resulted in 17,916 species with predicted ranks across 20 taxonomic groups for which data and expertise existed, then reviewed by experts from the 13 states and the District of Columbia. Almost 200 experts provided knowledge on mammals, birds, reptiles, amphibians, fish (marine, diadromous, and freshwater), crayfish, freshwater mussels, marine invertebrates, terrestrial snails, Odonata (dragonflies and damselflies), Hymenoptera (bumble and solitary bees), Lepidoptera (butterflies, skippers, and moths), fireflies, tiger beetles, mayflies, stoneflies, caddisflies, and fairy, clam, and tadpole shrimp.

Table 1.1.1 Summary of biodiversity across taxonomic groups in the Northeast; includes the 20 taxonomic groups assessed for the RSGCN, showing the number of species from each group and the number of SGCN from each group within the Northeast.

Taxonomic Groups	*Northeast Species*	*Species of Greatest Concern*
Birds	426	284
Mammals	183	107
Amphibians	111	88
Reptiles	115	84
Fish – Fresh	335	213
Fish – Diadromous	28	14
Fish – Marine	661	102
Terrestrial Snails	268	182
Freshwater Bivalves	150	106
Crayfish	78	26

Fairy, Clam, & Tadpole Shrimp	18	5
Dragonflies and Damselflies	255	205
Butterflies and Skippers	224	134
Moths	2422	364
Tiger Beetles	40	35
Fireflies	43	13
Caddisflies	565	40
Mayflies	281	62
Stoneflies	253	67
Bumble Bees	23	17
Solitary Bees	399	131
Marine Invertebrates	465	95
Plants	6084	1785
Other species	4490	632
Total	17916	4788

The goal of the RSGCN list is to secure and restore Regional Species of Greatest Conservation Need (and their habitats) across the region's lands and waters through strategic, collaborative action. This goal is accomplished by maintaining a non-regulatory list of RSGCN to provide focus, resources, and collaboration to conserve these species of mutual conservation concern (and their habitats) for current and future generations in the Northeast. It creates a recognizable regional stewardship responsibility, implements proactive measures to prevent further declines of common species with conservation concerns, and prioritizes imperiled species. The RCN program spotlights species with population or habitat declines or emerging issues for collective conservation actions, fills data gaps, and enhances knowledge of a species' range-wide distribution, imperilment status, threats, and needed actions.

1.2 REGIONAL SPECIES OF GREATEST CONSERVATION NEED (RSGCN) METHODS

1.2.1 DEVELOPMENT OF RSGCN PROCESS IN THE NORTHEAST

HISTORY OF RSGCN METHOD

1980s: Since the 1980s, states have shared lists of species of concern and information about the species to support each other's efforts to protect them.

1999: The NEFWDTC evaluated 106 species and suggested 26 warranted federal listing consideration based on four factors:

- *Risk:* declining populations or high risk of disappearing from the Northeast
- *Data:* lack of data with suspicion of the danger of disappearing from the region

- *Area:* the Northeast comprises a significant portion of the species' global range.
- *Special Cases:* e.g., collecting pressure, taxonomic uncertainty, intensive management needed, etc.

2010: The Northeast Partners in Amphibian and Reptile Conservation (NEPARC) developed a prioritization method based on the State Wildlife Action Plan Species of Greatest Conservation Need and species' ranges.

- *Conservation Need*: the percent of states in the Northeast that identified the species as SGCN in 2005 SWAPs.
- *Regional Responsibility*: the portion of the species' North American range in the Northeast (estimated by taxa experts)

2013: The NEFWDTC worked with the North Atlantic Landscape Conservation Cooperative (LCC) to extend the NEPARC method to all taxa and update the RSGCN list.

2018: State Wildlife Action Plans, revised in 2015, provided the most recent review of Species of Greatest Conservation Need. The NEFWDTC updated the RSGCN list with three objectives:

- *Regional Species of Greatest Conservation Need:* to rank the most imperiled species that our region has responsibility for protecting.
- *Data Deficient:* to identify understudied taxa with potential conservation concern.
- *Stronghold Species:* to identify species that are imperiled outside the Northeast region but have relatively healthy populations in the Northeast.

1.2.2 APPROACH FOR SELECTING RSGCN 2023

Phase 1 of updating the RSGCN list involves the evaluation and refinement of the method. This revision benefits from both the Southeast (Rice et al. 2019) and Midwest (Terwilliger et al. 2021) applications of the original Northeast process (1990-2018), just as the other regions have benefited from the iterations in the Northeast. Each application has resulted in advancements in thinking and data processing efficiencies available to the Northeast for this current list update process.

TCI assembled and coordinated an RSGCN Method Team to refine and update the method. An Invertebrate Overview Team was formed to determine which new taxonomic groups could be added for evaluation. These teams comprised NEFWDTC, SWAP Coordinators, or Taxonomic Team members who worked on previous RSGCN list updates and several new state representatives. TCI reported progress to the NEFWDTC monthly. A survey was sent to states for input in improving the method.

Appendix 1A depicts the RSGCN selection criteria, filters, and processes used in the 2023 update. Differences and advancements are listed that compare the original

Northeast and updated methods. Taxonomic experts estimated regional responsibility and determined conservation needs based on biological population status and trend assessments.

Phase 2 of the RSGCN selection process focused on compiling and reviewing data from the 14 NEAFWA SWAPs and other sources to categorize candidate RSGCN based on agreed-upon criteria (*Appendix 1A*). TCI pre-screened the available data and prepared draft taxa lists for taxonomic team review. Once quality assurance and quality control (QA/QC) was complete, TCI applied the selection criteria to produce a species list in four categories: Likely RSGCN, Maybe RSGCN, Not Likely RSGCN, and Unknown RSGCN. This prescreening effort helped to organize and prepare the data for more efficient review by taxa experts.

Phase 3 included assembling an updated list of regional taxonomic experts. TCI coordinated the participation of almost 200 taxonomic experts from all 20 taxa groups to participate in the RSGCN selection process using the compiled and analyzed data. TCI facilitated the taxa teams' reviews for RSGCN selection. Each state selected a representative to serve on the review team for each taxonomic group. Every effort was made to include biologists with field experience covering the entire region, especially for invertebrate groups. TCI facilitated three rounds of webinars for selecting RSGCN by each taxa team and to capture and confirm species status information as well as habitat, limiting factors, threats, and actions for all species possible during this period.

The 2023 methodological advancements, informed by the RSGCN projects in the Southeast and Midwest, include new categories to more comprehensively capture species' conservation needs (see *Appendix 1A*). Three Watchlist categories were added, consistent with the Midwest RSGCN list: Watchlist [Assessment Priority], Watchlist [Interdependent Species], and Watchlist [Defer to an adjacent region]. The Watchlist [Assessment Priority] species category updates the previous Data Deficient classification. The new Watchlist [Interdependent Species] allows for including species on which an RSGCN depends but does not meet selection criteria to be independently identified as RSGCN. The new Watchlist [Defer to an adjacent region] allows RSGCN of low regional responsibility (i.e., less than 25%) but of conservation concern in the Northeast to be deferred to adjacent regions that now have their RSGCN lists. All fish and wildlife species known to occur in the Northeast were pre-screened for potential identification as RSGCN or Watchlist species. Species not currently identified in a Northeast SWAP as an SGCN but that the taxa teams identified as meeting selection criteria are now recognized as Proposed RSGCN or Proposed Watchlist species until a SWAP identifies them as SGCN.

The draft list was compiled and sent for review to the taxa teams, NEFWDTC, and NEAFWA. With the updated and expanded RSGCN list for the Northeast, the Northeast RSGCN Database was developed (Terwilliger Consulting Inc., and Northeast Fish and Wildlife Diversity Technical Committee. 2023). The updated Northeast RSGCN Database includes more than 500 data fields on the species status, distribution, habitats, threats, limiting factors, management needs, monitoring protocols, and research needs. TCI pre-populated the database with as much publicly available information as possible from publishes sources. Taxa teams also were asked to confirm state-level data in the database for each species, including data fields on S-Ranks, state listing status, whether the species is an SGCN in their state, and whether the species occurs in their state.

Phase 4 of the project finalized the RSGCN list, their habitats, and their limiting factors following the additional coordination with the taxa teams and NEFWDTC before submission to the NEAFWA Administrators and Directors for final approval. Analysis and supportive data with QA/QC, research, and reporting of the results completed the process. The data collected and managed during the RSGCN process represent a living database with multiple tables structured for the NEFWDTC to inform conservation actions regionally across NEAFWA. TCI evaluated options for products and platforms to maximize the utility and accessibility of the RSGCN list and its associated data, presenting them for consideration by the NEFWDTC in September 2022.

1.2.3 KEY DIFFERENCES/ADVANCEMENTS FOR THE 2023 RSGCN UPDATE:

- The pre-screening process begins with all species in the Northeast, not just SGCN.
- **Regional Responsibility**, the proportion of the species' North American or North Atlantic range overlapping the NEAFWA region (including the Canadian Provinces of Ontario, Quebec, New Brunswick, Nova Scotia, Newfoundland, Labrador, and Prince Edward Island), calculations were refined.
- **Concern Level**, which indicates the level of conservation status and needs in the region, are Very High, High, and Moderate.
- The formalization of **Regional Responsibility Overriding Factors (ROF)** and **Concern Overriding Factors (COF)**. The taxa teams identified ROF and COF to document the reasons for placing a species as RSGCN to clarify RSGCN status when it does not otherwise meet the Regional Responsibility or Concern selection criteria.
- Regional Responsibility Overriding Factors include:
    - ***Core Population***: Species found over a very large geographic area, but the strongest populations are in the NEAFWA region.

    - ***Climate Change Range Shift***: Species where predicted range shifts due to climate change would make the species a higher regional responsibility in the future.
    - ***Migratory Species***: Species where the overall geographic range does not meet the 50% threshold for regional responsibility, but specific seasonal ranges do. Migratory species may be included as RSGCN if:
        - ⩾ 50% of the breeding range occurs in the Northeast (the NEAFWA region, including Canadian Provinces)
        - ⩾ 50% of the migratory stopover habitat occurs in the Northeast
        - ⩾ 50% of the wintering habitat occurs in the Northeast
    - ***Highly Imperiled***: The species is highly imperiled throughout its range and is of high conservation concern in every region in which it occurs.
    - ***Disjunct Population:*** Species has a disjunct population that may contribute to genetic diversity or the three R's (resiliency, redundancy, or representation) when conducting species status assessments.
    - ***Stewardship Priority:*** The region has a significant stewardship responsibility for managing, restoring, or recovering the species.
- Concern Overriding Factors include:
    - ***Emerging:*** Species where conservation statuses are likely to change quickly due to a new or widespread threat, such as disease or a shift in market forces driving harvest or collection.
    - ***Climate Vulnerability*****:** Species where Concern Levels are expected to increase in the coming decades due to climate change.
    - ***Keystone Species*****:** Species that many other species rely on for their sustained presence.
    - ***Stronghold Species*****:** Species for which the Northeast supports the strongest populations and are imperiled outside of the region.
    - ***Genetic Distinctiveness*****:** Species or other taxonomic levels with unique genetics, such as isolated populations, DPS, subspecies, uncertain taxonomy, etc.
    - ***Cultural Values*****:** Species with historical significance or strong values to Indigenous peoples may be included as RSGCN in recognition of the importance of maintaining secure populations.
- Vertebrate and invertebrate taxa are screened with the same selection criteria.
- The Federal listing status criteria have expanded to include Candidate species and Endangered, Threatened, or Proposed.
- The S-Rank filter is now a regional average of all the states with an S-Rank for that species. However, an average regional S-Rank of less than S2 remains a filter.

- A new filter of State Protected Status is now included for species prescreened as Maybe RSGCN.
- In the 2017/18 review, species that were included based on established taxonomic-specific assessments have been formalized in the ROF (all) and COF (all).
- An RSGCN Watchlist was added for species that are of concern to the taxa teams but for which:
    - The species are data deficient, have uncertain taxonomy, or are showing varying trends in different parts of the region, prioritizing them for additional survey or research efforts = **Watchlist [Assessment Priority]**
    - The species is interdependent with an RSGCN but does not qualify as RSGCN on its own = **Watchlist [Interdependent Species]**
    - The region has low regional responsibility but high concern = **Watchlist [Deferral to adjacent region]**
- Species not currently identified as SGCN by at least one state in the region may now be considered **Proposed RSGCN** or **Proposed Watchlist** species.

Taxa teams remain the definitive authority on reviewing, confirming, or revising prescreened RSGCN recommendations, identifying Overriding Factor(s), determining RSGCN Concern Levels and Regional Responsibility, and recommending species for the Watchlist. Terwilliger Consulting Inc. coordinates their review and consensus process as part of the RCN Technical Services RCN project to the NEFWDTC. For more information on the methods and selection process, see *Appendix 1A*.

1.3 RSGCN 2023

Of 17,916 Northeast species, 7,270 were evaluated and prescreened using the NEAFWA RSGCN selection criteria and fell within the 20 Taxonomic Teams. The 2015 State Wildlife Action Plans list almost 27% (4,788 species) of these species as SGCN in the Northeast (Table 1.3.1). Of these SGCN, approximately 693 invertebrates from other taxonomic groups and 230 plants were beyond the scope of this assessment due to data deficiency, lack of current expertise across the entire taxon regionally, or scope of jurisdiction. Species that regularly occur in the region are included, and many invertebrate taxa are under review and therefore omitted from this analysis. The invertebrate list is incomplete, but because the RSGCN process continues to evaluate them, an increase from only two major invertebrate groups reviewed for 2018 increased to 13 invertebrate taxonomic groups through the 2023 RSGCN process and included in this analysis. Twenty Taxonomic Teams identified 382 RSGCN, 37 Proposed RSGCN (*Supplemental Information 1A*), 229 Watchlist Assessment Priority, and 62 Proposed Watchlist Assessment Priority (*Supplemental Information 1B*). Results are presented by

category below in this order. Of the total Northeast species considered for the RSGCN list, 5% warranted regional conservation needs and were assigned to one of the RSGCN list categories (Figure 1.3.1, Table 1.3.1). 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 in major taxonomic groups.

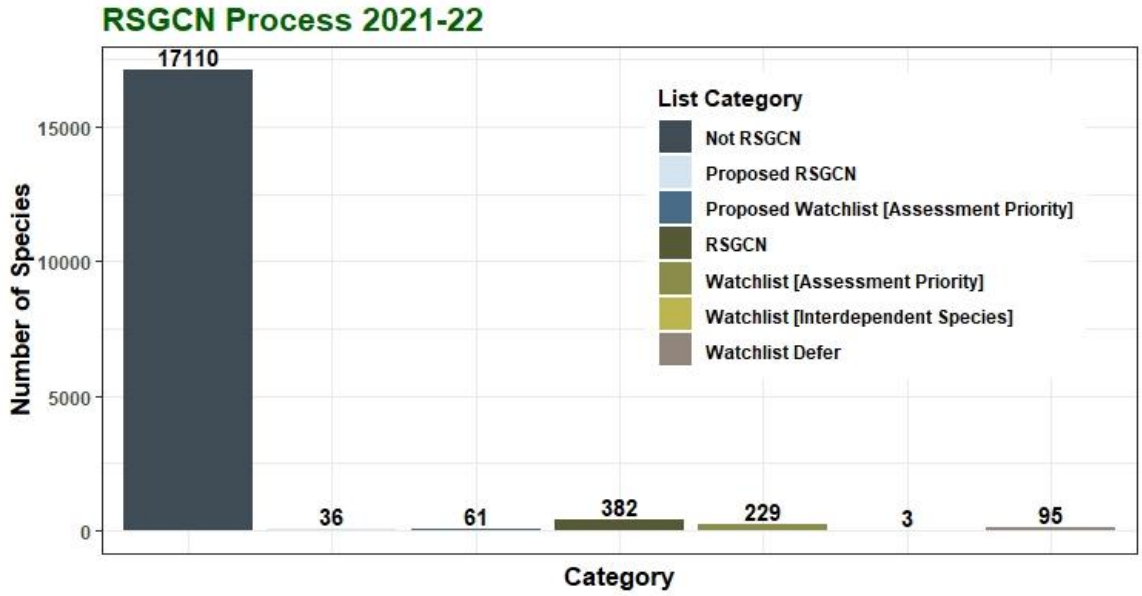


Figure 1.3.1 Number of Northeast species (17,916 total species) evaluated; includes the 20 taxonomic groups assessed for the 2023 RSGCN update.

The percentage of vertebrate species identified as SGCN in one or more of the Northeast State Wildlife Action Plans approaches 48% of the total number of vertebrate species in the Northeast (Table 1.3.1). For Invertebrates, Northeast states identified 39% of invertebrate species as SGCN in State Wildlife Action Plans. Major taxonomic groups with the highest percentage of RSGCN in the Northeast include Freshwater Fish (12%), Birds (9%), and Terrestrial Snails (7%). Of the 806 total RSGCN analyzed in Table 1.3.1, approximately 53% have high Regional Responsibility (>50% of their range occurs in the Northeast), and 50% have High or Very High regional concern.

Table 1.3.1 Number of total Northeast species, SGCN, and RSGCN (with categories); includes the 20 taxonomic groups assessed for the RSGCN.

	Northeast Species	*SGCN*	*RSGCN (incl. Proposed)*	*Assessment Priority (incl. Proposed)*	*Defer*	*Interdependent*	*All RSGCN/WL Categories*
Birds	426	284	28	30	12	0	70

Mammals	183	107	29	15	5	0	49
Amphibians	111	88	22	6	2	0	30
Reptiles	115	84	16	8	1	0	25
Fish – Fresh	335	213	47	34	16	0	97
Fish – Diadromous	28	14	9	2	0	0	11
Fish – Marine	661	102	27	12	3	2	44
Terrestrial Snails	268	182	32	24	4	0	60
Freshwater Bivalves	150	106	21	2	13	0	36
Crayfish	78	26	12	17	0	0	29
Fairy, Clam, & Tadpole Shrimp	18	5	3	2	0	0	5
Dragonflies and Damselflies	255	205	22	20	7	0	49
Butterflies and Skippers	224	134	26	12	5	0	43
Moths	2422	364	29	32	6	0	67
Tiger Beetles	40	35	8	4	1	0	13
Fireflies	43	13	13	6	0	0	19
Caddisflies	565	40	15	9	1	0	25
Mayflies	281	62	16	20	9	0	45
Stoneflies	253	67	31	2	0	0	33
Bumble Bees	23	17	3	3	4	0	10
Solitary Bees	399	131	5	21	6	1	33
Marine Invertebrates	465	95	4	9	0	0	13
Plants	6084	1785	n/a	n/a	n/a	n/a	n/a
Other species	4490	632	n/a	n/a	n/a	n/a	n/a
Total	17916	4788	418	290	95	3	806

RSGCN status categories total 806 species, with 47% (382) of those meeting the criteria for RSGCN or Watchlist status (Figure 1.3.2). The two Proposed categories represent 12% (97) of the 806 species not currently listed as SGCN in any Northeast SWAP. However, because they meet the other RSGCN or Watchlist criteria and often contain species whose taxonomy is new or updated, they will help inform the upcoming 2025 SWAP SGCN selection as species with regional concern. For example, the new RSGCN Watchlist [Assessment Priority] category contains 28% (229) of listed species highlighting species with data deficiencies, taxonomic uncertainties, or variable trends within the region. Three meet RSGCN Watchlist [Interdependent Species] criteria (*Supplemental Information 1C*), and 95 additional species are deferred to other regions for primary stewardship in the core of their range (*Supplemental Information 1D*).

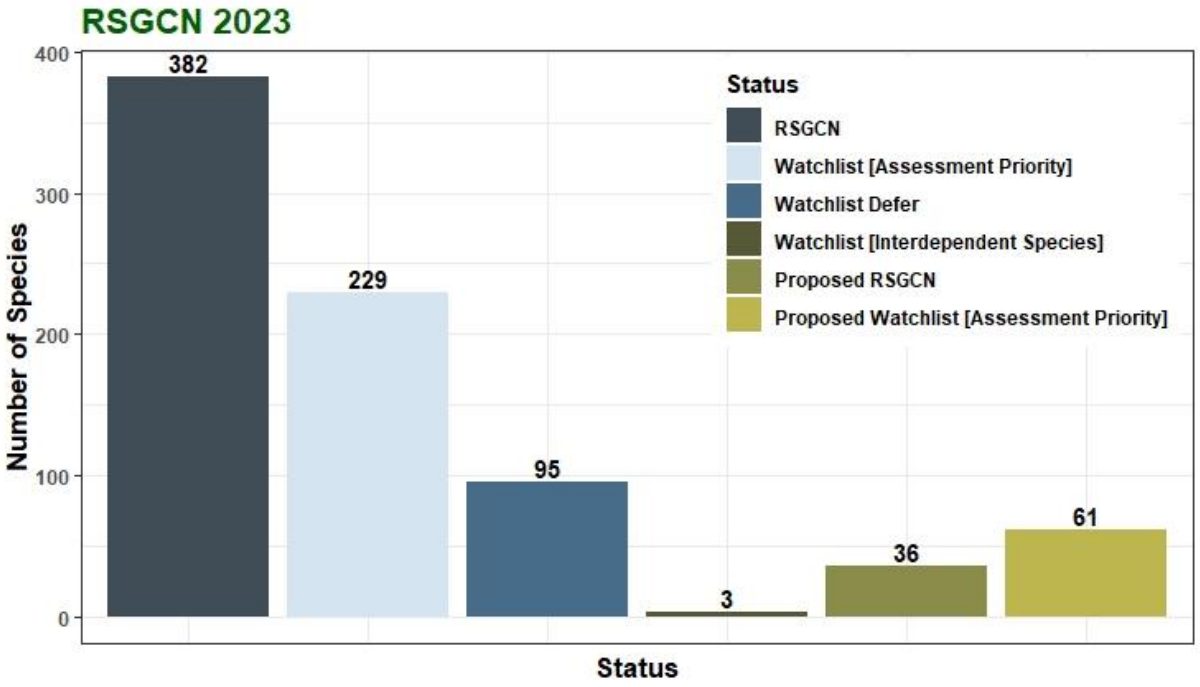


Figure 1.3.2 Number of species (806) in each 2023 RSGCN category.

RSGCN CATEGORIES: 382 RSGCN AND 36 PROPOSED RSGCN

RSGCN

382 SGCN met the regional responsibility and conservation concern criteria for RSGCN (Figure 1.3.2*; Supplemental Information 1A*). Lepidoptera (Butterflies, Skippers, and Moths) represents the largest taxonomic group of RSGCN evaluated, followed closely by freshwater fish (Figure 1.3.3). 56% of RSGCN are invertebrates (Figure 1.3.3, green), while the remaining 44% are vertebrates (Figure 1.3.3, purple).

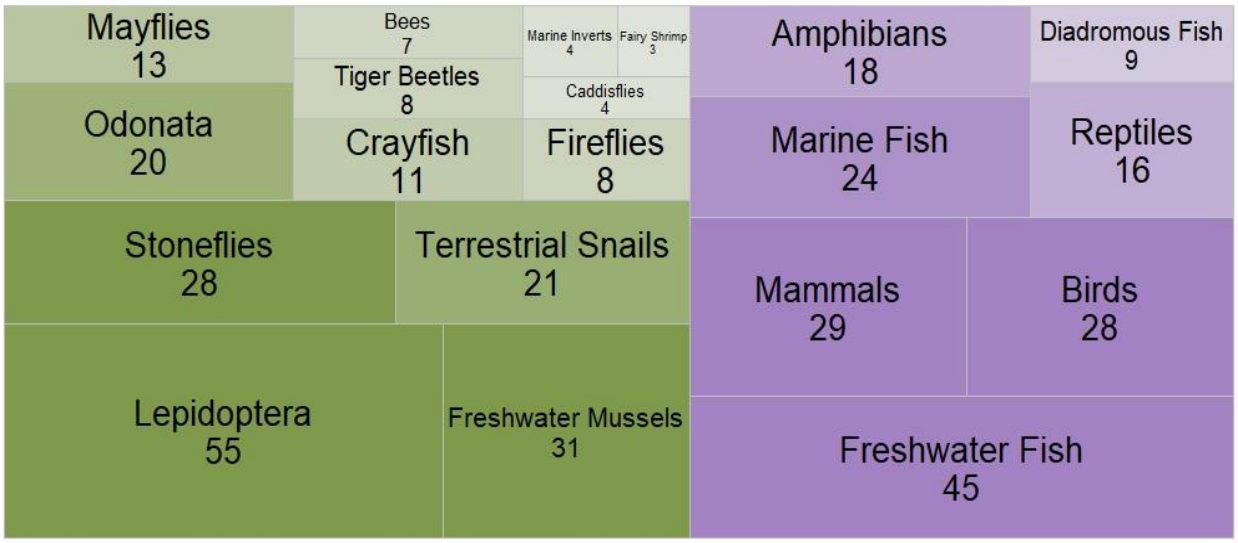


Figure 1.3.3 Number of RSGCN (382) by taxa, in each of the 20 taxa evaluated in the Northeast RSGCN list update.

PROPOSED RSGCN

Thirty-six (36) species met the regional responsibility and conservation concern criteria for RSGCN (not yet listed as SGCN in any Northeast SWAP). This Proposed RSGCN category often contains newly described species, those with recent taxonomy changes since the 2015 SWAPs, or taxonomic groups not comprehensively reviewed in all SWAPs (Figure 1.3.4). Caddisflies are the largest taxonomic group of Proposed RSGCN, outweighing all the vertebrates. Fireflies and amphibians are the next largest, with the other taxa groups containing a few species at most (Figure 1.3.4). Seventy-five percent of Proposed RSGCN are invertebrates (Figure 1.3.4, green), while the remaining 25% are vertebrates (Figure 1.3.4, purple).

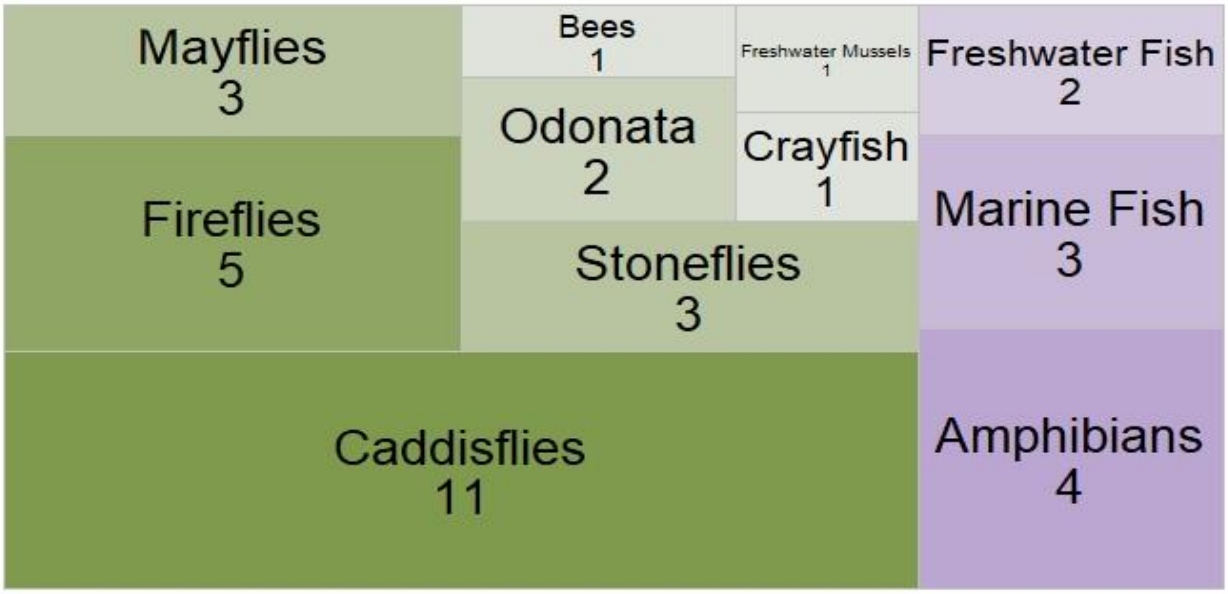


Figure 1.3.4 Number of Proposed RSGCN (36) by taxa (20 total taxa evaluated in the Northeast RSGCN update).

CONCERN LEVEL RESULT HIGHLIGHTS

RSGCN were categorized by Very High, High, and Moderate conservation Concern Levels (*Supplemental Information 1A*). **Of the 382 RSGCN, 37% are Very High** (121) regional concern by taxa team experts. Freshwater mussels and freshwater fish were assigned the most species (18 and 16 respectively) as Very High concern (Figure 1.3.5). **High** concern contained the most RSGCN with 44% (167), and species and Lepidoptera listed the greatest number of species (29, Figure 1.3.5). **Moderate** conservation concern contains the remaining 25% (94) of RSGCN (Figure 1.3.5).

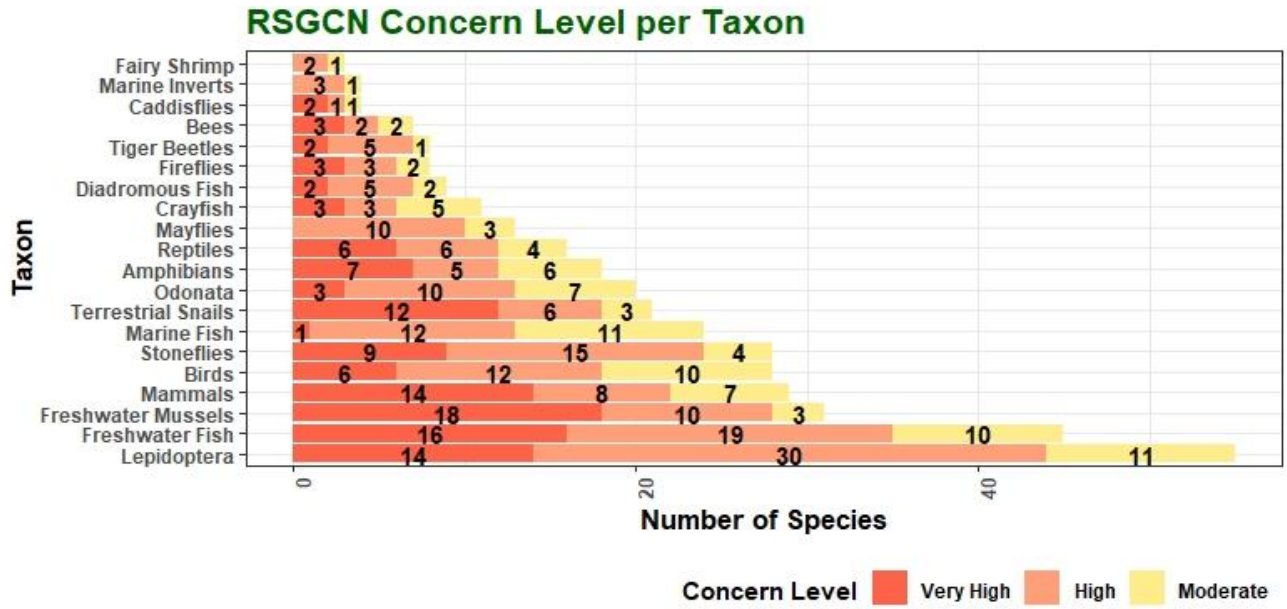


Figure 1.3.5 Number of RSGCN by conservation Concern Level in each taxon.

The percent of species listed in each Concern Level group within each taxon varies across taxa. For example, Marine Fish and Crayfish list the highest percentage of species as Moderate concern. At the same time, Terrestrial Snails and Freshwater Mussels are assigned the highest percentage of species at the Very High Concern Level within their taxa (Figure 1.3.6).

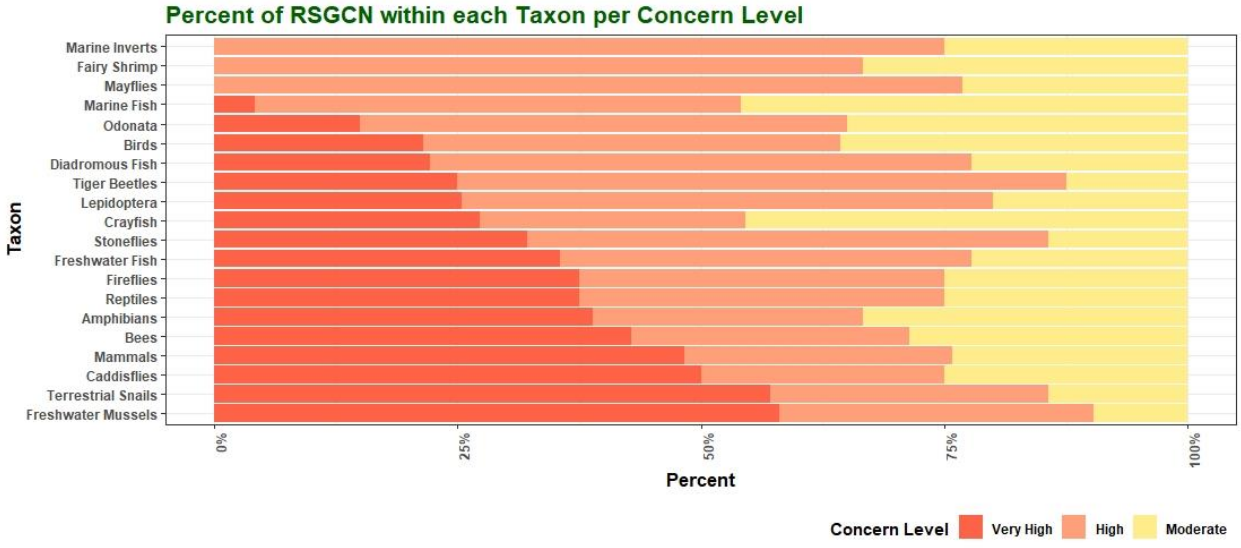


Figure 1.3.6 Percent of Concern Level status within each Northeast RSGCN taxon.

REGIONAL RESPONSIBILITY RESULTS HIGHLIGHTS

Regional responsibility varies across RSGCN taxa groups. Nine of the 20 taxa groups contain all categories of regional responsibility (Figure 1.3.7, Figure 1.3.8). Sixteen of 20 taxa groups include endemic species. For example, Stoneflies list 16 species as endemic, Terrestrial Snails list 15, and Freshwater Fish list 15 (Figure 1.3.7).

REGIONAL RESPONSIBILITY AND NORTHEAST ENDEMIC SPECIES

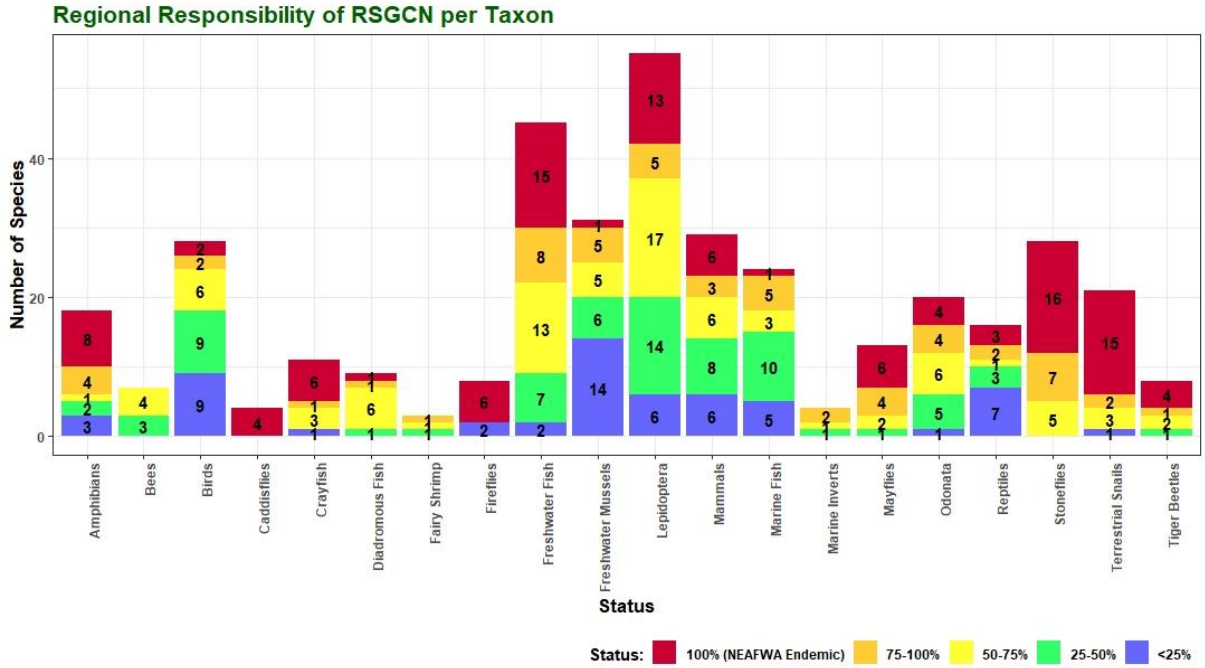


Figure 1.3.7 Regional responsibility levels of RSGCN by taxa. Endemic species are shown in red.

Six taxa (Caddisflies, Crayfish, Fireflies, Stoneflies, Terrestrial Snails, and Tiger Beetles) list 50% or more of their RSGCN as endemic to the NEAFWA region (Figure 1.3.8). In addition, there are four taxonomic groups, mostly migratory, with disproportionately high proportions of RSGCN species below 50% Regional Responsibility that required identification of Regional Responsibility Overriding Factor(s) (Birds=18, Freshwater Mussels =20, Marine Fish =15, Reptiles =10; Figure 1.8). Overriding factors within each taxonomic group allow for the inclusion of low Regional Responsibility species as RSGCN, including:

- **Birds**: Highly Imperiled (9), Stewardship Priority (8), Core Population (6), Migratory Species (5).
- **Freshwater Mussels**: Highly Imperiled (16), Core Population (7), Stewardship Priority (4).
- **Marine Fish**: Migratory Species (11).
- **Reptiles**: Highly Imperiled (7), Migratory Species (4), Disjunct (3).

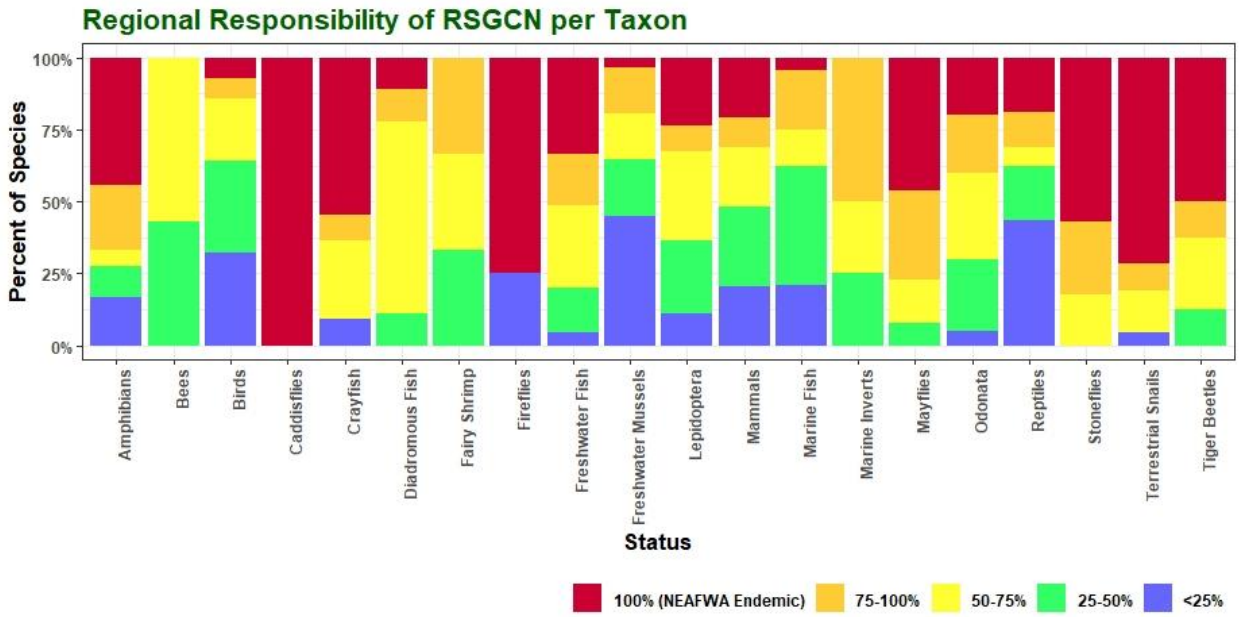


Figure 1.3.8 Percent Regional Responsibility for RSGCN by taxa. Endemics in red.

NEAFWA ENDEMIC RSGCN

There are 109 endemic RSGCN in the Northeast representing 16 of the 20 taxa groups. Of those, 49 RSGCN species have a Very High Concern Level (Figure 1.3.9). Eighteen of these Very High concern RSGCN endemics occur in more than one state within the region, while 30 species are single-state endemics. Virginia has the highest number of single-state endemics.

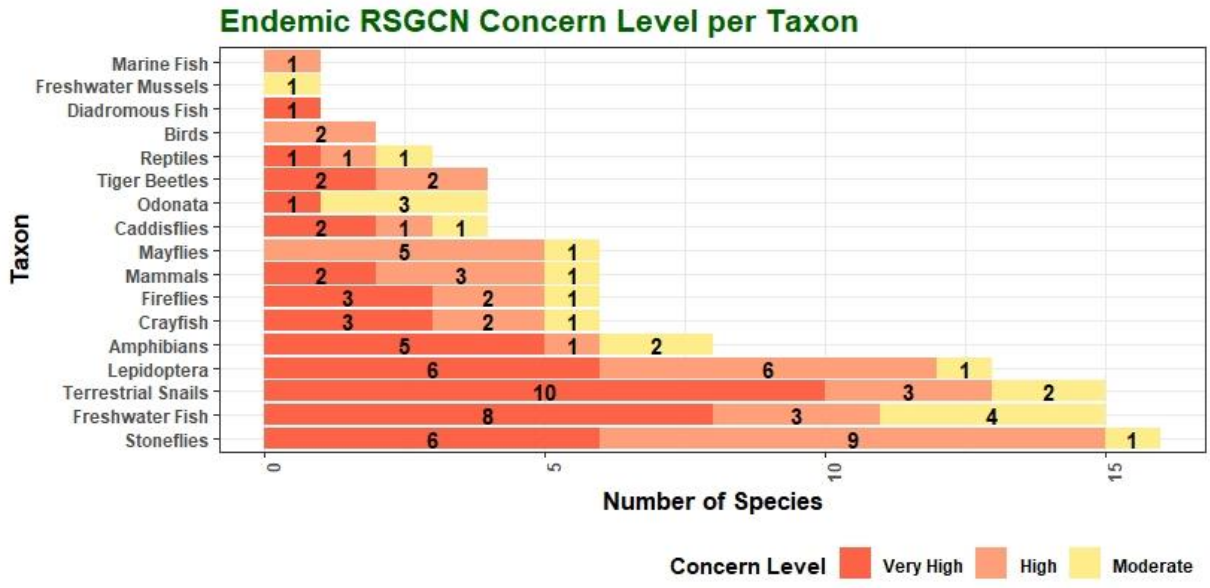


Figure 1.3.9 Number of endemic RSGCN by taxa with Concern Levels in the Northeast.

DATA GAP ANALYSIS HIGHLIGHTS

The available information on life history, habitat, vulnerability, and threats in the Northeast RSGCN Database varied widely across 20 different RSGCN taxa (Terwilliger Consulting Inc. and Northeast Fish and Wildlife Diversity Technical Committee 2023). A pre-population effort using publicly available information (before taxa team review and confirmation) resulted in substantive data on seasonal activity and habitat associations for inclusion in the database. At least one habitat group and one habitat type were associated with nearly all but a few species. The database contains much less data for invertebrate groups than vertebrates, reflecting the lack of information found or available for these less-studied taxa. The analysis indicated that more data gaps exist for species behavior, ecology, threats, monitoring and research needs, and data fields (Figure 1.3.10). The gap analysis currently represents data in the database, not the scientific literature available, but the trend is similar. A full literature search on the Web of Science on all the RSGCN species showed comparative results. Additional strategic data gaps can continue to be filled, and NEFWDTC priorities and recommendations will be implemented as part of the Technical Services RCN 3.0 project. A Technical Services RCN 2.0 project supplemented filling database gaps for priority taxa. This additional work added significant data to the RSGCN Database by focusing on data-deficient species, targeting Hymenoptera (Bumble and Solitary Bees) and Lepidoptera (Butterflies, Skippers, and Moths, Figure).

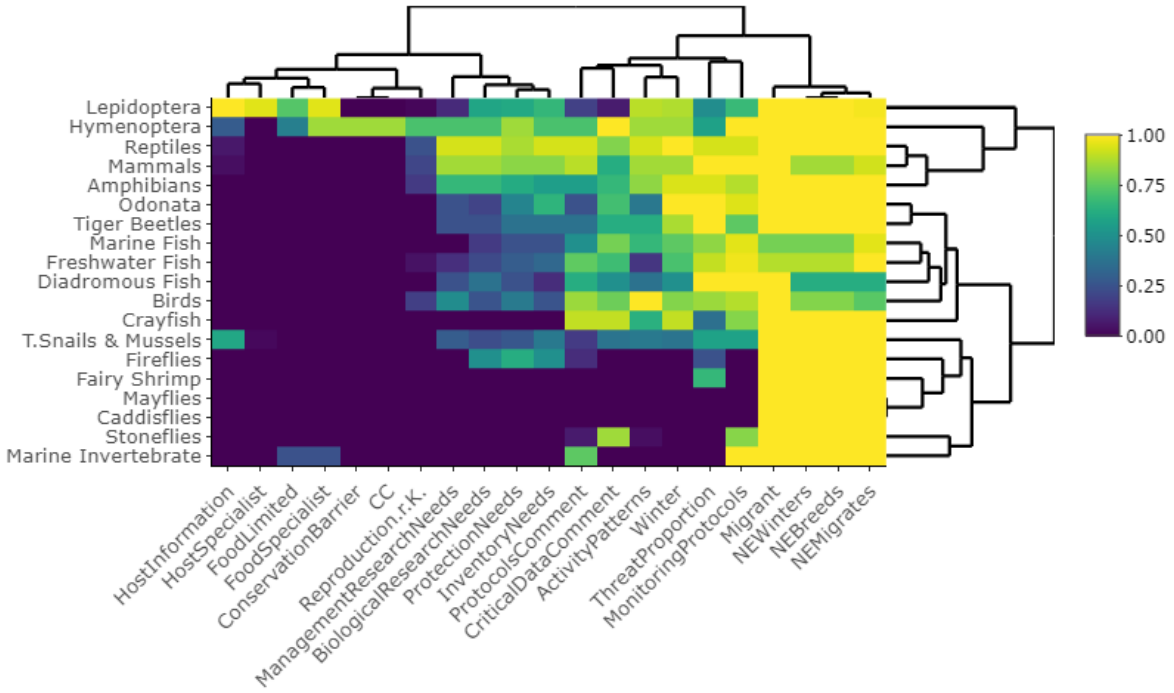


Figure 1.3.10 Proportion (1 = 100% of data known, 0 = 0% data known) of data categories by taxa in the RSGCN Database shown from least known to most known (left to right), highlighting data gaps. Branches on the top and left show similarities between known information.

STATE AND REGIONAL OPPORTUNITIES

States can use shared geographic responsibility to set priorities for RSGCN conservation across the Northeast. Conservation corridors and multi-state habitat protection can expand regional efforts. Virginia supports the highest number of RSGCN of any state, partially due to the number of endemics in the state, its diverse habitats, and its geographic location between the Northeast and Southeast regions. Exploring the number of RSGCN by state area shows opportunities for collaboration where states with the smaller spatial area still have large numbers of RSGCN (Figure 1.3.11). As climate impacts increase, RSGCN considerations help inform a regional approach to climate adaptation strategies as species ranges and habitats shift.

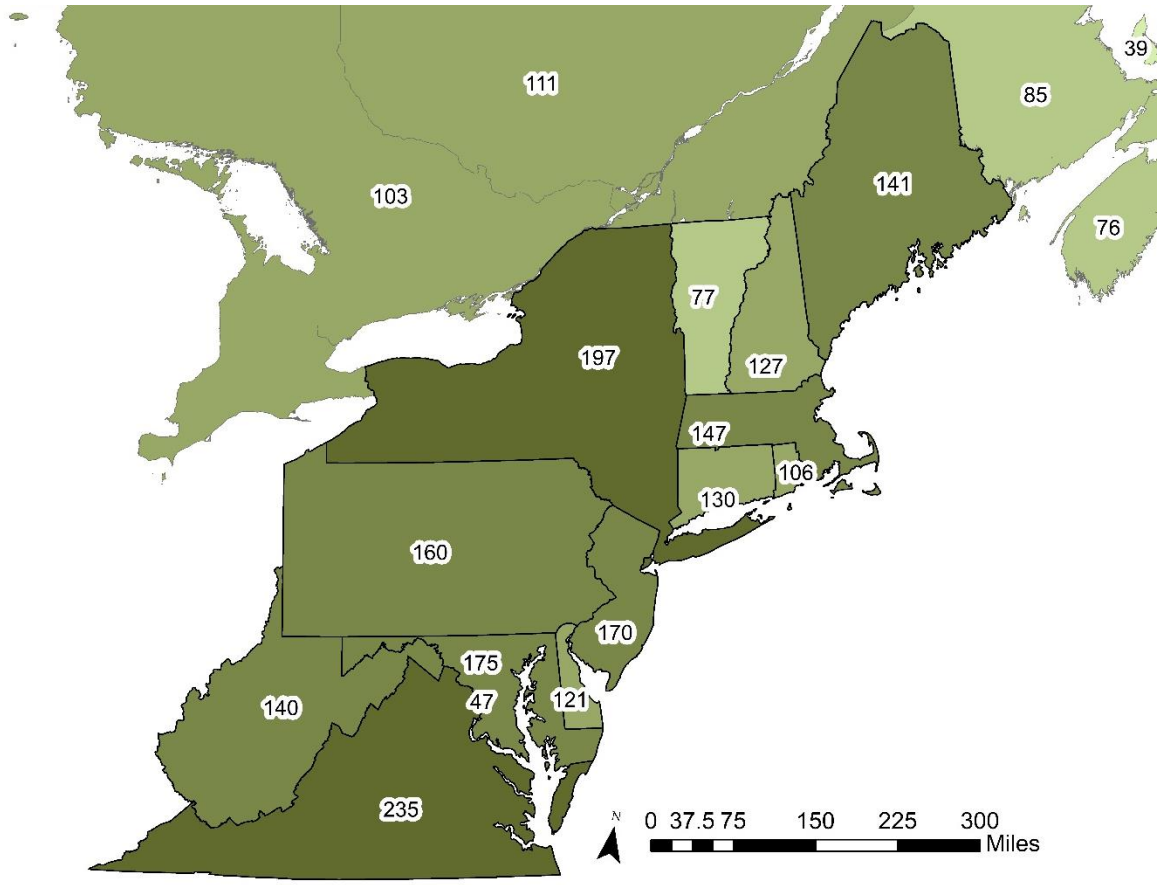


Figure 1.3.11 Map showing NEAFWA States with the number of RSGCN species occurring in each state; darker colors indicate more RSGCN species per state, while lighter colors represent fewer RSGCN species. See *Supplemental Information 1E* for state breakdowns of all RSGCN categories.

2023 RSGCN CHANGES AND OPPORTUNITIES

This fourth iteration of the RSGCN list included more species than the 2013 and 2018 lists. (Figure1.3.12). In 2013, almost 350 species within only nine taxonomic groups met RSGCN qualifications for regional conservation concerns. By 2018 358 species within 14 taxonomic groups were placed on the RSGCN list (Figure1.3.12). This 2023 RSGCN list

contains 382 species from 20 taxonomic groups (Figure1.3.12). The increase in RSGCN species reflects the refinement of the process explained in Section 1.2.2 and *Appendix 1A*, especially the inclusion of additional taxonomic groups and the inclusion of non-SGCN species as proposed. Including more taxa groups was possible as additional expertise and data are available in each RSGCN list revision and update. Improvements to the process including improved standardized pre-screening efforts, can also explain changes within taxa groups totals.

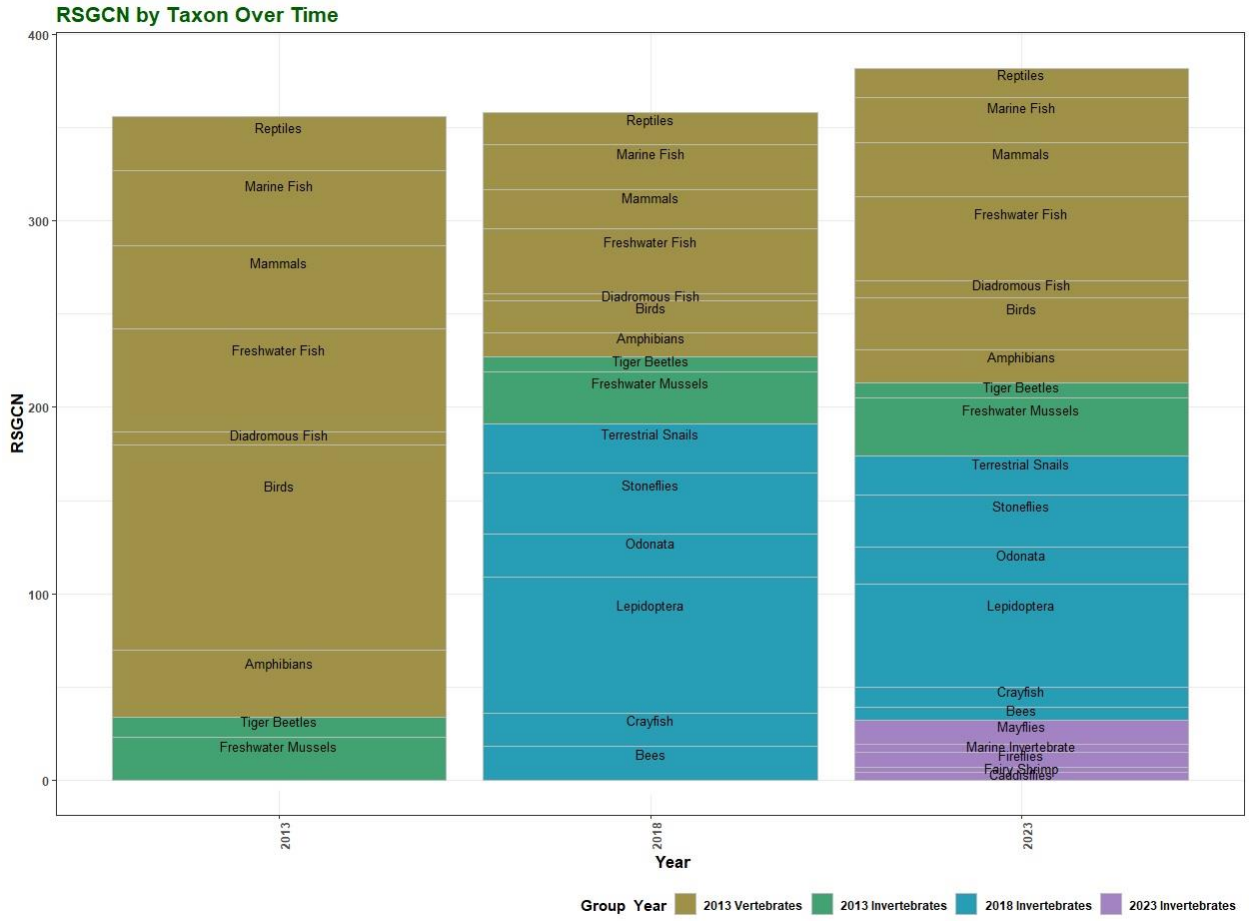


Figure1.3.12 Comparison of the number of RSGCN in the 2013, 2018, and 2023 list revisions by taxa.

The status of some RSGCN changed while remaining on the list (Figure 1.3.13). More than half of the RSGCN did not change status with this five-year update, but 39 RSGCN had a conservation concern decrease, while 22 had a concern increase. In addition, 126 RSGCN species were added to the list; the remaining additions reflect the new categories (Figure 1.3.13). The three fish taxa groups (diadromous, freshwater, and marine) showed the most increase (30%), but proportionally that increase is lower than other taxon groups. Ephemeroptera (Mayflies), Trichoptera (Caddisflies), Fireflies, Marine Invertebrates, and Fairy, Clam, and Tadpole Shrimp are newly added

invertebrate taxonomic groups and do not show concern increases or decreases. Stonefly RSGCN were not updated in 2023 and are pending the ongoing RCN 3.0 project results. Sixty-four former RSGCN taxa from 2018 had status changes from RSGCN to conduct a regional assessment of the taxonomic group Watchlist species.

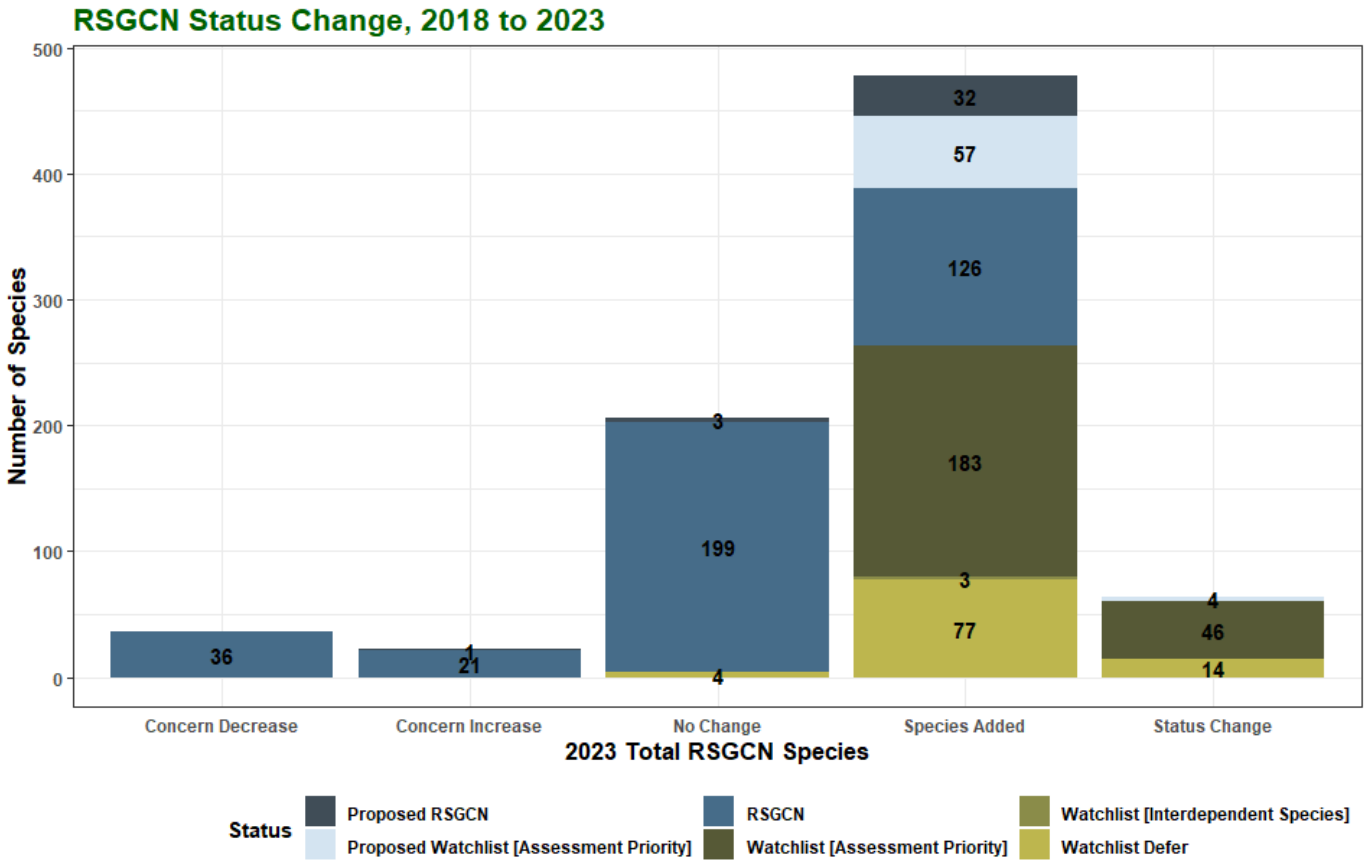


Figure 1.3.13 Status changes between the 2018 and the 2023 RSGCN lists grouped by the 2023 RSGCN category.

ADDITIONAL SPECIES CONSIDERED – NEW RSGCN WATCHLISTS

RSGCN WATCHLIST [ASSESSMENT PRIORITY]

229 species were identified as RSGCN Watchlist [Assessment Priority] (Figure 1.3.14)**.** Just under half (43%) of the RSGCN Watchlist [Assessment Priority] species are vertebrates, with the remaining 57% representing invertebrates. Twenty-five Watchlist [Assessment Priority] species are endemic to the NEAFWA region. This category, new to the Northeast region, incorporates RSGCN, previously identified as Data Deficient in 2018, which remain priorities for regional surveying efforts. In some cases, the taxa teams identified regional differences in species status and trends. Other

species were data deficient, but enough concern or known declines were noted to warrant inclusion as a Watchlist species. Current taxonomic uncertainties or reclassifications were ongoing for other species, which precluded taxa experts' ability to assess the status or distribution of these taxa. These species should be a priority for assessment efforts to collect additional data to document status, trends, and threats across the region.

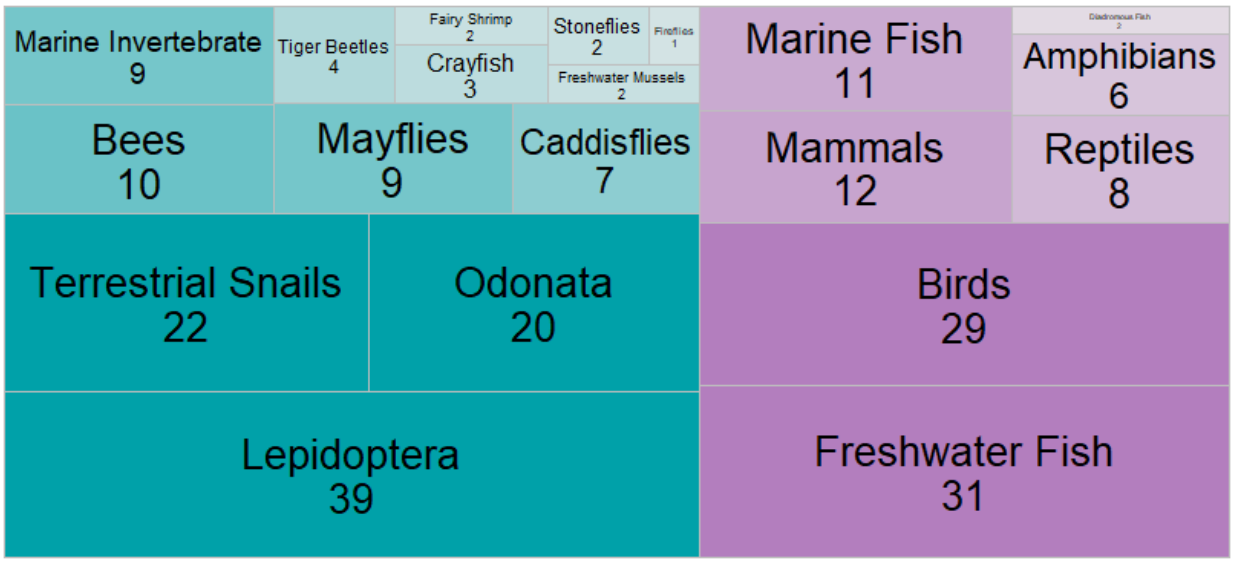


Figure 1.3.14 Number of 2023 RSGCN Watchlist Assessment Priority species by taxa.

PROPOSED RSGCN WATCHLIST [ASSESSMENT PRIORITY]

62 species were identified as Proposed RSGCN Watchlist [Assessment Priority] (Figure 1.3.15). Vertebrates represent less than a quarter (13%) of the Proposed RSGCN Watchlist [Assessment Priority] species. Invertebrates comprise the majority of Proposed RSGCN Watchlist [Assessment Priority] species at 54 (87%), with over half being Lepidoptera. Vertebrate taxa are better vetted as SGCN than invertebrates leading to the discrepancy; only 159 invertebrates are SGCN in seven or more (>50%) states across the Northeast. This category greatly informs coordinated regional inclusivity of invertebrates when updating the 2025 SGCN lists.

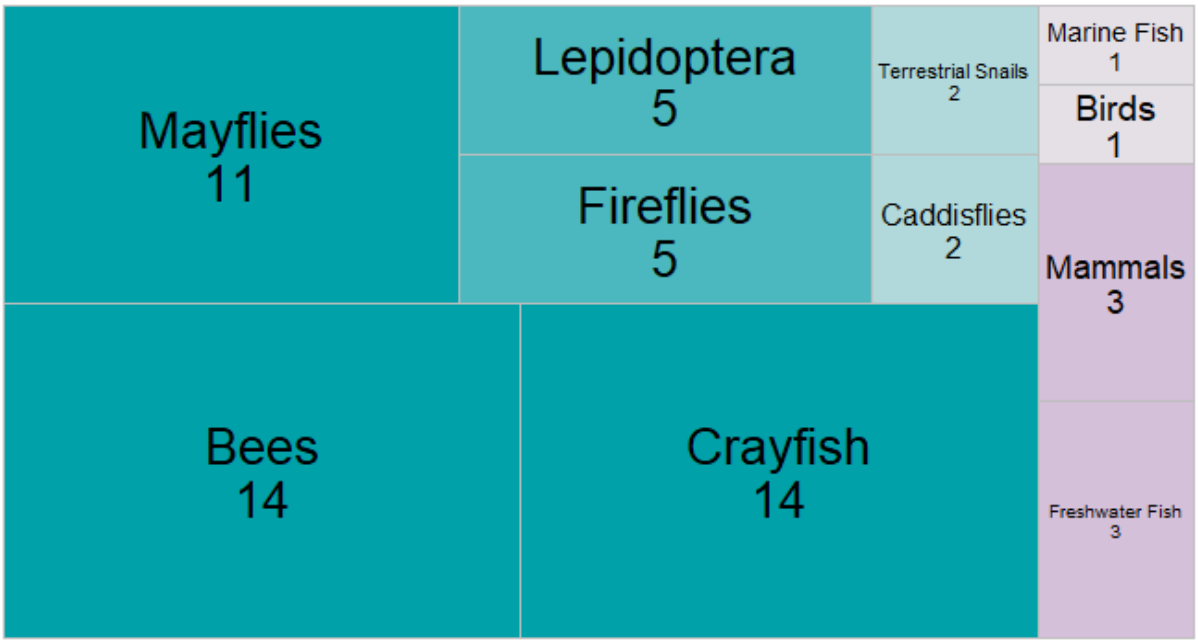


Figure 1.3.15 Number of 2023 Proposed RSGCN Watchlist Assessment Priority by taxa.

RSGCN WATCHLIST [INTERDEPENDENT SPECIES]

Two marine fish and one solitary bee are **Watchlist [Interdependent Species]** in the Northeast, meaning they are interdependent with another RSGCN but do not meet the criteria for RSGCN status on their own. *Ammodytes americanus* (American Sand Lance), *Ammodytes dubius* (Northern Sand Lance), and Melitta melittoides occur in six, three, and two states within the Northeast. Both sand lance species are considered important forage species for many marine species and several RSGCN, including the Northern Right Whale (*Eubalaena glacialis*) and at least 15 other species. The melittid bee is interdependent with a Watchlist Assessment Priority cuckoo bee species, *Nomada rodecki*. It was considered by the taxa team as an important parasitic species to highlight for conservation and can be used to umbrella additional similarly threatened bee species.

RSGCN WATCHLIST [DEFERRAL TO ADJACENT REGION(S)]

Ninety-five (95) species were of enough concern to the taxa experts to warrant conservation need but occurred only on the periphery of the Northeast region and therefore deferred to the adjacent region(s) for primary stewardship and conservation (Figure 1.3.16). This means that Northeast states where each occurs will continue their conservation efforts but signifies that the Northeast acknowledges that its actions do not affect the majority of the species range and population status. Six deferral categories span four Association of Fish and Wildlife Agencies (AFWA) regions, with some combined (Figure 1.3.17). Most RSGCN Watchlist [Deferral] species were deferred to the

Southeast due to the overlap in species ranges in Virginia and West Virginia. The Midwest deferrals represent the second largest number of species, followed by deferrals to Canada and the West (Figure 1.3.17).

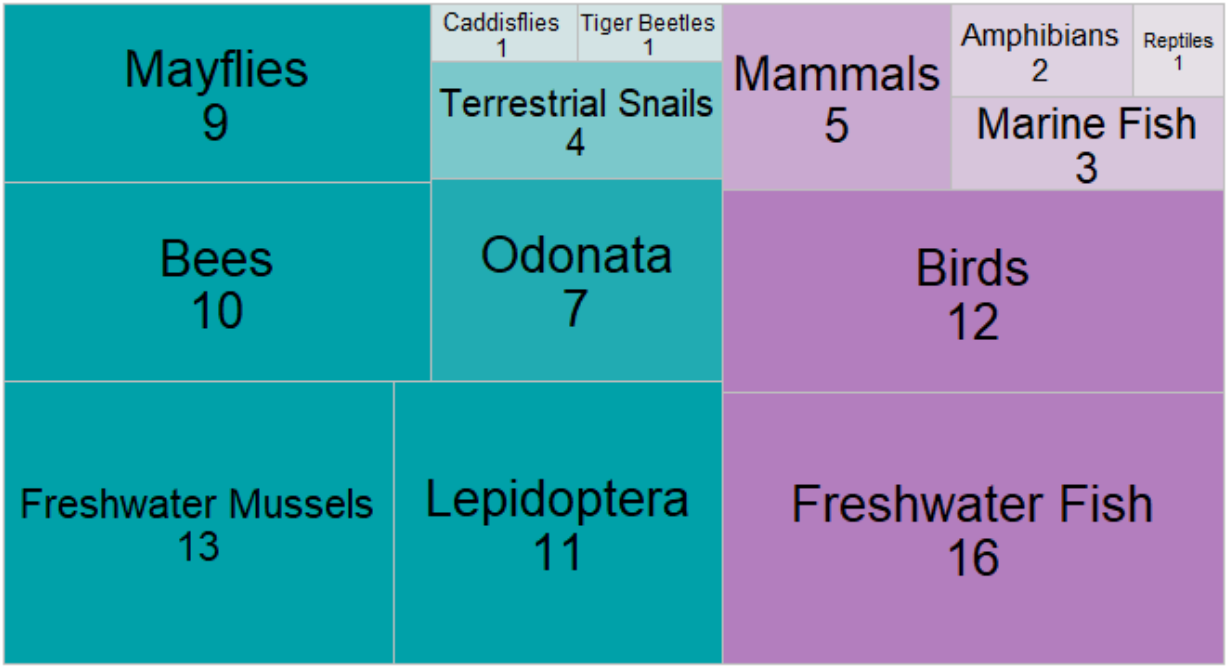


Figure 1.3.16 The number of Watchlist [Deferral] species by taxa.

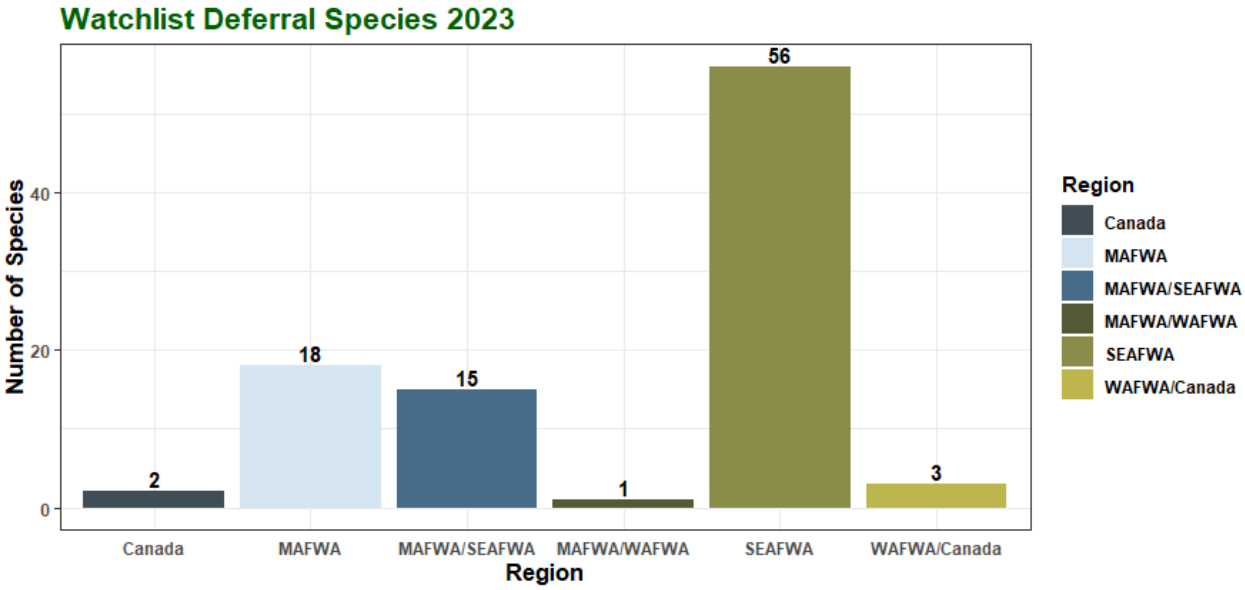


Figure 1.3.17 Regions with RSGCN Watchlist [Deferral] species from the Northeast.

1.3.1 AMPHIBIANS

Of the 111 amphibians (Class Amphibia) in the NEAFWA regional footprint. Of the total number of amphibians occurring in the Northeast US, 89 were listed as SGCN in at least one of the fourteen 2015 Northeast SWAPS. Of these 89 species listed as SGCN in Northeast SWAPs, 18 Amphibians met the criteria for RSGCN, including three anurans and 15 salamanders (Table 1.3.2). An additional four non-SGCN species met the criteria for Proposed RSGCN, six Watchlist [Assessment Priority], and two Watchlist [Deferrals]. Therefore, no amphibian species from the 2018 RSGCN list have been removed from the 2023 list. However, two subspecies, *Cryptobranchus alleganiensis alleganiensis* and *Pseudotriton montanus montanus* are now listed at the nominal level instead to reflect continuing taxonomic uncertainty and changes.

Big Levels Salamander, © Will Lattea

Regional Priority Concern Highlights:

- Species trends differ across the region or inter-regionally: taxa populations appear to be increasing or decreasing across the region; other taxa range shifts are moving in various directions (e.g., north, south, or an elevation change).
- Climate change vulnerability and range shifts are occurring in high-elevation salamanders especially.
- Bd and chytrid continue to be a major threat.

Species Information, Research & Monitoring Needs:

- Taxonomic/genetic research and clarification continue for many salamanders.
- Additional need for standard protocols for research, inventory, and monitoring.
- Climate change information as an amplifier of currently known threats.

RSGCN: 18 AMPHIBIANS

The 2023 Northeast RSGCN list includes 18 species of amphibians, of which 15 are salamanders, and three are frogs. Two species, the Cheat Mountain Salamander (*Plethodon nettingi*) and Shenandoah Salamander (*Plethodon shenandoah*), are federally protected as Threatened and Endangered, respectively. Concern levels across this group of amphibians range from seven species listed as Very High concern, five species considered as High concern, with an additional six species listed as Moderate Concern Level by the regional reptile and amphibian taxonomic team (Table 1.3.2). The

West Virginia Spring Salamander (*Gyrinophilus subterraneus*), Valley and Ridge Salamander (*Plethodon hoffmani*), New Jersey Chorus Frog (*Pseudacris kalmi*), Peaks of Otter Salamander (*Plethodon hubrichti*), Cheat Mountain Salamander, Cow Knob Salamander (*Plethodon punctatus*), Shenandoah Salamander, and Shenandoah Mountain Salamander (*Plethodon virginia*) are endemic to the Northeast region. Most of these endemics are listed as very High concern.

Table 1.3.2 RSGCN Amphibians (2023).

Subtaxon	Scientific Name	Common Name	Regional Responsibility	Concern Level
Salamanders	*Plethodon hubrichti*	Peaks of Otter Salamander	100% (NEAFWA Endemic)	Very High
Salamanders	*Plethodon nettingi*	Cheat Mountain Salamander	100% (NEAFWA Endemic)	Very High
Salamanders	*Plethodon punctatus*	Cow Knob Salamander	100% (NEAFWA Endemic)	Very High
Salamanders	*Plethodon shenandoah*	Shenandoah Salamander	100% (NEAFWA Endemic)	Very High
Salamanders	*Plethodon virginia*	Shenandoah Mountain Salamander	100% (NEAFWA Endemic)	Very High
Salamanders	*Plethodon pauleyi*	Yellow-spotted Woodland Salamander	75-100%	Very High
Salamanders	*Ambystoma tigrinum*	Eastern Tiger Salamander	<25%	Very High
Salamanders	*Gyrinophilus subterraneus*	West Virginia Spring Salamander	100% (NEAFWA Endemic)	High
Frogs and Toads	*Lithobates kauffeldi*	Mid-Atlantic Coast Leopard Frog	75-100%	High
Salamanders	*Ambystoma laterale*	Blue-spotted Salamander	75-100%	High
Salamanders	*Cryptobranchus alleganiensis*	Hellbender	25-50%	High
Salamanders	*Plethodon welleri*	Weller's Salamander	<25%	High

Salamanders	*Plethodon hoffmani*	Valley and Ridge Salamander	100% (NEAFWA Endemic)	Moderate
Frogs and Toads	*Pseudacris kalmi*	New Jersey Chorus Frog	100% (NEAFWA Endemic)	Moderate
Salamanders	*Ambystoma jeffersonianum/laterale complex*	Jefferson/Blue-spotted Salamander Complex	75-100%	Moderate
Salamanders	*Desmognathus welteri*	Black Mountain Salamander	50-75%	Moderate
Salamanders	*Aneides aeneus*	Green Salamander	25-50%	Moderate
Frogs and Toads	*Dryophytes andersonii*	Pine Barrens Treefrog	<25%	Moderate

PROPOSED RSGCN: 4 AMPHIBIANS

Four species of amphibians are not currently listed in Northeast SWAPs as SGCN but were of concern to the taxa team, which concurred with their qualification for the 2023 Proposed RSGCN list. All four of these species are salamanders (Table 1.3.3). These species were recently split from other taxonomies; *Desmognnathus planiceps* from *D. fuscus, Plethod dixi* and *P. jacksoni* from *P. wherlei,* and *P. sherando* from *P. cinereus*.

Table 1.3.3 The Proposed RSGCN salamanders, all of these are found in VA.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Plethodon dixi	Dixie Cavern Salamander	100% (NEAFWA Endemic)	Very High
Plethodon jacksoni	Blacksburg Salamander	75-100%	Very High
Plethodon sherando	Big Levels Salamander	100% (NEAFWA Endemic)	Very High
Desmognathus planiceps	Flat-headed Salamander	50-75%	Moderate

OVERVIEW

RSGCN were assigned to their key habitats, with most species using more than one habitat across different life stages. Of the RSGCN and Proposed RSGCN Amphibians, approximately 73% use Forests and Woodlands, 41% use Riparian Floodplains, and 36% use both High-elevation Forests and Cliff and Talus habitats (Figure 1.3.18).

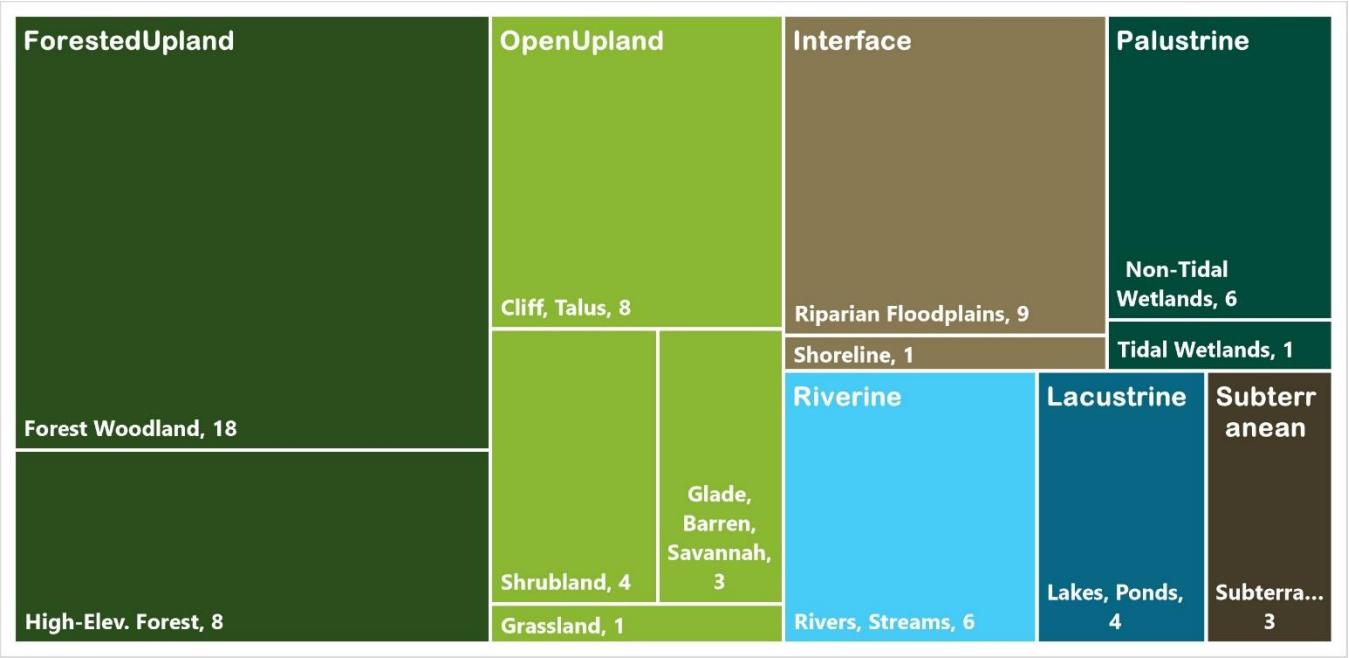


Figure 1.3.18 Number of RSGCN and Proposed RSGCN Amphibian habitat in the Northeast. Habitat group names are at the top of each color block and grouped by color; habitat type names appear at the bottom of each proportionally sized square and are colored by habitat group (see *Chapter 2* for more information on habitats).

Amphibian species in the Northeast are under threat and vulnerable to multiple threats. Threats are categorized using the modified CMP Threat Levels 1, 2, and 3 (*Supplemental Information* 3). The highest percentage of RSGCN and Proposed RSGCN Amphibians are threatened by: Biological Resource Use (91%), Climate Change (77%), and Pollution (77%; Table 1.3.4). Within the Biological Resource Use category, threats include logging and forest management. Best management practices such as the timing of cutting, canopy cover left intact, downed woody debris, and buffers around riparian zones can help alleviate these threats for amphibians (Macneil et al. 2013). Pollution, such as acid rain, herbicides and pesticides, and runoff, impact the greatest number of RSGCN and Proposed RSGCN Amphibians in the Northeast. Finally, Climate Change threats include temperature and precipitation fluctuations and droughts. The combination of these threats together impacts Amphibians and others in aquatic habitats. For example, earlier springs in the Northeast due to climate change combine to increase species exposure to pollution from road salt (Delaune et al. 2021); this is one example of how Climate change can amplify other threats such as Pollution and Transportation and service corridors.

Table 1.3.4 Level 1 threats with the number and percent of RSCGN and Proposed RSGCN Amphibian species threatened. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Biological Resource Use (Threat 5.0)	20	91%
Climate Change (Threat 11.0)	17	77%
Pollution (Threat 9.0)	17	77%
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	14	64%
Transportation & Service Corridors (Threat 4.0)	14	64%
Residential & Commercial Development (Threat 1.0)	13	59%
Agriculture & Aquaculture (Threat 2.0)	12	55%
Natural System Modifications (Threat 7.0)	10	45%
Energy Production & Mining (Threat 3.0)	8	36%
Human Intrusions & Disturbance (Threat 6.0)	7	32%
Other (Threat 12.0)	2	9%

WATCHLIST AMPHIBIANS

There are eight amphibian Watchlist species, six species that taxa teams identified as Watchlist [Assessment Priority], and two species identified for deferral to adjacent regions. Watchlist Assessment Priority species inform 2025 SWAP revisions and serve as a tool to prioritize research and monitoring needs for these taxa. Watchlist species deferred to adjacent regions also inform nationwide cross-regional collaboration and conservation communication for broader landscape conservation efforts.

WATCHLIST [ASSESSMENT PRIORITY]: 6 AMPHIBIANS

Similar to the 2023 Amphibian RSGCN list, salamanders outnumber anurans on the 2023 Watchlist [Assessment Priority] list. Taxa team experts assigned four salamander species, one toad, and one frog species as Watchlist [Assessment Priority] (Table 1.3.5). Two salamander species have a regional responsibility of 50-75%, indicating their range primarily occurs in the Northeast. The other four species have regional responsibility under 25%. Watchlist [Assessment Priority] species differ from RSGCN in that they do not have a conservation Concern Level due to a lack of information on population status, natural history, and threats. Therefore, they are aptly highlighted as needing additional assessment and data.

Table 1.3.5 Amphibian 2023 Watchlist [Assessment Priority] species.

Subtaxon	Scientific Name	Common Name	Regional Responsibility
Frogs and Toads	*Scaphiopus holbrookii*	Eastern Spadefoot	<25%
Frogs and Toads	*Lithobates pipiens*	Northern Leopard Frog	<25%

Salamanders	*Ambystoma opacum*	Marbled Salamander	<25%
Salamanders	*Ambystoma jeffersonianum*	Jefferson Salamander	50-75%
Salamanders	*Necturus maculosus*	Mudpuppy	<25%
Salamanders	*Gyrinophilus porphyriticus duryi*	Kentucky Spring Salamander	50-75%

Both the Eastern Spadefoot (*Scaphiopus holbrookii)* and Northern Leopard Frog (*Lithobates pipiens*) have reports of population declines in the Northeastern portion of their ranges. Still, the amount and reasons for the decline are largely unknown. The Amphibian taxa team concluded that more monitoring and research are needed to understand these declines at the range edges and any potential implications in the core of their range, even though their regional responsibility is below 25%.
The four Watchlist [Assessment Priority] salamander species are all SGCN in several northeastern states. The Kentucky Spring Salamander (*Gyrinophilus porphyriticus duryi*) was identified as a species lacking natural history and distribution data and would benefit from additional monitoring and research. While the other three salamander species are more widespread, disease and climate change threats are on the rise, and it is unknown how the northeastern populations will respond.

WATCHLIST [DEFER TO ADJACENT REGION]: 2 AMPHIBIANS.

The Amphibian Taxa Team identified Northern Pygmy Salamander (*Desmognathus organi*) and the Mud Salamander (*Pseudotriton montanus*) as regional conservation concern but recognized the core of their ranges fall to the south. Therefore, their primary stewardship is in the southeastern United States (Table 1.3.6). The Northern Pygmy Salamander has a narrow distribution restricted to the high-elevation forests in southern Virginia.

Table 1.3.6 2023 Watchlist [Deferral] Amphibians.

Subtaxon	Scientific Name	Common Name	Deferred Region(s)	Listed in Deferred Region(s)
Salamander	*Desmognathus organi*	Northern Pygmy Salamander	SEAFWA	RSGCN in SEAFWA
Salamander	*Pseudotriton montanus*)	Mud Salamander	SEAFWA	RSGCN in SEAFWA

REGIONAL EFFORTS IN NORTHEAST AMPHIBIAN CONSERVATION

Since the last Northeast Conservation Synthesis in 2013 (TCI and NEFWDTC 2013), considerable advancements have contributed to the knowledge and conservation of this taxa through coordinated regional efforts. The Regional Conservation Needs Program

(RCN) has sponsored several projects to address priority needs identified for this taxon. For example, the Atlantic Coast Leopard Frog is a recently described cryptic species primarily associated with large coastal marshes and early successional floodplain meadows and swamps along the riparian corridors of medium-large rivers. During the summer months, fields surrounding wetlands may be used for foraging, but the extent of upland habitat use is currently unknown. Little is known about the species' ecology, and research is needed to understand conservation challenges and to inform conservation planning and management. Assessing dispersal capabilities and gene flow among populations and determining if the isolation of populations has led to inbreeding depression are important considerations. There is evidence of historic declines in the northern portion of the region. Although the species has been able to persist in highly urbanized areas in the Northeast, dense housing and urban areas are a threat. Understanding environmental tolerances (e.g., salinity, pH, etc.) is important. The Atlantic coast leopard frog is vulnerable to changing climatic conditions, especially coastal populations. Atlantic Coast Leopard Frogs occur sympatrically with northern leopard frogs, and understanding potential competitive interactions, differences in habitat use, and possible hybridization is important. The Final RCN report by Schlesinger et al. (2017) showed that in the southern portion of the northeastern region, Atlantic Coast Leopard Frogs are sympatric with southern leopard frogs, and similar work is needed to understand interactions among these two species.

The Appalachian Mountains are the global center of endemism for salamander taxa as it is considered the center for adaptive radiation for the Order Caudata (salamanders). Included on the 2023 RSGCN list are many narrowly endemic and rare species (75 to 100% regional responsibility), such as the Cheat Mountain, Cow Knob, Peaks of Otter, Shenandoah Mountain, Shenandoah, Yellow-spotted Woodland, Valley and Ridge, Blue-spotted, and West Virginia Spring Salamanders. Of these species, there are eight in the genus *Plethodon*, three species of the genus *Ambystoma,* and four others in their own genus. There is ongoing genetic work in all these genera, as potential impacts from climate change on genetically isolated high-elevation populations may be detrimental and warrant species protection.

The Hellbender (*Cryptobranchus alleganiensis*), a large aquatic salamander associated with major rivers in the eastern United States, has been identified as a high-priority species for the RCN grant program. The **Hellbender eDNA RCN Report** (2016) found positive sampled sites in New York, Pennsylvania, Maryland, and Virginia, with an unreliable detection in WV. Populations of Hellbenders have declined precipitously due to water pollution, sedimentation, and the damming and channelization of major rivers throughout the eastern United States. In addition, chytrid fungi have been responsible for reducing captive populations and are thought to be causing additional declines in the wild populations of the species. The Ozark subspecies of the hellbender,

which may be elevated to full species, was added to the federal Endangered Species list in 2011. The 2018 Species Status Report predicts future range declines (USFWS 2018). Conserving the Hellbender will require integrated conservation action on the part of state, federal, and private conservation agencies, exactly the sort of partnership that can continue to be supported and fostered through the RCN Grant Program. The two RCN projects confirmed the distribution and status of Hellbenders throughout the region and provided several protocols and standard operating procedures for research, sampling, and disease prevention. NEPARC[2] and its Regional Working Groups have developed additional protocols and conservation resources for amphibians and reptiles.

1.3.2 BIRDS

426 Birds (Class Aves) inhabit the NEAFWA regional footprint. Of those, 273 were listed as SGCN in at least one of the 14 2015 Northeast SWAPs. Twenty-eight of these bird species met the criteria as RSGCN, including 12 landbirds, nine waterbirds and waterfowl, five shorebirds, one landfowl, and one raptor. Forty-two birds are listed in one of the Watchlist categories: 29 Watchlist [Assessment Priority] and 11 Watchlist [Deferrals], and one additional non-SGCN species met the criteria for Proposed Watchlist [Assessment Priority].


American Oystercatcher, © Greg Gard

<u>Regional Priority Concern Highlights:</u>

- Coastal habitat loss intensified by climate change sea level rise.
- Wind development concerns along mountain and coastal migratory routes.
- Invasive insect threats to forest birds.
- Aerial insectivore threats from insecticide spraying.
- Habitat loss threats continue on wintering grounds.
- Unidentified causes of population decline remain.
- Emerging diseases and virus increase.

<u>Species Information, Research & Monitoring Needs</u>

- A regional colonial waterbird survey is recommended.
- For one of the better-known taxa, additional coordinated survey efforts, range shift data due to climate change are needed, and wind development impacts remain unknown.

RSGCN: 28 BIRDS

Twenty-eight bird species have been identified as RSGCN in the Northeast based on conservation concern and regional responsibility status (Table 1.3.7). Of these, the NEFWDTC Bird Taxonomic Team listed six bird species as Very High concern, 12 as High concern, and ten as Moderate concern in the Northeast. Two listed entities are northeast endemics, Ipswich Sparrow (*Passerculus sandwichensis princeps*) and Coastal Plain Swamp Sparrow (*Melospiza georgiana nigrescens*), with three others having a regional responsibility greater than 75%. In addition, eight previously listed RSGCN Birds had listing revisions due to listing nominal species, subspecies, or population entities.

Table 1.3.7 2023 RSGCN Birds. Note that the Regional Responsibility listed is the overall geographic range. Northeast Regional Responsibility may differ for breeding, migration, and wintering seasons.

Subtaxon	Scientific Name	Common Name	Regional Responsibility	Concern Level
Landbirds	*Antrostomus vociferus*	Eastern Whip-poor-will	25-50%	High
Landbirds	*Passerculus sandwichensis princeps*	Ipswich Sparrow	100% (NEAFWA Endemic)	High
Landbirds	*Melospiza georgiana nigrescens*	Coastal Plain Swamp Sparrow	100% (NEAFWA Endemic)	High
Landbirds	*Catharus bicknelli*	Bicknell's Thrush	75-100%	High
Landbirds	*Setophaga cerulea*	Cerulean Warbler	<25%	High
Shorebirds	*Calidris canutus rufa*	Red Knot	<25%	High
Shorebirds	*Calidris maritima*	Purple Sandpiper	50-75%	High
Shorebirds	*Charadrius melodus*	Piping Plover (Atlantic Coast pop.)	25-50%	High
Landfowl	*Bonasa umbellus*	Ruffed Grouse	25-50%	High
Waterbirds	*Rynchops niger*	Black Skimmer	<25%	High
Waterbirds	*Sternula antillarum*	Least Tern	25-50%	High
Waterfowl	*Anas rubripes*	American Black Duck	50-75%	High
Landbirds	*Sturnella magna*	Eastern Meadowlark	<25%	Moderate
Landbirds	*Euphagus carolinus*	Rusty Blackbird	50-75%	Moderate
Landbirds	*Hylocichla mustelina*	Wood Thrush	25-50%	Moderate
Landbirds	*Vermivora cyanoptera*	Blue-winged Warbler	<25%	Moderate
Raptors	*Aquila chrysaetos*	Golden Eagle (Eastern pop.)	50-75%	Moderate
Shorebirds	*Scolopax minor*	American Woodcock	25-50%	Moderate
Waterbirds	*Haematopus palliatus*	American Oystercatcher	25-50%	Moderate
Waterbirds	*Sterna hirundo*	Common Tern	<25%	Moderate
Waterfowl	*Branta bernicla hrota*	Pale-bellied Brant	75-100%	Moderate
Waterfowl	*Histrionicus histrionicus*	Harlequin Duck (Eastern pop.)	25-50%	Moderate

Landbirds	*Lanius ludovicianus*	Loggerhead Shrike	<25%	Very High
Landbirds	*Vermivora chrysoptera*	Golden-winged Warbler (Appalachian pop.)	<25%	Very High
Landbirds	*Ammospiza caudacuta*	Saltmarsh Sparrow	50-75%	Very High
Shorebirds	*Charadrius melodus*	Piping Plover (Great Lakes pop.)	<25%	Very High
Waterbirds	*Laterallus jamaicensis jamaicensis*	Black Rail	25-50%	Very High
Waterbirds	*Sterna dougallii*	Roseate Tern	50-75%	Very High

No birds were listed as Proposed RSGCN since all birds of conservation concern are SGCN in at least one state.

OVERVIEW

Twenty-eight bird species have been identified as RSGCN in the Northeast based on conservation status and need (Table 1.3.7). Many of the 28 Bird RSGCN are emblematic of an important and vulnerable Northeast habitat, including coastal beaches, coastal islands, salt marshes, early successional habitats, and unfragmented forests (Figure 1.3.19).

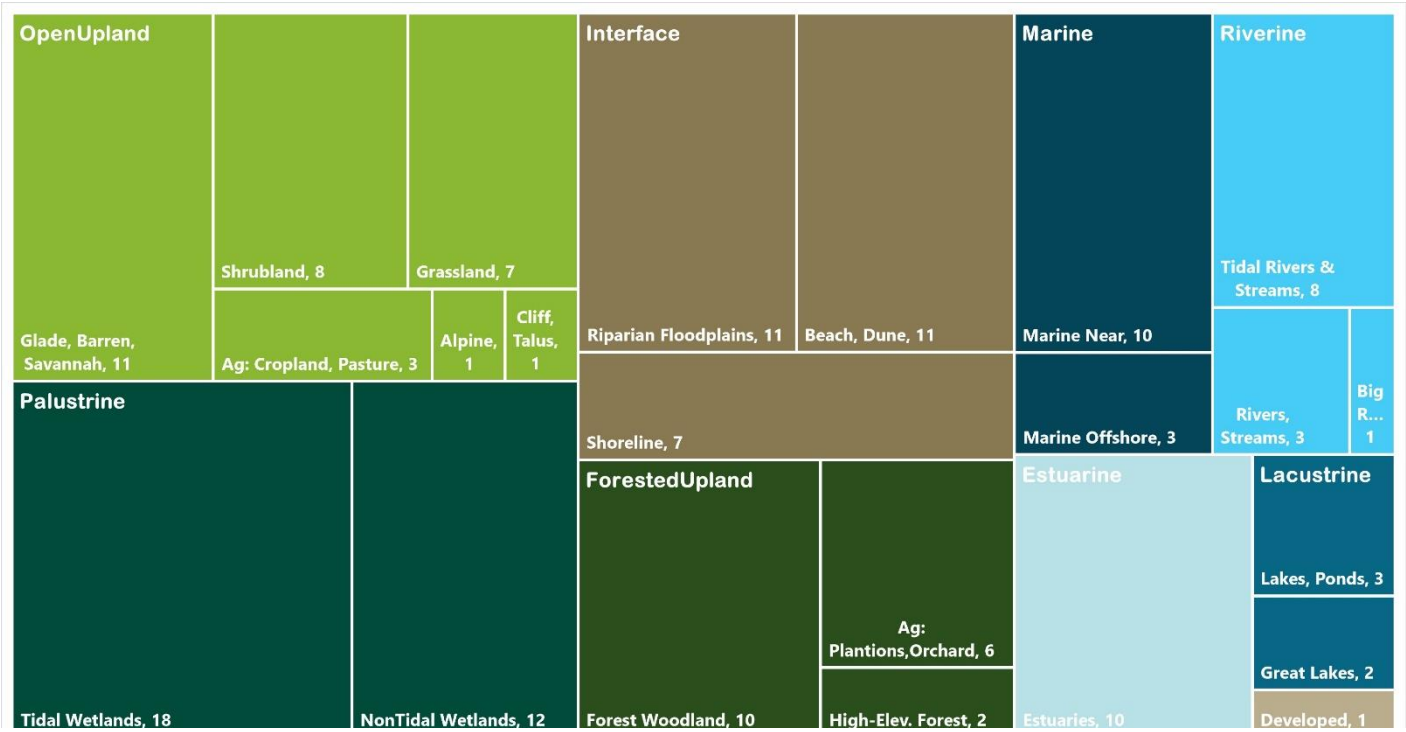


Figure 1.3.19 Number of 2023 RSGCN Birds associated with each habitat group and type. Species may be associated with multiple habitat types. Greater than 50% of RSGCN bird habitat in the Northeast are in Open uplands, Palustrine, and Interface habitat groups. Habitat group names are at the top of each color block and grouped by color; habitat type names appear at the bottom of each proportionally sized square and are colored by habitat group (see *Chapter 2* for more information on habitats).

Twenty-eight RSGCN birds inhabit the Northeast region's coast in salt marshes, beaches, dunes, or offshore islands. Throughout the Northeast, for centuries, human activities have heavily impacted these habitats through development, pollution, marsh filling and draining, spraying for mosquito control, and recreational use of beaches (see *Chapter 2*). In sum, these activities represent formidable threats to coastal bird species. Among these species, the Piping Plover (*Charadrius melodus*), Red Knot (*Calidris canutus rufa*), and Roseate Tern (*Sterna dougallii*) have been the subjects of considerable conservation attention in the Northeast due to their current listing under the US Endangered Species Act.

The **2022 State of the Birds** report identified seventy tipping point species. They have lost more than half of their population in the last 50 years and will lose another 50% of the remnant population within the next 50 years. Tipping point 2023 RSGCN birds include Black Rail (*Laterallus jamaicensis (jamaicensis)*), Least Tern (*Sternula antillarum*), Golden-winged Warbler (*Vermivora chrysoptera*), Saltmarsh Sparrow (*Ammospiza caudacuta*), and Bicknell's Thrush (*Catharus bicknelli*). Other species that have lost 50% of their population are stabilizing. Two RSGCN eastern forest birds, the Cerulean Warbler (*Setophaga cerulea*) and Wood Thrush (*Hylocichla mustelina*), while showing long-term population declines, have exhibited recent stabilizing in areas where regional habitat protections have been a priority (NABCI 2022).

Table 1.3.8 Level 1 threats with the number and percent of RSCGN and Proposed RSGCN Bird species threatened. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Climate Change (Threat 11.0)	**26**	**93%**
Pollution (Threat 9.0)	**26**	**93%**
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	**22**	**79%**
Residential & Commercial Development (Threat 1.0)	**22**	**79%**
Human Intrusions & Disturbance (Threat 6.0)	**21**	**75%**
Natural System Modifications (Threat 7.0)	**20**	**71%**
Energy Production & Mining (Threat 3.0)	**17**	**61%**
Agriculture & Aquaculture (Threat 2.0)	**15**	**54%**
Biological Resource Use (Threat 5.0)	**15**	**54%**
Transportation & Service Corridors (Threat 4.0)	**15**	**54%**
Other (Threat 12.0)	**12**	**43%**

Threats to RSGCN and Proposed RSGCN Birds are categorized using the modified CMP Threat Levels 1, 2, and 3 (*Supplemental Information 3*). The highest percentage of RSGCN and Proposed RSGCN Birds are threatened by Climate Change (93%) and Pollution (93%) as the top threats in the Northeast, followed by Invasive and Problematic Species, Pathogens and Genes (79%) and Residential and Commercial Development (79%) as the second highest threats (Table 1.3.8). Climate Change impacts include changes in the vegetation communities due to climate change, phenological mismatch, storms, and severe weather events. For example, climate change is responsible for the predicted extinction of the Saltmarsh Sparrow within 20-30 years (Field et al. 2017). The Northeast Climate Change Synthesis report contains more detailed patterns in range shifts, habitat use, and actions with these threats (Staudinger et al. 2015 and 2023 in prep.). Oil spills, herbicides and pesticides, and acid rain are additional threats within Pollution that impact the greatest number of RSGCN and Proposed RSGCN birds in the Northeast (Table 1.3.8). Nest predation was the top threat to ground-nesting birds (Invasive and Problematic Species, Pathogens and Genes - specifically terrestrial mammals). Finally, Residential and Commercial Development threatens Birds most due to low-density housing areas.

WATCHLIST BIRDS

In total, the Bird Taxonomic Team identified 44 bird species as Watchlist species, 30 as Watchlist [Assessment Priority], one as Proposed Watchlist [Assessment Priority], and 12 species identified for deferral to adjacent regions.

WATCHLIST [ASSESSMENT PRIORITY]: 30 BIRDS

The 30 2023 Watchlist [Assessment Priority] bird species include 13 Landbirds, four raptors, four shorebirds, one landfowl (Order Galliformes), and eight waterbird or waterfowl species (Table 1.3.9). While birds are one of the most closely monitored taxa groups, experts have flagged some species needing additional or continuous monitoring. Climate change amplifies habitat loss and degradation, while diseases and pollution continue to threaten birds at alarming rates. In addition, many birds' overall geographic regional responsibility falls below the threshold of 50%. Still, seasonal responsibility for breeding grounds, migration stopovers, and wintering grounds elevate and qualify the Northeast as key stewards in these bird conservation seasonal cycles.

Many of the Watchlist [Assessment Priority] birds have emerging threats and climate change vulnerabilities that require monitoring and research due to the steep declines across this subtaxon, as indicated in breeding bird surveys. Eight Watchlist [Assessment Priority] birds were flagged in the State of the Birds (2022) as tipping point species. Similar to the RSGCN species in this list, these Watchlist species have lost more than

50% of their population over the past six decades and are projected to lose 50% more of the remnant population: Bobolink (*Dolichonyx oryzivorus*), Chimney Swift (*Chaetura pelagica*), King Rail (*Rallus elegans*), Prairie Warbler (*Setophaga discolor*), Ruddy Turnstone (*Arenaria interpres (morinella)*), Seaside Sparrow (*Ammospiza maritima*), Semipalmated Sandpiper (*Calidris pusilla*), and Whimbrel (*Numenius phaeopus*) (NABCI 2022).

Table 1.3.9 Watchlist [Assessment Priority] Birds 2023. Note that the Regional Responsibility listed is the overall geographic range. Northeast Regional Responsibility may differ for breeding, migration, and wintering seasons.

Subtaxon	Scientific Name	Common Name	Regional Responsibility
Landbirds	*Coccyzus erythropthalmus*	Black-billed Cuckoo	<25%
Landbirds	*Chordeiles minor*	Common Nighthawk	<25%
Landbirds	*Chaetura pelagica*	Chimney Swift	<25%
Landbirds	*Empidonax minimus*	Least Flycatcher	<25%
Landbirds	*Riparia riparia*	Bank Swallow	<25%
Landbirds	*Icteria virens*	Yellow-breasted Chat	<25%
Landbirds	*Dolichonyx oryzivorus*	Bobolink	<25%
Landbirds	*Ammodramus savannarum*	Grasshopper Sparrow	<25%
Landbirds	*Ammospiza maritima*	Seaside Sparrow	25-50%
Landbirds	*Catharus fuscescens*	Veery	<25%
Landbirds	*Setophaga striata*	Blackpoll Warbler	25-50%
Landbirds	*Setophaga discolor*	Prairie Warbler	<25%
Landbirds	*Cardellina canadensis*	Canada Warbler	25-50%
Raptors	*Accipiter gentilis*	Northern Goshawk	<25%
Raptors	*Falco peregrinus (anatum)*	Peregrine Falcon	<25%
Raptors	*Falco sparverius*	American Kestrel	<25%
Raptors	*Tyto alba*	Barn Owl	<25%
Shorebirds	*Arenaria interpres (morinella)*	Ruddy Turnstone	<25%
Shorebirds	*Numenius phaeopus*	Whimbrel	<25%
Shorebirds	*Calidris pusilla*	Semipalmated Sandpiper	25-50%
Shorebirds	*Tringa semipalmata*	Willet	<25%
Landfowl	*Bonasa umbellus*	Ruffed Grouse	25-50%

Waterbirds	*Phalacrocorax carbo*	Great Cormorant	50-75%
Waterbirds	*Egretta thula*	Snowy Egret	<25%
Waterbirds	*Nycticorax nycticorax*	Black-crowned Night-Heron	<25%
Waterbirds	*Ixobrychus exilis*	Least Bittern	<25%
Waterbirds	*Plegadis falcinellus*	Glossy Ibis	25-50%
Waterbirds	*Rallus elegans*	King Rail	25-50%
Waterfowl	*Bucephala islandica*	Barrow's Goldeneye (Eastern pop.)	25-50%
Waterfowl	*Somateria mollissima (dresseri)*	Common Eider	75-100%

PROPOSED WATCHLIST [ASSESSMENT PRIORITY]: 1 BIRD

Nelson's Sparrow (*Ammospiza nelsoni subvirgatus*) is a subspecies not currently on any Northeast state SGCN list (the nominal species is listed in New Hampshire and Maine). Bird Taxonomic Team experts flagged this species for observed population declines. Because 80% of its breeding range is in Canada, more research is needed on forest conditions and dependence on wetlands. Therefore, it is a Proposed Watchlist Assessment Priority species.

WATCHLIST [DEFER TO ADJACENT REGION]: 12 BIRDS

Bird Taxonomic Team experts identified 12 Watchlist [Deferral] Birds (Table 1.3.10). Midwest deferrals include seven birds, with four listed as RSGCN in MAFWA. Seven birds were also deferred to the Southeast, four listed as RSGCN in SEAFWA. Two other species are deferred to the Western US or north to Canada. The six birds not listed in the adjacent regions are opportunities for NEAFWA and neighbors to collaborate.

Table 1.3.10 Watchlist [Deferral] Birds 2023.

Subtaxon	Scientific Name	Common Name	Deferred Region(s)	Listed in Deferred Region(s)
Shorebirds	*Bartramia longicauda*	Upland Sandpiper	MAFWA	RSGCN in MAFWA
Waterbirds	*Sterna forsteri*	Forster's Tern	MAFWA	No
Waterbirds	*Chlidonias niger*	Black Tern	MAFWA	RSGCN in MAFWA
Waterbirds	*Egretta tricolor*	Tricolored Heron	SEAFWA	No
Waterbirds	*Egretta caerulea*	Little Blue Heron	SEAFWA	RSGCN in SEAFWA
Waterbirds	*Gelochelidon nilotica*	Gull-billed Tern	SEAFWA	RSGCN in SEAFWA

Waterbirds	*Thalasseus maximus*	Royal Tern	SEAFWA	No
Landfowl	*Colinus virginianus*	Northern Bobwhite	MAFWA / SEAFWA	RSGCN in MAFWA/SEAFWA
Landbirds	*Centronyx henslowii*	Henslow's Sparrow	MAFWA / SEAFWA	RSGCN in MAFWA/SEAFWA
Landbirds	*Pooecetes gramineus*	Vesper Sparrow	MAFWA / SEAFWA	No
Landbirds	*Coccothraustes vespertinus*	Evening Grosbeak	MAFWA / WAFWA	No
Landbirds	*Contopus cooperi*	Olive-sided Flycatcher	WAFWA / Canada	No

REGIONAL EFFORTS IN NORTHEAST BIRD CONSERVATION

Piping plovers and American oystercatchers, red knots, and least terns rely on sandy beaches under constant threat across the Northeast from human development and recreational use. The USFWS published **The Red Knot Draft Recovery Plan** in 2021 (USFWS 2021). This remarkable bird nests in the high arctic, overwinters in the southernmost part of South America and feeds along the mid-Atlantic shores (especially Delaware Bay) on horseshoe crab eggs during spring migration. Conservation measures implemented for their breeding, migration, and wintering areas also benefit other shorebirds, including the willet, ruddy turnstone, semipalmated and purple sandpipers, and sanderling that inhabit the Delaware Bay and other estuaries along the Northeast coast (see *Chapter 2*).

Four RCN reports focused on shrublands and young forests (see *Chapter 2*). Two reports in this series include the Northeast conservation plan and BMP for the central Appalachian Mountains for the American Woodcock, an RSGCN species (Gilbart 2012, TWMP[3]).

Sea-level rise from climate change is an ongoing threat to the Northeast's extensive salt marsh systems, many of which are already heavily degraded from past ditching, filling, and associated coastal development. The Northeast encompasses almost the entire breeding range of the Saltmarsh Sparrow and has high responsibility for black rail, both of which nest in salt marsh habitat. And while freshwater marshes are generally better protected today than in the past, they remain far less common than they were historically and are still subject to degradation from pollution and development.

The eastern Black Rail is a secretive marsh bird and has experienced range contraction in the Northeast; more information can be found in the RCN project final report status assessment (Watts 2016).

Colonial nesting water birds represent an important guild that includes gulls, terns, skimmers, herons, and egrets. All these species had declined significantly by the early 20th century due to overharvesting. By the latter half of the century, species like terns had been displaced from many colonies by increasing gull populations. However, these populations have declined recently as landfills have closed or implemented more effective sanitation measures. Roseate terns are highly vulnerable since the bulk of the population is concentrated in a handful of colonies from New York to Maine. The Cape Cod and offshore Massachusetts islands are key staging sites for Massachusetts and New York colonies. In addition to the ongoing threat from gulls, these colonies are also subject to risks such as oil spills and sea-level rise.

The Black Duck Joint Venture, a partnership established under the North American Waterfowl Management Plan, has brought together scientists, conservationists, and hunting organizations across the species' historical range to coordinate conservation efforts, including monitoring, research, and communications. **The American Black Duck Conservation Plan** was published in 2020 with the following strategic goals: protect marsh migration corridors, develop BMPs (see *Chapter 5*), Restore tidal and non-tidal wetlands, improve wetland management, and control invasive species (Hartley & Weldon 2020, see *Chapter 2*). These efforts continue to benefit other wetland and marsh species, such as the bitterns, rails, sedge and marsh wrens, herons, egrets, grebes, and shorebirds, through conserving the freshwater marshes in the region.

Because most birds on the RSGCN list are migratory, it is increasingly important to acknowledge that many face threats outside a given state or even the Northeast as a whole. Birds are affected by habitat loss, disturbance, altered food supplies, and even direct human persecution at any stage of their annual cycle. In some cases, these threats are highest in the non-breeding season. For example, almost all Bicknell's thrushes winter on the Caribbean Island of Hispaniola, where deforestation is an important issue. If habitat conservation does not occur on this species' winter grounds, there is only so much the Northeast can do to ensure its survival.

Similarly, migratory shorebirds breed in the arctic and winter in South America and only occur in the region during stopovers. States are increasingly aware of their role in full life cycle conservation for these species, even though they do not breed in the region. The Association of Fish and Wildlife Agencies (AFWA) has provided draft wording, information, and tools that can be used to develop an international section or to integrate full lifecycle conservation into these plans to assist the states in including

international conservation issues and actions within their State Wildlife Action Plans. The NECASC[4] Climate Change Synthesis will inform SWAP coordinators about RSGCN species actions, threats, risks, and responses to climate change in the Northeast. For RCN monitoring protocols specific to birds, see *Chapter 5*.

1.3.3 DIADROMOUS FISH

There are 28 Diadromous Fish (Class Actinopterygii and Class Petromyzontida (Sea Lamprey (*Petromyzon marinus*) diadromous population)) that inhabit the NEAFWA regional footprint. Of those, 11 were listed as SGCN in at least one of the 14 2015 Northeast SWAPS. Nine of these Diadromous Fish met the criteria as RSGCN. Two are listed in one of the Watchlist categories: Watchlist [Assessment Priority]. No Diadromous Fish are Watchlist [Deferrals] or Proposed Watchlist [Assessment Priority]. Two of these RSGCN are Federally listed as Endangered.

Shortnose Sturgeon, © Robert S. Michelson

<u>Regional Priority Concern Highlights:</u>

- Restoration efforts for Blueback herring do not seem to show significant improvement.
- Dams/fish passage and aquatic connectivity (roads, bridges) pose major threats as barriers to migration are primary concerns.

- Entrapment and impingement of juveniles at powerplant and municipal intakes cause issues at this life stage.

Species Information, Research & Monitoring Needs

- Life history and population surveys are needed.
- Offshore monitoring protocols exist for ~50% of RSGCN.
- Data are lacking for species and populations that move out of the Northeast range for winter.

RSGCN: 9 DIADROMOUS FISH

Nine Diadromous Fish are RSGCN in the Northeast based on conservation concerns and regional responsibility (Table 1.3.11). Two were ranked Very High concern, five were ranked High concern, and two species were Moderate concern in the Northeast. The Gulf of Maine population of Atlantic Salmon (*Salmo salar* pop. 5) is endemic to the Northeast (100% Regional Responsibility), and the native population of Rainbow Smelt (*Osmerus mordax*) has a regional responsibility of 75-100%. Other RSGCN in this group have lower regional responsibilities because they migrate out of the northeast in the winter, but conservation concern in the region helps protect the spawning grounds.

Table 1.3.11 RSGCN Diadromous Fish 2023. Note that the Regional Responsibility listed is for the overall geographic range. Northeast regional responsibility may vary for breeding, migration, and wintering seasons.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Acipenser brevirostrum	Shortnose Sturgeon	50-75%	Very High
Salmo salar pop. 5	Atlantic Salmon (Gulf of Maine)	100% NEAFWA Endemic	Very High
Anguilla rostrata	American Eel	25-50%	High
Alosa sapidissima	American Shad	50-75%	High
Alosa pseudoharengus	Alewife	50-75%	High
Osmerus mordax	Rainbow Smelt (native pop.)	75-100%	High
Acipenser oxyrinchus	Atlantic Sturgeon	50-75%	High
Alosa aestivalis	Blueback Herring	50-75%	Moderate
Alosa mediocris	Hickory Shad	50-75%	Moderate

Since all Diadromous Fish of conservation concern were listed as SGCN in at least one state, none were Proposed RSGCN.

OVERVIEW

The nine RSGCN Diadromous Fish use five habitat groups (outlined in *Chapter 2*), and within those, RSGCN Diadromous fish use nine habitat types during at least one of their life stages. One hundred Diadromous fish use estuaries, rivers and streams, and marine near-shore habitats, 89% use big rivers and tidal rivers (Figure 1.3.20). These habitats are vital for reproduction and juvenile life stages for these species.

Figure 1.3.20 Number of RSGCN Diadromous Fish associated with each habitat in the Northeast. Note that the Regional Responsibility listed is for the overall geographic range. Northeast regional responsibility may vary for breeding, migration, and wintering seasons. Habitat group names are at the top of each color block and grouped by color; habitat type names appear at the bottom of each proportionally sized square and are colored by habitat group (see *Chapter 2* for more information on habitats).

RSGCN Diadromous Fish are all (100%) threatened by Energy and Mining Production, Natural Systems Modification, and Pollution (Table 1.3.12). The top threats in these categories are Hydroelectric Dams, Water Level Management Using Dams, and Runoff, respectively. While Diadromous Fish are vulnerable to many threats, dam removal has the greatest potential to aid in conserving this taxon (Waldman & Quinn 2022).

Table 1.3.12 Level 1 threats with number and percent of RSCGN Diadromous Fish threatened by each. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Energy Production & Mining (Threat 3.0)	9	100%
Natural System Modifications (Threat 7.0)	9	100%

Pollution (Threat 9.0)	9	100%
Biological Resource Use (Threat 5.0)	8	89%
Climate Change (Threat 11.0)	8	89%
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	7	78%
Transportation & Service Corridors (Threat 4.0)	6	67%
Human Intrusions & Disturbance (Threat 6.0)	5	56%
Residential & Commercial Development (Threat 1.0)	5	56%
Agriculture & Aquaculture (Threat 2.0)	4	44%
Other (Threat 12.0)	2	22%

WATCHLIST

Diadromous Watchlist [Assessment Priority] Fish were identified for more assessment because while these fish have the same threats as the RSGCN Diadromous Fish, there are unknown threats hypothesized to be coming from poor marine ecosystem health.

WATCHLIST [ASSESSMENT PRIORITY]: 2 DIADROMOUS FISH

Taxonomic Team experts identified the Striped Bass (*Morone saxatilis*) and Diadromous populations of Sea Lamprey (*Petromyzon marinus*) as Watchlist [Assessment Priority] (Table 1.3.13). Striped bass has major spawning groups within the Northeast. Stock assessments show they are overfished. Sea Lamprey have seen numbers declining even in secure watersheds like the Connecticut River. Assessment is needed to evaluate whether marine threats contribute to continued declines.

Table 1.3.13 Watchlist [Assessment Priority] Diadromous Fish 2023.

Scientific Name	Common Name	Regional Responsibility
Morone saxatilis	Striped Bass	25-50%
Petromyzon marinus	Sea Lamprey (diadromous pop.)	50-75%

REGIONAL EFFORTS IN NORTHEAST CONSERVATION

NOAA Fisheries[5] has an **Atlantic Salmon Research Hub** with a recovery plan, data, and information. This research leads to aquatic recovery and the RCN connectivity project. The University of Maine hosts the **Diadromous Species Restoration Research Network[6]**. The focus of this group is to promote collaborative research and restoration for diadromous fish. Atlantic Salmon are co-managed by The Penobscot Indian Nation, USFWS, and Maine DMR and have developed the **Collaborative Management Strategy for the Gulf of Maine Atlantic Salmon Recovery Program**. Tagging Atlantic Salmon in Greenland, NOAA biologists help track juvenile

salmon to learn more about the marine life stages. Several up-to-date sources of information can be useful to the Northeast states in developing the marine component of their Wildlife Action Plans, like the recovery plan for the Gulf of Maine Atlantic Salmon (USFWS & NMFS 2018). NOAA's National Marine Fisheries Service and the Atlantic States Marine Fisheries Commission maintain status information on species of conservation need. The Atlantic Coast Fish Habitat Partnership's[7] current plan, which presents important overview information on many of the Northeast states SGCN and RSGCN species. This plan summarizes key species, habitat, threat, and conservation action information. Recent review articles by the American Fisheries Society and USGS with information about fish declines in North America are available through Action Bioscience[8].

1.3.4 FRESHWATER FISH

335 (Class Actinopterygii and Petromyzontida) inhabit the NEAFWA regional footprint. Forty-five of these Freshwater Fish met the criteria as RSGCN. Fifty are listed in one of the Watchlist categories: 31 Watchlist [Assessment Priority], 16 Watchlist [Deferrals], and five non-SGCN species met the criteria for Proposed RSGCN and Proposed Watchlist [Assessment Priority]. Six RSGCN and two Watchlist [Deferral] Freshwater Fish are listed under the Endangered Species Act as Endangered or Threatened.


Candy Darter, © Derek Wheaton

<u>Regional Priority Concern Highlights:</u>

- Need for clear communication messages on issues like Brook trout and similar species across multiple states.
- Climate change impacts to freshwater habitats
- Competition with introduced / non-native species (shiners especially and stocked pops vs. natives).

<u>Species Information, Research & Monitoring Needs</u>

- Native populations/genetics assessments are needed for many species (e.g., those with stocked populations).
- Climate change and activity and behavioral data are needed.

RSGCN: 45 FRESHWATER FISH

Experts identified 45 Freshwater Fish as RSGCN in the Northeast based on conservation concerns and regional responsibility (Table 1.3.14). Sixteen were ranked Very High concern, 19 were ranked High concern, and ten species were classified as Moderate concern in the Northeast. Fifteen are endemic to the Northeast (100% Regional Responsibility). The other RSGCN in this group has lower regional responsibilities because they migrate out of the northeast in the winter. Still, conservation concern in the region helps protect the spawning grounds.

Table 1.3.14 2023 RSGCN Freshwater Fish in the Northeast.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Notropis bifrenatus	Bridle Shiner	75-100%	Very High
Notropis chalybaeus	Ironcolor Shiner	25-50%	Very High
Notropis semperasper	Roughhead Shiner	100% (NEAFWA Endemic)	Very High
Erimystax cahni	Slender Chub	25-50%	Very High
Cottus sp. 1	Bluestone Sculpin	100% (NEAFWA Endemic)	Very High
Cottus sp. 4	Clinch Sculpin	100% (NEAFWA Endemic)	Very High
Cottus sp. 5	Holston Sculpin	50-75%	Very High
Cottus sp. 7	Checkered Sculpin	100% (NEAFWA Endemic)	Very High
Etheostoma sellare	Maryland Darter	100% (NEAFWA Endemic)	Very High
Etheostoma osburni	Candy Darter	100% (NEAFWA Endemic)	Very High
Percina rex	Roanoke Logperch	75-100%	Very High
Etheostoma percnurum	Duskytail Darter	50-75%	Very High
Coregonus hoyi	Bloater	50-75%	Very High
Catostomus utawana	Summer Sucker	100% (NEAFWA Endemic)	Very High
Crystallaria cincotta	Diamond Darter	100% (NEAFWA Endemic)	Very High
Lepomis peltastes	Northern Sunfish	25-50%	Very High

Percina bimaculata	Chesapeake Logperch	100% (NEAFWA Endemic)	High
Ichthyomyzon fossor	Northern Brook Lamprey	25-50%	High
Ichthyomyzon greeleyi	Mountain Brook Lamprey	50-75%	High
Acipenser fulvescens	Lake Sturgeon	50-75%	High
Prosopium cylindraceum	Round Whitefish	50-75%	High
Notropis scabriceps	New River Shiner	75-100%	High
Phenacobius teretulus	Kanawha Minnow	75-100%	High
Noturus flavipinnis	Yellowfin Madtom	50-75%	High
Noturus gilberti	Orangefin Madtom	75-100%	High
Cottus baileyi	Black Sculpin	75-100%	High
Enneacanthus chaetodon	Blackbanded Sunfish	<25%	High
Etheostoma maculatum	Spotted Darter	50-75%	High
Percina notogramma	Stripeback Darter	100% (NEAFWA Endemic)	High
Percina gymnocephala	Appalachia Darter	75-100%	High
Percina macrocephala	Longhead Darter	50-75%	High
Thoburnia hamiltoni	Rustyside Sucker	75-100%	High
Aphredoderus sayanus gibbosus	Western Pirate Perch	<25%	High
Lethenteron appendix	American Brook Lamprey	25-50%	High
Salvelinus alpinus oquassa	Landlocked Arctic Char	100% (NEAFWA Endemic)	High
Margariscus margarita	Allegheny Pearl Dace	100% (NEAFWA Endemic)	Moderate
Exoglossum laurae	Tonguetied Minnow	50-75%	Moderate
Enneacanthus obesus	Banded Sunfish	50-75%	Moderate
Etheostoma fusiforme	Swamp Darter	25-50%	Moderate
Etheostoma vitreum	Glassy Darter	50-75%	Moderate
Etheostoma kanawhae	Kanawha Darter	50-75%	Moderate
Etheostoma longimanum	Longfin Darter	100% (NEAFWA Endemic)	Moderate

Etheostoma variatum	Variegate Darter	25-50%	Moderate
Percina peltata	Shield Darter	100% (NEAFWA Endemic)	Moderate
Cottus kanawhae	Kanawha Sculpin	100% (NEAFWA Endemic)	Moderate

PROPOSED RSGCN: 2 FRESHWATER FISH

Two Freshwater Fish species are not SGCN as of 2023 in the 14 Northeastern states; therefore, they are listed as Proposed RSGCN, and taxa team experts suggest looking at these species as future SGCN and RSGCN (Table 1.3.15).

Table 1.3.15 Proposed RSGCN 2023 Freshwater Fish.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Chrosomus sp. cf. saylori	Clinch Dace	75-100%	Very High
Aphredoderus sayanus sayanus	Eastern Pirate Perch	25-50%	High

OVERVIEW

RSGCN and Proposed RSGCN Freshwater Fish inhabit Lacustrine, Palustrine, and Riverine habitat groups (Figure 1.3.21, see *Chapter 2*). Rivers and Streams are home to 96% of these fish, 28% in Lakes and Ponds, and 15% in Nontidal Wetlands (Figure 1.3.21).

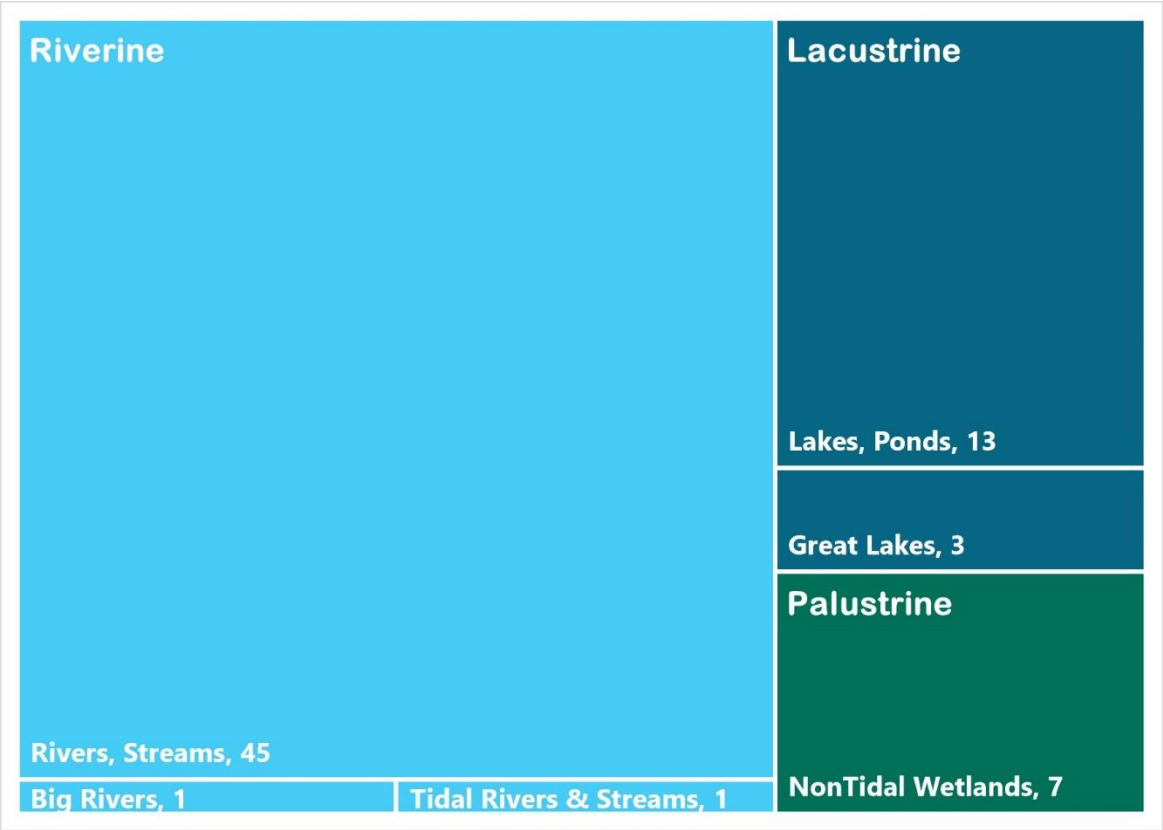


Figure 1.3.21 Number of RSGCN and Proposed RSGCN Freshwater Fish associated with each habitat in the Northeast. Species may be associated with multiple habitat types. Habitat group names are at the top of each color block and grouped by color; habitat type names appear at the bottom of each proportionally sized square and are colored by habitat group (see *Chapter 2* for more information on habitats).

Freshwater Fish (RSGCN and Proposed RSGCN) threats include Pollution (96%), Invasive and Problematic Species, Pathogens, and Genes (66%), and Climate Change (55%, Table 1.3.16). Top Pollution threats are soil erosion and sedimentation, industrial discharges, and runoff. Loss of genetic integrity, interspecific competition with a favored species, and aquatic animals also threaten Freshwater Fish. Climate Change threats to these species are due to temperature and precipitation fluctuations and gradual regime changes. In an analysis of drivers in the decline of freshwater fish, globally, invasive species, climate change, and habitat loss/degradation are the top threats. At the same time, in the US, total phosphorus, nitrogen, and riparian vegetation cover were listed as the top three threats (Brain & Prosser 2022). Additionally, Miranda et al. (2022) found that pollution from an analysis of IUCN Red-List fish species is the top threat for freshwater fishes.

Table 1.3.16 Level 1 threats with the number and percent of RSCGN and Proposed RSGCN Freshwater Fish threatened by each. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Pollution (Threat 9.0)	45	96%
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	31	66%
Climate Change (Threat 11.0)	26	55%
Natural System Modifications (Threat 7.0)	22	47%
Biological Resource Use (Threat 5.0)	18	38%
Energy Production & Mining (Threat 3.0)	12	26%
Agriculture & Aquaculture (Threat 2.0)	10	21%
Transportation & Service Corridors (Threat 4.0)	9	19%
Other (Threat 12.0)	8	17%
Human Intrusions & Disturbance (Threat 6.0)	7	15%
Residential & Commercial Development (Threat 1.0)	6	13%

WATCHLIST

Taxonomic Team experts identified 50 Freshwater Fish as Watchlist species, 31 fishes as Watchlist [Assessment Priority], three as Proposed Watchlist [Assessment Priority], and 16 species were identified for deferral to adjacent regions.

WATCHLIST [ASSESSMENT PRIORITY]: 31 FRESHWATER FISH

Taxa team experts identified 31 Freshwater Fish as Watchlist [Assessment Priority] species based on Regional Responsibility and Concern Level (Table 1.3.17). For example, the Comely Shiner (*Notropis amoenus*), which the region has 100-75% Regional Responsibility for (Table 1.3.17), was flagged by the taxa teams as needing targeted surveys. Experts have found it in the James and Rappahannock drainages but only sporadically. This species also occurs with mimic shiners; research is required to see if these fish are taking up niche space for the Comely Shiner.

Table 1.3.17 Watchlist [Assessment Priority] Freshwater Fish 2023.

Scientific Name	Common Name	Regional Responsibility
Notropis amoenus	Comely Shiner	75-100%
Notropis procne	Swallowtail Shiner	50-75%
Coregonus clupeaformis	Lake Whitefish	50-75%
Salvelinus namaycush	Lake Trout (native pop.)	50-75%
Salvelinus fontinalis	Brook Trout (wild pop.)	50-75%
Esox americanus	Redfin Pickerel	25-50%

Notropis ariommus	Popeye Shiner	25-50%
Notropis heterodon	Blackchin Shiner	25-50%
Notropis heterolepis	Blacknose Shiner	25-50%
Phenacobius mirabilis	Suckermouth Minnow	<25%
Phenacobius crassilabrum	Fatlips Minnow	<25%
Couesius plumbeus	Lake Chub	25-50%
Lythrurus lirus	Mountain Shiner	<25%
Catostomus catostomus	Longnose Sucker	25-50%
Carpiodes velifer	Highfin Carpsucker	<25%
Ictiobus cyprinellus	Bigmouth Buffalo	<25%
Lota lota	Burbot	<25%
Fundulus rathbuni	Speckled Killifish	<25%
Cottus cognatus	Slimy Sculpin	50-75%
Acantharchus pomotis	Mud Sunfish	25-50%
Ambloplites cavifrons	Roanoke Bass	50-75%
Etheostoma chlorobranchium	Greenfin Darter	<25%
Etheostoma jessiae	Blueside Darter	<25%
Etheostoma vulneratum	Wounded Darter	<25%
Percina aurantiaca	Tangerine Darter	<25%
Percina copelandi	Channel Darter	25-50%
Percina crassa	Piedmont Darter	<25%
Ammocrypta pellucida	Eastern Sand Darter	25-50%
Etheostoma denoncourti	Golden Darter	25-50%
Sander canadensis	Sauger	<25%
Etheostoma brevispinum	Carolina Fantail Darter	<25%

PROPOSED WATCHLIST [ASSESSMENT PRIORITY]: 3 FRESHWATER FISH

Three Freshwater Fish made the Proposed RSGCN category (Table 1.3.18). The Potmac Sculpin (*Cottus girardi*) is an endemic Freshwater Fish that occurs in four states (Maryland, Pennsylvania, Virginia, and West Virginia).

Table 1.3.18 Proposed Watchlist [Assessment Priority] Freshwater Fish 2023.

Scientific Name	Common Name	Regional Responsibility
Etheostoma meadiae	Bluespar Darter	50-75%
Percopsis omiscomaycus	Trout-perch	<25%
Cottus girardi	Potomac Sculpin	100% (NEAFWA Endemic)

WATCHLIST [DEFER TO ADJACENT REGION]: 16 FRESHWATER FISH

There are 16 Watchlist [Deferral] Freshwater Fish that Fish Taxonomic Team experts identified (Table 1.3.19). Eight of the taxon are deferred to the Midwest, with four fishes listed as RSGCN and one listed as Watchlist [Assessment Priority] in MAFWA. Twelve were also deferred to the Southeast; six are RSGCN in SEAFWA. No other species are deferred to the Western US or north to Canada. The eight not yet listed in the adjacent regions are opportunities for NEAFWA and neighbors to collaborate.

Table 1.3.19 2023 Freshwater Fish Watchlist [Deferral].

Scientific Name	Common Name	Deferred Region	Listed in Deferred Region
Ichthyomyzon bdellium	Ohio Lamprey	MAFWA/SEAFWA	MAFWA/ SEAFWA
Clinostomus elongatus	Redside Dace	MAFWA	MAFWA
Notropis alborus	Whitemouth Shiner	SEAFWA	SEAFWA
Cyprinella whipplei	Steelcolor Shiner	SEAFWA	No
Erimystax x-punctatus	Gravel Chub	MAFWA	Watchlist MAFWA
Erimyzon sucetta	Lake Chubsucker	MAFWA/SEAFWA	No
Cycleptus elongatus	Blue Sucker	MAFWA/SEAFWA	SEAFWA
Ameiurus brunneus	Snail Bullhead	SEAFWA	No
Fundulus catenatus	Northern Studfish	SEAFWA	No
Etheostoma cinereum	Ashy Darter	SEAFWA	No
Percina sciera	Dusky Darter	SEAFWA	No
Percina burtoni	Blotchside Logperch	SEAFWA	No
Percina maculata	Blackside Darter	MAFWA	No
Ammocrypta clara	Western Sand Darter	MAFWA/SEAFWA	MAFWA/SEAFWA
Erimonax monachus	Spotfin Chub	SEAFWA	SEAFWA
Chrosomus cumberlandensis	Blackside Dace	MAFWA	MAFWA/SEAFWA

REGIONAL EFFORTS IN NORTHEAST CONSERVATION

Several up-to-date sources of information can be useful to the Northeast states in developing the marine component of their Wildlife Action Plans. First, NOAA's National Marine Fisheries Service and the Atlantic States Marine Fisheries Commission maintain status information on species of conservation need. The Atlantic Coast Fish Habitat Partnership's recent plan[7], which presents important overview information on many of the Northeast states SGCN and RSGCN species. This plan summarizes key species, habitat, threat, and conservation action information. Finally, recent review articles by the American Fisheries Society and USGS with information about fish declines in North America can be found at Action Bioscience[8].

1.3.5 MARINE FISH

There are 661 Marine Fish (four Classes: Actinopterygii, Teleostei, Myxini, and Chondrichthyes) that inhabit the NEAFWA regional footprint in the North Atlantic. Twenty-four of these Marine Fish met the criteria as RSGCN; three are Proposed RSGCN. Sixteen are in one of the Watchlist categories: 11 Watchlist [Assessment Priority], two Watchlist [Interdependent], and three Watchlist [Deferrals], and one non-SGCN species met the criteria for Proposed Watchlist [Assessment Priority].

Regional Priority Concern Highlights:

- Climate change – range shifts, increasing temperature unknowns.
- Loss of eelgrass habitat.
- Offshore wind development.
- Fishery-independent assessments.

Species Information, Research & Monitoring Needs:

- Surveys/life history data for several skates and sharks.
- Information is needed concerning regional responsibility and seasonal activity data for migrating marine fish.

RSGCN: 24 MARINE FISH

The 2023 Northeast RSGCN list includes 24 species of marine fish. Concern levels across this group of Marine Fish range from one species, Weakfish (*Cynoscion regalis*), listed as Very High concern, to 12 species considered as High concern, with an additional 11 species listed as Moderate Concern Level (Table 1.3.20). One Marine Fish, the Atlantic Herring (*Clupea harengus*), is a NEAFWA endemic; Taxonomic Team experts agree that the stock is in decline and that this species severs several important ecological roles, such as important food source for upper trophic levels.

Table 1.3.20 Marine Fish RSGCN list 2023. Note that the Regional Responsibility listed is for the overall geographic range. Northeast regional responsibility may vary for breeding, migration, and wintering seasons.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Cynoscion regalis	Weakfish	25-50%	Very High
Rhincodon typus	Whale Shark	25-50%	High
Carcharodon carcharias	White Shark	25-50%	High
Cetorhinus maximus	Basking Shark	25-50%	High
Isurus paucus	Longfin Mako	<25%	High
Carcharhinus obscurus	Dusky Shark	<25%	High
Clupea harengus	Atlantic Herring	100% (NEAFWA Endemic)	High
Gadus morhua	Atlantic Cod	25-50%	High
Thunnus thynnus	Bluefin Tuna	<25%	High
Pseudopleuronectes americanus	Winter Flounder	75-100%	High
Dipturus laevis	Barndoor Skate	75-100%	High
Leucoraja ocellata	Winter Skate	75-100%	High
Malacoraja senta	Smooth Skate	75-100%	High
Centropristis striata	Black Sea Bass	25-50%	Moderate
Carcharias taurus	Sand Tiger	25-50%	Moderate
Lamna nasus	Porbeagle	50-75%	Moderate
Alopias vulpinus	Common Thresher Shark	25-50%	Moderate
Isurus oxyrinchus	Shortfin Mako	<25%	Moderate
Carcharhinus plumbeus	Sandbar Shark	25-50%	Moderate
Carcharhinus signatus	Night Shark	<25%	Moderate
Sphyrna zygaena	Smooth Hammerhead	50-75%	Moderate
Pomatomus saltatrix	Bluefish	25-50%	Moderate
Tautoga onitis	Tautog	75-100%	Moderate
Amblyraja radiata	Thorny Skate	50-75%	Moderate

PROPOSED RSGCN: 3 MARINE FISH

These three species of Marine Fish are not currently listed in Northeast SWAPs as SGCN but were of concern to the taxa team, which concurred with their qualification for the 2023 Proposed RSGCN list. Yellowtail Flounder (*Limanda ferruginea*) and Atlantic Halibut (*Hippoglossus hippoglossus*) have stock assessments that indicate overfishing. The White Marlin (*Kajikia albida*) has no commercial fishery but are highly migratory sportfish (Table 1.3.21).

Table 1.3.21 Proposed RSGCN Marine Fish 2023.

Scientific Name	Common Name	Regional Responsibility	Concern Final
Limanda ferruginea	Yellowtail Flounder	75-100%	Moderate
Hippoglossus hippoglossus	Atlantic Halibut	50-75%	Moderate
Kajikia albida	White Marlin	25-50%	Moderate

OVERVIEW

The 27 RSGCN and Proposed RSGCN Marine Fish can be found in four habitat groups and five habitat types (see *Chapter 2*). All (100%) of these fish use Marine Off-shore habitats, 81% use Marine Near-shore, and 56% use Estuaries. Smaller numbers of these Marine Fish use Tidal Rivers and Tidal wetlands (Figure 1.3.22).

Figure 1.3.22 Number of RSGCN and Proposed RSGCN Marine Fish associated with each habitat in the Northeast. Species may be associated with multiple habitat types. Habitat group names are at the top of each color block and grouped by color, habitat type names appear at the bottom of each proportionally sized square and colored by habitat group (see *Chapter 2* for more information on habitats).

Threatening Marine Fish are Biological Resource Use (100%), Climate Change (81%), and Pollution (59%, Table 1.3.22). Biological resource use threats include commercial fishing, recreational or subsistence fishing, and commercial harvesting. Miranda et al. (2022) found that fishing is the main threat to marine fishes. In addition, climate

change is causing direct and indirect threats to marine ecosystems, including fish listed as RSGCN. Several studies have suggestions to help managers mitigate the effects of climate change and reduce it as an amplifier for other threats (Lomonico et al. 2021, Thorstad et al. 2020).

Table 1.3.22 Level 1 threats with the percent of RSCGN and Proposed RSGCN Marine Fish threatened by each. The top Level 3 threats from each Level 1 category with the percent of species threatened by each Level 3. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Biological Resource Use (Threat 5.0)	27	100%
Climate Change (Threat 11.0)	22	81%
Pollution (Threat 9.0)	16	59%
Energy Production & Mining (Threat 3.0)	15	56%
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	12	44%
Human Intrusions & Disturbance (Threat 6.0)	9	33%
Other (Threat 12.0)	7	26%
Transportation & Service Corridors (Threat 4.0)	5	19%
Agriculture & Aquaculture (Threat 2.0)	4	15%
Natural System Modifications (Threat 7.0)	1	4%
Residential & Commercial Development (Threat 1.0)	1	4%

WATCHLIST

Taxonomic Teams identified 17 Marine Fish species as Watchlist species. Eleven species as Watchlist [Assessment Priority], one species is listed as Proposed Watchlist [Assessment Priority], two species are listed as Watchlist [Interdependent], and three species were identified for deferral to adjacent regions.

WATCHLIST [ASSESSMENT PRIORITY]: 11 MARINE FISH

Taxonomic Team experts assigned 11 Marine Fish Watchlist [Assessment Priority] (Table 1.3.23). There are two species, Atlantic Torpedo (*Torpedo nobiliana*) and Atlantic Tomcod (*Microgadus tomcod*), that are Endemic to the North Atlantic and the Northeast. Seven Marine Fish Watchlist [Assessment Priority] species have greater than 50% regional responsibility, indicating their range primarily occurs in the Northeast. The Cownose Ray (*Rhinoptera bonasus*) has Regional Responsibility between 50-25%. Two more Watchlist Marine Fish have Regional Responsibility under 25%. Watchlist [Assessment Priority] species differ from RSGCN in that they do not have a conservation Concern Level due to a lack of information on population status, natural history, and threats. Therefore, they are aptly highlighted as needing additional assessment and data.

Table 1.3.23 Marine Fish Watchlist [Assessment Priority] 2023. Note that the Regional Responsibility listed is for the overall geographic range. Northeast regional responsibility may vary for breeding, migration, and wintering seasons.

Scientific Name	Common Name	Regional Responsibility
Torpedo nobiliana	Atlantic Torpedo	100% (NEAFWA Endemic)
Microgadus tomcod	Atlantic Tomcod	100% (NEAFWA Endemic)
Prionace glauca	Blue Shark	75-100%
Paralichthys oblongus	Fourspot Flounder	75-100%
Dasyatis centroura	Roughtail Stingray	50-75%
Fundulus luciae	Spotfin Killifish	50-75%
Syngnathus fuscus	Northern Pipefish	50-75%
Leucoraja garmani	Rosette Skate	50-75%
Rhinoptera bonasus	Cownose Ray	25-50%
Sphyrna lewini	Scalloped Hammerhead	<25%
Hippocampus erectus	Lined seahorse	<25%

PROPOSED WATCHLIST [ASSESSMENT PRIORITY]: 1 MARINE FISH

Golden Tilefish (*Lopholatilus chamaeleonticeps*) is a subspecies not currently on any Northeast state SGCN list. The highest abundance of Golden Tilefish occurs between Massachusetts and New Jersey. Taxonomic Team experts indicated that they are very susceptible to temperature change, leading to high climate vulnerability. The Northeast has 50-75% Regional Responsibility. This species is commercially and recreationally fished.

WATCHLIST [INTERDEPENDENT SPECIES]: 2 MARINE FISH

Watchlist [Interdependent Species] are species on which an RSGCN or Proposed RSGCN depend but which does not independently qualify as RSGCN. Taxonomic Team experts flagged both Marine Fish listed in this category as highly important migratory forage species that need more assessment due to being very data-limited (Table 1.3.24).

Table 1.3.24 2023 Watchlist [Interdependent Species] Marine Fish.

Scientific Name	Common Name	Regional Responsibility
Ammodytes americanus	American Sand Lance	75-100%
Ammodytes dubius	Northern Sand Lance	75-100%

WATCHLIST [DEFER TO ADJACENT REGION]: 3 MARINE FISH

Taxonomic Team experts deferred three Watchlist [Deferral] Marine Fish (Table 1.3.25). All three taxa are deferred to the Southeast with one species, Great Hammerhead (*Sphyrna mokarran*) listed as RSGCN in SEAFWA at High Concern Level.

Table 1.3.25 Watchlist [Defer to Adjacent Region] Marine Fish 2023.

Scientific Name	Common Name	Deferred Region(s)	Listed in Deferred Region(s)
Sphyrna mokarran	Great Hammerhead	SEAFWA	RSGCN in SEAFWA
Syngnathus floridae	Dusky Pipefish	SEAFWA	No
Micropogonias undulatus	Atlantic Croaker	SEAFWA	No

REGIONAL EFFORTS IN NORTHEAST CONSERVATION

Several up-to-date sources of information can be useful to the Northeast states in developing the marine component of their Wildlife Action Plans. First, NOAA's National Marine Fisheries Service and the Atlantic States Marine Fisheries Commission maintain status information on species of conservation need. The Atlantic Coast Fish Habitat Partnership's recent plan[7], which presents important overview information on many of the Northeast states SGCN and RSGCN species. This plan summarizes key species, habitat, threat, and conservation action information. Finally, recent review articles by the American Fisheries Society and USGS with information about fish declines in North America can be found at Action Bioscience[8].

1.3.6 MAMMALS

There are 183 (Class Mammalia) that inhabit the NEAFWA regional footprint. Twenty-nine of these mammals met the criteria as RSGCN. Twenty are listed in one of the Watchlist categories: 12 Watchlist [Assessment Priority], five Watchlist [Deferrals], and three non-SGCN species met the criteria for Proposed Watchlist [Assessment Priority]. Twelve Mammals are federally listed.

Regional Priority Concern Highlights:

- Wind turbine threats (migratory bats).
- Offshore wind development (marine mammals).
- Cave hibernating bat populations may be stabilizing post-white nose syndrome.
- Regionally extirpated species could not manage/conserve at this time and were excluded from the RSGCN assessment.

Species Information, Research & Monitoring Needs:

- Regional status assessments.
- Research on small mammal populations.
- Small mammals are data deficient and need more surveys.

RSGCN: 29 MAMMALS

The 2023 Northeast RSGCN list includes 29 species of mammals, of which nine are bats, nine are small mammals, seven are marine mammals, two are mesocarnivores, and two are rabbits and hares (Table 1.3.26). Seven mammals (five marine mammals and two bats) are listed as Federally Endangered. Mammal Concern levels range from 48% Very High concern, 28% High concern, and 24% Moderate concern level (Table 1.3.26). The New England Cottontail (*Sylvilagus transitionalis*) and five small mammals are endemic within the Northeast.

Table 1.3.26 2023 Mammal RSGCN. Note that the Regional Responsibility listed is for the overall geographic range. Northeast regional responsibility may vary for breeding, migration, and wintering seasons.

Subtaxon	Scientific Name	Common Name	Regional Responsibility	Concern Level
Bats	*Myotis lucifugus*	Little Brown Myotis	25-50%	Very High
Bats	*Myotis septentrionalis*	Northern Long-eared Bat	25-50%	Very High
Bats	*Myotis sodalis*	Indiana Myotis	25-50%	Very High
Rabbits and Hares	*Sylvilagus transitionalis*	New England Cottontail	100% (NEAFWA Endemic)	Very High

Marine Mammals	*Physeter macrocephalus*	Sperm Whale	<25%	Very High
Marine Mammals	*Balaenoptera borealis*	Sei Whale	25-50%	Very High
Marine Mammals	*Balaenoptera physalus*	Fin Whale	<25%	Very High
Marine Mammals	*Balaenoptera musculus*	Blue Whale	25-50%	Very High
Marine Mammals	*Eubalaena glacialis*	North Atlantic Right Whale	50-75%	Very High
Other Mammals	*Lynx canadensis*	Canada Lynx	25-50%	Very High
Bats	*Corynorhinus townsendii virginianus*	Virginia Big-eared Bat	25-50%	Very High
Small Mammals:Rodentia	*Neotoma magister*	Allegheny Woodrat	50-75%	Very High
Small Mammals:Moles and Shrews	*Sorex cinereus nigriculus*	Tuckahoe Masked Shrew	100% (NEAFWA Endemic)	Very High
Bats	*Perimyotis subflavus*	Tricolored Bat	<25%	Very High
Bats	*Myotis leibii*	Eastern Small-footed Myotis	50-75%	High
Small Mammals:Rodentia	*Microtus chrotorrhinus*	Rock Vole	75-100%	High
Marine Mammals	*Megaptera novaeangliae*	Humpback Whale	50-75%	High
Small Mammals:Rodentia	*Glaucomys sabrinus fuscus*	Virginia Northern Flying Squirrel	100% (NEAFWA Endemic)	High
Small Mammals:Rodentia	*Sciurus niger cinereus*	Delmarva Fox Squirrel	100% (NEAFWA Endemic)	High
Small Mammals:Rodentia	*Synaptomys borealis sphagnicola*	Northern Bog Lemming	75-100%	High
Small Mammals:Rodentia	*Microtus chrotorrhinus carolinensis*	Southern Rock Vole	75-100%	High

Small Mammals:Rodentia	*Microtus pennsylvanicus provectus*	Block Island Meadow Vole	100% (NEAFWA Endemic)	High
Bats	*Lasionycteris noctivagans*	Silver-haired Bat	<25%	Moderate
Bats	*Lasiurus borealis*	Eastern Red Bat	<25%	Moderate
Bats	*Lasiurus cinereus*	Hoary Bat	<25%	Moderate
Other Mammals	*Spilogale putorius*	Eastern Spotted Skunk	25-50%	Moderate
Rabbits and Hares	*Sylvilagus obscurus*	Appalachian Cottontail	50-75%	Moderate
Small Mammals:Rodentia	*Sciurus niger vulpinus*	Fox Squirrel	100% (NEAFWA Endemic)	Moderate
Marine Mammals	*Phocoena phocoena*	Harbor Porpoise	50-75%	Moderate

Since all mammals of conservation concern were listed as SGCN in at least one state, no mammals were listed as Proposed RSGCN.

OVERVIEW

RSGCN Mammals use every habitat group and every habitat type described in *Chapter 2*. Sixty-nine percent of RSGCN Mammals use Forest Woodlands, 48% use Glade, Barren, and Savannah habitats, and 48% use Riparian Floodplains (Figure 1.3.23). The RSGCN Mammals are a diverse group of species, like bats, small mammals, and whales, explaining the large number of other habitats that less than 50% of them inhabit.

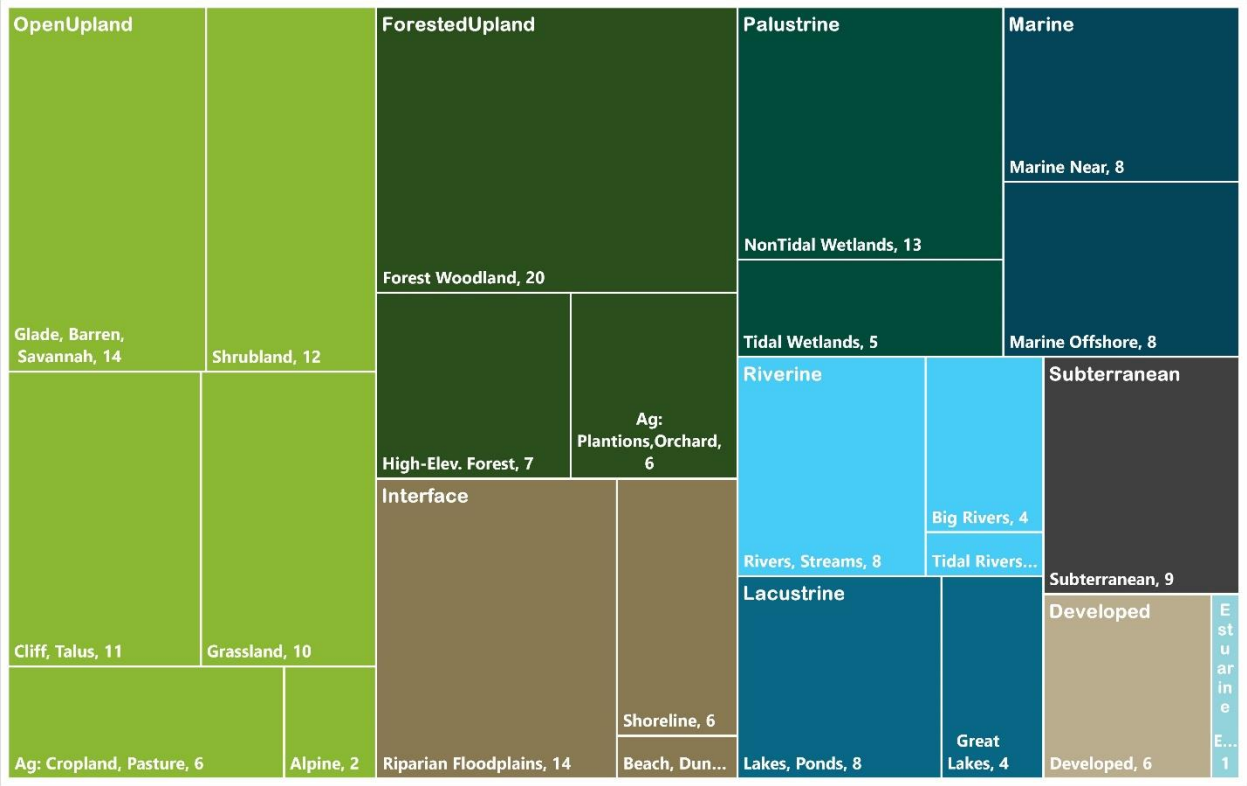


Figure 1.3.23 Number of RSGCN Mammal associated with each habitat in the Northeast. Species may be associated with multiple habitat types. Habitat group names are at the top of each color block and grouped by color; habitat type names appear at the bottom of each proportionally sized square and are colored by habitat group (see *Chapter 2* for more information on habitats). Estuaries are the smallest block in the lower right-hand corner, and one mammal uses this habitat.

RSGCN Mammals are all (100%) threatened by Climate Change. Climate change impacts include increased temperature fluctuations, changes in vegetation communities, and storms and severe weather. Ninety-seven percent of this taxon are threatened by Invasive and Problematic Species, Pathogens, and Genes; these threats are increased predation by mesopredators, and viral and fungal pathogens (Table 1.3.27). Biological Resource Use is the third Level 1 threat to Mammals, threatening 93% of them. Threats from this category fall under logging and wood harvesting, where mammals are threatened by complete or partial removal of the forest floor and management of cutting areas (Table 1.3.27). Forest management across regional landscapes can benefit mammals and other threatened species; see *Chapter 7* for Forest Service and other partners forest species lists, action plans, and more. Littlefield and D'Amato (2022) reviewed research on the trade-offs of forest habitat management and climate change via forest carbon, two top threats for mammals. Their study, and others, show that these top threats can be mitigated and managed properly across the landscape for the benefit of all wildlife. Research in Pennsylvania is one example showing the difference in species richness and abundance across wildlife taxa depending on forest management intensity (Fredericksen et al. 2000). Well-thought-out regional plans across varieties of

land ownership can uphold the integrity of the forested mosaic landscape to counter many threats to RSGCN species.

Table 1.3.27 Level 1 threats with the number and percent of RSCGN Mammals threatened by each. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Climate Change (Threat 11.0)	29	100%
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	28	97%
Biological Resource Use (Threat 5.0)	27	93%
Transportation & Service Corridors (Threat 4.0)	25	86%
Pollution (Threat 9.0)	24	83%
Energy Production & Mining (Threat 3.0)	23	79%
Residential & Commercial Development (Threat 1.0)	21	72%
Natural System Modifications (Threat 7.0)	19	66%
Human Intrusions & Disturbance (Threat 6.0)	16	55%
Agriculture & Aquaculture (Threat 2.0)	14	48%
Other (Threat 12.0)	8	28%

WATCHLIST

In total, 20 mammals are listed as Watchlist species, 12 species that taxa teams identified as Watchlist [Assessment Priority], three species listed as Proposed Watchlist [Assessment Priority], and five species identified for deferral to adjacent regions.

WATCHLIST [ASSESSMENT PRIORITY]: 12 MAMMALS

Mammal Taxonomic Team experts assigned 12 Mammals to the 2023 Mammal Watchlist [Assessment Priority] list. These include seven small mammals, three mesocarnivores (Other Mammals), one hare, and one ungulate (Table 1.3.28). One small mammal is a northeastern endemic, and two other small mammals have a Regional Responsibility of 50-75%, indicating their range primarily occurs in the Northeast. Two other small mammals have Regional Responsibility between 50-75%. The other species have regional responsibility under 50%. Watchlist [Assessment Priority] species differ from RSGCN because they do not have a conservation Concern Level due to a lack of information on population status, natural history, and threats. Mammal Taxonomic Team experts stated that small mammals within the region are in dire need of additional assessment and information.

Table 1.3.28 2023 Watchlist [Assessment Priority] Mammals. Note that the Regional Responsibility listed is for the overall geographic range. Northeast regional responsibility may vary for breeding, migration, and wintering seasons.

Subtaxon	Scientific Name	Common Name	RSGCN Status	Regional Responsibility
Small Mammals: Moles and Shrews	*Sorex albibarbis*	Eastern Water Shrew	Watchlist [Assessment Priority]	75-100%
Small Mammals: Moles and Shrews	*Sorex palustris*	American Water Shrew	Watchlist [Assessment Priority]	25-50%
Small Mammals: Moles and Shrews	*Sorex dispar*	Long-tailed Shrew	Watchlist [Assessment Priority]	75-100%
Small Mammals: Moles and Shrews	*Cryptotis parva*	North American Least Shrew	Watchlist [Assessment Priority]	<25%
Rabbits and Hares	*Lepus americanus*	Snowshoe Hare	Watchlist [Assessment Priority]	25-50%
Small Mammals: Rodentia	*Synaptomys cooperi*	Southern Bog Lemming	Watchlist [Assessment Priority]	50-75%
Other Mammals	*Mustela nivalis*	Least Weasel	Watchlist [Assessment Priority]	25-50%
Other Mammals	*Martes americana*	American Marten	Watchlist [Assessment Priority]	25-50%
Other Mammals	*Urocyon cinereoargenteus*	Gray Fox	Watchlist [Assessment Priority]	<25%
Ungulates	*Alces alces*	Moose	Watchlist [Assessment Priority]	25-50%
Small Mammals: Moles and Shrews	*Sorex hoyi winnemana*	Southern Pygmy Shrew	Watchlist [Assessment Priority]	50-75%
Small Mammals: Rodentia	*Microtus pennsylvanicus shattucki*	Penobscot Meadow Vole	Watchlist [Assessment Priority]	100% (NEAFWA Endemic)

PROPOSED WATCHLIST [ASSESSMENT PRIORITY]: 3 MAMMALS

Three species of small mammals are not currently listed in NE SWAPS as SGCN but were of concern to the Taxonomic Team, who concurred with their qualification for the 2023 Proposed Watchlist [Assessment Priority] list. Two of these species are endemic, and one has a regional responsibility greater than 75% (Table 1.3.29).

Table 1.3.29 2023 Proposed Watchlist [Assessment Priority] 2023.

Subtaxon	Scientific Name	Common Name	RSGCN Status	Regional Responsibility
Small Mammals: Rodentia	*Microtus breweri*	Beach Vole	Proposed Watchlist [Assessment Priority]	100% (NEAFWA Endemic)
Small Mammals: Rodentia	*Glaucomys sabrinus macrotis*	Northern Flying Squirrel	Proposed Watchlist [Assessment Priority]	75-100%
Small Mammals: Rodentia	*Peromyscus leucopus ammodytes*	Monomoy White-footed Deermouse	Proposed Watchlist [Assessment Priority]	100% (NEAFWA Endemic)

WATCHLIST [DEFER TO ADJACENT REGION]: 5 MAMMALS

Mammal Taxonomic Team experts placed four bats and one small mammal on the deferral list due to conservation concerns but recognized the core of the ranges fall to the south, and therefore stewardship, are in the southeastern United States (Table 1.3.30). The only deferred small mammal, the Carolina Northern Flying Squirrel (*Glaucomys sabrinus coloratus*), and two of the bats, Southeastern Myotis (*Myotis austroriparius*) and Eastern Big-eared Bat (*Corynorhinus rafinesquii macrotis*), are already listed as RSGCN in the Southeast.

Table 1.3.30 2023 Mammal Watchlist [Deferral] list.

Subtaxon	Scientific Name	Common Name	Region Deferred	Listed in Deferred Region(s)
Small Mammals: Rodentia	*Glaucomys sabrinus coloratus*	Carolina Northern Flying Squirrel	SEAFWA	SEAFWA
Bats	*Myotis austroriparius*	Southeastern Myotis	SEAFWA	SEAFWA
Bats	*Lasiurus seminolus*	Seminole Bat	SEAFWA	No
Bats	*Corynorhinus rafinesquii*	Rafinesque's Big-eared Bat	SEAFWA	SEAFWA
Bats	*Corynorhinus rafinesquii macrotis*	Eastern Big-eared Bat	SEAFWA	No

REGIONAL EFFORTS IN MAMMAL NORTHEAST CONSERVATION

The Northeast Regional Conservation Needs Grant Program funded projects specific to Mammals. Bats have been a primary focus, rightfully so, considering there are 13 listed in an RSGCN category. One such project, **Design and Implement Conservation Strategies for Northeast Species of Greatest Conservation Need: Bat Cave Gating[1],** provided funding to reduce human disturbance at bat hibernacula cave sites across the northeast in 2016. Another RCN project[1] developed a five-factor analysis status review for the little brown bat, while others focused on White-nose syndrome and its effects on bats and testing for treatments. Two reports on the Allegheny Woodrat were written in 2015 through the RCN program. One report examined the variation in acorn mast production and Allegheny Woodrat populations in Western Maryland (Duda et al. 2015). Another report assessed their populations in Maryland, where they are endangered (Pearce et al. 2015).

1.3.7 REPTILES

There are 115 (Class Reptilia) that inhabit the NEAFWA regional footprint. Sixteen of these Reptiles met the criteria as RSGCN, including seven freshwater turtles, five snakes, and four sea turtles. Nine are listed in one of the Watchlist categories: 16 Watchlist [Assessment Priority] and one Watchlist [Deferrals]. Seven of these Reptiles are listed as Federally Threatened or Endangered.

Bog Turtle @ Sean McCandless

Regional Priority Concern Highlights:

- Range constriction & habitat modifications.
- Climate change vulnerabilities.

- Illegal trade (especially turtles).
- Sea turtles: vessel strikes, offshore wind, fisheries interactions.
- Challenges for conservation posed by unique or disjunct populations across species ranges – taxonomy, distributions, population status, etc.

Species Information, Research & Monitoring Needs:

- Increased sampling of fossorial species.
- Conservation barriers need to be addressed.
- Lack of survey/population data for cryptic species, especially long-term datasets.

RSGCN: 16 REPTILES

The 2023 Northeast RSGCN list includes 16 species of reptiles. Concern levels across this group of Reptiles range from six turtles listed as Very High concern, six taxon considered High concern, and four species listed as Moderate Concern Level (Table 1.3.31). One snake, the Mountain Earthsnake (*Virginia valeriae pulchra*), and two populations of Freshwater turtles are NEAFWA endemics. In addition, there are seven entities on the Reptile RSGCN list that the Northeast has less than 25% Regional Responsibility; the Overriding Factors for low Regional Responsibility for this group include several Highly Imperiled, Migratory, Disjunct Populations that warrant RSGCN listing.

Table 1.3.31 2023 Reptile RSGCN. Note that the Regional Responsibility listed is for the overall geographic range. Northeast regional responsibility may vary for breeding, migration, and wintering seasons.

Subtaxon	Scientific Name	Common Name	Regional Responsibility	Concern Level
Sea Turtles (Marine)	*Dermochelys coriacea*	Leatherback Sea Turtle	<25%	Very High
Sea Turtles (Marine)	*Lepidochelys kempii*	Kemp's Ridley Sea Turtle	<25%	Very High
Sea Turtles (Marine)	*Caretta caretta*	Loggerhead Sea Turtle	<25%	Very High
Sea Turtles (Marine)	*Chelonia mydas*	Green Sea Turtle	<25%	Very High
Turtles	*Emydoidea blandingii*	Blanding's Turtle	<25%	Very High
Turtles	*Glyptemys muhlenbergii*	Bog Turtle (Northern pop.)	100% (NEAFWA Endemic)	Very High

Turtles	*Pseudemys rubriventris*	Northern Red-bellied Cooter (Massachusetts pop.)	100% (NEAFWA Endemic)	High
Snakes	*Crotalus horridus*	Timber Rattlesnake	<25%	High
Snakes	*Pituophis melanoleucus melanoleucus*	Northern Pinesnake	25-50%	High
Turtles	*Clemmys guttata*	Spotted Turtle	50-75%	High
Turtles	*Glyptemys insculpta*	Wood Turtle	75-100%	High
Snakes	*Sistrurus catenatus*	Eastern Massasauga	<25%	High
Snakes	*Thamnophis brachystoma*	Short-headed Gartersnake	75-100%	Moderate
Snakes	*Virginia valeriae pulchra*	Mountain Earthsnake	100% (NEAFWA Endemic)	Moderate
Turtles	*Malaclemys terrapin*	Diamond-backed Terrapin	25-50%	Moderate
Turtles	*Terrapene carolina*	Eastern Box Turtle	25-50%	Moderate

Since all Reptiles of conservation concern were listed as SGCN in at least one state, none were listed as Proposed RSGCN.

OVERVIEW

RSGCN Reptiles inhabit nine habitat groups and 21 habitat types (see *Chapter 2*). These Reptiles used two habitats more than all the others, Riparian Floodplains and Non-tidal Wetlands (each used by 50% of RSGCN Reptiles). Forty-four percent of RSGCN Reptiles inhabit each of these five habitat types: Forest Woodlands, Grassland, Glade, Barren, and Savannah, Shrubland, and Agriculture: Cropland (Figure 1.3.24). Four of those are Open Uplands, and one is Forested Upland. Thirty-eight percent or less of these reptiles use 14 other habitat types.

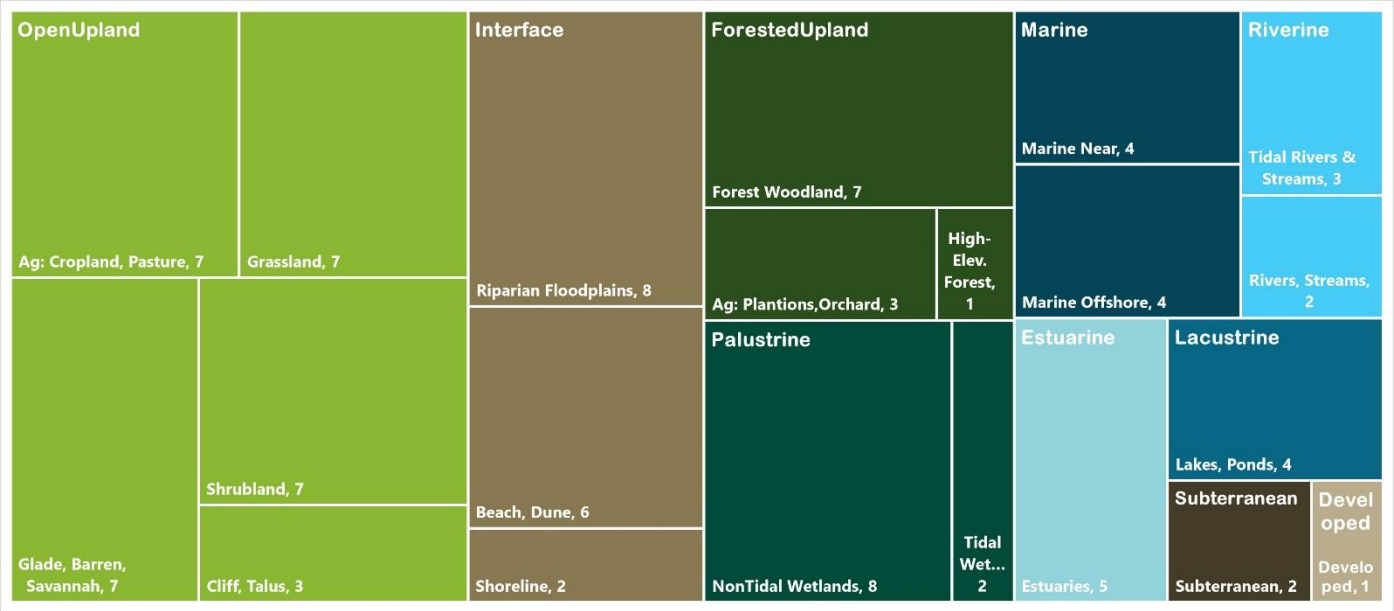


Figure 1.3.24 Number of RSGCN Reptile associated with each habitat in the Northeast. Species may be associated with multiple habitat types. Habitat group names are at the top of each color block and grouped by color, habitat type names appear at the bottom of each proportionally sized square and colored by habitat group (see *Chapter 2* for more information on habitats).

The top three Level 1 threats, Biological Resource Use, Climate Change, and Invasive and Problematic Species, Pathogens and Genes, impact 100% of RSGCN Reptiles. Ninety-four percent of these Reptiles are threatened by the following three Level 1 categories, Natural Systems Modifications, Residential & Commercial Development, and Transportation & Service Corridors (Table 1.3.32). Hunting and collection of reptiles is a concern as poaching/persecution of terrestrial animals from illegal animal trade, primarily for turtles. Climate change threats to reptiles include changes in vegetation communities and increases in temperature fluctuations; these mostly harm nest success and temperature-dependent sex determination in nests, skewing future populations sex ratios, along with storms and severe weather. Pathogens (bacterial, fungal, viral) and prion diseases all threaten >50% of RSGCN Reptiles, along with increased predation by mesopredators like raccoons (Table 1.3.32). Cox et al. (2022) found that conservation measures to protect other vertebrates can protect reptiles from these threats like habitat preservation, control of trade, and invasive species management.

Table 1.3.32 Level 1 threats with the number and percent of RSCGN Reptiles threatened by each. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Biological Resource Use (Threat 5.0)	16	100%
Climate Change (Threat 11.0)	16	100%

Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	16	100%
Natural System Modifications (Threat 7.0)	15	94%
Residential & Commercial Development (Threat 1.0)	15	94%
Transportation & Service Corridors (Threat 4.0)	15	94%
Agriculture & Aquaculture (Threat 2.0)	14	88%
Pollution (Threat 9.0)	14	88%
Human Intrusions & Disturbance (Threat 6.0)	12	75%
Energy Production & Mining (Threat 3.0)	10	63%
Other (Threat 12.0)	6	38%

WATCHLIST

In total, nine species are listed as Watchlist species, eight that the Reptile Taxonomic Team identified as Watchlist [Assessment Priority], and one that identified for deferral to adjacent regions. Watchlist Assessment Priority species inform 2025 SWAP revisions and serve as a tool to prioritize research and monitoring needs for these taxa. Watchlist species deferred to adjacent regions also inform nationwide cross-regional collaboration and conservation communication.

WATCHLIST [ASSESSMENT PRIORITY]: 8 REPTILES

The 2023 Reptile Watchlist [Assessment Priority] list contains six snakes, one lizard, and one freshwater turtle (Table 1.3.33). Two snake species, Northern Black Racer (*Coluber constrictor constrictor*) and Smooth Greensnake (*Opheodrys vernalis*), have a Regional Responsibility of 50-75%; both are dependent on early successional forests and require more research to inform conservation and management of these species. The Eastern Ribbonsnake (*Thamnophis saurita*) has 25-50% Regional Responsibility, and the other five species have Regional Responsibility under 25%. Watchlist [Assessment Priority] species differ from RSGCN in that they do not have a conservation Concern Level due to a lack of information on population status, natural history, and threats. Therefore, they are aptly highlighted as needing more assessment and data.

Table 1.3.33 Reptile Watchlist [Assessment Priority] list for 2023. Note that the Regional Responsibility listed is for the overall geographic range. Northeast regional responsibility may vary for breeding, migration, and wintering seasons.

Subtaxon	Scientific Name	Common Name	Regional Responsibility
Lizards	*Plestiodon anthracinus*	Coal Skink	<25%
Snakes	*Pantherophis guttatus*	Red Cornsnake	<25%
Snakes	*Lampropeltis getula*	Eastern Kingsnake	<25%

Snakes	*Heterodon platirhinos*	Eastern Hog-nosed Snake	<25%
Turtles	*Apalone spinifera*	Spiny Softshell	<25%
Snakes	*Thamnophis saurita*	Eastern Ribbonsnake	25-50%
Snakes	*Coluber constrictor constrictor*	Northern Black Racer	50-75%
Snakes	*Opheodrys vernalis*	Smooth Greensnake	50-75%

WATCHLIST [DEFER TO ADJACENT REGION]: 1 REPTILE

Atlantic Hawksbill Sea Turtle (*Eretmochelys imbricata imbricata*) is a highly migratory sea turtle with few occurrences in the Northeast. The Reptile Taxonomic Team still has concerns for this species and deferred it to the Southeast. While the occurrences in the Northeast are historically low, the Atlantic Hawksbill uses the Northeast for seasonal foraging habitat and is susceptible to cold stunning in bays and estuaries. Climate change could lead to more occurrences as the waters warm.

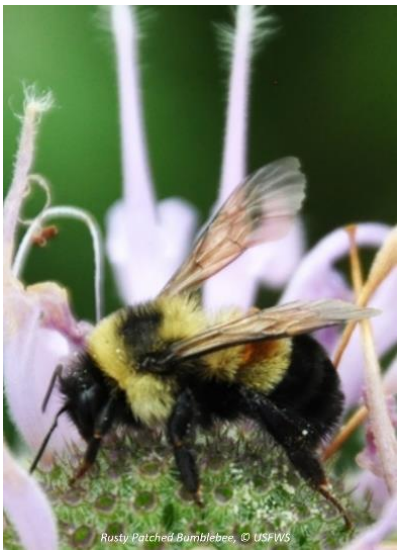
REGIONAL EFFORTS IN NORTHEAST CONSERVATION

Projects funded through the RCN Grant Program[1] for Reptiles include: **The Wood Turtle (*Glyptemys insculpta*) in the Northeastern United States: A Status Assessment and Conservation Strategy, Assessment and evaluation of prevalence of fungal dermatitis in New England Timber Rattlesnake populations, The Northern Diamondback Terrapin (*Malaclemys terrapin terrapin*) in the NE United States: A regional conservation strategy, Conservation genetics of the Wood Turtle from ME to VA, Northern Red Bellied Cooter Five Factor Analysis, Northern and peripheral populations of the Timber Rattlesnake, Spotted Turtle Conservation, Eastern Box Turtle Conservation, Road Mitigation, Wood & Blanding's Turtle Conservation, and Eastern Box Turtle Genetics**. Northeast Partners in Amphibian and Reptile Conservation (NEPARC)[2] and the Northeast Turtles website[9] has more information. The Working Lands for Wildlife has a Northeast Turtle Project[10] in seven states, where the Natural Resource Conservation Service (NRCS) works with private landowners towards conservation and wildlife improvements.

1.3.8 BUMBLE AND SOLITARY BEES

519 Bees (Order Hymenoptera) inhabit the NEAFWA regional footprint. Seven of these Bumble Bees (3 species) and Solitary Bees (4 species) met the criteria as RSGCN, and one Solitary Bee is listed as Proposed RSGCN. Thirty-five are listed in one of the

Watchlist categories: there are ten Watchlist [Assessment Priority], one Watchlist [Interdependent Species], 10 Watchlist [Defer to Adjacent Region], and 14 non-SGCN species met the criteria for Proposed Watchlist [Assessment Priority]. One RSGCN, the Rusty-patched Bumble Bee (*Bombus affinis*), is federally listed as Endangered.



Regional Priority Concern Highlights:

- Phenology mismatch due to climate change.
- Conflicts with invasive species control and the use of insecticides.
- Development, loss of host plants, all tied to habitat disturbance and loss.

Species Information, Research & Monitoring Needs:

- Targeted surveys for many Watchlist [Assessment Priority] species with data deficiencies.
- Identification of finer habitat details needed.
- Population occurrences to inform other data needs.

RSGCN: 7 BEES

The 2023 Northeast RSGCN list includes seven species of Bees. Concern levels across this group of Bees range from three species listed as Very High concern, two taxa considered as High concern, with two species listed as Moderate Concern Level (Table 1.3.34). All seven have a Regional Responsibility of 25-50% to 50-75%. The Overriding Factors for this group include several Highly Imperiled, Core populations, Disjunct Populations, among others that warrant RSGCN listing.

Table 1.3.34 2023 Bee RSGCN. Note that the Regional Responsibility listed is for the overall geographic range. Northeast regional responsibility may vary for breeding, migration, and wintering seasons.

Subtaxon	Scientific Name	Common Name	Regional Responsibility	Concern Level
Bumble Bees	*Bombus affinis*	Rusty-patched Bumble Bee	25-50%	Very High
Bumble Bees	*Bombus ashtonii*	Ashton Cuckoo Bumble Bee	25-50%	Very High
Solitary Bees	*Macropis patellata*	Patellar Oil-collecting Bee	50-75%	Very High

Solitary Bees	*Epeoloides pilosulus*	Macropis Cuckoo Bee	50-75%	High
Solitary Bees	*Protandrena abdominalis*	a mining bee pa	50-75%	High
Bumble Bees	*Bombus terricola*	Yellow-banded Bumble Bee	25-50%	Moderate
Solitary Bees	*Macropis ciliata*	Fringed Loosestrife Oil-collecting Bee	50-75%	Moderate

PROPOSED RSGCN: 1 BEE

One species of Solitary Bee is not currently listed in Northeast SWAPs as SGCN but was of concern to the Bee Taxonomic Team experts, who concurred with listing Parnassia Mining Bee (*Andrena parnassiae*) as a 2023 Proposed RSGCN species. This specialist solitary bee was recently found in Connecticut, Massachusetts, and New Jersey. It is dependent on calcareous fens and host plant *Parnissia palustris*.

OVERVIEW

RSGCN and Proposed RSGCN Bumble and Solitary Bees use five habitat groups and nine habitat types (see *Chapter 2*). Eighty-eight percent of these Bees use Grassland and Non-tidal Wetlands as the top two habitat types inhabited by this taxon. Sixty-three percent of this group use Shrubland and Forest Woodland (Figure1.3.25). Open Upland holds the greatest number of habitat types that these Bees use; the three Bees using developed lands is a surrogate for Open Upland habitat, with bees using gardens, parks, and man-made structures (NatureServe[11]).

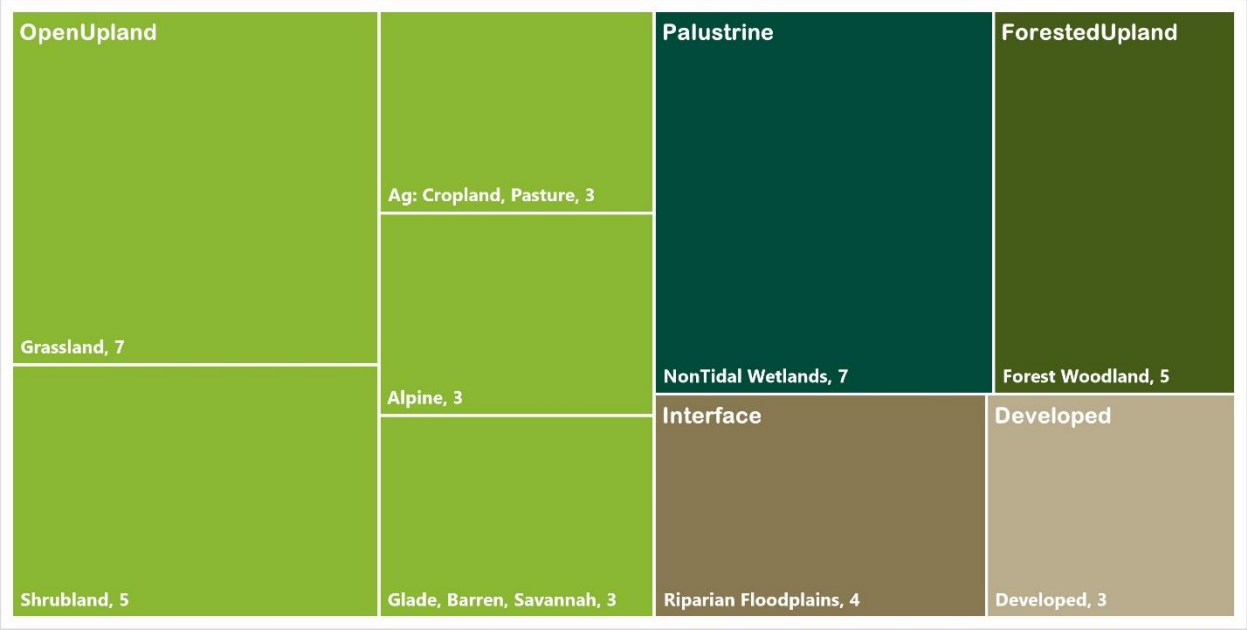


Figure1.3.25 Number of RSGCN and Proposed RSGCN Bumble and Solitary Bee associated with each habitat in the Northeast. Species may be associated with multiple habitat types. Habitat group names are at the top of each color block and grouped by color; habitat type names appear at the bottom of each proportionally sized square and are colored by habitat group (see *Chapter 2* for more information on habitats).

Bumble and Solitary Bees on the RSGCN list are threatened most by Residential and Commercial Development (88%), Climate Change (75%), and Invasive and Problematic Species, Pathogens and Genes (75%, Table 1.3.35). Low-density housing Areas, dense housing and urban areas, and commercial and industrial areas are the top threats within Development. Climate Change threats include phenological mismatch, changes in vegetation communities, and increased precipitation regime fluctuation. There are six top threats within Threat 8.0 impacting this taxon: terrestrial animals, increased grazing by vertebrates, bacterial and fungal pathogens, prion disease, and loss of genetic integrity. In addition, five additional Level 1 threats threaten 50% of these species (Table 1.3.35). With developed areas as the number one threat to native bee populations in the Northeast and climate change amplifying them, urban pollinator conservation can reduce these threats and connect people to nature in their urban environments (Baldock 2020). Mawdsley and Stoner gave a workshop to the North American Wildlife and Natural Resources Conference with a case study showing how Nebraska implemented pollinator conservation and partnerships in their 2015 SWAP revision.

Table 1.3.35 Level 1 threats with the number and percent of RSCGN and Proposed RSGCN Bumble and Solitary Bees threatened by each. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Residential & Commercial Development (Threat 1.0)	7	88%
Climate Change (Threat 11.0)	6	75%
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	6	75%
Agriculture & Aquaculture (Threat 2.0)	4	50%
Biological Resource Use (Threat 5.0)	4	50%
Energy Production & Mining (Threat 3.0)	4	50%
Other (Threat 12.0)	4	50%
Pollution (Threat 9.0)	4	50%
Human Intrusions & Disturbance (Threat 6.0)	3	38%
Natural System Modifications (Threat 7.0)	3	38%
Transportation & Service Corridors (Threat 4.0)	3	38%

WATCHLIST

In total, 35 Bees are listed as Watchlist species, ten species that Taxonomic Team experts identified as Watchlist [Assessment Priority], 14 species listed as Proposed Watchlist [Assessment Priority] because they are not SGCN in any of the 14 Northeast states, one species listed as Watchlist [Interdependent Species], and ten species that were identified for deferral to adjacent regions.

WATCHLIST [ASSESSMENT PRIORITY]: 10 BEES

The ten 2023 Watchlist [Assessment Priority] Bee species include seven Solitary Bees and three Bumble Bees (Table 1.3.36). One of them, the American Bumble Bee (*Bombus pensylvanicus*), is an RSGCN in the Midwest and Southeast. The Common Loosestrife Oil Bee (*Macropis nuda*) is a Proposed RSGCN in the Midwest. Five of these Bees were listed as RSGCN in the Northeast in 2018, but many of these species are data deficient. With the addition of the Watchlist [Assessment Priority] to flag species that need more research, these species were a better fit for this category. While these Watchlist Bees are flagged for more assessment, from the threat data in the RSGCN Database, the top three Level 1 threats for Watchlist [Assessment Priority] Bees are Climate Change, Invasive & Problematic Species, Pathogens & Genes, and Agriculture.

Table 1.3.36 Watchlist [Assessment Priority] Bees 2023.

Subtaxon	Scientific Name	Common Name	Regional Responsibility
Solitary Bees	*Andrena braccata*	a mining bee	100% (NEAFWA Endemic)

Solitary Bees	*Colletes bradleyi*	a cellophane bee	100% (NEAFWA Endemic)
Solitary Bees	*Lasioglossum arantium*	a sweat bee	50-75%
Solitary Bees	*Macropis nuda*	Common Loosestrife Oil Bee	50-75%
Bumble Bees	*Bombus citrinus*	Lemon Cuckoo Bumble Bee	25-50%
Solitary Bees	*Lasioglossum pectinatum*	a sweat bee	25-50%
Bumble Bees	*Bombus fervidus*	Yellow Bumble Bee	<25%
Bumble Bees	*Bombus pensylvanicus*	American Bumble Bee	<25%
Solitary Bees	*Anthophora walshii*	Walsh's Digger Bee	<25%
Solitary Bees	*Megachile integra*	a leafcutter bee	<25%

PROPOSED WATCHLIST [ASSESSMENT PRIORITY]: 14 BEES

14 Bees were not listed as SGCN in 2015 within the 14 Northeast states that Taxonomic Team experts flagged for Proposed Watchlist [Assessment Priority] (Table 1.3.37). These are Solitary Bees, three of which are endemic to the Northeast.

Table 1.3.37 Proposed Watchlist [Assessment Priority] Bees 2023.

Subtaxon	Scientific Name	Common Name	Regional Responsibility
Solitary Bees	*Lasioglossum izawsum*	Awesome Sweat Bee	100% (NEAFWA Endemic)
Solitary Bees	*Andrena daeckei*	a mining bee	100% (NEAFWA Endemic)
Solitary Bees	*Nomada electa*	a cuckoo bee	100% (NEAFWA Endemic)
Solitary Bees	*Hylaeus saniculae*	Sanicle Yellow-faced Bee	50-75%
Solitary Bees	*Nomada banksi*	Bank's Cuckoo Nomad Bee	50-75%
Solitary Bees	*Nomada rodecki*	a cuckoo bee	50-75%
Solitary Bees	*Nomada sphaerogaster*	a cuckoo bee	50-75%
Solitary Bees	*Triepeolus rugosus*	Punctate Central Florida Cuckoo Bee	50-75%
Solitary Bees	*Osmia felti*	Felt's Mason Bee	50-75%
Solitary Bees	*Colletes consors mesocopus*	a partner plasterer bee	25-50%
Solitary Bees	*Dianthidium simile*	Similar Carder Bee	25-50%

Solitary Bees	*Andrena persimulata*	Protuberance Miner Bee	<25%
Solitary Bees	*Andrena rehni*	Rehn's Miner Bee	<25%
Solitary Bees	*Epeolus canadensis*	Canadian Cuckoo Nomad Bee	<25%

WATCHLIST [INTERDEPENDENT SPECIES]: 1 BEE

One Solitary Bee, a melittid bee (*Melitta melittoides*), is listed as a Watchlist [Interdependent Species]. The melittid bee is interdependent with a Watchlist [Assessment Priority] cuckoo bee species, *Nomada rodecki*. It was considered by the taxa team as an important parasitic species to highlight for conservation. It can be used to umbrella additional similarly threatened bee species that specialize on *Lyonia ligustrina*, a wetland plant.

WATCHLIST [DEFER TO ADJACENT REGION]: 10 BEES

Taxonomic Team experts deferred ten Bees to adjacent regions with more Regional Responsibility, four Bumble Bees, and six Solitary Bess (Table 1.3.38). Over half of these Bees are not currently listed in the regions they are deferred to, creating opportunities for cross-regional collaboration.

Table 1.3.38 Watchlist [Interdependent Species] Bees 2023.

Subtaxon	Scientific Name	Common Name	Deferred Region(s)	Listed in Deferred Region(s)
Solitary Bees	*Colletes ciliatus*	a cellophane bee	MAFWA	No
Solitary Bees	*Osmia illinoensis*	a mason bee	MAFWA	RSGCN in MAFWA
Solitary Bees	*Megachile rugifrons*	a leafcutter bee	MAFWA	No
Solitary Bees	*Andrena fulvipennis*	an andrenid bee	SEAFWA	No
Solitary Bees	*Nomada seneciophila*	a cuckoo bee	SEAFWA	No
Solitary Bees	*Megachile ingenua*	a leafcutter bee	SEAFWA	RSGCN in MAFWA
Bumble Bees	*Bombus fraternus*	Southern Plains Bumble Bee	MAFWA/ SEAFWA	RSGCN in MAFWA/ SEAFWA
Bumble Bees	*Bombus variabilis*	Variable Cuckoo Bumble Bee	MAFWA/ SEAFWA	RSGCN in MAFWA/ SEAFWA

Bumble Bees	*Bombus insularis*	Indiscriminate Cuckoo Bumble Bee	WAFWA/ Canada	No
Bumble Bees	*Bombus suckleyi*	Suckley's Cuckoo Bumble Bee	WAFWA/ Canada	No

REGIONAL EFFORTS IN NORTHEAST BEE CONSERVATION

Pollinators help plants to complete their reproductive cycles and are vital to healthy functioning ecosystems. Most pollinator species are invertebrates, specifically insects. Major pollinator groups in the Northeast include social and solitary bees and many flies, beetles, butterflies, and moths. Given that Bumble and Solitary Bees use many habitats and have many threats, there is considerable concern about the conservation status and population trends of these important taxa across North America. RCN project **Habitat for Pollinators: Improving Management of Regionally Significant Xeric Grassland, Barrens, and Woodlands in the Northeast** (Milam 2018) gathered base bee datasets and developed a standardized pollinator protocol. Another RCN project: **Development of an Online Database to Enhance the Conservation of SGCN Invertebrates in the Northeastern Region** developed an online database[12] for SGCN Invertebrates. Cornell's Pollinator Network[13] is a great resource for research and guides to create habitats and combat threats. Reports focusing on pollinators are available for state fish and wildlife agencies from the Xerces Society[14] and the Heinz Center[15] for use by states in revising their SWAPs. Reports by Mawdsley and Humpert (2016), **Revised State Wildlife Action Plans Offer New Opportunities for Pollinator Conservation in the USA** and Mawdsley and Stoner (2016) **Urban Pollinator Conservation in the US State Wildlife Action Plans** have recommendations on incorporating and planning for pollinators in SWAPs.

1.3.9 CRAYFISH

The Northeast region has at least 78 species of crayfish (Family Cambaridae). More than one-third of Northeast species, 29, are listed in one of the RSGCN categories. The Crayfish Taxonomic Team identified 11 species as RSGCN, with one listed as Proposed RSGCN. Two of the Watchlist categories have the remaining listed Crayfish: three Watchlist [Assessment Priority] and 14 non-SGCN species met the criteria for Proposed Watchlist [Assessment Priority]. This list is missing one species previously included in the RSGCN list. In 2017, the taxa team added a crayfish population from western New York as a Proposed RSGCN under the epithet *Lacunicambarus cf. diogenes*. Subsequent work by Glon et al. (2022) indicated that this population belonged to the newly revived *L. nebrascensis*, which the 2022 taxa team did not list due to its wide distribution across the Midwest.

Regional Priority Concern Highlights:

• Invasive crayfish species are a primary threat to native species.
• Water quality impacts, especially due to pollution from coal mining, may eliminate populations.
• Numerous climate change impacts, including changes to water temperature, chemistry, and flow are detrimental, as are secondary consequences such as sedimentation and amplified pollution due to increased storm frequency and intensity.
• As detritivores, heavy metals may bioaccumulate in some crayfish species.
• Habitat loss, fragmentation, and degradation, especially due to sedimentation, are a concern for many species.

Species Information, Research & Monitoring Needs:

- Taxonomy, genetics, and descriptions of former *C. acuminatus* complex is necessary and may identify more than eight new species endemic to NEAFWA.
- The taxonomic split of *Creaserinus fodiens* into three species in the Northeast results in an additional need for description, habitat associations, and analysis of historical records.
- Inventory, research, and management needs are largely unknown for most species.

RSGCN: 11 CRAYFISH

The Taxonomic Team identified eleven crayfish species that met the criteria for RSGCN in the 2023 update (Table 1.3.39). Two of these species are federally protected under the Endangered Species Act. The Big Sandy Crayfish (*Cambarus callainus*) is Threatened, and the Guyandotte River Crayfish (*Cambarus veteranus*) is Endangered. Two additional species, Greenbrier Cave Crayfish (*Cambarus nerterius*) and Chowanoke Crayfish (*Faxonius virginiensis*), are currently Under Review for federal listing. Many crayfish are restricted to specific watersheds, and six RSGCN crayfish are endemic to the Northeast region. One of the species listed, Digger Crayfish (*Creaserinus fodiens*), has a regional responsibility below 25%. Still, recent work has illustrated that this species is ripe for revision and may be redescribed as three separate species. The Crayfish

Taxonomic Team elected to retain this species on the list until the redescription occurs and the potential for unique genetics and disjunct populations in the region is addressed.

Table 1.3.39 2023 Crayfish RSGCN list.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Cambarus magerae	Big Stone Crayfish	100% (NEAFWA Endemic)	Very High
Cambarus nerterius	Greenbrier Cave Crayfish	100% (NEAFWA Endemic)	Very High
Cambarus veteranus	Guyandotte River Crayfish	100% (NEAFWA Endemic)	Very High
Cambarus callainus	Big Sandy Crayfish	50-75%	High
Cambarus pauleyi	Meadow River Mudbug	100% (NEAFWA Endemic)	High
Cambarus elkensis	Elk River Crayfish	100% (NEAFWA Endemic)	High
Cambarus hatfieldi	Tug Valley Crayfish	75-100%	Moderate
Cambarus smilax	Greenbrier River Crayfish	100% (NEAFWA Endemic)	Moderate
Cambarus theepiensis	Coalfields Crayfish	50-75%	Moderate
Creaserinus fodiens	Digger Crayfish	<25%	Moderate
Faxonius virginiensis	Chowanoke Crayfish	50-75%	Moderate

PROPOSED RSGCN: 1 CRAYFISH

One species is on the 2023 Proposed RSGCN list, Allegheny Mountain Mudbug (*Cambarus fetzneri*). This species is a regional endemic of Moderate concern that recently split from *Cambarus monongalensis* (Loughman et al. 2019). The distribution of the species in Virginia is well understood, but further investigations of West Virginia populations are needed, and it may be a good target for citizen science.

OVERVIEW

Ten of the 14 Northeast states list crayfish as SGCN. Across the Northeast, RSGCN and Proposed RSGCN occur in five habitat groups and five habitat types (see *Chapter 2*). Eighty-three percent of these crayfish use rivers and streams, 25% use Non-tidal Wetlands, and 25% use Riparian Floodplains (Figure 1.3.26). The other two habitat types where these entities are found are subterranean habitats and developed areas. The Developed habitat type comes from NatureServe. It cites residential yards, roadside ditches, suburban areas, and orchards as one of the Allegheny Mountain Mudbug habitat types, alongside seeps, springs, and wetlands.

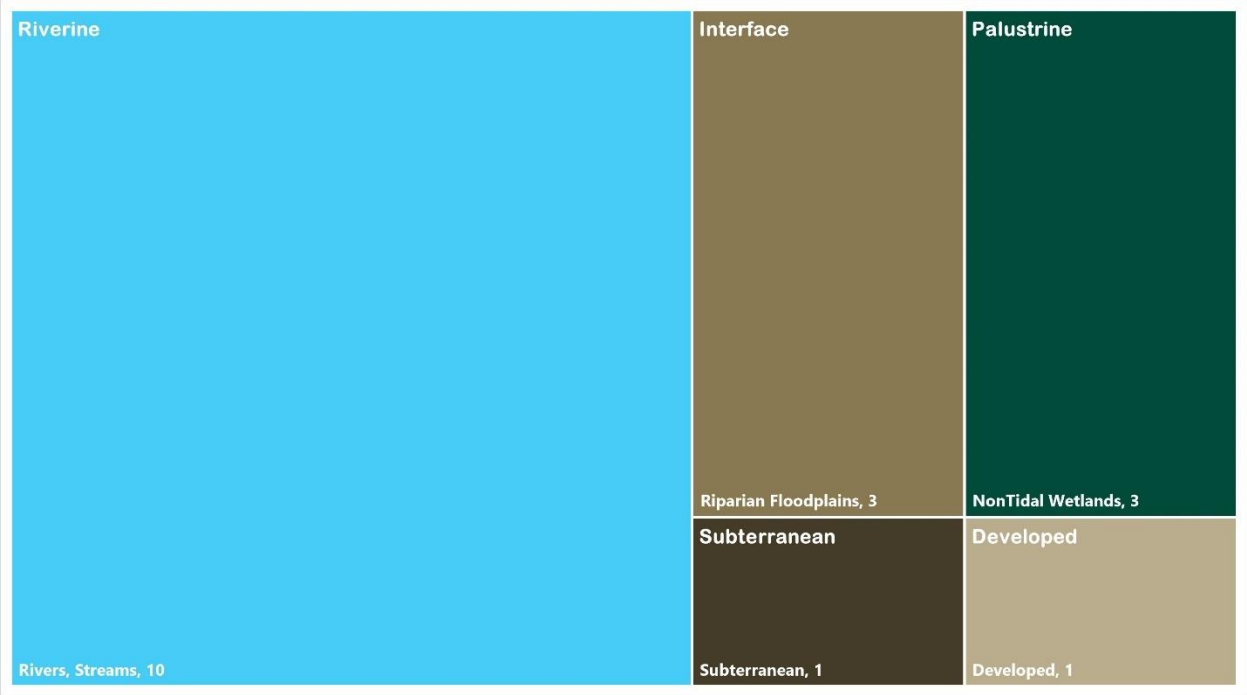


Figure 1.3.26 Number of RSGCN and Proposed RSGCN Crayfish associated with each habitat in the Northeast. Species may be associated with multiple habitat types. Habitat group names are at the top of each color block and grouped by color; habitat type names appear at the bottom of each proportionally sized square and are colored by habitat group (see *Chapter 2* for more information on habitats).

The 12 RSGCN and Proposed RSGCN Crayfish are threatened by Invasive and Problematic Species, Pathogens and Genes and Pollution over twice as much as other threats. Aquatic animals, specifically non-native crayfish, are out-competing native crayfish. Taxonomic Team experts report that Pollution would be a higher threat, except in some instances, it helps native species outcompete the non-native crayfish who cannot survive in heavily polluted areas. Soil erosion and sedimentation threaten 67% of listed crayfish. Together reducing non-native crayfish and sedimentation would alleviate pressure on these species. Climate Change is the third Level 1 threat to crayfish in the Northeast. Droughts, overabundant rains, and increased fluctuations in the precipitation regime all threaten these RSGCNs (Table 1.3.40).

Table 1.3.40 Level 1 threats with the number and percent of RSCGN and Proposed RSGCN Crayfish threatened by each. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	10	83%
Pollution (Threat 9.0)	10	83%
Climate Change (Threat 11.0)	4	33%
Natural System Modifications (Threat 7.0)	3	25%
Agriculture & Aquaculture (Threat 2.0)	2	17%

Biological Resource Use (Threat 5.0)	2	17%
Residential & Commercial Development (Threat 1.0)	2	17%
Transportation & Service Corridors (Threat 4.0)	1	8%

WATCHLIST

In total, 17 Crayfish species were listed as Watchlist species, three species that taxa teams identified as Watchlist [Assessment Priority], and 14 as Proposed Watchlist [Assessment Priority].

WATCHLIST [ASSESSMENT PRIORITY]: 3 CRAYFISH

Experts assigned three crayfish to the Watchlist [Assessment Priority] list (Table 1.3.41). One species, Blue Teays Mudbug (*Cambarus loughmani*), is recently described and requires further surveys to better establish its distribution, habitat needs, and potential threats. One species, Devil Crayfish (*Lacumicambarus diogene*), has undergone several taxonomic revisions in recent years, leaving their current status in the Northeast unclear without further refinement of the distribution of the various species that have split off. The third species, Spinycheek Crayfish (*Faxonius limosus*), is widespread and fairly common in the Northeast. Historically, it was found in several drainages in the region's southern parts, but recent surveys have not seen it at many of the historic sites. These declines may result from the spread of invasive crayfish species, especially Rusty and Virile Crayfish (*Faxonius rusticus* and *F. virilis*, respectively), in the southern parts of the Northeast. Though the Spinycheek Crayfish is not a major conservation concern, the taxa team included it as a Watchlist species to monitor potential status changes in the future.

Table 1.3.41 2023 Watchlist [Assessment Priority] Crayfish.

Scientific Name	Common Name	Regional Responsibility
Faxonius limosus	Spinycheek Crayfish	100% (NEAFWA Endemic)
Cambarus loughmani	Blue Teays Mudbug	100% (NEAFWA Endemic)
Lacunicambarus diogene	Devil Crawfish	50-75%

PROPOSED WATCHLIST [ASSESSMENT PRIORITY] SPECIES (2023)

There are 14 species on the Proposed Watchlist [Assessment Priority] list, most of which are recent divisions of two species complexes (Table 1.3.42). Most species on the list belong to the Acuminate Crayfish (*Cambarus acuminatus*) complex. This complex may contain as many as 30 species, 11 of which occur in the Northeast region, and nine may be regional endemics. The taxa team elected to include all potential *acuminatus* complex species in the Proposed Watchlist until their taxonomy and distribution has been clarified. The next two species on this list form a complex with Digger Crayfish.

Again, these species will remain on the Proposed Watchlist until their taxonomic validity and distribution are established, and their conservation Concern Level can be assessed. The final species on this list, Quinebaug River Crayfish (*Faxonius quinebaugensis*), requires additional genetic work to determine whether it is a valid species worthy of consideration or represents a population of Virile Crayfish.

Table 1.3.42 Proposed Watchlist [Assessment Priority] Crayfish 2023.

Scientific Name	Common Name	Regional Responsibility
Faxonius quinebaugensis	Quinebaug River Crayfish	100% (NEAFWA Endemic)
Cambarus sp. nov. Appomattox	an acuminate crayfish	100% (NEAFWA Endemic)
Cambarus sp. nov. Blackwater	an acuminate crayfish	100% (NEAFWA Endemic)
Cambarus sp. nov. MD-VA	an acuminate crayfish	100% (NEAFWA Endemic)
Cambarus sp. nov. mid-James	an acuminate crayfish	100% (NEAFWA Endemic)
Cambarus sp. nov. Pamunkey	an acuminate crayfish	100% (NEAFWA Endemic)
Cambarus sp. nov. PA-VA	an acuminate crayfish	100% (NEAFWA Endemic)
Cambarus sp. nov. Pigg	an acuminate crayfish	100% (NEAFWA Endemic)
Cambarus sp. nov. Rappahannock	an acuminate crayfish	100% (NEAFWA Endemic)
Cambarus sp. nov. Rivanna	an acuminate crayfish	100% (NEAFWA Endemic)
Cambarus sp. nov. Dan	an acuminate crayfish	50-75%
Cambarus sp. nov. Yadkin 1	an acuminate crayfish	<25%
Creaserinus uhleri	a crayfish	unknown
Creaserinus sp. nov.	a crayfish	unknown

REGIONAL EFFORTS IN NORTHEAST CRAYFISH CONSERVATION

The southern Appalachian Mountains, including Virginia and West Virginia, have nearly two-thirds of the world's crayfish diversity (Taylor et al. 2007). Like other aquatic taxa, crayfish are disproportionately more imperiled than other terrestrial taxa. The elevated risk for crayfish can be attributed to the restrictive nature of riverine systems, the general degradation of freshwater habitats, and the small distributions of many crayfish species (Richman et al. 2015, Crandall & Buhay 2008). Crayfish differ from other aquatic taxa in that they exhibit higher levels of endemism, with almost half of all American crayfish restricted to a single state (Taylor et al. 2007, Richman et al. 2015).

Despite the general acknowledgment of crayfish as a taxon of concern, little regional research and monitoring have targeted this group. Individual researchers are reviewing the taxonomy of some clades, resulting in the description of several new species as described above. In addition, several states use citizen science programs and public records posted to resources such as iNaturalist as tools to monitor crayfish species within their states. Still, no comprehensive assessments have occurred since Taylor et al.'s 2007 reassessment of the American Fisheries Society's list of crayfish conservation status and Richman et al.'s 2015 IUCN assessment of the drivers of crayfish decline globally. A targeted review of Northeastern species would provide a richer context for the regional conservation of this aquatic group.

1.3.10 EPHEMEROPTERA: MAYFLIES

Nearly 300 mayflies (Ephemeroptera) occur in the Northeast region. Approximately 22%, 62 species, are listed as SGCN in at least one of the 14 2015 Northeast SWAPs. The Taxonomic Team identified 13 Mayflies as meeting the criteria for RSGCN in the 2023 list. An additional three species met the criteria for Proposed RSGCN, nine for Watchlist [Assessment Priority], and 11 for Proposed Watchlist [Assessment Priority]. The 2023 revision of the RSGCN list is the first-time mayflies were assessed, so all these species are new to the Northeast RSGCN list.

<u>Regional Priority Concern Highlights:</u>

- Mayflies are susceptible to several aquatic threats, including pollution and sedimentation.
- Habitat disturbance and modifications can lead to local extirpations.
- Climate change may result in water temperature shifts, changing hydrology, and saltwater intrusion.

<u>Species Information, Research & Monitoring Needs:</u>

- More information is needed for nearly every species across multiple topics, including basic information on distribution, taxonomic validity, and status.
- Coordinating with Stroud Research Water Center would provide access to their "enormous number of unpublished records," which may include records on otherwise poorly known species.

- Many mayflies are described from the nymph or adult stages; efforts to rear species through the full lifecycle will help 'match' juvenile and adult forms.

RSGCN: 13 MAYFLIES

There are 13 Mayfly species on the 2023 Northeast RSGCN list. Concern level for this group is not as elevated as for the stoneflies and caddisflies, with ten species listed, High concern and three as Moderate, with no mayflies currently considered Very High concern (Table 1.3.43). Nearly half of the RSGCN mayflies are endemic to the Northeast; *Epeorus frisoni, Heptagenia culacantha*, *Siphlonisca aerodromia*, *Siphlonurus barbaroides*, and *Siphlonurus demaryi*. One mayfly, *Afghanurus rusticalis*, has regional responsibility below 50% but was still included as its known distribution is a series of disjunct populations scattered across the Northeast and Midwest.

Table 1.3.43 2023 RSGCN Mayflies.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Epeorus frisoni	Roaring Brook Mayfly	100% (NEAFWA Endemic)	High
Afghanurus horrida	Rough Flat-headed Mayfly	75-100%	High
Siphlonurus barbaroides	Wild Primitive Minnow Mayfly	100% (NEAFWA Endemic)	High
Siphlonurus barbarus	Barbarous Primitive Minnow Mayfly	75-100%	High
Siphlonisca aerodromia	Tomah Mayfly	100% (NEAFWA Endemic)	High
Parameletus midas	Midas Primitive Minnow Mayfly	50-75%	High
Ameletus browni	Brown's Comb Minnow Mayfly	75-100%	High
Baetisca rubescens	Provancher's Armored Mayfly	75-100%	High
Barbaetis benfieldi	Benfield's Bearded Small Minnow Mayfly	75-100%	High
Siphlonurus demaryi	Demary's Primitive Minnow Mayfly	100% (NEAFWA Endemic)	High
Heptagenia culacantha	a flat-headed mayfly	100% (NEAFWA Endemic)	Moderate
Epeorus punctatus	Dotted Flat-headed Mayfly	50-75%	Moderate
Afghanurus rusticalis	Rusty Flat-headed Mayfly	25-50%	Moderate

PROPOSED RSGCN: 3 MAYFLIES

Three mayflies not currently SGCN in the Northeast SWAPs otherwise met the criteria for the taxa team to include them as Proposed RSGCN on the 2023 list. One species is endemic to the region, one is primarily found in the Northeast, and the third is more widely distributed (Table 1.3.44). Like *Arghanurus rusticalis*, *Epeorus subpallidus* is located in many widespread but disjunct populations along the Appalachian Mountains, especially in high-quality streams, and may be highly sensitive to environmental impacts. The other two species have limited distribution and some specialized habitat requirements, though they are not currently facing any major known threats.

Table 1.3.44 Proposed RSGCN Mayflies 2023.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Rhithrogena brunneotincta	Brown Flat-headed Mayfly	100% (NEAFWA Endemic)	High
Epeorus subpallidus	a mayfly	25-50%	Moderate
Eurylophella coxalis	Barton's Spiny Crawler Mayfly	75-100%	Moderate

OVERVIEW

Eight of the 14 Northeast states list Mayflies as SGCN. Northeast RSGCN and Proposed RSGCN use four habitat groups and five habitat types (see *Chapter 2*). All these Mayflies (100%) can be found in Riparian Floodplains, 94% use Rivers and Streams, and 38% use Non-tidal Wetlands (Figure 1.3.27).

Figure 1.3.27 Number of RSGCN and Proposed RSGCN Mayfly associated with each habitat in the Northeast. Species may be associated with multiple habitat types. Habitat group names are at the top of each color block and grouped by color; habitat type names appear at the bottom of each proportionally sized square and are colored by habitat group (see *Chapter 2* for more information on habitats).

Climate Change threatens 100% of RSGCN and Proposed RSGCN Mayflies and other EPT: Stoneflies and Caddisflies. The top threats under this category are temperature related: gradual temperature change, increase in temperature fluctuations; and precipitation related: gradual change in the precipitation regime and increase in fluctuations in the precipitation regime (Table 1.3.45). In addition, runoff, nutrient loads, herbicides and pesticides, and domestic wastewater are top Pollution threats to Mayflies (Table 1.3.45).

Table 1.3.45 Level 1 threats with the percent of RSCGN and Proposed RSGCN Mayflies threatened by each. The top Level 3 threats from each Level 1 category with the percent of species threatened by each Level 3. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Climate Change (Threat 11.0)	16	100%
Pollution (Threat 9.0)	16	100%
Natural System Modifications (Threat 7.0)	6	38%
Transportation & Service Corridors (Threat 4.0)	5	31%
Other (Threat 12.0)	4	25%
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	3	19%
Residential & Commercial Development (Threat 1.0)	2	13%

Biological Resource Use (Threat 5.0)	1	6%
Energy Production & Mining (Threat 3.0)	1	6%

WATCHLIST

In total, 20 Mayfly species were listed as Watchlist species. In addition, the EPT Taxonomic Team identified nine Mayflies as Watchlist [Assessment Priority] and 11 Mayfly species listed as Proposed Watchlist [Assessment Priority].

WATCHLIST [ASSESSMENT PRIORITY]: 9 MAYFLIES

The taxa team included the nine species on the 2023 Watchlist [Assessment Priority] list for various reasons, though uncertainties related to species distributions were a factor for each species (Table 1.3.46). *Eurylophella poconoensis* was previously thought to be a narrow endemic but was recently discovered several states away from its type locality. Along with *P. vicinum*, it occupies lacustrine habitats infrequently targeted for mayfly surveys, explaining their current lack of occurrence records. *Anthopotamus verticis* and *Neoleptophlebia assimilis* are more widespread in other regions, but their distribution at their range edges in the Northeast are unknown. The remaining four mayflies on this list are uncommon, but uncertainties about their full distribution, sensitivity to threats, identification, and taxonomic issues warranted their inclusion as Watchlist [Assessment Priority] species.

Table 1.3.46 Watchlist [Assessment Priority] Mayflies for 2023.

Scientific Name	Common Name	Regional Responsibility
Eurylophella bicoloroides	Nova Scotia Spiny Crawler Mayfly	100% (NEAFWA Endemic)
Siphloplecton costalense	Speith's Great Speckled Olive Mayfly	75-100%
Epeorus suffusus	Blushing Flat-headed Mayfly	75-100%
Eurylophella poconoensis	Poconos Chocolate Dun	75-100%
Procloeon vicinum	Potomac Small Minnow Mayfly	75-100%
Rhithrogena anomala	Anomalous Flat-headed Mayfly	50-75%
Ameletus tertius	Trinity Comb Minnow Mayfly	50-75%
Neoleptophlebia assimilis	Southeastern Prong-gilled Mayfly	50-75%
Anthopotamus verticis	Walker's Tusked Sprawler	25-50%

PROPOSED WATCHLIST [ASSESSMENT PRIORITY]: 11 MAYFLIES

The eleven species on the Proposed Watchlist [Assessment Priority] list had no known major threats or concerns during the 2015 SWAP revisions and were thus not listed as

SGCN (Table 1.3.47). Continued data deficiencies are the primary reason the taxa team included these species in the 2023 RSGCN update. One species, *Rhithrogena jejuna*, has largely gone unreported as it was largely misidentified as one of two western species. Until these species descriptions are clarified, and historic records reviewed, our understanding of this species in the Northeast will remain confused. Two species, *Anafroptilum victoriae* and *Pseudocentroptiloides usa* have limited occurrence records. One species, *Procloeon pennulatum* is just at the southern end of its range in the Northeast; the taxa team elected to include it due to the potential for climate change-driven range shifts. The remaining seven species were included as generally data deficient, with little known about their habitats, distribution, and potential threats.

Table 1.3.47 Proposed Watchlist [Assessment Priority] Mayflies 2023.

Scientific Name	Common Name	Regional Responsibility
Leucrocuta umbratica	Shady Flat-headed Mayfly	75-100%
Ameletus walleyi	Walley's Comb Minnow Mayfly	75-100%
Rhithrogena amica	Loveable Flat-headed Mayfly	50-75%
Leucrocuta walshi	Walsh's Flat-headed Mayfly	50-75%
Rhithrogena jejuna	Hungry Flat-headed Mayfly	25-50%
Leucrocuta juno	Juno's Flat-headed Mayfly	25-50%
Afghanurus inconspicua	Inconspicuous Flat-headed Mayfly	25-50%
Acentrella nadineae	a mayfly	25-50%
Anafroptilum victoriae	Victoria's Small Minnow Mayfly	NA
Procloeon pennulatum	Eaton's Small Minnow Mayfly	NA
Pseudocentroptiloides usa	American Small Minnow Mayfly	NA

WATCHLIST [DEFER TO ADJACENT REGION] SPECIES (2023)

The taxa team identified nine mayfly species whose ranges fall predominantly in the Southeast region (Table 1.3.48). In general, though a portion of each species' range falls within the Northeast region, the EPT Taxa Team did not feel that they knew enough about these species to assess their conservation Concern Levels and will defer to experts from the Southeast on these species.

Table 1.3.48 Watchlist [Defer to Adjacent Region] Mayflies 2023.

Scientific Name	Common Name	Deferred Region	Listed in Deferred Region
Ameletus janetae	a mayfly	SEAFWA	No
Neoephemera eatoni	a large square-gilled mayfly	SEAFWA	No
Habrophlebiodes celeteria	a leptophlebiid mayfly	SEAFWA	No
Ephemera blanda	West Virginia Burrowing Mayfly	SEAFWA	No
Leptophlebia bradleyi	Bradley's Prong-gilled Mayfly	SEAFWA	No
Isonychia hoffmani	Hoffman's Isonychia Mayfly	SEAFWA	No
Dannella provonshai	an ephemerellid mayfly	SEAFWA	No
Acentrella barbarae	a mayfly	SEAFWA	No
Tsalia berneri	Berner's Ephemerella Mayfly	SEAFWA	No

REGIONAL EFFORTS IN NORTHEAST MAYFLY CONSERVATION

Mayflies are historically underrepresented and under-surveyed in the Northeast. Only eight states included mayflies as SGCN in their 2015 review – Connecticut, Maryland, Maine, New York, Pennsylvania, Rhode Island, Virginia, and Vermont. This reflects the historical lack of data and information on the taxon and the present lack of regional expertise. Regional surveys and assessments will be necessary to understand the current status of mayflies in the Northeast.

1.3.11 FAIRY, CLAM, AND TADPOLE SHRIMP

The Fairy, Clam, and Tadpole Shrimps (orders Diplostraca, Anostraca, and Notostraca, respectively) represent one of the smallest taxonomic groups in this review, with only 17 species identified as occurring in the Northeast region. Only two fairy shrimp and three clam shrimp species are listed as SGCN in the Northeast SWAPs. One fairy and two clam shrimp met the criteria for RSGCN, while the remaining two species were assigned to the Watchlist [Assessment Priority]. 2023 was the first year the shrimps were assessed, so these five species are all new to the 2023 list.

Regional Priority Concern Highlights:

- Lack of regional expertise & data deficiencies prevent a full understanding of threats.

Species Information, Research & Monitoring Needs:

- Several species are known only from anthropogenic habitats (e.g., tire ruts on dirt roads, flooded hay fields, or golf course sand traps); identifying their natural habitat associations would improve understanding of these species.
- Inventory and distribution surveys are needed for all species.
- Basic life history data is lacking for all species, as is information about behaviors, ecology, and seasonal activity.

RSGCN: 3 FAIRY OR CLAM SHRIMP

The three shrimp species on the 2023 RSGCN list include one fairy shrimp and two clam shrimp (Table 1.3.49). None of these species are regional endemics. Two clam shrimp are both High concern and, interestingly, found in anthropologically altered habitats, pools formed by tire treads. Hypotheses are that these species were historically associated with bison wallows. Although the habitat for the Smoothlip Fairy Shrimp (*Eubranchipus intricatus*) is a rare type of vernal pool in the disjunct population that occurs in the Northeast, its distribution is further reaching across southeastern Canada and the adjacent USA.

Table 1.3.49 RSGCN Fairy, Clam, Tadpole Shrimp 2023.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Cyzicus gynecia	Feminine Clam Shrimp	50-75%	High
Eulimnadia agassizii	Agassiz Clam Shrimp	75-100%	High
Eubranchipus intricatus	Smoothlip Fairy Shrimp	25-50%	Moderate

OVERVIEW

Four Northeast states (CT, MA, NJ, NY) list Fairy, Clam, and Tadpole Shrimp as SGCN. The three RSGCN Fairy and Clam Shrimp (100%) can be found in the Palustrine Habitat group in the Non-Tidal Wetland habitat type (Figure 1.3.28). These species are vernal pool specialists that live in freshwater, fish-free waterbodies to avoid predation.

Figure 1.3.28 Number of RSGCN Fairy and Clam Shrimp associated with each habitat in the Northeast. Species may be associated with multiple habitat types. Habitat group names are at the top of each color block and grouped by color; habitat type names appear at the bottom of each proportionally sized square and are colored by habitat group (see *Chapter 2* for more information on habitats).

Fairy, Clam, And Tadpole Shrimp are a data-deficient taxonomic group, including data deficiencies concerning threats. What is known is that Pollution and Residential and Commercial Development both threaten 67% of these species (Table 1.3.50). The other four Level 1 threats jeopardize 33% of RSGCN shrimp species. Runoff, low-density housing areas, commercial and industrial areas, and campgrounds are all identified as

Development threats. The key is filling gaps of knowledge and habitat use to get the big picture of how these threats, and possibly more, impact this new group of RSGCN.

Table 1.3.50 Level 1 threats with the number and percent of RSCGN Fairy, Clam, and Tadpole Shrimp threatened by each. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Pollution (Threat 9.0)	2	67%
Residential & Commercial Development (Threat 1.0)	2	67%
Biological Resource Use (Threat 5.0)	1	33%
Climate Change (Threat 11.0)	1	33%
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	1	33%
Natural System Modifications (Threat 7.0)	1	33%

WATCHLIST

Taxonomic Teams identified two species as Watchlist species, both as Watchlist [Assessment Priority].

WATCHLIST [ASSESSMENT PRIORITY]: 2 FAIRY OR CLAM SHRIMP

Only two species met the criteria for Watchlist [Assessment Priority], one fairy and one clam shrimp (Table 1.3.51). Unfortunately, both of these species are data deficient with poorly understood distributions. The Eastern Fairy Shrimp (*Eubranchipus holmanii*) has only a handful of confirmed locations in the Northeast and is undersampled. The Euroamerican Clam Shrimp (*Limnadia lenticularis*) is widely distributed but highly disjunct and is known from southern New England, Florida thru South Carolina, and across Europe.

Table 1.3.51 Watchlist [Assessment Priority] Fairy, Clam, and Tadpole Shrimps 2023.

Scientific Name	Common Name	Regional Responsibility
Eubranchipus holmanii	Eastern Fairy Shrimp	25-50%
Limnadia lenticularis	Euroamerican Clam Shrimp	25-50%

REGIONAL EFFORTS IN NORTHEAST FAIRY & CLAM SHRIMP CONSERVATION

The fairy, clam, and tadpole shrimps are historically underrepresented and under-surveyed in the Northeast. With their small body size and close association with temporary bodies of water, they can be extremely difficult to monitor and survey. Only four states included shrimp as SGCN in their 2015 review – Connecticut, Massachusetts, New Jersey, and New York. This reflects the historical lack of data and information on

the taxon and the present lack of regional expertise. Regional surveys and assessments will be necessary to understand the current status of shrimp in the Northeast.
Though no regional assessments of this taxonomic group are taking place, some state programs may improve our understanding of ephemeral shrimps. The **Gulf of Maine Research Institute's Ecosystem Investigation Network**[16] facilitates several citizen science projects intended to improve understanding of how climate change impacts species, habitats, and communities. One of their projects targets vernal pools, the primary habitat for fairy, clam, and tadpole shrimp. This project aims to assess the distribution of caddisflies, fairy shrimp, and amphibian species in vernal pools in the Northeast and determine how these distributions may shift in response to climate change.

In 2022, the Vermont Center for Ecostudies piloted an effort to locate fairy shrimp in vernal pools across the state as a part of their existing Vermont Vernal Pool Monitoring Project[17]. This project establishes a baseline of essential data on the health of these unique ecosystems and the species that inhabit them. Before this project, only one species of fairy shrimp was known to occur in Vermont, though other species occur in adjacent states. At the end of the 2022 season, they confirmed that at least one other species could be found in the state and hope to identify more species in future surveys.

1.3.12 FIREFLIES

There are 43 fireflies (Family Lampyridae) known to occur in the 14 Northeast region. Eight Fireflies met the criteria as RSGCN. The Taxonomic Team identified five additional species not listed as SGCN in the 2015 Northeast SWAPs as Proposed RSGCN. Six Fireflies are listed in Watchlist categories: one Watchlist [Assessment Priority], and five non-SGCN species met the criteria for Proposed Watchlist [Assessment Priority]. As 2023 is the first-year fireflies were assessed for the RSGCN list, all these species were additions.


Bethany Beach Firefly, © Christopher Heckscher

Regional Priority Concern Highlights:

• Ecotourism of synchronous fireflies (and the resulting cultural values) is increasing awareness but may also be a threat if managed improperly.

• Artificial light pollution negatively impacts all photic insect species.

• Invasive species (e.g., *Phragmites* in coastal wetlands) significantly impact some species.

• Climate change, especially conversion of freshwater interdunal swale wetlands to salt marsh, saltwater intrusion of Atlantic White. Cedar floodplain forests, and inundation of salt marsh from sea level rise, impact some species with specialized habitat requirements.

Species Information, Research & Monitoring Needs:

• Especially for coastal species with apparent disjunct populations, distribution surveys may identify additional locations and expand known ranges.

• Recently described species need identification of habitat associations and preferences.

• Recent taxonomic splits of the *Photuris* genus and historical misidentifications may complicate our understanding of the distribution and status of these species.

• Some species need data to fill gaps in life history and habitat management information.

RSGCN: 8 FIREFLIES

The 2023 Northeast RSGCN list contains eight firefly species (Table 1.3.52). One of these species, the Bethany Beach Firefly (*Photuris bethaniensis*), is currently under review for federal listing as either endangered or threatened. Concern levels for the RSGCN fireflies are evenly distributed, with three species at Very High concern, three at High concern, and two a Moderate concern. Six of the eight species are regional endemics. The Regional Responsibility for the remaining two species, Florida Sprite (*Photinus floridanus*) and Keel-necked Firefly (*Pyractomena ecostata*) is below 25%. Still, both species have disjunct populations in the Northeast region that require particular attention.

Table 1.3.52 RSGCN Fireflies 2023.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Photuris pyralomima	Pyralis-mimicking Firefly	100% (NEAFWA Endemic)	Very High
Photuris bethaniensis	Bethany Beach Firefly	100% (NEAFWA Endemic)	Very High
Photuris mysticalampas	Mysterious Lantern Firefly	100% (NEAFWA Endemic)	Very High
Photuris pensylvanica	Dot-dash Firefly	100% (NEAFWA Endemic)	High
Pyractomena ecostata	Keel-necked Firefly	<25%	High
Photuris cinctipennis	Belted Firefly	100% (NEAFWA Endemic)	High
Photuris salina	Salt Marsh Firefly	100% (NEAFWA Endemic)	Moderate
Photinus floridanus	Florida Sprite	<25%	Moderate

PROPOSED RSGCN: 5 FIREFLIES

Five firefly species not current SGCN in the Northeast SWAPs met the criteria for Proposed RSGCN (Table 1.3.53). Anna's and Cowesalon Creek Firefly (*Photuris anna* and *Photuris cowaseloniensis*, respectively) are new species described after 2015. The other three species have existing concerns that would elevate them as RSGCN but do not occur in the states that reviewed fireflies for the 2015 SWAPs.

Table 1.3.53 Proposed RSGCN Fireflies 2023.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Photuris potomaca	Potomac River Firefly	75-100%	Very High
Photuris anna	Anna's Firefly	100% (NEAFWA Endemic)	High
Photuris cowaseloniensis	Cowesalon Creek Firefly	100% (NEAFWA Endemic)	Moderate
Photinus scintillans	Pale Firefly	50-75%	Moderate
Photinus carolinus	Synchronous Firefly	50-75%	Moderate

OVERVIEW

Only two states (DE and MD) list fireflies as SGCN, and MD lists a single species (Bethany Beach). RSGCN and Proposed RSGCN Firefly habitat include five habitat groups and nine habitat types (see *Chapter 2*). These Fireflies inhabit Riparian Floodplains (54%) and Non-Tidal Wetlands (31%) in greater numbers than the other habitat types. Twenty-three percent of Northeast listed Fireflies use Forest Woodlands, Grasslands, and Tidal Wetlands (Figure 1.3.29).

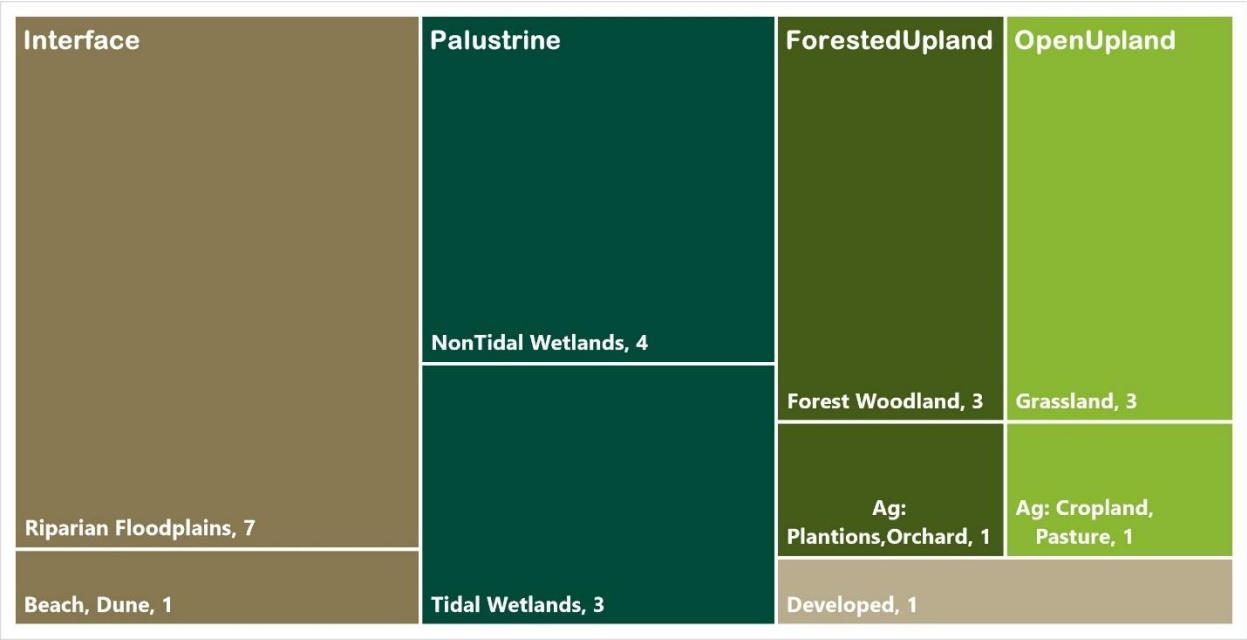


Figure 1.3.29 Number of RSGCN and Proposed RSGCN Firefly associated with each habitat in the Northeast. Species may be associated with multiple habitat types. Habitat group names are at the top of each color block and grouped by color; habitat type names appear at the bottom of each proportionally sized square and are colored by habitat group (see *Chapter 2* for more information on habitats).

Eight Level 1 threats are known to threaten RSGCN and Proposed RSGCN Fireflies. Pollution threatens 100% of these species, specifically light pollution (Table 1.3.54). Owens et al. (2022a) found that light pollution impacts both development and behaviors, especially courtship behaviors. Species-specific impacts from light pollution were exhibited in the genus Photinus; some had little effect on movement or mating, while other species had complete mate success failure (Owens et al. 2022b). Other factors threatening this taxon that aren't as well-known include Climate Change (31%) threats and Natural System Modifications (23%). These include gradual changes in precipitation regimes, increased fluctuations in precipitation regimes, and groundwater withdrawal (Table 1.3.54). Research is needed to continue filling gaps in knowledge of Firefly threats.

Table 1.3.54 Level 1 threats with the number and percent of RSCGN and Proposed RSGCN Fireflies threatened by each. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Pollution (Threat 9.0)	13	100%
Climate Change (Threat 11.0)	4	31%
Natural System Modifications (Threat 7.0)	3	23%
Residential & Commercial Development (Threat 1.0)	3	23%
Agriculture & Aquaculture (Threat 2.0)	2	15%

Biological Resource Use (Threat 5.0)	1	8%
Human Intrusions & Disturbance (Threat 6.0)	1	8%
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	1	8%

WATCHLIST

Six Firefly species are Watchlist species, one Firefly that Taxonomic Teams identified as Watchlist [Assessment Priority], and five species listed as Proposed Watchlist [Assessment Priority].

WATCHLIST [ASSESSMENT PRIORITY]: 1 FIREFLY

A single species met the criteria for Watchlist [Assessment Priority] on the 2023 list update. The Confusing Firefly (*Photuris tremulans*) lives up to its name; the species is part of a complex and, depending on which the description, is either a widespread, common species or is morphologically distinct and potentially rare and endemic to the region. Genetic research and field surveys will be necessary to delineate this species from its conspecifics. Therefore, it is listed as 25-50% Regional Responsibility and High Concern Level.

PROPOSED WATCHLIST [ASSESSMENT PRIORITY]: 5 FIREFLIES

The 2023 Proposed Watchlist [Assessment Priority] list includes five firefly species (Table 1.3.55). Two of these species, *Photuris eliza* and *P. sellicki* were recently described in 2021 and require additional research and surveys to determine distribution, habitat needs, and threats. The two *Pyractomena* species are associated with freshwater marshes. Although they were both historically considered common, the Firefly taxa team agreed that they are now uncommon and difficult to find, potentially due to the loss of suitable habitat over the last 50 years. The final species on this list, *Photinus consimilis* was included due to ongoing taxonomic uncertainty as this may represent a species complex. Genetic research will be necessary to resolve uncertainties.

Table 1.3.55 Proposed Watchlist [Assessment Priority] Fireflies 2023.

Scientific Name	Common Name	Regional Responsibility
Photuris eliza	Eliza's Firefly	100% (NEAFWA Endemic)
Photuris sellicki	Sellick's Firefly	100% (NEAFWA Endemic)
Pyractomena palustris	Marsh Diver Firefly	50-75%
Pyractomena similis	a firefly	50-75%
Photinus consimilis	Cattail Flash-train Firefly	<25%

REGIONAL EFFORTS IN NORTHEAST FIREFLY CONSERVATION

In 2015, fireflies were one of the taxonomic groups with the poorest representation across the region. For example, only two Northeast states, Delaware and Maryland, included fireflies as SGCN in their SWAPs; Maryland included only one species in their list, the Bethany Beach Firefly, which is now under review for federal listing under the Endangered Species Act. The extremely limited number of states, including fireflies in their 2015 lists, suggests that regional expertise was limited at that time.

Interest in fireflies has increased since 2015. **Firefly Watch**[18] started in 2008, is a citizen science initiative that tracks trends in firefly populations in backyards across the United States, though many observers are concentrated in the Northeast. The project is a collaboration between researchers at Tufts University and Massachusetts Audubon. During the 2015 SWAPs, no comprehensive review and assessment of the North American firefly fauna had occurred. Since then, the IUCN SSC Firefly Specialist Group, in collaboration with other researchers, published an extinction risk assessment for 132 North American fireflies (Fallon et al. 2021). This was followed by a report from the Xerces Society for Invertebrate Conservation, which synthesized the assessment results, including the greatest threats to fireflies and beneficial conservation actions, and provided species profiles for the most imperiled firefly species (Fallon et al. 2022). The primary threats to fireflies are habitat loss and degradation, light pollution, climate change, and severe weather. Of the 132 species reviewed, 14% are of conservation concern, 1% are Near Threatened, and 32% are of Least Concern. Unfortunately, these numbers are overwhelmed by the 53% of North American firefly species being data deficient, making more comprehensive assessment impossible.

1.3.13 FRESHWATER MUSSELS

Freshwater mussels (Order Unionoida) are a moderately sized taxonomic group in the Northeast, with 118 species known to occur in the region. In the 14 Northeast SWAPs, 106 mussels were listed as SGCN in at least one state. The taxa team identified 31 freshwater mussels that met the criteria for listing as RSGCN in the 2023 list update, one Proposed RSGCN, two Watchlist [Assessment Priority], and 13 Watchlist [Deferrals]. This revision removed two mussels that were previously included in the 2017 RSGCN list. The Carolina lance (*Elliptio angustata*) was historically thought to occur in Virginia, but recent genetic work has revealed that the species is not found in the state, and records are likely of the closely related Northern Lance (*Elliptio fisheriana*). The second species, Yellow Blossom (*Epioblasma florentina*), is now considered extirpated in the region and may be extinct throughout its range.

Regional Priority Concern Highlights:

- How to address extirpated or recently declared extinct species?
- Climate change, including water temperature, salinity changes, and sea level rise, is a major threat.
- Water quality is crucial for most mussels and is impacted by development, agriculture, and various sources of pollution.
- Invasive species are outcompeting native species in some watersheds.
-

Species Information, Research & Monitoring Needs:

- Taxonomic revisions and research studies for multiple species are ongoing.
- Population decline information is lacking.
- Glochidia hosts are largely unknown for many mussel species.
- Host species interactions and limitations; their influence on dependent mussels is poorly understood.

RSGCN: 31 FRESHWATER MUSSELS

The 31 mussels on the 2023 RSGCN list are disproportionate of elevated conservation concern, with 18 species at Very High concern, ten at High concern, and only three at Moderate concern (Table 1.3.56). In contrast to many other taxonomic groups, the mussels included are shared priorities with other regions, with 20 RSGCN with Regional Responsibility levels below 50% and only one regional endemic, the Eastern Pearlshell (*Margaritifera margaritifera*). Mussels are also disproportionately federally listed, with 16 Endangered species, 2 Threatened species, and 2 Proposed Threatened (Table 1.3.56). These federally listed species account for many of the region's RSGCN that fall under 50% responsibility.

Table 1.3.56 RSGCN Freshwater Mussels 2023. Includes column with the Federal Listing States: E = Endangered, T = Threatened, PT = Proposed Threatened.

Scientific Name	Common Name	Regional Responsibility	Concern Level	Federal Listing
Alasmidonta heterodon	Dwarf Wedgemussel	75-100%	Very High	E
Alasmidonta varicosa	Brook Floater	75-100%	Very High	NA
Fusconaia cor	Shiny Pigtoe	25-50%	Very High	E, XN
Fusconaia cuneolus	Finerayed Pigtoe	<25%	Very High	E, XN
Fusconaia masoni	Atlantic Pigtoe	25-50%	Very High	T
Pleurobema clava	Clubshell	<25%	Very High	E, XN
Parvaspina collina	James Spinymussel	50-75%	Very High	E
Pleurobema plenum	Rough Pigtoe	<25%	Very High	E, XN
Lasmigona subviridis	Green Floater	75-100%	Very High	NA
Villosa fabalis	Rayed Bean	25-50%	Very High	E
Venustaconcha trabalis	Tennessee Bean	<25%	Very High	E, XN
Plethobasus cooperianus	Orangefoot Pimpleback	<25%	Very High	E, XN
Plethobasus cyphyus	Sheepnose	<25%	Very High	E
Epioblasma triquetra	Snuffbox	<25%	Very High	E
Hemistena lata	Cracking Pearlymussel	<25%	Very High	E, XN
Epioblasma rangiana	Northern Riffleshell	50-75%	Very High	E
Theliderma sparsa	Appalachian Monkeyface	50-75%	Very High	E, XN
Theliderma intermedia	Cumberland Monkeyface	<25%	Very High	E, XN
Elliptio lanceolata	Yellow Lance	25-50%	High	T
Lampsilis cariosa	Yellow Lampmussel	50-75%	High	NA
Fusconaia subrotunda	Longsolid	<25%	High	PT
Lasmigona holstonia	Tennessee Heelsplitter	<25%	High	NA
Simpsonaias ambigua	Salamander Mussel	<25%	High	NA
Obovaria subrotunda	Round Hickorynut	25-50%	High	PT
Leptodea ochracea	Tidewater Mucket	75-100%	High	NA
Ligumia nasuta	Eastern Pondmussel	50-75%	High	NA
Ptychobranchus subtentus	Fluted Kidneyshell	<25%	High	E

Theliderma cylindrica	Rabbitsfoot	<25%	High	NA
Alasmidonta undulata	Triangle Floater	75-100%	Moderate	NA
Villosa constricta	Notched Rainbow	25-50%	Moderate	NA
Margaritifera margaritifera	Eastern Pearlshell	100% (NEAFWA Endemic)	Moderate	NA

PROPOSED RSGCN: 1 FRESHWATER MUSSEL

The single Proposed RSGCN on this list, the Golden Riffleshell (*Epioblasma aureola*), was elevated to a species in 2017. It is endemic, restricted to Indian Creek in southwestern Virginia after a chemical spill eliminated much of the population in the Clinch River. Therefore, the Taxonomic Team listed Golden Riffleshell as a Very High concern level species.

OVERVIEW

These mussels have been hard-hit by a broad range of factors, including water pollution, sedimentation, stream alteration, dams, gravel mining, and harvest of the mussels for use in button factories and more recently, for the cultured pearl industry (Williams et al. 1993). In recent years, considerable conservation resources have been dedicated to conserving and restoring remnant mussel populations. Conservation actions that can benefit mussels include removing pollution sources, restoring historic flow patterns in streams to reduce sedimentation, and removing dams and other barriers to the movement of fish hosts transporting larval mussels. In addition, formal protection for many of these species under the federal Endangered Species Act and the species protection statutes of many states prevent commercial harvest of the mussels for their shells. Another conservation action currently being used is the translocation of mussels gleaned from healthy populations to supplement other reduced populations whose viability is at risk. Research at **Virginia Tech's Freshwater Mollusk Conservation Center**[19] and **White Sulphur Springs National Fish Hatchery**[20], and other institutions are helping to determine the conditions necessary for captive propagation of freshwater mussel species. Captive propagation intends to develop source populations for future species restoration and reintroduction efforts and to re-establish populations where they have been extirpated.

RSGCN and Proposed RSGCN inhabit four habitat groups and seven habitat types (see *Chapter 2*). One hundred percent of Northeast listed Freshwater Mussels occur in Rivers and Streams. Big Rivers and Lakes and Ponds were the second most inhabited by these mussels, with 25% of them found in each (Figure 1.3.30).

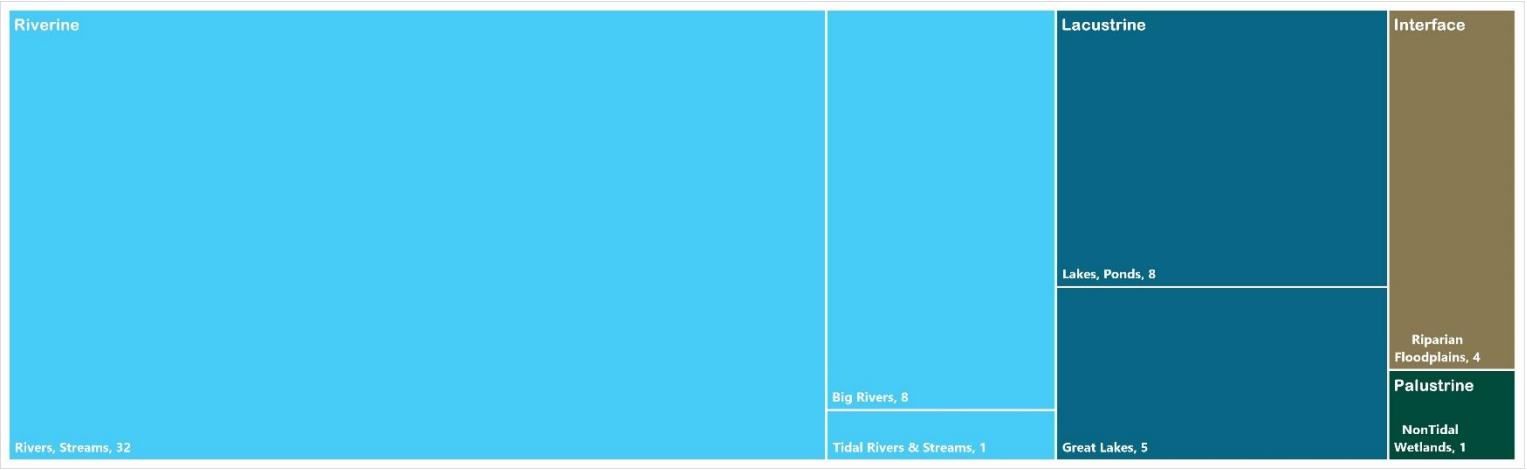


Figure 1.3.30 Number of RSGCN and Proposed RSGCN Freshwater Mussel associated with each habitat in the Northeast. Species may be associated with multiple habitat types. Habitat group names are at the top of each color block and grouped by color, habitat type names appear at the bottom of each proportionally sized square and colored by habitat group (see *Chapter 2* for more information on habitats).

Pollution, Invasive and Problematic Species, Pathogens and Genes, and Climate Change threaten Northeast RSGCN and Proposed RSGCN Freshwater Mussels more than any other threat (Table 1.3.57). Other industrial discharges threaten this taxon, followed by runoff and domestic wastewater. These 32 Mussels are also threatened by aquatic animals, loss of genetic integrity, and interspecific competition with a favored species. Climate change threats include storms and severe weather, increased fluctuation in the precipitation regime (11.4.4), and gradual temperature change. Finally, water level management using dams threatens 66% of these species.

Table 1.3.57 Level 1 threats with the number and percent of RSCGN and Proposed RSGCN Freshwater Mussels threatened by each. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Pollution (Threat 9.0)	32	100%
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	28	88%
Climate Change (Threat 11.0)	23	72%
Natural System Modifications (Threat 7.0)	22	69%
Energy Production & Mining (Threat 3.0)	16	50%
Transportation & Service Corridors (Threat 4.0)	15	47%
Agriculture & Aquaculture (Threat 2.0)	13	41%
Human Intrusions & Disturbance (Threat 6.0)	11	34%
Biological Resource Use (Threat 5.0)	10	31%
Residential & Commercial Development (Threat 1.0)	10	31%
Other (Threat 12.0)	8	25%

WATCHLIST

In total, 15 Freshwater Mussels are Watchlist species, two species that Taxonomic Teams identified as Watchlist [Assessment Priority], and 13 species identified for deferral to adjacent regions.

WATCHLIST [ASSESSMENT PRIORITY]: 2 FRESHWATER MUSSELS

The two mussel species included on the Watchlist [Assessment Priority] list have uncertain distributions due to taxonomic issues between the two (Table 1.3.58). There is a possibility that Northern Lance (*Elliptio fisheriana*) and Atlantic Spike (*Elliptio producta*) represent a single species that should be synonymized. If this occurs, the synonymized species will not reach the necessary Concern Levels for inclusion on the RSGCN list due to fairly wide distribution. Therefore, the Freshwater Mussel Taxonomic Team elected to add these species to the Watchlist until the taxonomy is resolved, making it possible to assess the resulting species accurately.

Table 1.3.58 Watchlist [Assessment Priority] Freshwater Mussels 2023.

Scientific Name	Common Name	Regional Responsibility
Elliptio fisheriana	Northern Lance	50-75%
Elliptio producta	Atlantic Spike	25-50%

WATCHLIST [DEFER TO ADJACENT REGION]: 13 FRESHWATER MUSSELS

A total of 13 species with low regional responsibility but high conservation concern in the Northeast were deferred to adjacent regions: ten to SEAFWA, one to MAFWA, and two to both SEAFWA and MAFWA (Table 1.3.59). Nine of these species are federally Endangered, explaining their high concern in the region. In addition, many of these deferred mussels occur in river basins that are part of the Cumberland Plateau rather than the Atlantic Slope drainages and are thus more ecologically aligned with the Southeast region.

Table 1.3.59 Watchlist [Defer to Adjacent Region] Freshwater Mussels 2023.

Scientific Name	Common Name	Deferred Region(s)	Listed in Deferred Region(s)
Elliptio crassidens	Elephantear	MAFWA	RSGCN in MAFWA
Dromus dromas	Dromedary Pearlymussel	SEAFWA	RSGCN in SEAFWA
Lemiox rimosus	Birdwing Pearlymussel	SEAFWA	RSGCN in SEAFWA
Cyprogenia stegaria	Fanshell	SEAFWA	RSGCN in MAFWA/ SEAFWA

Epioblasma brevidens	Cumberlandian Combshell	SEAFWA	RSGCN in SEAFWA
Epioblasma capsaeformis	Oyster Mussel	SEAFWA	RSGCN in SEAFWA
Pleurobema oviforme	Tennessee Clubshell	SEAFWA	RSGCN in SEAFWA
Medionidus conradicus	Cumberland Moccasinshell	SEAFWA	RSGCN in SEAFWA
Pegias fabula	Littlewing Pearlymussel	SEAFWA	RSGCN in MAFWA/ SEAFWA
Pleuronaia barnesiana	Tennessee Pigtoe	SEAFWA	RSGCN in SEAFWA
Pleuronaia dolabelloides	Slabside Pearlymussel	SEAFWA	RSGCN in SEAFWA
Margaritifera monodonta	Spectaclecase	MAFWA/ SEAFWA	RSGCN in MAFWA/ SEAFWA
Lampsilis abrupta	Pink Mucket	MAFWA/ SEAFWA	RSGCN in MAFWA/ SEAFWA

REGIONAL EFFORTS IN NORTHEAST FRESHWATER MUSSEL CONSERVATION

No formal assessment of the Northeastern freshwater mussel assemblage has yet occurred, but significant work within the taxa is ongoing. With nearly 40 federally listed or proposed species whose distribution includes part of the Northeast region, most have active Recovery Plans. These plans outline recovery objectives and proposed actions to help achieve those objectives. The ongoing conservation efforts to benefit these federally listed species may also benefit any other RSGCN mussels that co-occur with the targeted species.

Global assessments of freshwater mussel conservation status indicated that the greatest threats to North American species included natural system modification and pollution. However, invasive species, urban and residential development, agriculture, and energy production also impact mussel species (Böhm et al. 2021). In addition, many mussels in the United States have been undergoing declines since the 1960s that are not understood, highlighting the data deficiencies within this taxonomic group (Haag 2019). Further research is needed on poorly understood factors that may impact mussel health in the Northeast, including invasive species, disease, and the relative vulnerability of certain habitat types to anthropogenic influences (Haag 2019, Haag et al. 2019).

1.3.14 LEPIDOPTERA: BUTTERFLIES, SKIPPERS, AND MOTHS

There are 2,646 Butterflies, Skippers, and Moths (Order Lepidoptera) that inhabit the NEAFWA regional footprint. Fifty-five of these Butterflies, Skippers, and Moths met the

criteria as RSGCN, including 26 Butterflies and Skippers and 29 Moths. Another 55 Butterflies, Skippers, and Moths are listed in one of the Watchlist categories: 39 Watchlist [Assessment Priority], 11 Watchlist [Deferrals], and five non-SGCN species met the criteria for Proposed Watchlist [Assessment Priority].

Regional Priority Concern Highlights:

- Overabundant herbivores threaten diverse forest ecosystems.
- Fire regime imbalance.
- Insectivore spraying for invasive control (Spongy moth).

Species Information, Research & Monitoring Needs:

- Targeted surveys for many Watchlist [Assessment Priority] species with data deficiencies, perhaps by grouping species assemblages.
- Not much is known about how climate change affects most Lepidoptera.
- Other gaps are present across species except for Monarch butterflies.

RSGCN: 55 BUTTERFLIES, SKIPPERS, AND MOTHS

The 2023 Northeast RSGCN list includes 55 species of Butterflies, Skippers, and Moths (Table 1.3.60). Three of these are Federally listed. The regional Lepidoptera Taxonomic Team listed 30 species at High concern, with an additional 11 species listed at Moderate Concern Level. Thirteen are endemic to the Northeast. Only four of these species have been new additions to the list since 2018.

Table 1.3.60 RSGCN Butterflies, Skippers, and Moths 2023.

Subtaxon	Scientific Name	Common Name	Regional Responsibility	Concern Level
Butterflies and Skippers	*Erynnis persius persius*	Persius Duskywing	50-75%	Very High
Butterflies and Skippers	*Callophrys irus*	Frosted Elfin	50-75%	Very High

Butterflies and Skippers	*Plebejus samuelis*	Karner Blue	25-50%	Very High
Moths	*Papaipema sp. 1*	Flypoison Borer Moth	100% (NEAFWA Endemic)	Very High
Moths	*Papaipema sp. 2 nr. pterisii*	Ostrich Fern Borer Moth	50-75%	Very High
Moths	*Crambus daeckellus*	Daecke's Pyralid Moth	100% (NEAFWA Endemic)	Very High
Moths	*Hemileuca maia menyanthevora*	Bogbean Buckmoth	100% (NEAFWA Endemic)	Very High
Moths	*Agrotis buchholzi*	Buchholz's Dart Moth	50-75%	Very High
Moths	*Chaetaglaea cerata*	Waxed Sallow Moth	25-50%	Very High
Moths	*Drasteria occulta*	Occult Drasteria Moth	100% (NEAFWA Endemic)	Very High
Moths	*Papaipema sulphurata*	Decodon Stem Borer Moth	100% (NEAFWA Endemic)	Very High
Moths	*Photedes carterae*	Carter's Noctuid Moth	25-50%	Very High
Moths	*Macaria exonerata*	Barrens Itame	100% (NEAFWA Endemic)	Very High
Moths	*Euchlaena milnei*	Milne's Looper Moth	25-50%	Very High
Butterflies and Skippers	*Problema bulenta*	Rare Skipper	50-75%	High
Butterflies and Skippers	*Erynnis martialis*	Mottled Duskywing	<25%	High
Butterflies and Skippers	*Atrytone arogos arogos*	Arogos Skipper	50-75%	High
Butterflies and Skippers	*Poanes massasoit chermocki*	Chermock's Mulberry Wing	100% (NEAFWA Endemic)	High
Butterflies and Skippers	*Pyrgus centaureae wyandot*	Appalachian Grizzled Skipper	25-50%	High
Butterflies and Skippers	*Euchloe olympia*	Olympia Marble	<25%	High
Butterflies and Skippers	*Callophrys hesseli*	Hessel's Hairstreak	50-75%	High

Butterflies and Skippers	*Erora laeta*	Early Hairstreak	50-75%	High
Butterflies and Skippers	*Calephelis borealis*	Northern Metalmark	50-75%	High
Butterflies and Skippers	*Argynnis diana*	Diana Fritillary	<25%	High
Butterflies and Skippers	*Tharsalea dorcas claytoni*	Clayton's Copper Butterfly	75-100%	High
Butterflies and Skippers	*Boloria chariclea montinus*	White Mountain Fritillary	100% (NEAFWA Endemic)	High
Butterflies and Skippers	*Oeneis polixenes katahdin*	Katahdin Arctic	100% (NEAFWA Endemic)	High
Butterflies and Skippers	*Oeneis melissa semidea*	White Mountain Arctic	100% (NEAFWA Endemic)	High
Butterflies and Skippers	*Argynnis idalia*	Regal Fritillary	25-50%	High
Moths	*Lithophane lepida*	Pale Pinion	50-75%	High
Moths	*Brachionycha borealis*	Boreal Fan Moth	<25%	High
Moths	*Abagrotis benjamini*	Benjamin's Coastal Heathland Cutworm Moth	75-100%	High
Moths	*Heterocampa varia*	a prominent moth	25-50%	High
Moths	*Acronicta dolli*	Doll's Dagger Moth	25-50%	High
Moths	*Apamea inebriata*	The Drunk Apamea	50-75%	High
Moths	*Catocala marmorata*	Marbled Underwing	75-100%	High
Moths	*Hadena ectypa*	The Starry Campion Moth	25-50%	High
Moths	*Psectrotarsia hebardi*	Hebard's Noctuid Moth	50-75%	High
Moths	*Catocala herodias gerhardi*	Herodias or Pine Barrens Underwing	75-100%	High
Moths	*Catocala pretiosa pretiosa*	Precious Underwing	100% (NEAFWA Endemic)	High
Moths	*Apodrepanulatrix liberaria*	New Jersey Tea Inchworm	50-75%	High
Moths	*Erastria coloraria*	Broad-lined Erastria	<25%	High

Moths	*Metarranthis apiciaria*	Barrens Metarranthis Moth	25-50%	High
Moths	*Metarranthis pilosaria*	Coastal Bog Metarranthis	100% (NEAFWA Endemic)	High
Butterflies and Skippers	*Euphyes bimacula*	Two-spotted Skipper	50-75%	Moderate
Butterflies and Skippers	*Erynnis lucilius*	Columbine Duskywing	25-50%	Moderate
Butterflies and Skippers	*Pieris virginiensis*	West Virginia White	50-75%	Moderate
Butterflies and Skippers	*Satyrium edwardsii*	Edwards' Hairstreak	25-50%	Moderate
Butterflies and Skippers	*Callophrys polios*	Hoary Elfin	25-50%	Moderate
Butterflies and Skippers	*Callophrys lanoraieensis*	Bog Elfin	100% (NEAFWA Endemic)	Moderate
Butterflies and Skippers	*Plebejus idas empetri*	Crowberry Blue	75-100%	Moderate
Butterflies and Skippers	*Danaus plexippus*	Monarch	<25%	Moderate
Moths	*Sthenopis pretiosus*	Gold-spotted Ghost Moth	50-75%	Moderate
Moths	*Papaipema duplicatus*	Dark Stoneroot Borer Moth	50-75%	Moderate
Moths	*Hypomecis buchholzaria*	Buchholz's Gray	25-50%	Moderate

Since all Butterflies, Skippers, and Moths of conservation concern were listed as SGCN in at least one state, none were listed as Proposed RSGCN.

OVERVIEW

RSGCN Butterflies, Skippers, and Moths inhabit five Northeast habitat groups and fourteen habitat types (see *Chapter 2*). Seventy-one percent of these species use Forest Woodland, 60% use Glade, Barren, and Savannah, and 58% use Grassland (Figure 1.3.31).

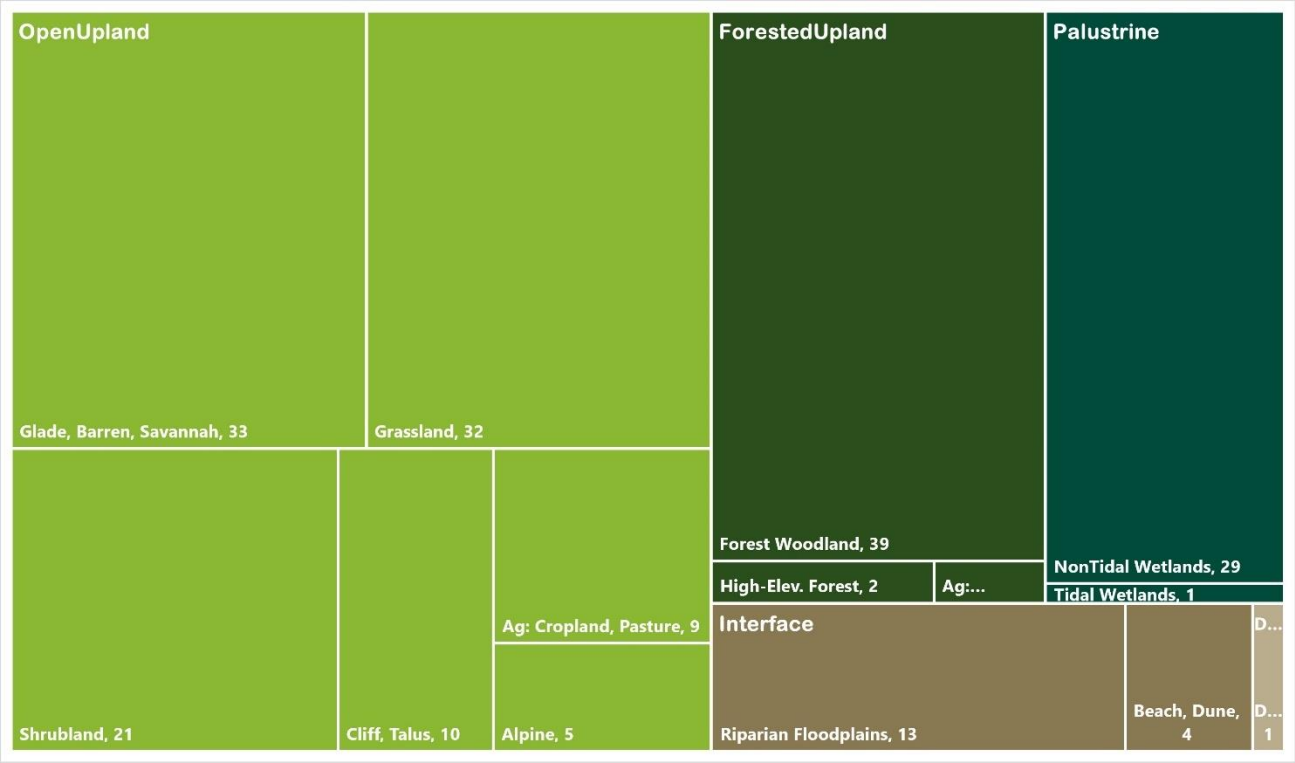


Figure 1.3.31 Number of RSGCN Butterfly, Skipper, and Moth associated with each habitat in the Northeast. Species may be associated with multiple habitat types. Habitat group names are at the top of each color block and grouped by color; habitat type names appear at the bottom of each proportionally sized square and are colored by habitat group (see *Chapter 2* for more information on habitats).

RSGCN Butterflies, Skippers, and Moths top Level 1 threats are Pollution (75%), Residential and Commercial Development (67%), and Natural System Modifications (60%, Table 1.3.61). Many of these Lepidoptera are threatened by herbicides and pesticides. Other Pollution threats come from soil erosion, sedimentation, and acid rain (Table 1.3.61). Low-density housing areas, commercial and industrial areas, and dense housing and urban areas are the top Residential and Commercial Development threats. Natural System Modifications are increased fire regime, suppression of the fire regime, and vegetation succession (Table 1.3.61). Other notable threats for this group of RSGCN are climate change threats, such as changes in vegetation communities, and problematic species threats like terrestrial animals due to White-tailed Deer (*Odocoileus virginianus*) browsing pressure in forested habitats. The common theme between these threats is habitat degradation and loss.

Table 1.3.61 Level 1 threats with the number and percent of RSCGN Butterflies, Skippers, and Moths threatened by each. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Pollution (Threat 9.0)	41	75%

Residential & Commercial Development (Threat 1.0)	37	67%
Natural System Modifications (Threat 7.0)	33	60%
Climate Change (Threat 11.0)	27	49%
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	27	49%
Biological Resource Use (Threat 5.0)	23	42%
Transportation & Service Corridors (Threat 4.0)	17	31%
Agriculture & Aquaculture (Threat 2.0)	16	29%
Human Intrusions & Disturbance (Threat 6.0)	16	29%
Energy Production & Mining (Threat 3.0)	14	25%
Other (Threat 12.0)	10	18%

WATCHLIST

In total, the Butterfly, Skipper, and Moth Taxonomic Team listed 55 species as Watchlist species, 39 species that taxa teams identified as Watchlist [Assessment Priority], five species listed as Proposed Watchlist [Assessment Priority], and 11 species that were identified for deferral to adjacent regions.

WATCHLIST [ASSESSMENT PRIORITY]: 39 BUTTERFLIES, SKIPPERS, AND MOTHS

The 39 2023 Watchlist [Assessment Priority] Lepidoptera species includes 11 Butterflies and Skippers and 28 Moths (Table 1.3.62). Two of them are RSGCN in the Midwest. Twelve of these Lepidoptera were listed as RSGCN in the Northeast in 2018, but many of these species are data deficient. With the addition of the Watchlist [Assessment Priority] to flag species that need more research, these species were a better fit for this category. In addition, two are endemics in the Northeast, Pink-edged Sulphur (High altitude pop.) (*Colias interior*) and Early Metarranthis Moth (*Metarranthis sp. 3*), and in need of research and taxonomic clarification.

Table 1.3.62 Watchlist [Assessment priority] Butterflies, Skippers, and Moths 2023.

Subtaxon	Scientific Name	Common Name	Regional Responsibility
Moths	*Metarranthis sp. 3*	Early Metarranthis Moth	100% (NEAFWA Endemic)
Butterflies and Skippers	*Colias interior*	Pink-edged Sulphur (High altitude pop.)	100% (NEAFWA Endemic)
Butterflies and Skippers	*Cupido amyntula maritima*	Western Tailed-Blue	75-100%
Moths	*Hemileuca lucina*	New England Buckmoth	75-100%
Moths	*Glena cognataria*	Blueberry Gray	75-100%

Moths	*Cyclophora culicaria*	Sand-myrtle Geometer	50-75%
Butterflies and Skippers	*Tharsalea epixanthe*	Bog Copper	50-75%
Butterflies and Skippers	*Chlosyne harrisii*	Harris's Checkerspot	50-75%
Moths	*Hemaris gracilis*	Slender Clearwing	50-75%
Moths	*Schizura apicalis*	Plain Schizura	50-75%
Moths	*Cerma cora*	Bird Dropping Moth	50-75%
Moths	*Eucoptocnemis fimbriaris*	Fringed Dart Moth	50-75%
Moths	*Exyra fax*	Pitcher Plant Moth	50-75%
Moths	*Papaipema appassionata*	Pitcher Plant Borer Moth	50-75%
Moths	*Papaipema stenocelis*	Chain Fern Borer Moth	50-75%
Moths	*Zanclognatha martha*	Pine Barrens Zanclognatha	50-75%
Moths	*Plagodis kuetzingi*	Purple Plagodis Moth	50-75%
Moths	*Neoligia semicana*	Northern Brocade Moth	25-50%
Moths	*Phoberia ingenua*	Uncommon Oak Moth	25-50%
Moths	*Psectraglaea carnosa*	Pink Sallow	25-50%
Moths	*Zale lunifera*	Pine Barrens Zale Moth	25-50%
Moths	*Acronicta albarufa*	Barrens Dagger Moth	25-50%
Moths	*Papaipema cerina*	Golden Borer Moth	25-50%
Moths	*Papaipema furcata*	Ash Borer Moth	25-50%
Moths	*Schinia septentrionalis*	Northern Flower Moth	25-50%
Moths	*Pyrrhia aurantiago*	Aureolaria Seed Borer	25-50%
Butterflies and Skippers	*Boloria myrina*	Silver-bordered Fritillary	25-50%
Moths	*Ceratomia undulosa*	Waved Sphinx	25-50%
Butterflies and Skippers	*Atrytonopsis hianna*	Dusted Skipper	25-50%
Butterflies and Skippers	*Tharsalea hyllus*	Bronze Copper	25-50%
Butterflies and Skippers	*Satyrium acadica*	Acadian Hairstreak	25-50%

Butterflies and Skippers	*Celastrina neglectamajor*	Appalachian Azure	25-50%
Butterflies and Skippers	*Chlosyne nycteis*	Silvery Checkerspot	25-50%
Butterflies and Skippers	*Satyrium favonius ontario*	Northern Oak Hairstreak	25-50%
Moths	*Sphinx chersis*	Great Ash Sphinx Moth	25-50%
Moths	*Chytonix sensilis*	Masked Marvel	25-50%
Moths	*Lycia rachelae*	Twilight Moth	<25%
Moths	*Manduca jasminearum*	Ash Sphinx	<25%
Moths	*Lithophane lemmeri*	Lemmer's Noctuid Moth	<25%

PROPOSED WATCHLIST [ASSESSMENT PRIORITY]: 5 BUTTERFLIES, SKIPPERS, AND MOTHS

Five species of Butterflies, Skippers, and Moths are not currently listed in Northeast SWAPs as SGCN but were of concern to the Taxonomic Teams who concurred with their qualification for the 2023 Proposed Watchlist [Assessment Priority] list. Two of the Moths are endemic to the Northeast (Table 1.3.63). Expert input indicates most of these are rare and vulnerable species across the region. The Fringe-tree Sallow (*Sympistis chionanthi*) is an ash obligate species.

Table 1.3.63 Proposed RSGCN Butterflies, Skippers, and Moths 2023.

Subtaxon	Scientific Name	Common Name	Regional Responsibility
Moths	*Caloptilia flavella*	Wax Myrtle Leafminer	100% (NEAFWA Endemic)
Moths	*Acleris comandrana*	a tortricid moth	100% (NEAFWA Endemic)
Moths	*Erannis tiliaria*	Linden Looper	25-50%
Moths	*Sympistis chionanthi*	Fringe-tree Sallow	25-50%
Butterflies and Skippers	*Plebejus idas scudderi*	Northern Blue	<25%

WATCHLIST [DEFER TO ADJACENT REGION]: 11 BUTTERFLIES, SKIPPERS, AND MOTHS

Taxonomic Team experts deferred 11 Butterflies, Skippers, and Moths to adjacent regions with more Regional Responsibility, five Butterflies and Skippers and six Moths

(Table 1.3.64). The Southeast does not list Lepidoptera yet; three are listed on the Midwest RSGCN list: one Proposed RSGCN and two Watchlist. The deferred regions do not list over half of these Butterflies, Skippers, and Moths, creating opportunities for cross-regional collaboration.

Table 1.3.64 Watchlist [Defer to Adjacent Region] Butterflies, Skippers, and Moths 2023.

Subtaxon	Scientific Name	Common Name	Deferred Region	Listed in Deferred Region
Butterflies and Skippers	*Neonympha mitchellii*	Mitchell's Satyr	MAFWA	Proposed RSGCN in MAFWA
Moths	*Sphinx canadensis*	Canadian Sphinx	MAFWA	No
Moths	*Papaipema astuta*	Yellow Stoneroot Borer	MAFWA	No
Moths	*Lytrosis permagnaria*	a geometrid moth	SEAFWA	No
Butterflies and Skippers	*Euphyes pilatka*	Palatka Skipper	SEAFWA	No
Butterflies and Skippers	*Satyrium kingi*	King's Hairstreak	SEAFWA	No
Moths	*Papaipema araliae*	Aralia Shoot Borer Moth	SEAFWA	No
Moths	*Melanapamea mixta*	Coastal Plain Apamea Moth	SEAFWA	No
Butterflies and Skippers	*Euphyes dukesi*	Dukes' Skipper	MAFWA/ SEAFWA	No
Moths	*Sphinx franckii*	Franck's Sphinx	MAFWA/ SEAFWA	No
Butterflies and Skippers	*Pontia protodice*	Checkered White	MAFWA/ SEAFWA	No

REGIONAL EFFORTS IN NORTHEAST LEPIDOPTERA CONSERVATION

RCN projects for Lepidoptera species include the **Conservation and Management of Rare Wetland Butterflies: Strategies for Monitoring, Modeling** and **Wetland Enhancement in the Mid-Atlantic Region and Development of an Online Database to Enhance the Conservation of SGCN Invertebrates in the**

Northeastern Region[1]**,** which includes the website database where at the final report listed 28% of its species are Lepidoptera**.** In addition, there are projects for the Frosted Elfin and the Monarch Butterfly to determine the region-wide conservation status of these species and other butterflies and moths in the Northeast. Finally, the USGS sponsors the **Butterflies and Moths of North America**[21], a citizen Science project recruiting volunteers to collect data on Butterfly and Moth occurrence.

1.3.15 MARINE INVERTEBRATES

This 2023 update to the Northeast RSGCN list is the first-time marine invertebrates were considered for assessment as RSGCN. Of the 13 Northeast states and DC, two are landlocked, Vermont and West Virginia, and thus were not involved in decisions for this taxonomic group. Moreover, jurisdiction for marine species often falls to separate state marine agencies rather than state wildlife agencies, so many states do not have expertise with marine invertebrates. At least 465 marine invertebrate species are known to occur within the state waters of the 11 Northeast states with coastal areas. Only 95 of these were listed as SGCN in the 2015 Northeastern SWAPs. The Marine Taxonomic Team identified four species as RSGCN and nine entities as Watchlist [Assessment Priority].

Regional Priority Concern Highlights:

- Offshore wind power sitting near/in shellfish grounds has unpredictable impacts on many species.
- Climate change range shifts due to ocean acidification and temperature increases.
- Loss of eelgrass habitat and other nursery areas is a major concern for many invertebrates that form the basis of oceanic food chains.
- New diseases are a major concern.
- New fisheries may change the pressures on some species.
- Innovative bait techniques (fishing) have contributed to meeting conservation goals.

Species Information, Research & Monitoring Needs:

- Inventory, management, and data needs are not identified for many species and their habitats.


Bay Scallop, © Peconic Estuary Partnership

RSGCN: 4 MARINE INVERTEBRATES

The taxa team identified four species as RSGCN in the 2023 update, including two arthropods and two bivalves (Table 1.3.65). None of these species are endemic to Northeastern waters, but the Northeast represents the bulk of these species' ranges or core populations. Horseshoe Crab (*Limulus polyphemus*) is an ecologically important species due to the dependence of some migratory shorebirds as a food source during migration. Still, the taxa team elevated the species to RSGCN due to longstanding concerns about population stability. American Lobster has long been a major conservation concern in the region due to harvest pressure, but disease and climate change may have more severe impacts in the future. Bay Scallops (*Argopecten irradians*) have been impacted by a loss of eelgrass habitat across the Northeast, and Atlantic Sea Scallops (*Placopecten magellanicus*) are facing potential future threats in the form of climate change and offshore wind installations.

Table 1.3.65 RSGCN Marine Invertebrates 2023.

Subtaxon	Scientific Name	Common Name	Regional Responsibility	Concern Level
Marine Bivalves	*Placopecten magellanicus*	Atlantic Sea Scallop	75-100%	High
Marine Bivalves	*Argopecten irradians*	Bay Scallop	25-50%	High
Marine Crustaceans	*Homarus americanus*	American Lobster	75-100%	High
Horseshoe Crabs	*Limulus polyphemus*	Horseshoe Crab	50-75%	Moderate

OVERVIEW

Nine of the 14 Northeast states list marine invertebrates as SGCN (nine of the ten coastal states). All these species are listed with overriding factors, including cultural values, climate vulnerability, and emerging threats. RSGCN Marine Invertebrates are found in four habitat groups and five habitat types (see *Chapter 2*). The top three habitat types are Estuaries, Marine Near-shore, and Marine Offshore, all inhabited by 75% of these RSGCN Marine Invertebrates (Figure 1.3.32).

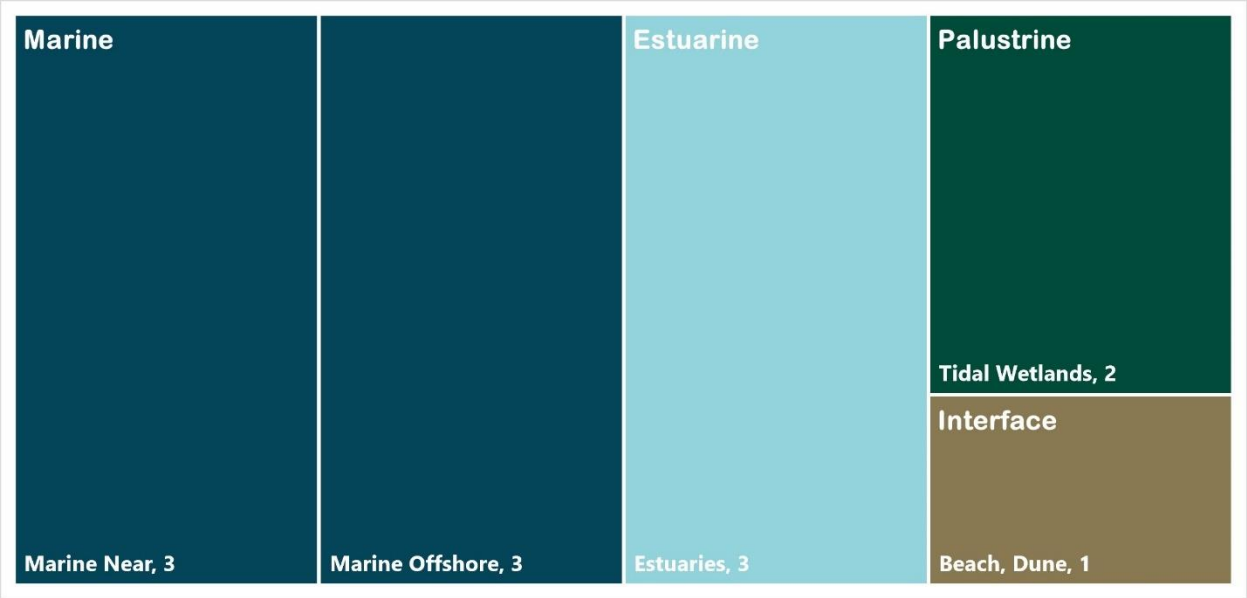


Figure 1.3.32 Number of RSGCN Marine Invertebrates associated with each habitat in the Northeast. Species may be associated with multiple habitat types. Habitat group names are at the top of each color block and grouped by color; habitat type names appear at the bottom of each proportionally sized square and are colored by habitat group (see *Chapter 2* for more information on habitats).

The four RSGCN Marine Invertebrates have four Level 1 threats impacting all of them (100%); Biological Resource Use, Climate Change, Invasive and Problematic Species, Pathogens and Genes, and Pollution, with four other threat categories that threaten at least half of them (Table 1.3.66). Commercial fishing is the top threat under Biological

Resource Use. Changes in vegetation communities, changes in the pH of habitats, and gradual temperature changes threaten 75% of Marine Invertebrates (Table 1.3.66). Harmful algae blooms and protozoan-induced diseases threaten 50% or more of these species (Table 1.3.66). Finally, the top threats under Pollution are domestic wastewater, nutrient loads, drifting plastic, and entanglement rubbish, all threatening 75% of this taxon (Table 1.3.66).

Table 1.3.66 Level 1 threats with the number and percent of RSCGN Marine Invertebrates threatened by each. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Biological Resource Use (Threat 5.0)	4	100%
Climate Change (Threat 11.0)	4	100%
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	4	100%
Pollution (Threat 9.0)	4	100%
Energy Production & Mining (Threat 3.0)	2	50%
Human Intrusions & Disturbance	2	50%
Natural System Modifications	2	50%
Transportation & Service Corridors	2	50%
Residential & Commercial Development	1	25%
Agriculture & Aquaculture	1	25%

WATCHLIST

Nine species were listed as Watchlist species, all identified as Watchlist [Assessment Priority].

WATCHLIST [ASSESSMENT PRIORITY]: 9 MARINE INVERTS

The nine marine invertebrates on the Watchlist [Assessment Priority] include three bivalves, three crabs, two snails, and one starfish (Table 1.3.67). Two of the bivalves, the Eastern Oyster (*Crassostrea virginica*) and Soft-Shell Clam (*Mya arenaria*), were heavily impacted by disease and overharvest and are still recovering in much of the Northeast. The third bivalve, Northern Quahog (*Mercenaria mercenaria*), was not affected the same way historically, but uncertainties about the status of current populations and extremely high cultural importance in several states prompted the taxa team to include the species to keep an eye on any changing trends. The three crab entities were included as data-limited species with high economic or ecological importance. The Taxonomic Team experts flagged the Knobbed and Channeled Whelks (*Busycon carica* and *Busycotypus caniculatus*, respectively) as species with emerging concerns related to changing harvest pressures and potential threats related to offshore wind and other disturbances to benthic habitats. Finally, the Common Seastar (*Asterias forbesi*) is included as anecdotal evidence suggests that they may have gone through

recent declines due to disease. Further research is necessary to determine the status of this species.

Table 1.3.67 Watchlist [Assessment Priority] Marine Invertebrates 2023.

Subtaxon	Scientific Name	Common Name	Regional Responsibility
Marine Crustaceans	*Cancer borealis*	Jonah Crab	75-100%
Starfish and Brittle Stars	*Asterias forbesi*	Common Seastar	50-75%
Marine Snails	*Busycon carica*	Knobbed Whelk	50-75%
Marine Snails	*Busycotypus canaliculatus*	Channeled Whelk	50-75%
Marine Bivalves	*Crassostrea virginica*	Eastern Oyster	25-50%
Marine Bivalves	*Mercenaria mercenaria*	Northern Quahog	25-50%
Marine Bivalves	*Mya arenaria*	Soft Shell Clam	25-50%
Marine Crustaceans	*Callinectes sapidus*	Blue Crab	<25%
Marine Crustaceans	*Uca spp.*	fiddler crab spp.	<25%

REGIONAL EFFORTS IN NORTHEAST MARINE INVERTEBRATE CONSERVATION

This group is among the most diverse, including species from multiple Orders, Classes, and Phyla. Unfortunately, this group is also largely data deficient and not well represented in common sources of information such as NatureServe and the IUCN Redlist.

1.3.16 ODONATA: DRAGONFLIES AND DAMSELFLIES

There are 255 (Order Odonata) that inhabit the NEAFWA regional footprint. Twenty Dragonflies and Damselflies met the criteria as RSGCN, and two non-SGCN species met the criteria for Proposed RSGCN. Twenty-seven are listed in one of the Watchlist categories: 20 Watchlist [Assessment Priority] and seven Watchlist [Deferrals].

Regional Priority Concern Highlights:

- Climate change impacts: range shifts, water quality & quantity, water temp, loss of high elevation wetlands.
- The southern end of the range sees declines in abundance and disappearing populations.
- Coastal plain species hang on in New Jersey Pine Barrens but are rare elsewhere in the Northeast.

Species Information, Research & Monitoring Needs:

- Population estimates and surveys are needed for most species.
- Detailed research is required on ecology, behavior, and activity.
- No monitoring protocols exist for this RSGCN group.

RSGCN: 20 DRAGONFLIES AND DAMSELFLIES

The 2023 Northeast RSGCN list includes 20 species of Dragonflies and Damselflies. Concern levels across this group range from three species listed at Very High concern, ten taxa considered at High concern, with seven species listed at Moderate concern level (Table 1.3.68). Four endemic species and another four have Regional Responsibility of 75-100%. The species with lower Regional Responsibility in the Northeast have Overriding factors of being Highly Imperiled, and their Core Populations are within the Northeast. Three of these are RSGCN in the Midwest, Pygmy Snaketail (*Ophiogomphus howei*), Skillet Clubtail (*Gomphurus ventricosus*), Elfin Skimmer (*Nannothemis bella*); an additional four of these species are Watchlist [Assessment Prioritiy] in the Midwest.

Table 1.3.68 RSGCN Dragonflies and Damselflies 2023.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Gomphurus septima	Septima's Clubtail	25-50%	Very High
Williamsonia lintneri	Ringed Boghaunter	50-75%	Very High

Enallagma recurvatum	Pine Barrens Bluet	100% (NEAFWA Endemic)	Very High
Phanogomphus quadricolor	Rapids Clubtail	25-50%	High
Stenogomphurus rogersi	Sable Clubtail	50-75%	High
Ophiogomphus anomalus	Extra-striped Snaketail	50-75%	High
Ophiogomphus howei	Pygmy Snaketail	25-50%	High
Gomphurus ventricosus	Skillet Clubtail	25-50%	High
Somatochlora georgiana	Coppery Emerald	<25%	High
Somatochlora kennedyi	Kennedy's Emerald	50-75%	High
Somatochlora forcipata	Forcipate Emerald	75-100%	High
Somatochlora incurvata	Incurvate Emerald	75-100%	High
Cordulegaster erronea	Tiger Spiketail	50-75%	High
Nannothemis bella	Elfin Skimmer	50-75%	Moderate
Somatochlora elongata	Ski-tipped Emerald	75-100%	Moderate
Calopteryx angustipennis	Appalachian Jewelwing	25-50%	Moderate
Enallagma laterale	New England Bluet	100% (NEAFWA Endemic)	Moderate
Enallagma minusculum	Little Bluet	75-100%	Moderate
Neurocordulia michaeli	Broad-tailed Shadowdragon	100% (NEAFWA Endemic)	Moderate
Enallagma pictum	Scarlet Bluet	100% (NEAFWA Endemic)	Moderate

PROPOSED RSGCN: 2 DRAGONFLIES AND DAMSELFLIES

Two species of Dragonflies and Damselflies are not currently listed in Northeast SWAPs as SGCN but were of concern to the Odonata Taxonomic Team experts, who concurred with listing them as a 2023 Proposed RSGCN species (Table 1.3.69). Both are Highly Imperiled species; St. Croix Snaketail (*Ophiogomphus susbehcha*) is a Disjunct Population. The Midwest listed St. Croix as RSGCN.

Table 1.3.69 Proposed RSGCN Dragonflies and Damselflies 2023.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Ophiogomphus incurvatus	Appalachian Snaketail	25-50%	High
Ophiogomphus susbehcha	St. Croix Snaketail	25-50%	High

OVERVIEW

The 20 RSGCN and two Proposed RSGCN Dragonflies and Damselflies are found in five Northeast habitat groups and seven habitat types (see *Chapter 2*). These Odonate species use these four habitat types more than others; 86% use Rivers and Streams, 82% use Riparian Floodplains, and 77% use Non-tidal Wetlands and Forest Woodland (Figure 1.3.33). Therefore, protecting connectivity in the matrix of aquatic habitat types used by these taxa with the Forest Upland habitat group is vital across life stages.

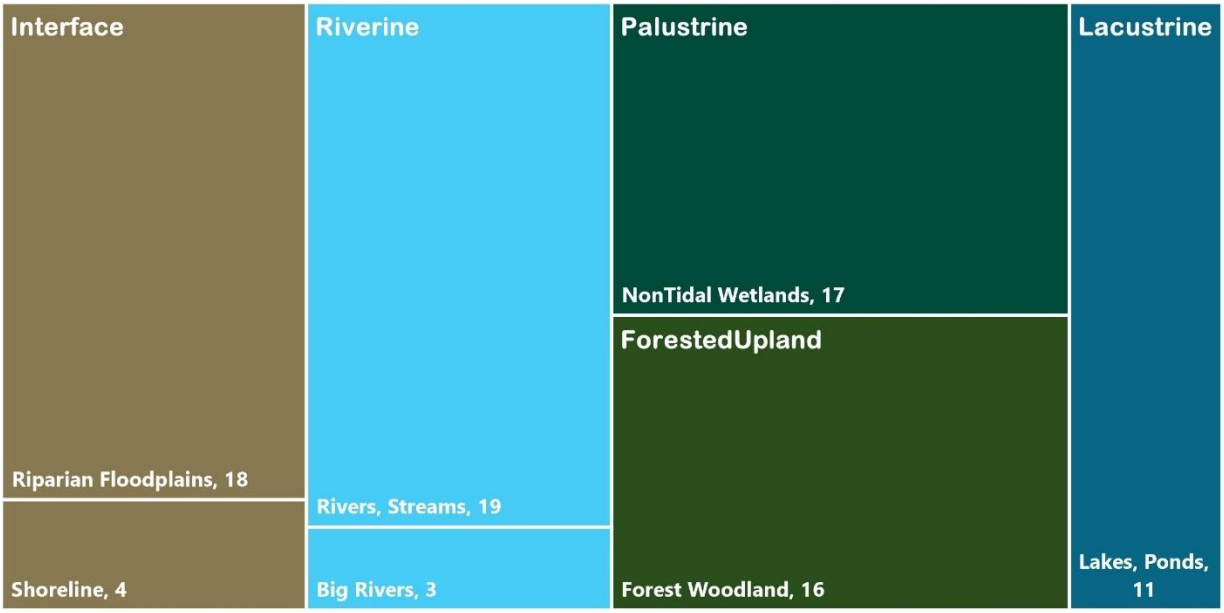


Figure 1.3.33 Number of RSGCN and Proposed RSGCN Dragonfly and Damselfly associated with each habitat in the Northeast. Species may be associated with multiple habitat types. Habitat group names are at the top of each color block and grouped by color; habitat type names appear at the bottom of each proportionally sized square and are colored by habitat group (see *Chapter 2* for more information on habitats).

Climate Change (95% of species), Natural Systems Modifications (86% of species), and Biological Resource Use (82% of species) threaten RSGCN and Proposed RSGCN Dragonflies and Damselflies (Table 1.3.70). Under the top two Level 1 threats, droughts, overabundant rain, and storms and severe weather, along with water level management using dams, water management using culverts, and shoreline alteration all threaten greater than 50% of these species (Table 1.3.70). Biological resource use top threats include complete removal of forest floor, partial removal of forest floor, and commercial harvesting (Table 1.3.70). Many of the threats to these Odonates can be alleviated with habitat protections and habitat management.

Table 1.3.70 Level 1 threats with the percent of RSCGN and Proposed RSGCN Dragonflies and Damselflies threatened by each. The top Level 3 threats from each Level 1 category with the percent of species threatened by each Level 3. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Climate Change (Threat 11.0)	21	95%
Natural System Modifications (Threat 7.0)	19	86%
Biological Resource Use (Threat 5.0)	18	82%
Pollution (Threat 9.0)	16	73%
Residential & Commercial Development (Threat 1.0)	13	59%
Human Intrusions & Disturbance (Threat 6.0)	10	45%
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	10	45%
Transportation & Service Corridors (Threat 4.0)	9	41%
Agriculture & Aquaculture (Threat 2.0)	6	27%
Other (Threat 12.0)	5	23%
Energy Production & Mining (Threat 3.0)	3	14%

WATCHLIST

In total, 27 species were listed as Watchlist species, 20 species that the Taxonomic Team identified as Watchlist [Assessment Priority], and seven species were identified for deferral to adjacent regions.

WATCHLIST [ASSESSMENT PRIORITY]: 20 DRAGONFLIES AND DAMSELFLIES

The 20 2023 Watchlist [Assessment Priority] Dragonflies and Damselflies include one endemic species and 11 species with Regional Responsibility of 75-100% in the Northeast (Table 1.3.71). Thirteen of these Watchlisted species did not get listed in the previous 2018 RSGCN list in the Northeast primarily to data deficiencies. Seven others were listed in 2018 but fit better as Watchlist species because they require more research to conserve and manage them properly. The Midwest listed four of these species as RSGCN, two others as Watchlist [Assessment Priority].

Table 1.3.71 Watchlist [Assessment Priority] Dragonflies and Damselflies 2023.

Scientific Name	Common Name	Regional Responsibility
Celithemis martha	Martha's Pennant	100% (NEAFWA Endemic)
Phanogomphus descriptus	Harpoon Clubtail	75-100%
Boyeria grafiana	Ocellated Darner	75-100%
Ophiogomphus mainensis	Maine Snaketail	75-100%
Ophiogomphus carolus	Riffle Snaketail	75-100%

Ophiogomphus aspersus	Brook Snaketail	75-100%
Lanthus parvulus	Northern Pygmy Clubtail	75-100%
Lanthus vernalis	Southern Pygmy Clubtail	75-100%
Hylogomphus abbreviatus	Spine-crowned Clubtail	75-100%
Williamsonia fletcheri	Ebony Boghaunter	75-100%
Somatochlora brevicincta	Quebec Emerald	75-100%
Calopteryx amata	Superb Jewelwing	75-100%
Stylurus scudderi	Zebra Clubtail	50-75%
Rhionaeschna mutata	Spatterdock Darner	50-75%
Gomphurus fraternus	Midland Clubtail	25-50%
Tachopteryx thoreyi	Gray Petaltail	25-50%
Leucorrhinia glacialis	Crimson-ringed Whiteface	25-50%
Cordulegaster obliqua	Arrowhead Spiketail	25-50%
Stylurus amnicola	Riverine Clubtail	25-50%
Lestes unguiculatus	Lyre-tipped Spreadwing	<25%

WATCHLIST [DEFER TO ADJACENT REGION]: 7 DRAGONFLIES AND DAMSELFLIES

Taxonomic Team experts deferred seven Dragonflies and Damselflies to adjacent regions with more Regional Responsibility (Table 1.3.72). The Midwest is currently the only other region to list Dragonflies and Damselflies; therefore, over half of these Odonates are not presently listed in the regions they are deferred to, creating opportunities for cross-regional collaboration.

Table 1.3.72 Watchlist [Defer to Adjacent Region] Dragonflies and Damselflies 2023.

Scientific Name	Common Name	Deferred Region(s)	Listed in Deferred Region(s)
Ophiogomphus colubrinus	Boreal Snaketail	Canada	No
Leucorrhinia patricia	Canada Whiteface	Canada	No
Hylogomphus viridifrons	Green-faced Clubtail	to MAFWA	RSGCN in MAFWA
Stylurus notatus	Elusive Clubtail	MAFWA	RSGCN in MAFWA
Cordulegaster obliqua fasciata	Banded Spiketail	SEAFWA	No

Hylogomphus apomyius	Banner Clubtail	SEAFWA	No
Enallagma weewa	Blackwater Bluet	Watchlist [Defer to SEAFWA]	No

REGIONAL EFFORTS IN NORTHEAST DRAGONFLY AND DAMSELFLY CONSERVATION

The RCN project **A Conservation Status Assessment of Odonata in the Northeastern US**[1] was the first regional Odonate assessment. It contains information on habitat vulnerability and conservation concerns. White et al. (2015) published the results of Odonate prioritization in the Northeast. New Hampshire Audubon has a conservation plan for the endemic damsels too[22].

1.3.17 PLECOPTERA: STONEFLIES

A total of 253 stoneflies (Order Plecoptera) are known to occur in the Northeast region. Just over a quarter of these species (67) are listed as SGCN in at least one of the NEAFWA SWAPs. Unlike the other taxa reviewed for the 2023 RSGCN list, a taxonomic team did not formally assess the stoneflies. Instead, changes to listed stoneflies will be deferred until later, as a regional assessment of the taxon is already planned for 2023-2026 and is described below. At the time of this synthesis, the stoneflies included on the 2023 list are the same as those in the 2018 list and have 28 RSGCN, three Proposed RSGCN, and two Watchlist [Assessment Priority] species.

<u>Regional Priority Concern Highlights:</u>

- One of the most environmentally sensitive aquatic insects.
- The taxonomic team deferred decisions to the upcoming RCN 3.0 Status Assessment.

<u>Species Information, Research & Monitoring Needs:</u>

- More information is needed for nearly every species across multiple topics, including basic information on distribution, taxonomic validity, and current status.
- Details on habitat vulnerabilities, use, and management are also needed.

RSGCN: 28 STONEFLIES

There are a total of 28 Stoneflies on the 2023 RSGCN list. Across this group, nine stoneflies are considered Very High concern, 15 are High concern, and four are Moderate concern (Table 1.3.73). Just over 57% of the caddisflies on the RSGCN list are regional endemics; six of these species are narrow range endemics, restricted to a single state. *Isoperla myersi* is found only in New York, *Soyedina merritti* in Pennsylvania, and four species are found only in Virginia: *Acroneuria flinti*, *Isoperla major*, *Taeniopteryx nelsoni*, and *Tallaperla lobata*. These single-state endemics are evenly split between High and Very High concern. The Midwest listed Illinois Snowfly (*Allocapnia illinoensis*) as RSGCN and Maine Stone (*Neoperla mainensis*) as Proposed RSGCN.

Table 1.3.73 RSGCN Stoneflies 2023.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Allocapnia frumi	Monongahela Snowfly	100% (NEAFWA Endemic)	Very High
Taeniopteryx nelsoni	Cryptic Willowfly	100% (NEAFWA Endemic)	Very High
Acroneuria arida	Elegant Stone	50-75%	Very High
Neoperla mainensis	Maine Stone	50-75%	Very High
Isoperla major	Big Stripetail	100% (NEAFWA Endemic)	Very High
Diura washingtoniana	Presidential Springfly	100% (NEAFWA Endemic)	Very High
Alloperla vostoki	Scotia Sallfly	50-75%	Very High
Soyedina merritti	Powdermill Forestfly	100% (NEAFWA Endemic)	Very High
Sweltsa holstonensis	Holston Sallfly	100% (NEAFWA Endemic)	Very High
Tallaperla lobata	Lobed Roachfly	100% (NEAFWA Endemic)	High
Prostoia hallasi	Swamp Forestfly	75-100%	High
Ostrocerca prolongata	Bent Forestfly	75-100%	High

Allocapnia harperi	Stonyfork Snowfly	100% (NEAFWA Endemic)	High
Allocapnia simmonsi	Spatulate Snowfly	100% (NEAFWA Endemic)	High
Acroneuria flinti	Manassas Stonefly	100% (NEAFWA Endemic)	High
Isoperla myersi	Paddle Stripetail	100% (NEAFWA Endemic)	High
Diploperla kanawholensis	Kanawhole Springfly	50-75%	High
Alloperla voinae	Lawrence Sallfly	75-100%	High
Alloperla aracoma	Aracoma Sallfly	75-100%	High
Alloperla biserrata	Dusky Sallfly	100% (NEAFWA Endemic)	High
Sweltsa palearata	Shenandoah Sallfly	100% (NEAFWA Endemic)	High
Utaperla gaspesiana	Gaspe Sallfly	75-100%	High
Sweltsa pocahontas	Pocahontas Sallfly	100% (NEAFWA Endemic)	High
Remenus kirchneri	Blue Ridge Springfly	100% (NEAFWA Endemic)	High
Allocapnia illinoensis	Illinois Snowfly	50-75%	Moderate
Megaleuctra flinti	Shenandoah Needlefly	100% (NEAFWA Endemic)	Moderate
Hansonoperla appalachia	Appalachian Stonefly	75-100%	Moderate
Isoperla gibbsae	Quebec Stripetail	75-100%	Moderate

PROPOSED RSGCN: 3 STONEFLIES

Three stoneflies not currently listed as SGCN in the Northeast SWAPs are included in the 2023 Proposed RSGCN list (Table 1.3.74). Two of these species are single-state endemics, with *Alloperla stipitata* found only in Virginia and *Leuctra laura* found only in New Hampshire. *Isoperla stewarti* was described in 2015 from North Carolina and was located in Virginia too late for inclusion in their 2015 SGCN list. Described before 2015, *Alloperla stipitate,* concern for the species did not increase until later surveys determined that the species occurs in only a handful of locations in the James River

drainage. *Leuctra laura,* described earlier, but New Hampshire did not include stoneflies in its 2015 SGCN list.

Table 1.3.74 Proposed RSGCN Stoneflies 2023.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Leuctra laura	Hampshire Needlefly	100% (NEAFWA Endemic)	Very High
Alloperla stipitata	Blue Ridge Sallfly	100% (NEAFWA Endemic)	High
Isoperla stewarti	Stewart Stripetail	50-75%	Moderate

OVERVIEW

Nine of 14 Northeast states list Stoneflies as SGCN. RSGCN Stoneflies inhabit four habitat groups and six habitat types across the Northeast; all are aquatic (see *Chapter 2*). Ninety-seven percent of Stoneflies use Rivers and Streams, and 94% use Riparian Floodplains. The four other habitat types identified below are used by less than 15% of these Stoneflies (Figure 1.3.34).

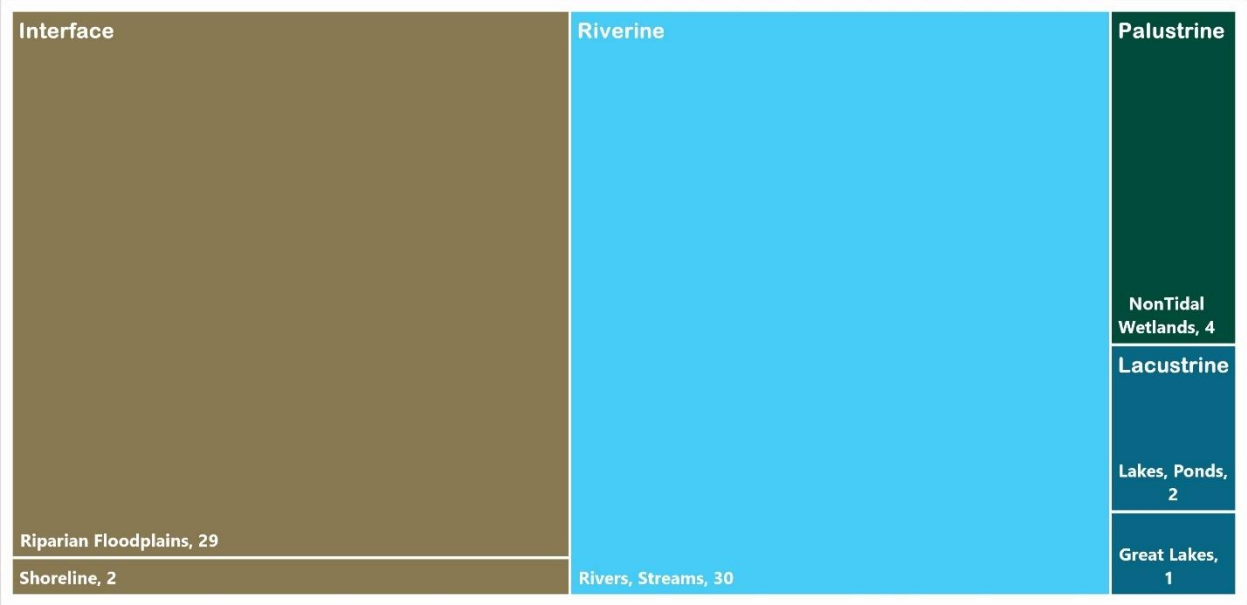


Figure 1.3.34 Number of RSGCN and Proposed RSGCN Stonefly associated with each habitat in the Northeast. Species may be associated with multiple habitat types. Habitat group names are at the top of each color block and grouped by color; habitat type names appear at the bottom of each proportionally sized square and are colored by habitat group (see *Chapter 2* for more information on habitats).

Climate Change and Pollution threaten all RSGCN and Proposed RSGCN Stoneflies. Top Climate Change threats include gradual temperature changes, increase in temperature fluctuations, gradual changes in precipitation regime, and increased fluctuations in the precipitation regime (Table 1.3.75). Top Pollution threats include domestic wastewater,

runoff, nutrient loads, and herbicides and pesticides (Table 1.3.75). The Stonefly RCN 3.0 project may highlight these threats and their impact on Stoneflies.

Table 1.3.75 Level 1 threats with the number and percent of RSCGN and Proposed RSGCN Stoneflies threatened by each. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Climate Change (Threat 11.0)	31	100%
Pollution (Threat 9.0)	31	100%
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	2	6%
Natural System Modifications (Threat 7.0)	2	6%
Transportation & Service Corridors (Threat 4.0)	2	6%

WATCHLIST

Two Stoneflies are listed as Watchlist species, both as Watchlist [Assessment Priority].

WATCHLIST [ASSESSMENT PRIORITY]: 2 STONEFLIES

The 2017 RSGCN list included two species as data deficient, now listed as Watchlist [Assessment Priority] in the 2023 list (Table 1.3.76). These two species are known from only a handful of locations; more surveys will be necessary to establish the full distribution, habitat needs, and current threats to these species. In addition, the Midwest listed the Splendid Stonefly (*Hansonoperla hokolesqua*) as a Proposed Watchlist [Assessment Priority].

Table 1.3.76 Watchlist [Assessment Priority] Stoneflies 2023.

Scientific Name	Common Name	Regional Responsibility
Leuctra monticola	Montane Needlefly	50-75%
Hansonoperla hokolesqua	Splendid Stonefly	50-75%

REGIONAL EFFORTS IN NORTHEAST STONEFLY CONSERVATION

Stoneflies are one of the most environmentally sensitive taxa after freshwater mussels and crayfish (Hogan and Grubbs 2022). This sensitivity makes them a potential tool for monitoring changes due to pollution, climate change, and habitat degradation. Despite their possible status as a bioindicator, the stoneflies have not been well researched or monitored in the Northeast region. Only nine states included stoneflies in their 2015 SGCN lists: Delaware, Maryland, Maine, New York, Pennsylvania, Rhode Island, Virginia, Vermont, and West Virginia. Lack of expertise may be preventing the other states from assessing this taxon.

To address regional data and expertise deficiencies, the Northeast Diversity Technical Team is planning an upcoming RCN project to assess northeastern stoneflies. This formal assessment will inform the management and protection of stonefly species. Project objectives include developing standardized survey protocols, compiling data from published literature and museum collections, and implementing field surveys. These data will describe species' habitat needs and threats, and specimens will be barcoded to assess regional genetic diversity. Ultimately, this project will determine the conservation status of all northeastern stonefly species. This project is expected to begin in 2023; final reports should be available in 2027.

1.3.18 TERRESTRIAL SNAILS

At least 268 terrestrial snails (Class Gastropoda) are known to occur in the 14 NEAFWA states. More than half of these species, 182, were listed as SGCN in at least one of the fourteen 2015 Northeast SWAPs. Of these 182 Northeast SGCN, 21 snails (Orders Stylommatophora and Neritopsina) met the criteria for RSGCN. Taxonomic Team experts listed 28 in one of the Watchlist categories: 22 Watchlist [Assessment Priority], two non-SGCN species met the criteria for Proposed Watchlist [Assessment Priority], and four for Watchlist [Deferrals]. Three species that were RSGCN on the 2018 Northeast list were removed in this 2023 revision. *Anguispira clarkii* was originally included as a data-deficient species but has since been synonymized with *Anguispira alternata*. The Round Supercoil (*Paravitrea reesei*) and Carter Threetooth (*Triodopsis anteridon*) were considered Moderate concern in 2018 based primarily on their apparent scarcity. However, the Snail Taxonomic Team indicated that the rarity of these species is due to being naturally uncommon rather than a response to any threats.

Regional Priority Concern Highlights:

- Many terrestrial snails require specific microclimates, making them vulnerable to climate change, changing water patterns & hydrology.
- Deforestation & habitat fragmentation may eliminate important microhabitats or isolate populations.
- Exotic earthworms disrupt forest floor nutrient cycles and remove leaf litter, eliminating shelter and food resources.

Species Information, Research & Monitoring Needs:

- The lack of regional expertise and survey work has left many species data deficient.
- Taxonomic and genetic studies are needed to clarify misidentification issues from occurrence records, especially for cryptic species such as members of the family Succineidae.
- Data needs include abundance and distribution of terrestrial snails, habitat conditions, availability, management data, seasonal and behavior, and threat information.

RSGCN: 21 TERRESTRIAL SNAILS

Of the 21 terrestrial snails included on the 2023 Northeast RSGCN list, 15 are regional endemics occurring only in the Northeastern states (Table 1.3.77). Three of these regional endemics are protected under the US Endangered Species Act. Chittenango Ambersnail (*Novisuccinea chittenangoensis*) and Cheat Threetooth (*Triodopsis platysayoides*) are both threatened, while Virginia Coil (*Polygyriscus virginianus*) is endangered. Several of the regional endemics, including the Greenbrier Tigersnail (*Anguispira stihleri*), Shaggy Coil (*Helicodiscus diadema*), Rubble Coil (*Helicodiscus lirellus*), Greenbrier Coil (*Helicodiscus villosus*), Chittenango Ambersnail, Virginia Coil, Brush Creek Threetooth (*Triodopsis juxtidens robinae*), and Cheat Threetooth are narrow-range endemics, restricted to incredibly small areas such as single valleys, stream reaches, and bluffs. The limited distribution of many terrestrial snails elevates the Concern Level for these species, with 12 of the RSGCN considered Very High

concern, six species considered High concern and only three species listed as Moderate concern.

Table 1.3.77 RSGCN Terrestrial Snails 2023.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Novisuccinea chittenangoensis	Chittenango Ambersnail	100% (NEAFWA Endemic)	Very High
Webbhelix multilineata	Striped Whitelip	<25%	Very High
Paravitrea ceres	Sidelong Supercoil	100% (NEAFWA Endemic)	Very High
Paravitrea hera	Spirit Supercoil	100% (NEAFWA Endemic)	Very High
Vertigo clappi	Cupped Vertigo Snail	50-75%	Very High
Mesomphix luisant	Glossy Button	100% (NEAFWA Endemic)	Very High
Helicodiscus villosus	Greenbrier Coil	100% (NEAFWA Endemic)	Very High
Helicodiscus diadema	Shaggy Coil	100% (NEAFWA Endemic)	Very High
Helicodiscus lirellus	Rubble Coil	100% (NEAFWA Endemic)	Very High
Polygyriscus virginianus	Virginia Coil	100% (NEAFWA Endemic)	Very High
Anguispira stihleri	Greenbrier Tigersnail	100% (NEAFWA Endemic)	Very High
Triodopsis juxtidens robinae	Brush Creek Threetooth	100% (NEAFWA Endemic)	Very High
Glyphyalinia raderi	Maryland Glyph	75-100%	High
Paravitrea mira	Funnel Supercoil	75-100%	High
Paravitrea septadens	Brown Supercoil	50-75%	High
Helicodiscus triodus	Talus Coil	100% (NEAFWA Endemic)	High
Stenotrema simile	Bear Creek Slitmouth	100% (NEAFWA Endemic)	High
Triodopsis platysayoides	Cheat Threetooth	100% (NEAFWA Endemic)	High
Vertigo parvula	Smallmouth Vertigo	50-75%	Moderate
Glyphyalinia picea	Rust Glyph	100% (NEAFWA Endemic)	Moderate
Paravitrea pontis	Natural Bridge Supercoil	100% (NEAFWA Endemic)	Moderate

No terrestrial snails not currently listed as SGCN in at least one Northeastern SWAP were considered by the taxa team to be of sufficient concern to elevate to the Proposed RSGCN.

OVERVIEW

Eleven of 13 states list snails as RSGCN. The 21 RSGCN Terrestrial Snails inhabit five habitat groups and six habitat types (see *Chapter 2*). The three habitat types they use most are staggered across three habitat groups, with 62% occurring in Forest Woodland, 48% occurring in open Cliff and Talus habitat, and 24% in Riparian Floodplains (Figure 1.3.35). Taxonomic Team experts have indicated that this taxon's data needs are habitat condition, availability information, and additional occupancy studies.

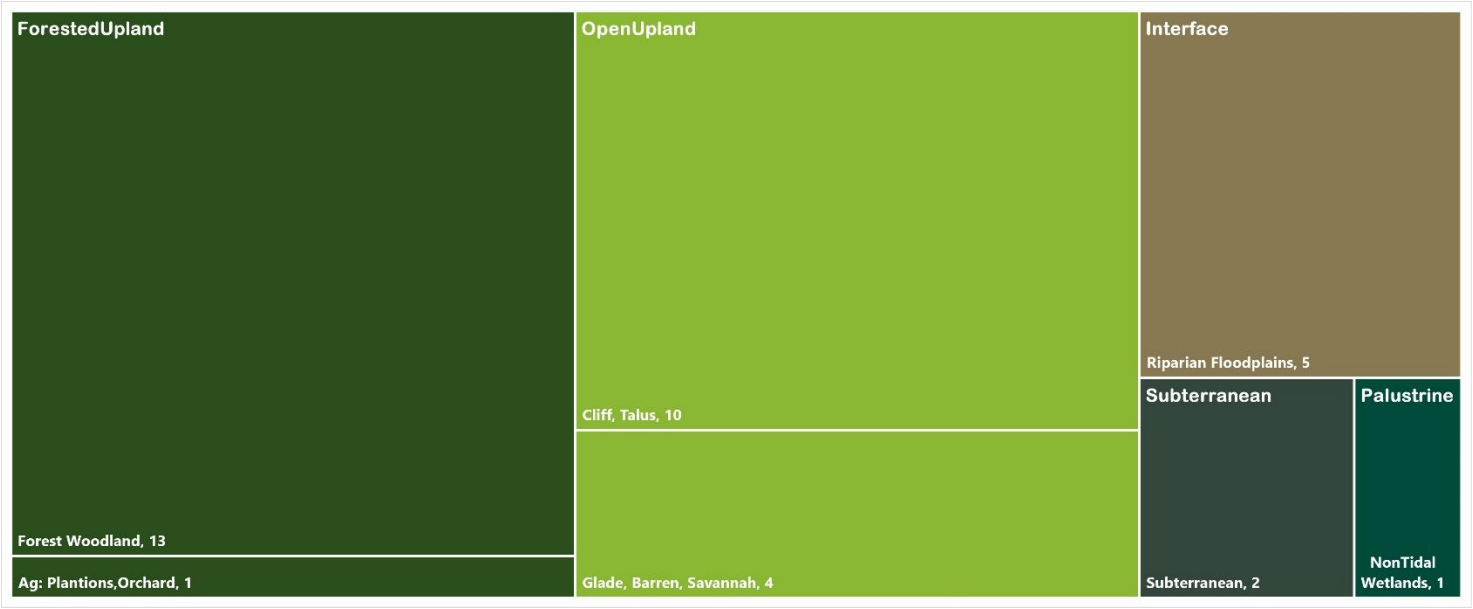


Figure 1.3.35 Number of RSGCN and Proposed RSGCN Terrestrial Snail associated with each habitat in the Northeast. Habitat group names are at the top of each color block and grouped by color, habitat type names appear at the bottom of each proportionally sized square and colored by habitat group (see *Chapter 2* for more information on habitats).

RSGCN Terrestrial Snails threat information is limited because many species need more research, as the habitat data needs above. However, while not an actual threat, the lack of natural history information in combination with known steep declines for these RSGCN snails could be seen as the top threat as indicated by 86% of these species' Level 1 threat category is Other. In addition, Climate Change threatens fourteen percent of these snails with threats of increase in temperature fluctuations, overabundant rains, droughts, gradual change in precipitation regime, increased fluctuations in the precipitation regime, and storms and severe weather (Table 1.3.78). Finally, the Geological Event that threatens one of these RSGCN snails is landslides.

Table 1.3.78 Level 1 threats with the number and percent of RSCGN Terrestrial Snails threatened by each. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Other (Threat 12.0)	18	86%
Climate Change (Threat 11.0)	3	14%
Geological Events (Threat 10.0)	1	5%
Human Intrusions & Disturbance (Threat 6.0)	1	5%
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	1	5%
Natural System Modifications (Threat 7.0)	1	5%
Pollution (Threat 9.0)	1	5%
Residential & Commercial Development (Threat 1.0)	1	5%

WATCHLIST

In total, Taxonomic Teams identified 28 Terrestrial Snails as Watchlist. No snails were identified as interdependent species by the taxa team members. However, snails are crucial in cycling certain nutrients, especially calcium, in forested ecosystems (Hotepp 2002). Birds, in particular, may depend on snails to obtain sufficient levels of calcium for egg production (Graveland 1996; Mänd et al. 2000).

WATCHLIST [ASSESSMENT PRIORITY]: 22 TERRESTRIAL SNAILS

Data deficiency across this taxon resulted in a comparatively large number of Terrestrial Snails in this list. There are 22 Watchlist [Assessment Priority] species in the 2023 list (Table 1.3.79). These species can be broken into two groups; those included due to taxonomic uncertainty and those requiring additional survey work. Ten species require genetic work to ascertain their validity or taxonomic review of specimens to ensure proper classification. Twelve species require further research and survey work to determine habitat requirements, distribution, and population status. The remaining two species, West Virginia Glyph (*Glphalinia sp. 1*) and Balsam Globe (*Mesodon andrewsae*), require taxonomic and survey work.

Table 1.3.79 Watchlist [Assessment Priority] Terrestrial Snails 2023.

Scientific Name	Common Name	Regional Responsibility
Glyphyalinia sp. 1	West Virginia Glyph	100% (NEAFWA Endemic)
Triodopsis sp. 1	Piney Creek Threetooth	100% (NEAFWA Endemic)
Triodopsis rugosa	Buttressed Threetooth	100% (NEAFWA Endemic)
Triodopsis picea	Spruce Knob Threetooth	100% (NEAFWA Endemic)
Oxyloma subeffusum	Chesapeake Ambersnail	100% (NEAFWA Endemic)
Mesomphix sp. 1	Pygmy Button	100% (NEAFWA Endemic)

Gastrodonta fonticula	Appalachia Bellytooth	75-100%
Appalachina sayana	Spike-lip Crater Snail	75-100%
Patera panselenus	Virginia Bladetooth	50-75%
Pallifera secreta	Severed Mantleslug	50-75%
Vitrina angelicae	Eastern Glass-snail	50-75%
Striatura exigua	Ribbed Striate Snail	50-75%
Patera laevior	Smooth Bladetooth	25-50%
Oxyloma retusum	Blunt Ambersnail	25-50%
Megapallifera wetherbyi	Blotchy Mantleslug	25-50%
Paravitrea blarina	Shrew Supercoil	25-50%
Vertigo ventricosa	Five-tooth Vertigo Snail	25-50%
Pallifera ohioensis	Redfoot Mantleslug	25-50%
Pallifera hemphilli	Black Mantleslug	<25%
Ventridens coelaxis	Bidentate Dome	<25%
Mesodon andrewsae	Balsam Globe	<25%
Helicodiscus multidens	Twilight Coil	<25%

PROPOSED WATCHLIST [ASSESSMENT PRIORITY] SPECIES (2023)

Two species, Mudbank Ambersnail (*Catinella vagans*) and Penn Ambersnail (*Succinea pennsylvanica*), were identified by the taxa team as meeting the criteria for Watchlist [Assessment Priority] that are not already listed as SGCN in the Northeast (Table 1.3.80). These two species belong to the family Succineidae, whose members are extremely difficult to identify. Much of this family requires serious genetic and morphological work to determine the validity of various species, and further review of historical records will also be necessary as specimens are often only identified at the family level, not the genus or species.

Table 1.3.80 Proposed Watchlist [Assessment Priority] Terrestrial Snails 2023.

Scientific Name	Common Name	Regional Responsibility
Succinea pennsylvanica	Penn Ambersnail	100% (NEAFWA Endemic)
Catinella vagans	Mudbank Ambersnail	100% (NEAFWA Endemic)

WATCHLIST [DEFER TO ADJACENT REGION]: 4 TERRESTRIAL SNAILS

The taxa team identified four terrestrial snails with elevated conservation concerns but whose distribution falls primarily in other regions (Table 1.3.81). The Banded Tigersnail (*Angispira kochi*) is mainly a Midwestern species but has undergone severe declines in the Northeast, resulting in disjunct populations. The Cherrystone Drop (*Hendersonia occulta*) appears to have a split distribution, with one population in the Midwest and one in the southern Appalachians. Additional surveys across the Southeast and Midwest may locate populations that link the two together. The remaining species, Malleated Vertigo (*Vertigo malleata*) and Swamp Vertigo (*V. teskeyae*), are primarily southeastern species. The former occurs in unique, acidic habitats, while the latter is taxonomically uncertain and may be impacted by climate change-related threats.

Table 1.3.81 Watchlist [Defer to Adjacent Region] Terrestrial Snails 2023.

Scientific Name	Common Name	Deferred Region(s)	Listed in Deferred Region(s)
Anguispira kochi	Banded Tigersnail	MAFWA	No
Vertigo malleata	Malleated Vertigo	SEAFWA	No
Vertigo teskeyae	Swamp Vertigo	SEAFWA	No
Hendersonia occulta	Cherrystone Drop	MAFWA/ SEAFWA	No

REGIONAL EFFORTS IN NORTHEAST TERRESTRIAL SNAIL CONSERVATION

At the time of the 2013 Northeast Conservation Synthesis, very little was known about the terrestrial snail fauna of the Northeast. This prompted a Regional Conservation Needs Program project to assess the status of Northeastern terrestrial snails. State agencies worked with the Carnegie Museum of Natural History to conduct a comprehensive survey of snails, with particular effort applied to under-surveyed species and habitats. The Carnegie Museum took the results from these inventories to update their website, "**Land Snails and Slugs of the Mid-Atlantic and Northeastern United States**"[23]. This website includes basic information on snail ecology and species profiles for over 300 Northeastern species, including range maps and museum records for most species, including 50 non-native species. When the website was completed in 2017, it provided a comprehensive picture of the current state of knowledge for all terrestrial snails in the Northeast.

1.3.19 TIGER BEETLES

Approximately 40 tiger beetles occur in the Northeast region. Of those species, 35 are SGCN in at least one of the 14 2015 SWAPs, the highest proportion amongst all the taxon reviewed. Only eight species ultimately met the criteria for RSGCN, with an additional four qualifying Watchlist [Assessment Priority] and a single Watchlist [Deferral]. None of the RSGCN in the 2018 list have been removed from the 2023 list.

Regional Priority Concern Highlights:

- Climate change is a major concern for several species, including sea level rise and inundation of salt marsh for coastal species, and inundation and scouring caused by large storm events for riparian species.
- Dam release schedules and invasive plant species may heavily impact some riparian species.
- Disturbance in the form of development and human activities (e.g., beach and ORV use) are largely detrimental.
- Management of disturbance-based habitats is necessary for some species, especially in fire-adapted habitats.

Species Information, Research & Monitoring Needs:

- One of the RCN 3.0 projects will be a Tiger Beetle Status Assessment, hopefully addressing many data deficiencies.
- Conservation barriers due to climate change are largely unknown.

RSGCN: 8 TIGER BEETLES

The 2023 update of the Northeast RSGCN list includes eight tiger beetle species, three at the nominal level and five at the subspecies level (Table 1.3.82). One nominal species, Puritan Tiger Beetle (*Ellipsoptera puritana*), and one subspecies, Eastern Beach Tiger Beetle (*Habroscelimorpha dorsalis dorsalis*), are federally threatened species. The two federally listed species are Very High concern. Of the remaining six, all but one species, the Appalachian Tiger Beetle (*Cicindela ancocisconensis*), are High Concern. Half of the Northeast RSGCN tiger beetles are regional endemics, including the New Jersey Pine Barrens Tiger Beetle (*Cicindela patruela consentanea*), Hentz's Tiger Beetle (*Cicindela rufiventris hentzii*), Puritan Tiger Beetle, and Eastern Beach Tiger Beetle. The first two subspecies may be narrow-range endemics, with the New Jersey Pine Barrens Tiger

Beetle found only in the Jersey barrens and Hentz's Tiger Beetle from the rocky hills surrounding Boston. The Puritan Tiger Beetle is a bit more widespread but is restricted to sites along the Connecticut River and the Chesapeake Bay.

Table 1.3.82 RSGCN Tiger Beetles 2023.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Ellipsoptera puritana	Puritan Tiger Beetle	100% (NEAFWA Endemic)	Very High
Habroscelimorpha dorsalis dorsalis	Eastern Beach Tiger Beetle	100% (NEAFWA Endemic)	Very High
Cicindela marginipennis	Cobblestone Tiger Beetle	50-75%	High
Cicindela patruela consentanea	New Jersey Pine Barrens Tiger Beetle	100% (NEAFWA Endemic)	High
Cicindela patruela patruela	Northern Barrens Tiger Beetle	50-75%	High
Cicindela rufiventris hentzii	Hentz's Tiger Beetle	100% (NEAFWA Endemic)	High
Habroscelimorpha dorsalis media	White Tiger Beetle	25-50%	High
Cicindela ancocisconensis	Appalachian Tiger Beetle	75-100%	Moderate

Considering how comprehensively the tiger beetles have been in the SWAPs, it is unsurprising that the taxa team did not identify any tiger beetles with high conservation concerns but were not already SGCN.

OVERVIEW

All but one of the 14 Northeast states list tiger beetles as SGCN. Despite their relatively low total number, the RSGCN Tiger Beetles use a wide range of habitat types (10) in three habitat groups (see *Chapter 2*). The most used habitats are Beach and Dune and Non-tidal Wetlands, each used by 38% of the species (Figure 1.3.36). After that, several different Open Upland and Interface habitats are used by one to three species each.

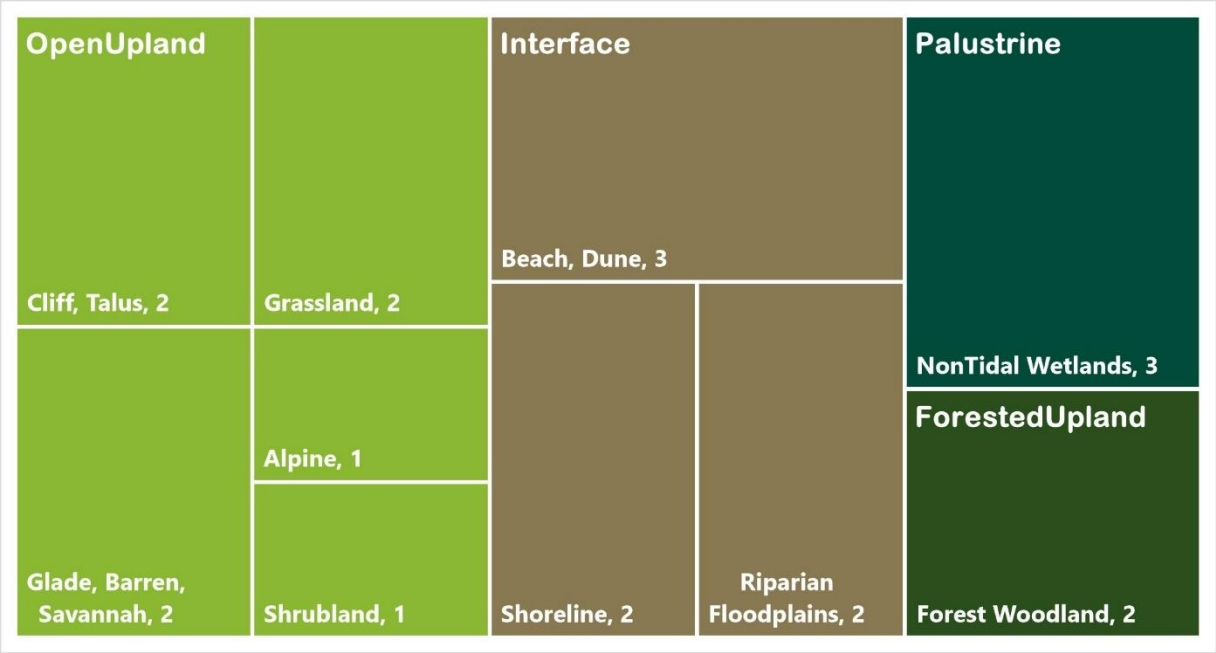


Figure 1.3.36 Number of RSGCN Tiger Beetle associated with each habitat in the Northeast. Species may be associated with multiple habitat types. Habitat group names are at the top of each color block and grouped by color; habitat type names appear at the bottom of each proportionally sized square and are colored by habitat group (see *Chapter 2* for more information on habitats).

Human Intrusions and Disturbance and Residential and Commercial Development are top Level 1 threats to Tiger Beetles, threatening 100% of RSGCN species (Table 1.3.83). Natural Systems Modifications and Climate Change are not far behind, threatening 88% and 75% of RSGCN Tiger Beetles, respectively (Table 1.3.83). The top threats all fall under recreational activities, motor vehicles, recreational uses of beaches, hiking, and boating (Table 1.3.83). Low-density housing areas, commercial and industrial areas, and dense housing and urban areas are the top threats within residential and commercial development (Table 1.3.83). Not surprisingly, the Natural Systems Modifications that threaten these Tiger Beetles most are shoreline alteration, vegetation succession, and water level management using dams (Table 1.3.83).

Certain guilds of tiger beetles are known to be at elevated risk for extirpation or even extinction. Documented population declines in many species of tiger beetles associated with ocean beaches, including two Northeast RSGCN, the federally listed *Cicindela dorsalis dorsalis* and its southern counterpart *Cicindela dorsalis media*. Riverine tiger beetles, such as RSGCN *Cicindela ancocisconensis* and *Cicindela marginipennis,* are also highly vulnerable to extirpation due to human activities. The federally listed (and RSGCN) tiger beetle *Cicindela puritana* combines both vulnerability types across its highly disjunct distribution, with populations found on riverine sandbars in New England and at cliffside beaches along the shores of the Chesapeake Bay.

Table 1.3.83 Level 1 threats with the number and percent of RSCGN Tiger Beetles threatened by each. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Human Intrusions & Disturbance (Threat 6.0)	8	100%
Residential & Commercial Development (Threat 1.0)	8	100%
Natural System Modifications (Threat 7.0)	7	88%
Climate Change (Threat 11.0)	6	75%
Biological Resource Use (Threat 5.0)	5	63%
Invasive & Problematic Species, Pathogens & Genes (Threat 8.0)	5	63%
Energy Production & Mining (Threat 3.0)	3	38%
Pollution (Threat 9.0)	3	38%
Other (Threat 12.0)	2	25%
Agriculture & Aquaculture (Threat 2.0)	1	13%
Transportation & Service Corridors (Threat 4.0)	1	13%

WATCHLIST

In total, five Tiger Beetles are listed in a Watchlist category. In addition, Taxonomic Teams identified four as Watchlist [Assessment Priority] and one species for deferral to an adjacent region.

WATCHLIST [ASSESSMENT PRIORITY]: 4 TIGER BEETLES

The 2023 Watchlist [Assessment Priority] includes four tiger beetles with regional responsibilities below 50% (Table 1.3.84). For one species, the Eastern Pinebarrens Tiger Beetle (*Cicindela abdominalis*), the taxa team elected to include this species despite being near its northern range limits as the status of the species outside of New Jersey is tenuous, and even within the New Jersey pine barrens, its distribution and status is uncertain. The Taxonomic Team included the Hairy-necked Tiger Beetle (*Cicindela hirticollis*); despite relatively stable populations as there were some questions about the presence and validity of two subspecies, *hirticollis* and *rhodensis* and as a coastal species, it is vulnerable to future climate change. Conservation concern is elevated for the last two species, Ghost and Margined Tiger Beetle (*Ellipsoptera lepida* and *E. marginata*, respectively), due to small and declining populations in the Northeast due to habitat loss.

Table 1.3.84 Watchlist [Assessment Priority] Tiger Beetles 2023.

Scientific Name	Common Name	Regional Responsibility
Ellipsoptera marginata	Margined Tiger Beetle	25-50%
Cicindela abdominalis	Eastern Pinebarrens Tiger Beetle	25-50%
Ellipsoptera lepida	Ghost Tiger Beetle	<25%

Cicindela hirticollis	Hairy-necked Tiger Beetle	<25%

WATCHLIST [DEFER TO ADJACENT REGION]: 1 TIGER BEETLE

A single species, Whitish Tiger Beetle (*Ellipsoptera gratiosa*) was deferred to the Southeast Region. Unfortunately, there is only one known population of this species in the Northeast located on the Virginia-North Carolina border, greatly restricting the ability to enact meaningful conservation actions in this region.

REGIONAL EFFORTS IN NORTHEAST TIGER BEETLE CONSERVATION

Tiger beetles attract researchers, citizen scientists, and photographers as they are often brightly colored, patterned, highly active, predatory, and easily observed. Yet, despite being highly charismatic, very few regional efforts have focused on this group. The Northeast Fish and Wildlife Diversity Technical Team intends to advance tiger beetle conservation with an upcoming RCN project. This project intends to comprehensively assess all tiger beetles in the Northeast using a framework like Odonate Conservation Assessment described above. This assessment will determine the status and distribution of all northeastern tiger beetles, identify knowledge gaps, develop standardized survey protocols, and implement surveys to comprehensively assess the current status, distribution, habitat needs, and potential threats for selected target species. This project is expected to begin in 2023; final reports should be available in 2027.

1.3.20 TRICHOPTERA: CADDISFLIES

At least 565 caddisflies (Trichoptera) are known to occur in the Northeast region. Of those, 40 caddisflies are listed as SGCN in at least one of the 14 northeast 2015 SWAPs. The EPT Taxonomic Team identified four caddisflies that met the criteria as RSGCN and 11 non-SGCN caddisflies as Proposed RSGCN. Ten are listed in one of the Watchlist categories: seven Watchlist [Assessment Priority], two Proposed Watchlist [Assessment Priority], and a single Watchlist [Deferrals]. This is the first-time caddisflies have been reviewed for the Northeast RSGCN list; all of these species are additions to the 2023 list.

Regional Priority Concern Highlights:

•Caddisflies are susceptible to several aquatic threats, including pollution and climate change-induced precipitation patterns and hydrology changes.

•Lack of regional expertise & data deficiencies precludes a full understanding of threats.

Species Information, Research & Monitoring Needs:

•Many species are under-surveyed and require inventory assessments.

•Location data is limited for some species, which may lead to erroneous claims of a rarity as an artifact of collection bias.

•Winter activity and life history data are lacking.

RSGCN: 4 CADDISFLIES

All four Caddisflies on the 2023 RSGCN list are regional endemics (Table 1.3.85). The two members of the genus *Beraea* are both of Very High concern. This genus is poorly represented, known from very few locations, and is likely highly sensitive to habitat loss or degradation as they appear to be spring specialists. They are also one of the only partially terrestrial caddisflies; nymphs live in organic matter and mud on the banks rather than within the water column.

Table 1.3.85 RSGCN Caddisflies 2023.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Beraea fontana	American Spring-loving Caddisfly	100% (NEAFWA Endemic)	Very High
Beraea nigritta	a caddisfly	100% (NEAFWA Endemic)	Very High
Polycentropus chenoides	a polycentropodid caddisfly	100% (NEAFWA Endemic)	High
Ceraclea uvalo	Spatulate Long-horned Caddisfly	100% (NEAFWA Endemic)	Moderate

PROPOSED RSGCN: 11 CADDISFLIES

Eleven caddisflies are listed as Proposed RSGCN in the 2023 list (Table 1.3.86). These species were not eligible in the 2017 list as they are not currently listed as SGCN in any

Northeast SWAP. Three of the eleven Proposed RSGCN are endemic to the region – *Adicrophleps hitchcoki*, *Banksiola calva*, and *Neophylax ottawa*.

Table 1.3.86 11 Proposed RSGCN Caddisflies 2023.

Scientific Name	Common Name	Regional Responsibility	Concern Level
Brachycentrus incanus	Hoary Humpless Caddisfly	50-75%	Very High
Manophylax altus	Mount Mitchell Caddisfly	50-75%	Very High
Banksiola calva	a giant casemaker caddisfly	100% (NEAFWA Endemic)	High
Polycentropus pixi	Pitch Trumpet-net Caddisfly	75-100%	High
Homoplectra monticola	a hydropsychid caddisfly	75-100%	High
Ceraclea ruthae	Ruth's Long-horned Caddisfly	75-100%	High
Lepidostoma ontario	Ontario Bizarre Caddisfly	50-75%	Moderate
Theliopsyche grisea	a caddisfly	50-75%	Moderate
Adicrophleps hitchcocki	a brachycentrid caddisfly	100% (NEAFWA Endemic)	Moderate
Heteroplectron americanum	American Comb-lipped Caddisfly	50-75%	Moderate
Neophylax ottawa	Ottawa Little Caddisfly	100% (NEAFWA Endemic)	Moderate

OVERVIEW

RSGCN and Proposed RSGCN Caddisflies are found in five habitat groups and eight habitat types (see *Chapter 2*). Of these, 73% inhabit Riparian Floodplains, and 67% inhabit Rivers and Streams (Figure 1.3.37). Only one caddisfly, the Mount Mitchell Caddisfly, is found in a terrestrial habitat type, High Elevation Forests.

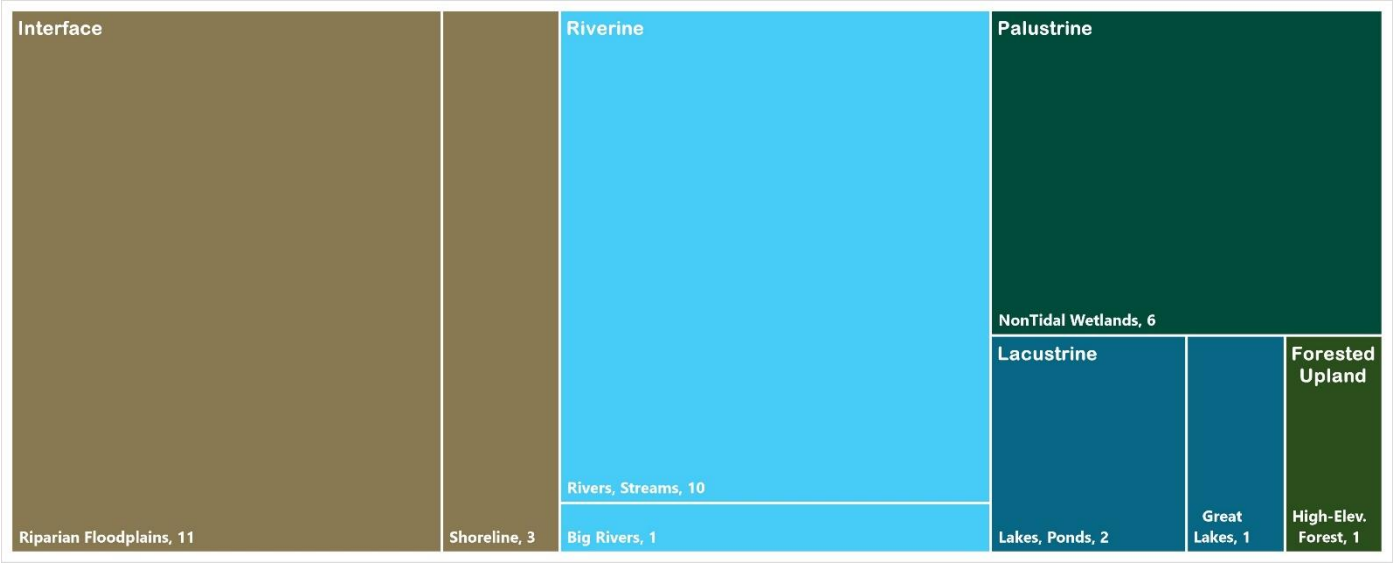


Figure 1.3.37 Number of RSGCN and Proposed RSGCN Caddisfly associated with each habitat in the Northeast. Species may be associated with multiple habitat types. Habitat group names are at the top of each color block and grouped by color, habitat type names appear at the bottom of each proportionally sized square and colored by habitat group (see *Chapter 2* for more information on habitats).

Two Level 1 Threats threaten nearly all these Caddisfly species. First, Climate Change threatens 100% of Northeast RSGCN and Proposed RSGCN Caddisflies (Table 1.3.87). The top Climate Change threats are changes in temperature and precipitation. Temperature-related threats are gradual temperature changes and an increase in temperature fluctuations. Precipitation-related threats due to Climate Change are gradual changes in the precipitation regime and increased fluctuations in the precipitation regime. Pollution threatens 93% of Caddisflies. Domestic wastewater, runoff, nutrient loads, and herbicides and pesticides all threaten 93% of species (Table 1.3.87). All pollution threats to Caddisflies are pollution to aquatic ecosystems, which makes sense because Caddisflies are mostly aquatic insects.

Table 1.3.87 Level 1 threats with the number and percent of RSCGN and Proposed RSGCN Caddisflies threatened by each. See *Supplemental Information 3* for threat categories and explanations.

Level 1 Threats	Number Taxon	Percent Taxon
Climate Change (Threat 11.0)	15	100%
Pollution (Threat 9.0)	14	93%

WATCHLIST

Ten Caddisflies were listed as Watchlist species; Taxonomic Teams identified seven as Watchlist [Assessment Priority], two species as Proposed Watchlist [Assessment Priority], and one species identified for deferral to adjacent regions.

WATCHLIST [ASSESSMENT PRIORITY]: 7 CADDISFLIES

Due to data deficiencies, the taxa team included most of the seven caddisflies on the Watchlist [Assessment Priority] (Table 1.3.88). The genus *Hydroptila* are known from only a few element occurrences; this apparent rarity may be an artifact of collection bias, as members of this genus are exceedingly small. For the remaining species, very little information is available, making it difficult to assess the current conservation concerns for the species. One species, *Cheumatopsyche vannotei*, is known only from historic records and may be extinct. Most species included are potentially regional endemics; further survey work would help determine their full distribution and assess whether they would rise to the level of regional concern.

Table 1.3.88 Watchlist [Assessment Priority] Caddisflies 2023.

Scientific Name	Common Name	Regional Responsibility
Hydatophylax victor	Conquering Northern Caddisfly	100% (NEAFWA Endemic)
Cheumatopsyche vannotei	Vannote's Cheumatopsyche Caddisfly	100% (NEAFWA Endemic)
Hydroptila blicklei	a purse casemaker caddisfly	100% (NEAFWA Endemic)
Hydroptila parachelops	a purse casemaker caddisfly	100% (NEAFWA Endemic)
Hydroptila tomah	a purse casemaker caddisfly	100% (NEAFWA Endemic)
Cernotina pallida	Pale Trumpet-net Caddisfly	50-75%
Cheumatopsyche helma	Helma's Net-spinning Caddisfly	25-50%

PROPOSED WATCHLIST [ASSESSMENT PRIORITY]: 2 CADDISFLIES

The two species in the Proposed Watchlist [Assessment Priority] list are similar to the other Assessment species in that they are largely data deficient, making their assessment difficult (Table 1.3.89). In addition, one of the two species again belongs to the genus *Hydroptila,* which is frequently under-surveyed due to the small size of the species.

Table 1.3.89 Proposed Watchlist [Assessment Priority] Caddisflies 2023.

Scientific Name	Common Name	Regional Responsibility
Hydroptila eramosa	Prolonged Microcaddisfly	100% (NEAFWA Endemic)
Ceraclea punctata	Dotted Long-horned Caddisfly	25-50%

WATCHLIST [DEFER TO ADJACENT REGION]: 1 CADDISFLY

One species was deferred to the Midwest region. This species, *Ceraclea albosticta*, was known to occur historically in New York and Pennsylvania. However, most known occurrences fall outside the region, and none have been recent. The species is suspected to be extinct. The EPT Taxonomic Team elected to leave the assessment of this species to the Midwest states, as they represent more of the historical core of the range rather than the range edges.

REGIONAL EFFORTS IN NORTHEAST CADDISFLY CONSERVATION

Caddisflies are historically underrepresented and under-surveyed in the Northeast. Only six states included caddisflies as SGCN in their 2015 review, Delaware, Maryland, Maine, Pennsylvania, Virginia, and Vermont. This reflects the historical lack of taxon data and the region's present lack of expertise. The disproportionate number of species in Watchlist categories rather than RSGCN further confirms the overall data deficiency of this taxon. Regional surveys and assessments will be necessary to understand the current status of caddisflies in the Northeast.

Though no regional assessments of this taxonomic group are taking place, some state programs may improve our understanding of caddisflies. The Gulf of Maine Research Institute's Ecosystem Investigation Network[16] facilitates several citizen science projects intended to enhance understanding of how climate change impacts species, habitats, and communities. One of their projects targets vernal pools, an important habitat for some giant and northern casemaker caddisflies. This project aims to assess the distribution of caddisflies, fairy shrimp, and amphibian species in vernal pools in the Northeast and determine how these distributions may shift in response to climate change.

1.4 PARTNERSHIP OPPORTUNITIES

Partnership opportunities for the 2025 SWAPs are listed below. For more in-depth partner information and sources, see *Chapter 7*.

1.4.1 US FISH AND WILDLIFE SERVICE, NORTHEAST REGION AT-RISK SPECIES LIST

The USFWS has an important role and responsibility in conserving wildlife and the habitats they occupy. The Endangered Species Act (ESA) provides the framework for addressing the most critically imperiled species. In the Northeast, more than 100 fish, wildlife, and plant species are listed as Threatened or Endangered under the Act, with

~75 more scheduled for review. However, hundreds of other species are facing threats and are declining and at risk of becoming candidates as well. For many of these species, pre-listing conservation actions may be able to address these threats and reverse declines before they become too severe.

The Science Applications program, in coordination with other USFWS programs and state partners, generated a list of 76 Priority At-Risk Species (ARS) representing a diverse array of taxa and habitats from across the Northeast Region where coordinated conservation effort may preclude the need to list these species under the ESA. Eleven At-Risk teams formed in 2021 around either single-species or multi-species groups. These teams include individuals from multiple USFWS programs, providing diverse experiences and capabilities to each group. Descriptions of the target, scope, and proposed actions for each team are below:

CHESAPEAKE LOGPERCH

The Chesapeake Logperch (*Percina bimaculata*) is listed as threatened in Pennsylvania and Maryland. Historically, this species was found in the Chesapeake Bay watershed in the District of Columbia, Maryland, Pennsylvania, and Virginia. It was limited the lower sections of the Potomac and Susquehanna rivers and their tributaries, and a few direct tributaries to the Chesapeake Bay. It thought to have been extirpated from the Potomac River drainage due to pollution and sedimentation. Threats to the Chesapeake Logperch are many: nutrient loading/sediment loading; Polychlorinated Biphenyls (PCBs) and Chlordane; pollution; and habitat loss/modification of natural systems (i.e., dams fragmenting riverine habitat, development, conversion to agricultural use); impingement (Peach Bottom Nuclear Facility intake structures); stranding in shallow pools (mid-summer months); introduced aquatic species (hybridization, introduction of foreign parasites and pathogens, habitat shifts) and invasive aquatic species, such as the Northern Snakehead (Channa argus), the Flathead Catfish (*Pylodictis olivaris*), and Zebra Mussels (*Dreissena polymorpha*).

Conservation goals and actions include 1) protect, conserve, and enhance viable extant populations in Maryland and Pennsylvania, 2) reintroduce this species to historical range (including the Potomac drainage), and augment existing populations, 3) monitor the species, and 4) protect streams and habitat from agricultural and urban run-off, 5) genetic characterization. The Team is working with state and federal partners to implement a captive rearing operation (multiple facilities). In addition, our state partners are working hard to complete the last year of a 5-year Comp-SWG study on the Logperch including determining life history, behavior, and habitat characteristics; identifying suitable release sites; releasing wild and propagated Logperch stocks; developing a Conservation Action Plan for logperch in Maryland. Federal partners have

initiated genetic analysis to advise genetic diversity implications for propagation efforts. The Team also works with academia on behavior, predator avoidance, and other studies.

NEW ENGLAND COTTONTAIL

The New England cottontail rabbit (*Sylvilagus transitionalis*) is the only rabbit native to the northeastern United States from the Hudson River Valley of New York eastward. The NEC is currently threatened by the loss of its habitat through development and forest succession. It may also be imperiled by encroachment into its range by the introduced eastern cottontail (Sylvilagus floridanus), which may compete with NEC and seems more able to use diverse and fragmented habitats and avoid predators. In 2012, state wild agencies from Connecticut, Maine, Massachusetts, New Hampshire, New York, and Rhode Island worked with U.S Fish and Wildlife Service and the Natural Resources Conservation Service to finalize a conservation strategy to conserve the New England cottontail throughout its current range.

ATLANTIC COAST BEACH AND SHOREBIRDS (AMERICAN OYSTERCATCHER, RUDDY TURNSTONE, WHIMBREL)

Shorebirds are among the most imperiled birds in North America, with population declines of 33% since 1980. Coastal areas of the Northeast Region host substantial populations of breeding, wintering, and migrating shorebirds, and some of the densest human populations in North America. Anthropogenic threats include habitat loss and degradation, human disturbance, predation, hunting, and sea level rise across their vast hemispheric ranges. The Beach and Shorebirds Team focuses on three species that represent a cross-section of shorebird life histories, seasonal habitat use, and management needs in the region. Each is listed as a USFWS Bird of Conservation Concern, and Species of Greatest Conservation Need in most coastal states in the region. To date, the team has focused on identifying our role in supporting existing conservation planning, such as the American Oystercatcher Hemispheric Conservation Plan, the Whimbrel Conservation Plan, and the Atlantic Flyway Shorebird Initiative. We have also prioritized increased engagement between USFWS staff from five programs and collaborative conservation entities such as the American Oystercatcher Working Group and groups of external partners with specific expertise in the three species (e.g., NGOs, state wildlife agencies, and universities). Lastly, the ARS team has initiated efforts to improve internal coordination across programs in our region. Although implementation is just getting underway, specific 2023 priorities include:

- Initiating actions to address human disturbance at priority regional refuges
- Planning and pursuing opportunities for habitat acquisition, restoration, & enhancement
- Increasing efficacy and stability of predation management at locations experiencing poor outcomes

- Initiating research to identify priority stopovers (Ruddy Turnstone & Whimbrel) and understand importance of marsh habitat for breeding American Oystercatchers
- Helping initiate the first conservation plan for Ruddy Turnstone, a poorly understood species
- Engaging with partners outside our region to support priority conservation activities in other areas

FOREST SONGBIRDS (GOLDEN-WINGED WARBLER, CERULEAN WARBLER, WOOD THRUSH)

More than 1 billion breeding birds have been lost from forest habitats across North America over the past 50 years. Declines of birds associated with early successional, mature, and structurally diverse Eastern deciduous forest have contributed to these overall losses of forest birds, with golden-winged warbler, cerulean warblers, and wood thrush exhibiting some of the steepest declines. These three SGCN species represent those different forest ages and structures that are missing from many Northeastern deciduous forests today. The Forest Songbirds Team is partnering closely with the Appalachian Mountains Joint Venture (AMJV), whose geography overlaps with the core breeding areas of these three forest birds, to engage and support private and public forest landowners in implementing forest management practices that enhance the age and structural diversity of Eastern deciduous forests. A good example of this is a collaborative project this Team initiated between the Service's Partners for Fish and Wildlife program, NRCS, and West Virginia DNR that is providing assistance to private landowners in implementing the forest management activities identified as required practices under landowner incentive programs. We look to collaborate on these kinds of activities within focal landscapes identified within the AMJV geography as well as additional focal areas outside of the AMJV that are important for these three at-risk forest songbirds. We plan to identify key audiences in each focal area for outreach regarding beneficial forest management practices for birds and available resources to assist in implementing them. We seek to collaborate with other agencies, especially state agencies and USDA, and NGOs with interests in forest bird conservation and creating healthy forest landscapes across the Northeast.

SALTMARSH SPARROW

Science Applications is working on Saltmarsh conservation across the Atlantic Coast.

PINE BARRENS INHABITANTS

Pine barrens are a unique habitat type often characterized by sandy soils and fire-dependent plant communities dominated by pine species, though oaks are often also a major component of the ecosystem. Many rare species utilize pine barren habitats, but the team is focused on two inhabitants, Frosted Elfin and Eastern Whip-poor-will. The

Pine Barrens Team is analyzing data from Science Application's Rapid Response Team, eBird, and other sources to identify priority sites for co-management of the two species. Once sites are identified, the Team will work with Refuges, state conservation agencies, and other partners to enact on-the-ground management to improve conditions for both species. The team also intends to develop Best Management Practices for the two target species within pine barrens and to develop a network of conservation practitioners for sharing research, management practices and needs, and information across the Northeast.

DIADROMOUS FISHES (ALEWIFE, BLUEBACK HERRING)

Alewife (*Alosa pseudoharengus*) and Blueback herring (*Alosa aestivalis*), collectively known as River Herring, are categorized as Species of Greatest Conservation Need (SGCN) in all New England states, New York, Pennsylvania, New Jersey, Delaware, and Virginia. Blueback herring are additionally categorized as SGCN in South Carolina and Florida [outside of Region 5]. River Herring Conservation Plans have been released by NOAA Fisheries and the Atlantic States Marine Fisheries Commission (ASMFC) within the last decade. Threats to River Herring populations include exclusion or reduced access to historic freshwater spawning and nursery habitats, barriers with inadequate fish passage measures, freshwater and estuarine habitat/water quality degradation, climate change impacts, and indirect (bycatch) fishing pressure. In both the marine and freshwater environments, shifts in water temperature, related temporal/spatial shifts in environmental conditions, prey availability, and predators may be negatively influencing River Herring populations.

Conservation goals for River Herring are aligned with those established in the ASMFC Amendment 2 to the Interstate Fishery Management Plan for American Shad and River Herring (River Herring) (2009): "Protect, enhance, and restore East Coast migratory spawning stocks of alewife and blueback herring in order to achieve stock restoration and maintain sustainable levels of spawning stock biomass." Priority objectives include 1) preventing further declines in population abundance, 2) promoting improvements in degraded or historic habitat throughout the species range, 3) improving access to historic freshwater spawning and nursery habitat, and 4) increasing understanding of the influences of River Herring bycatch in commercial fisheries as well as updating the status of stock dynamics and health.

FARMLAND POLLINATORS (MONARCH, AMERICAN AND YELLOW-BANDED BUMBLEBEE, ASHTON'S, LEMON, AND VARIABLE CUCKOO BUMBLE BEE)

In the Northeast, native bumble bee species are experiencing habitat loss, climate related threats, and competition form non-native species. The USFWS has identified five bumble bee species (American bumble bee, yellow banded bumble bee, Ashton's cuckoo bumble bee, lemon cuckoo bumble bee, and variable cuckoo bumble bee) as well as Monarch butterfly as priority at-risk species in need of proactive conservation. These species, collectively referred to as "farmland pollinators" are in need of region-wide

habitat restoration and management. Additionally, little is known on the population status and distribution for many of these rare species. The USFWS provided funding to the Native Bee Inventory and Monitoring Lab for a multi-part project that includes surveys, floral resource research, public outreach, and developing a regional conservation strategy for bumble bees. Additional projects supported by the farmland pollinator team include bumble bee surveys on National Wildlife Refuges across the Region, native thistle seed collection and propagation, and continued support for the New England Pollinator Partnership.

FRESHWATER MUSSELS (BROOK FLOATER, CUMBERLAND MOCCASINSHELL, PHEASANTSHELL, TENNESSEE CLUBSHELL, TIDEWATER MUCKET, YELLOW LAMPMUSSEL)

Across the continent, freshwater mussels have experienced drastic declines. Over 74 % of the 298 species found in North America are in some state of imperilment, with 93 species federally listed as endangered or threatened (Williams et al. 2017). Habitat degradation, which includes water pollution and impoundments, is by far the leading cause of these declines. Non-native species also have outcompeted some of our native species. Freshwater mussels also provide ecological and economic benefits to people and aquatic ecosystems. Like oysters, they filter millions of gallons of water and act as ecosystem engineers. They're crucial to a multi-billion-dollar pearl jewelry industry, and harvest of mussels is a reserved treaty right for some Native American tribes. Without intervention, freshwater mussels will continue to disappear within their range, and with loss of valuable ecosystem services at risk.

Using adaptive management and working at landscape scales in partnership with states and Tribes, The ARS team aims to restore and conserve these at-risk species of mussels and proactively address threats so that the USFWS can avoid the need to list these species under the Endangered Species Act.

With input from partners, the ARS team has been building a conservation plan called the Northeast Region Conservation Strategy for Freshwater Mussels that provides a framework and strategies for conserving and restoring at-risk species of freshwater mussels and their habitats from Maine to Virginia and West Virginia. Ultimately, the ARS team wants to decide on feasible, cost-effective actions that Service programs can take with partner support over the next five years to increase representation, redundancy, and resiliency (3 Rs) of each species, and ensure their long-term viability. In 2022, the ARS team interviewed biologists from 12 States, the Partnership for Delaware Estuary, USGS, and representatives from the Penobscot Nation. The ARS team developed a suite of questions aimed at identifying priority areas and management and science needs for conservation of mussels. They are synthesizing the information from these interviews into priority area maps and tables, which will highlight areas for conducting surveys, habitat restoration, land protection, propagation and stocking, and

science needs. Discussions held in 2021 with the Rappahanock, the Chickahominy, and the Upper Mattaponi Indian Tribes are also informing priority areas for conservation of at-risk mussels and their host fish in the Northeast Region Conservation Strategy for Freshwater Mussels.

In 2022, the ARS team also identified priority science needs for mussels that were included in the request for proposals through the USGS. And the ARS team identified priority projects for BIL funding that would benefit at-risk mussels.

In 2023, the ARS team will complete interviews with Tribal partners to further identify priority areas for conducting conservation for mussels. They will distribute the strategy to State and Tribal partners and other Service offices for review, incorporate comments and edits, and complete the At-Risk Conservation Strategy. Also in 2023, the RAS team will work to build local action plans within target watershed and implement projects.

MOUNTAIN BUTTERFLIES (WHITE MOUNTAIN ARCTIC, WHITE MOUNTAIN FRITILLARY)

The White Mountain arctic (*Oeneis melissa semidea*) and the White Mountain fritillary (*Boloria chariclea monitus*) are endemic butterflies that were left isolated at the summit of Mt. Washington after the last glaciation period approximately 13,000 years ago. Their distribution is limited to a 2800-acre alpine zone of the Presidential Range at the White Mountain National Forest. Potential stressors include trampling of habitat and individuals from off-trail recreational use, lack of redundancy due to the species' limited range, and potential negative effects to both species and their habitat from climate change. We are partnering with New Hampshire Fish and Game (NHFG), the White Mountain National Forest, the Mount Washington Observatory (WMO), and the Appalachian Mountain Club to develop and produce a public awareness and education campaign to inform the public of the presence and predicament of these species and develop signage to mark sensitive areas. There are ongoing research projects with NHFG, WMO, the University of New Hampshire, and the Northeast Adaptation Science Center to collect life history and abundance information on these two butterfly species. To date, these studies have successfully identified host species critical to complete the White Mountain Fritillary's reproductive cycle. Captive rearing protocols have been developed and implemented at the WMO and at the NHFG captive rearing facility. Studies that will continue into 2023 include DNA analysis to assess population structure, collection of demographic data, evaluation of impacts of climate change, species distribution modeling, and overwintering experiments.

NORTHEAST TURTLES (BLANDINGS, SPOTTED, AND WOOD TURTLE)

Habitat fragmentation and degradation is the biggest threat to these three species that occur in the northeast region. Human development contributes to additional threats

such as road mortality, predation, and illegal collection. The At-Risk Turtle team is focused on working with the states to implement conservation plans that are informed by standardized monitoring and genetic analysis. All three species have conservation area networks (CAN) that identify focal area sites which are targeted for land protection, management opportunity sites which are targeted for restoration, and finally sites in need of surveys. Due to data sensitivity, the Service does not have spatial information for the CANs. The team is working with individual states on the following objectives: 1) securing viable populations through land conservation (using grant programs like Land and Water Conservation Fund, Delaware Bay, Chesapeake WILD, and America the Beautiful, and NRCS's Wetland Reserve Easement program); 2) enhancing populations through restoration of habitat (work on refuge lands, Department of Defense (DoD) lands, and working with NRCS on private lands); 3) decreasing road mortality in areas with high mortality rates (work on refuges and with individual states using Department of Transportion funds); 4) addressing illegal trade in turtles (continue to provide leadership on the Collaborative to Combat Illegal Trade in Turtles; support law enforcement by identifying housing for confiscated turtles, and helping the states get turtles back to the wild through genetic and disease screening; development of outreach tools and human dimensions work to help develop a long term strategy to address illegal trade in turtles; assess population status (continue surveys on refuges and DoD lands, and through projects with the Northwest Atlantic Fisheries Organization; continue to support states in developing Competitive State Wildlife Grant projects); assess population status (lead for Spotted and Wood Turtle Species Status Assessments and assisting with Blanding's Turtle); augment populations (work with the states to identify needs particularly for Blanding's Turtle); and raise awareness (continue to feature conservation work and addressing threats through Environmental Assessments).

1.4.2 BIRDS

- Joint Ventures[24]
- Atlantic Flyway Shorebird Initiative[25]
- United States Shorebird Conservation Plan[26]
- Atlantic Marine Bird Cooperative[27]
- North American Waterbird Conservation Plan[28]
- North American Waterfowl Management Plan[29]
- Partners in Flight[30]
- U.S. Fish and Wildlife Service Birds of Conservation Concern[31]
- Audubon Survival by Degrees: 389 Bird Species on the Brink list[32]
- SHARP: Saltmarsh Habitat & Avian Research Program[33]

1.4.3 FISHES, CRAYFISH, AND FRESHWATER MUSSELS

- American Fisheries Society[34]
- National Fish Habitat Partnership[35]
- Atlantic Coastal Fish Habitat Partnership[36]
- Eastern Brook Trout Joint Venture[37]
- Great Lakes Basin Fish Habitat Partnership[38]
- Atlantic States Marine Fisheries Commission[39]
- New England Fishery Management Council[40]
- Mid-Atlantic Fishery Management Council[41]
- NOAA Northeast Fisheries Science Center[42]
- NOAA Greater Atlantic Regional Fisheries Office[43]

1.4.4 NATURAL RESOURCES CONSERVATION SERVICE

- New England Pollinator Partnership[44]
- Working Lands for Wildlife Program[45]
- Other conservation program priority species[46]

1.4.5 U.S. FOREST SERVICE SENSITIVE SPECIES LISTS

- USFS 2020 State Forest Action Plans Multistate Priority Areas: Supporting Landscape Scale Conservation and Shared Stewardship Across the Northeast and Midwest[47]
- USFS: Landscape Scale Conservation Interactive Web Map[48]

1.4.6 XERCES SOCIETY FOR INVERTEBRATE CONSERVATION AT-RISK INVERTEBRATES LIST

- Xerces.org[49]

1.4.7 OPPORTUNITIES WITH OTHER AFWA REGIONS

The Northeast continues to lead the RSGCN effort nationally as it updates its list for the 4th revision in 2023. This effort allows the 14 states to prioritize through analysis, evaluation, and consensus of the best scientific data and expertise, and focus their efforts together at a landscape or watershed scale where many of these species and issues are more effectively addressed. This enables each state to see the important role it plays in the species/ overall conservation. Similarly, this concept when expanded to the species entire range, provides the opportunity for interregional coordination. Table 1.4.1

shows the number of shared RSGCN/Proposed RSGCN between AFWA regions and these overlaps represent opportunities for additional coordination. Just as the coordination of federally listed Threatened and Endangered species are afforded coordination through USFWS At-Risk and ESA recovery efforts, states and their partners can proactively work together to conserve these species across their ranges to preempt the need for federal listing. This is often most effectively accomplished at the multi-species landscape or watershed scale.

Table 1.4.1 Number of RSGCN and Proposed RSGCN Species listed by multiple AFWA regions.

AFWA Region	Number of Shared RSGCN and Proposed RSGCN Species
NEAFWA and SEAFWA	120
NEAFWA and MAFWA	64
NEAFWA, SEAFWA, and MAFWA	30

The advancements in the RSGCN method now offer NEAFWA additional coordination opportunities with other regions. The Watchlist Deferral category provides not only an effective way to deal with "peripheral species" at the state and regional level, but also provides opportunities to coordinate conservation of those species with neighboring regions for more holistic management across their range. Table 4.7.2 shows the number of Watchlist Deferral Species from the 2023 Northeast RSGCN update, indicating significant opportunities for collaboration and coordination for these species as each region continues to fulfill its role in the overall conservation of each species.

The Northeast deferred 56 species to the Southeast as a reflection of those species with more secure populations centered the Southeast that reach the northern extent of their range in the mid-Atlantic states (Virginia and West Virginia watersheds, Appalachian Mountains, or Atlantic coast). Almost 20 species were deferred to the Midwest region (MAFWA) reflecting species whose populations primarily occur in the Midwest but overlap with NEAFWA in the Ohio River drainage, Great Lakes, or eastern Midwest landscapes. In all, almost 100 species provide opportunities for coordinated interregional conservation that secures both the core and peripheral range of these species.

Table 1.4.2 Number of Watchlist [Deferral] species identified in the RSGCN list update to other AFWA regions.

Watchlist [Deferral] Region	Number of Species
SEAFWA	56
MAFWA	18

SEAFWA and MAFWA	15
Canada	2
Canada and WAFWA	3
MAFWA and WAFWA	1
Total	**95**

1.5 DISCUSSION

1.5.1 THE NORTHEAST PROCESS ADVANCEMENTS

The refinement of the RSGCN process created a more inclusive list of RSGCN and allowed for the addition of new categories to focus on conservation needs. RSGCN criteria were applied to all Northeast species (17,000+) within 20 taxonomic groups resulting in a more inclusive prescreening process. The process resulted in identifying taxa not currently listed as SGCN in a northeast SWAP, which were added to new "Proposed" categories. This is a valuable advancement to inform 14 Northeast states' upcoming 2025 SWAP SGCN selection. Improvement in the additional RSGCN criteria broadens the ability and purpose of the RSGCN list to include taxa that may not be ranked high on one status ranking system but does not slip through the cracks as criteria can pick it up on other ranking systems (federal, state, IUCN, and NatureServe ranks). The addition of the Watchlist categories provides an additional proactive focus for conservation efforts. It prioritizes data-deficient species, including the 25 endemic Northeast species for which experts express concern but lack data.

1.5.2 CHANGES TO THE RSGCN LIST SINCE 2018

Tracking conservation regionally is vital in meeting the goals of RSGCN and the charges of the NEFWDTC. Analyzing taxa conservation status and needs over time allows managers to focus conservation efforts and plan with an adaptive management capacity. While RSGCN numbers have increased over the previous iterations of the process, this is primarily due to more inclusive methods and additions of taxa groups. As a result, concern has decreased for some species, and future analysis and technical services can provide a dashboard and regional tracking systems to ensure the region's most effective and productive conservation and management.

For example, Bees and Lepidoptera were more data-deficient. Many species were moved to the Watchlist [Assessment Priority] for further assessment due to the region's lack of data and expertise. Previously in the 2018 revision, these taxa were added as RSGCN but noted as data deficient. The 2018 list included more species that had concerns with not as much information. The RSGCN Watchlist [Assessment Priority] was valued and used

by teams for consistent themes: taxonomic uncertainty, data deficiency, and variable patterns across the region needing more evaluation and assessment.

1.5.3 RSGCN DISCUSSION

Experts have vetted **382 RSGCN** across the Northeast, with an additional 37 Proposed RSGCN positioned to inform the 2025 SWAP revisions. More invertebrates are listed than vertebrates across all list categories, with almost twice as many invertebrate taxa groups than vertebrates. However, even with these differences, there is coherence across taxa and RSGCN status (including new Watchlist categories) in the numbers of species across Concern Levels and regional responsibilities. This is true even with the variability in expertise across taxon groups and the information available across all these species. Since this is the 4th iteration, the process has been refined, ensuring consistency, including increasing consistency between regions.

Variability in the available information and expertise limits the complete coverage for some taxa. For example, more expertise exists in each state fish and wildlife agency for vertebrates than invertebrates. This speaks to the need for additional invertebrate expertise and has informed the RCN 3 prioritization for an invertebrate coordinator and tiger beetle and stonefly assessment projects. It also speaks to the need for coordination with sister state agencies that regulate marine species, invertebrates, and plants.

1.5.4 RECOMMENDATIONS

Priorities moving forward include filling data gaps identified through gap analysis in the RSGCN database. Data gaps in the RSGCN database should be filled to analyze species conservation needs via habitat and threats while also searching for key life history information on data-deficient species.

Refining a method to track conservation changes over time within the RSGCN process with taxa expert confirmation will be important. The deferral categories also indicate the need for follow-up and coordination between the regions and their conservation priorities. Building an action tracker informed by changing conservation status, threats, and management could mobilize the region under an adaptive management framework while tracking the most effective conservation actions.
Additionally, it is vital to include partners like the Northeast Climate Adaptation Science Center to prioritize climate change threats and actions for build adaptive capacity for species resilience and working with the new invertebrate coordinator to bolster the information needed to conserve invertebrates regionally. Meanwhile, focusing on subgroups such as small mammals can ensure conservation uniformity within the taxon. All these conservation actions are tied to threats and habitats. Building the data, expertise, and tools needed to represent taxa groups more proportionately remains a priority.

There is a continuing need to develop web-enabled platforms for data access to the RSGCN list and supportive data. Collaboration with the forthcoming Competitive State Wildlife Grant (C-SWG) SWAP database and enhanced NEFWDTC website will provide better access to this information on regional priorities with portals for conservation actions to be documented and shared across state lines. Lastly, continued refinements and improvements to the RSGCN process and better communication of results and information are needed so that the Northeast remains a regional conservation leader. These needs reflect a lack of capacity of both funding and expertise for states to be ready for the proposed Restoring America's Wildlife Act (RAWA) and to address the full complement of fish and wildlife diversity in the Northeast.

1.6 REFERENCES

Baldock, K. C. 2020. Opportunities and threats for pollinator conservation in global towns and cities. *Current Opinion In Insect Science*, 38, 63-71.

Böhm, M., N. I. Dewhurst-Richman, M. Seddon, S. E. H. Ledger, C. Albrecht, D. Allen, A. E. Bogan, J. Cordeiro, K. S. Cummings, A. Cuttelod, G. Darrigran, W. Darwall, Z. Feher, C. Gibson,D. L. Graf,F. Köhler, M. Lopes-Lima, G. Pastorino, K. E.Perez, and B. Collen. 2021. The conservation status of the world's fresh-water molluscs. *Hydrobiologia*, 848(12–13), 3231–3254.

Brain, R. A., and R. S. Prosser. 2022. Human induced fish declines in North America, how do agricultural pesticides compare to other drivers?. *Environmental Science and Pollution Research*, *29*(44), 66010-66040.

Cox, N., B. E. Young, P. Bowles, M. Fernandez, J. Marin, G. Rapacciuolo, ... and Y. Xie. 2022. A global reptile assessment highlights shared conservation needs of tetrapods. *Nature*, *605*(7909), 285-290.

Crandall, K. A., and J. E. Buhay. 2008. Global diversity of crayfish (Astacidae, Cambaridae, and Parastacidae—Decapoda) in freshwater. *Freshwater Animal Diversity Assessment*, 295-301.

Delaune, K. D., D. Nesich, J. M. Goos, R. A. Relyea. 2021. Impacts of salinization on aquatic communities: Abrupt vs. gradual exposures. *Environmental Pollution*, 85, 117636.

Duda, E., D. Feller, S. L. Brosi, K. Pearce, R. Brown, L. Smith, and T., Serfass. 2015. Twenty-five years of variation in acorn mast production on Allegheny woodrat populations in western Maryland. U.S. Report submitted for Regional Conservation Needs grant RCN.

Fallon, C. E., A. C. Walker, S. Lewis, J. Cicero, L. Faust, C. M. Heckscher,... and S. Jepsen. 2021. Evaluating firefly extinction risk: Initial red list assessments for North America. *PloS one*, 16(11), e0259379.

Fallon, C. E., E. Blevins, M. Blackburn, T. B. Cotten, and D. W. Stinson.2022. New distributional data for the northern forestfly, Lednia borealis Baumann and Kondratieff, 2010 (Plecoptera: Nemouridae), in Washington, USA. *Western North American Naturalist*, 82(2), 234-244.

Field, C. R., T. S. Bayard, C. Gjerdrum, J. M. Hill, S. Meiman, and C. S. Elphick. 2017. High-resolution tide projections reveal extinction threshold in response to sea-level rise. *Global Change Biology*, *23*(5), 2058-2070.

Fredericksen, T. S., B. D. Ross, W. Hoffman, E. Ross, M. L. Morrison, J. Beyea, M. B. Lester, and B. N. Johnson. 2000. The impact of logging on wildlife: A study in northeastern Pennsylvania. *Journal of Forestry*, 98(4), 4-10.

Gilbart, Meghan. 2012. Under Cover: Wildlife of Shrublands and Young Forest. Wildlife Management Institute. Cabot VT. 87 pages.

Glon, M. G., M. B. Broe, K. A. Crandall, M. Daly, S. Kong, R. F. Thoma, and J. V. Freudenstein. 2022. Anchored hybrid enrichment resolves the phylogeny of Lacunicambarus Hobbs, 1969 (Decapoda: Astacidea: Cambaridae). *Journal of Crustacean Biology* 42(1):ruab073.

Haag, W. R. 2019. Reassessing enigmatic mussel declines in the United States. *Freshwater Mollusk Biology and Conservation*, 22(2), 43–60

Haag, W. R., J. J. Culp, M. A. McGregor, R. Bringolf, and J. A. Stoeckel. 2019. Growth and survival of juvenile freshwater mussels in streams:mplications for understanding enigmatic mussel declines. *Freshwater Science*, 38(4), 753– 770.

Hartley, M. J. and A. J. Weldon. 2020. Saltmarsh Sparrow Conservation Plan. Atlantic Coast Joint Venture, acjv. org/documents/SALS_plan_final. pdf.

Littlefield, C. E. and A. W. D'Amato. 2022. Identifying trade-offs and opportunities for forest carbon and wildlife using a climate change adaptation lens. *Conservation Science and Practice*, *4*(4), e12631.

Lomonico, S., M. G. Gleason, J. R. Wilson, D. Bradley, K. Kauer, R. J. Bell, and T. Dempsey. 2021. Opportunities for fishery partnerships to advance climate-ready fisheries science and management. *Marine Policy*, *123*, 104252.

Macneil, J., B. Macgowan, A. Currylow, and R. Williams. 2013. Forest Management for Reptiles and Amphibians: A Technical Guide for the Midwest.

Mawdsley, J. R. and M. Humpert. 2016. Revised State Wildlife Action Plans Offer New Opportunities for Pollinator Conservation in the USA. Natural Areas Journal 36(4), 453-457.

Mawdsley, J. R. and K. Stoner. 2016. Urban Pollinator Conservation in the U.S. State Wildlife Action Plans. Transactions of the 80th North American Wildlife and Natural Resources Conference, p. 153.

Milam, J. 2018. Habitat for pollinators: improving management of regionally significant xeric grasslands, barrens, and woodlands in the northeast. Summary Report. The Northeast Association of Fish and Wildlife U.S. Fish and Wildlife Service.

Miranda, R., I. Miqueleiz, W. Darwall, C. Sayer, N. K. Dulvy, K. E. Carpenter, B. Polidoro, N. Dewhurst-Richman, C. Pollock, C. Hilton-Taylor, R. Freeman, B. Collen, and M. Böhm. 2022. Monitoring extinction risk and threats of the world's fishes based on the Sampled Red List Index. *Reviews in Fish Biology and Fisheries*, *32*(3), 975-991.

North American Bird Conservation Initiative (NABCI). 2022. The State of the Birds, United States of America, 2022. StateoftheBirds.org

Owens, A. C. and S. M. Lewis. 2022a. Artificial light impacts the mate success of female fireflies. *Royal Society Open Science*, 9(8), 220468.

Owens, A., M. Van den Broeck, R. De Cock, and S. M. Lewis. 2022b. Behavioral responses of bioluminescent fireflies to artificial light at night. *Frontiers in ecology and evolution*.-2013, currens, 10, 1-16.

Pearce, K.J., D. J. Feller, T. L. Serfass, and S. L. Brosi. 2015. Population estimates of the Allegheny woodrat (*Neotoma magister*) in Maryland based on long-term capture-recapture data. Report submitted for Regional Conservation Needs grant RCN.

Rice, T. M., E. Crisfield, and K. Terwilliger. 2019. Regional Species of Greatest Conservation Need in the Southeastern United States. Wildlife Diversity Committee, Southeast Association of Fish and Wildlife Agencies. 138 p.

Richman, N. I., M. Böhm, S. B. Adams, F. Alvarez, E. A. Bergey, J. J. Bunn,... & B. Collen. 2015. Multiple drivers of decline in the global status of freshwater crayfish (Decapoda: Astacidea). *Philosophical Transactions of the Royal Society B: Biological Sciences*, 370(1662), 20140060.

Schlesinger, M.D., J.A. Feinberg, N.H. Nazdrowicz, J.D. Kleopfer, J. Beane, J.F. Bunnell, J. Burger, E. Corey, K. Gipe, J.W. Jaycox, E. Kiviat, J. Kubel, D. Quinn,

C. Raithel, S. Wenner, E.L. White, B. Zarate, and H.B. Shaffer. 2017. Distribution, identification, landscape setting, and conservation of *Rana kauffeldi* in the northeastern U.S. Report to the Wildlife Management Institute for Regional Conservation Needs grant RCN 2013-03. Available from New York Natural Heritage Program, Albany, NY.

Taylor, C.A., G.A. Schuster, J.E. Cooper, R.J. DiStefano, A.G. Eversole, P. Hamr, H.H. Hobbs III, H.W. Robison, C.E. Skelton, and R.F. Thoma. 2007. A reassessment of the conservation status of crayfishes of the United States and Canada after 10+ years of increased awareness. *Fisheries,* 32(8):371-389.

Terrell, K., A. McMillan, R. Foster, E. Chapman, E. Thompson, D. Feller, A. Adams, J. Greathouse, and J. Kelopfer. 2016. Developing Coordinated research for Hellbender Conservation in the Northeast Region. Final Report. U.S. Report to the Wildlife Management Institute for Regional Conservation Needs grant RCN (2013-1).

Terwilliger Consulting Inc. (TCI) and Northeast Fish and Wildlife Diversity Technical Committee (NEFWDTC). 2013. Taking Action Together: Northeast Regional Synthesis for State Wildlife Action Plans. A report submitted to the Northeast Fish and Wildlife Diversity Committee. Locustville, VA. 194.

TCI and NEFWDTC. 2013 RSGCN list. Unpublished.

TCI and NEFWDTC. 2018 RSGCN list Unpublished.

Terwilliger, K., T. M. Rice, D. Drummey, and E. Crisfield. 2021. Regional Species of Greatest Conservation Need in the Midwestern United States. Prepared under a US Fish and Wildlife Service contract in cooperation with the Midwest Association of Fish and Wildlife Agencies and the Midwest Landscape Initiative by Terwilliger Consulting, Inc., Locustville, VA. 476 p.

TCI and NEFWDTC. 2023. Northeast Regional Species of Greatest Conservation Need (RSGCN) Database, version 1.0. Available at: <www.northeastwildlifediversity.org>.

Therres, G. D. 1999. Wildlife Species Of Regional Conservation Concern in the Northeastern United States. *Northeast Wildlife*, 54, 93-100.

Thorstad, E. B., D. Bliss, C. Breau, K. Damon-Randall, L. E. Sundt-Hansen, E. M. Hatfield, G. Horsburgh, H. Hansen, N. O. Maoileidigh, T. Sheehan, and S. G.

Sutton. 2021. Atlantic salmon in a rapidly changing environment—Facing the challenges of reduced marine survival and climate change. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *31*(9), 2654-2665.

U.S. Fish and Wildlife Service. 2018. Species status assessment report for the Eastern Hellbender (Cryptobranchus alleganiensis alleganiensis). 104 p.

U.S. Fish and Wildlife Service and National Marine Fisheries Service. 2018. Recovery plan for the Gulf of Maine Distinct Population Segment of Atlantic salmon (*Salmo salar*). 74 p.

U.S. Fish and Wildlife Service. 2021. Draft recovery plan for the rufa red knot (*Calidris canutus rufa*). U.S. Fish and Wildlife Service, North Atlantic-Appalachian Region, Hadley, Massachusetts. 21 pages.

Watts, B. D. 2016. Status and distribution of the eastern black rail along the Atlantic and Gulf Coasts of North America. The Center for Conservation Biology Technical Report Series, CCBTR-16-09. College of William and Mary/Virginia Commonwealth University, Williamsburg, VA. 148 p.

Waldman, J. R. andT. P., Quinn. 2022. North American diadromous fishes: Drivers of decline and potential for recovery in the Anthropocene. *Science Advances*, 8(4), eabl5486.

Williams, J. D., A. E. Bogan, R. S. Butler, K. S. Cummings, J. T. Garner, J. L. Harris, N. A. Johnson, and G. T. Watters. 2017. A revised list of the freshwater mussels (Mollusca: Bivalvia: Unionida) of the United States and Canada. Freshwater Mollusk Biology and Conservation 20:33-58.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18(9): 6-22.

1.7 ENDNOTES

Many online resources are available for learning about the topics in this chapter. However, URLs are not permanent resources; pathways may be changed or removed over time. These endnotes were all accessed in January and February of 2023 and were active at that point in time.

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[1] Northeast Fish and Wildlife Diversity, https://www.northeastwildlifediversity.org/.
[2] Northeast Partners in Amphibian and Reptile Conservation, http://northeastparc.org/.
[3] TWMP – The Woodcock Management Plan, https://timberdoodle.org/.
[4] NECASC – Northeast Climate Adaptation Center, https://necasc.umass.edu/.
[5] NOAA, www.fisheries.noaa.gov.
[6] Diadromous Fish Research Network, https://umaine.edu/mitchellcenter/diadromous-species-restoration-research-network/.
[7] Fish Habitat Partnership, http://fishhabitat.org/partnership/atlantic-coastal-fish-habitat-partnership.
[8] Action Bioscience, http://www.actionbioscience.org/biodiversity/walsh.html.
[9] Northeast Turtles, https://www.northeastturtles.org/.
[10] NRCS Turtles, https://www.nrcs.usda.gov/programs-initiatives/working-lands-for-wildlife/northeast-turtles.
[11] NatureServe, https://www.natureserve.org/.
[12] SGCN Invertebrates, https://www.invertebratezoology.org/SGCNInverts/.
[13] Pollinator Network, https://cals.cornell.edu/pollinator-network.
[14] Xerces, http://www.xerces.org/pollinator-conservation/.
[15] The Heinz Center, http://www.heinzctr.org/content/pollinators.
[16] GMRI, https://investigate.gmri.org/project/vernal_pool_macroinvertebrates/.
[17] Vermont Vernal Pool Project, https://vtecostudies.org/.
[18] Firefly Watch, https://www.massaudubon.org/get-involved/community-science/firefly-watch.
[19] Virginia Tech Mollusk Center, http://fishwild.vt.edu/mussel/.
[20] White Sulphur Springs National Fish Hatchery, http://www.fws.gov/northeast/wssnfh/index.html.
[21] Butterflies and Moths of N.A., http://www.butterfliesandmoths.org/.
[22] NH Audubon, https://www.nhaudubon.org/conservation/dragonflies-and-damselflies/.
[23] Carnegie Natural History Museum, https://www.carnegiemnh.org/science/mollusks/.
[24] USFWS, Migratory Bird Joint Ventures, https://www.fws.gov/partner/migratory-bird-joint-ventures
[25] Atlantic Flyway Shorebird Initiative, https://atlanticflywayshorebirds.org/
[26] Shore Bird Plan, https://www.shorebirdplan.org/
[27] Atlantic Marine Bird Cooperative, https://atlanticmarinebirds.org/
[28] USFWS, https://www.fws.gov/partner/north-american-waterbird-conservation-plan
[29] North America Waterfowl Management Plan, https://nawmp.org/
[30] Partners in Flight, https://partnersinflight.org/
[31] USFWS, https://www.fws.gov/sites/default/files/documents/birds-of-conservation-concern-2021.pdf
[32] Audubon, https://www.audubon.org/climate/survivalbydegrees
[33] Saltmarsh Habitat and Avian Research Program (SHARP), https://www.tidalmarshbirds.org/
[34] American Fisheries Society, https://fisheries.org/
[35] National Fish Habitat Partnership, https://www.fishhabitat.org/
[36] Atlantic Coastal Fish Habitat Partnership, https://www.atlanticfishhabitat.org/
[37] Eastern Brook Trout Joint Venture, https://easternbrooktrout.org/
[38] Great Lakes Basin Fish Habitat Partnership, https://www.fishhabitat.org/the-partnerships/great-lakes-basin-fish-habitat-partnership

[39] Atlantic States Marine Fisheries Commission, http://asmfc.org/
[40] New England Fishery Management Council, https://www.nefmc.org/
[41] Mid-Atlantic Fishery Management Council, https://www.mafmc.org/
[42] NOAA – Northeast Fisheries Science Center, https://www.fisheries.noaa.gov/about/northeast-fisheries-science-center
[43] NOAA – Greater Atlantic Regional Fisheries Office, https://www.fisheries.noaa.gov/about/greater-atlantic-regional-fisheries-office
[44] New England Pollinator Partnership, https://www.pollinator.org/
[45] NRCS – Working Lands for Wildlife Program, https://www.nrcs.usda.gov/programs-initiatives/working-lands-for-wildlife
[46] NRCS, https://www.nrcs.usda.gov/programs-initiatives/working-lands-for-wildlife
[47] USDA, https://www.fs.usda.gov/detail/r9/communityforests/?cid=fseprd1000829
[48] USFS – Landscape-Scale Conservation Interactive Web Map: https://usfs.maps.arcgis.com/apps/webappviewer/index.html?id=d96a1fbb9ccd4d26a3fd2971fa9dd92f
[49] Xerces Society for Invertebrate Conservation, https://xerces.org/