ELEMENT 3

Threats to Species of Greatest Conservation Need and Their Habitats

Maine's 2025 State Wildlife Action Plan

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Key to Acronyms

IUCN	International Union for the Conservation of Nature
MDIFW	Maine Department of Inland Fisheries and Wildlife
MDMR	Maine Department of Marine Resources
MNAP	Maine Natural Areas Program
MDOT	Maine Department of Transportation
SGCN	Species of Greatest Conservation Need

Prepared by Maine Department of Inland Fisheries and Wildlife in Collaboration with Maine Departments of Agriculture, Conservation, and Forestry and Marine Resources, and Key Conservation Partners

Element 3: Threats Affecting SGCN and Their Habitats

3.0 Abstract

Maine's State Wildlife Action Plan uses a coarse filter – fine filter approach to conservation ensuring that, where possible, individual conservation initiatives benefit multiple species, while also acknowledging that some species require individualized attention. We assigned threats to both habitats and to SGCN, to clearly identify the issues that should be addressed at each level in the conservation hierarchy. As with most other states in the Northeast, we assigned threats using the International Union for the Conservation of Nature (IUCN) Conservation Measures Partnership Threat Classification Scheme. While the IUCN scheme is useful for categorizing threats to SGCN and their habitats, we found that the scheme lacks the resolution to clearly identify the specific issues that should be considered for conservation attention. Therefore, when assigning threats we chose to adopt the primary (level 1) and secondary (level 2) IUCN categories but replaced the tertiary category with a detailed narrative that fully describes the issue and its impact on the species or habitat being considered. In addition, we adapted The Northeast Lexicon's - Threat Characteristics and Categorical Ratings, to identify characteristics for each threat assignment (Crisfield et al. 2013).

We assigned threats to Priority 1 and 2 SGCN and assigned Severity and Actionability characteristics for each threat – SGCN interaction. We implicitly considered the concepts of Likelihood, Certainty and Spatial Extent, and assigned only those threats that were determined to have a moderate or high impact for each of these characteristics. In addition, we prioritized threats with moderate or high Severity assigned to SGCN. We developed a simple matrix to prioritize SGCN threats, using the combination of the impact scores for Severity and Actionability. We identified threats for terrestrial and freshwater aquatic habitats using a combination of Anderson et al. (2013) as our primary reference, and expert opinion. Because no single comprehensive source is available that describes the state of marine habitats along Maine's coast, we used a wide variety of scientific publications, as well as expert knowledge of agency staff and partners, to compile information on threats. We assumed that the habitat systems within each terrestrial and marine macrogroup all faced similar conservation problems; therefore, we assigned threats to each macrogroup but did not identify threats separately for each habitat system. Except for some freshwater aquatic habitats (Lentic and Lotic), Vernal Pools, and Coastal Islands, where we identified threats for the habitat system. Unlike our approach for SGCN, we assigned all seven threat characteristics to each habitat – threat combination.

We assigned 49 unique threat categories to 458 Priority 1 and 2 SGCN species, for a total of 3,218 SGCN – threat combinations, and 30 unique threat categories to 28 habitat macrogroups, for a total of 704 habitat – threat combinations. Climate change, new development - including existing and new Roads and Railroads and Housing and Urban Areas, and Invasive Non-native-Alien Species-Diseases, impacted the largest number of habitats.

3.1 Introduction

In previous elements, we summarized what we know about the abundance and distribution of Maine's flora and fauna, described how we selected SGCN, and described how we identified and characterized Maine's key habitats. In this element, we outline how we integrated this with information on threats facing SGCN and their habitats.

The threats that impact SGCN are often multi-faceted, with a variety of ultimate and proximate causes that lead to negative impacts on a species' habitat, behavior, or health. In some cases, issues that have negative impacts for some species, such as a particular type of agriculture, may be highly beneficial to other species. Therefore, the factors that impact SGCN must be considered thoughtfully, with recognition that measures designed to resolve problems faced by one species may have negative implications for others. This is especially important in Maine, where much of the state is privately owned and managed for forestry or agricultural products; invariably these activities are less impactful on SGCN than alternate land uses, such as commercial development. Nonetheless, identifying problems for SGCN and their habitats is a fundamental step towards developing meaningful conservation actions that will have the greatest benefit for the full suite of SGCN present in Maine.

3.1.1 Significant Differences from Maine's 2015 Plan

In the 2015 Plan, Maine Department of Inland Fisheries and Wildlife (MDIFW) implemented the IUCN Conservation Measures Partnership Threats classification scheme. This scheme was similarly adopted throughout the Northeast and enabled consistent use of threats language between neighboring states. In 2025 we implemented updates to IUCN threats classification scheme consistent with The Northeast Lexicon (Crisfield et al. 2022). However, we opted to retain our 2015 approach when assigning Threats Characteristics (Table 3 - 2) described in the previous version of The Northeast Lexicon (Crisfield et al. 2013).

We used the same 2015 approach when assigning threats to SGCN and habitats. Specifically, we focused assigning threats to Priority 1 and Priority 2 SGCN, and largely did not assign threats to Priority 3 SGCN due to their relatively larger abundance or presumed more secure status on the landscape. The 2025 Plan identifies the most impactful threats to SGCN, with recognition that additional threats exist, but were either poorly understood or were ranked as low priority.

3.1.2 Assigning Threats – General Considerations

"Although Maine's Plan is ultimately intended to benefit SGCN, our plan focuses much attention on the habitats used by these species. This coarse filter – fine filter approach to conservation ensures that, where possible, individual conservation initiatives benefit multiple species, while also acknowledging that some species require individualized attention."

Although Maine's Plan is ultimately intended to benefit SGCN, our plan focuses much attention on the habitats used by these species. This coarse filter – fine filter approach to conservation ensures that, where possible, individual conservation initiatives benefit multiple species, while also acknowledging that some species require individualized attention. In keeping with this approach, we assigned threats to both habitats and to SGCN, which clearly identifies specific issues that should be addressed at each level in the conservation hierarchy. We assumed that the threats identified for habitats would apply to the SGCN that use those habitats, reducing or eliminating the need to assign these same threats to individual SGCN. To advance our goal of developing a highly prioritized, streamlined Plan, we used a strategic approach to identify threats to SGCN that are currently having, or in the near future are likely to have, a significant impact on high priority SGCN (see section 3.1.4 for further detail).

The 2025 Plan update largely mirrors the approach used during the 2015 revision. In 2015, we focused efforts on identifying threats specific to SGCN and their habitats, by consulting international, national, regional, and state

plans and initiatives, including Maine's 2005 Comprehensive Wildlife Conservation Strategy (MDIFW 2005). We also consulted scientific literature and state surveys, particularly for marine species, which were not fully included in Maine's 2005 Plan, and for plants, which were fully integrated into the 2025 Plan. Our knowledge of threats was also supplemented from our comprehensive species planning process (MDIFW 2005 and MDIFW 2015). As part of the planning process, we developed species assessments for individual species or groups of species, which required species experts to associate threats to species and their habitats. We relied on species experts within MDIFW, Maine Natural Areas Program (MNAP), and the Maine Department of Marine Resources (MDMR), who have years of experience and knowledge within their respective work programs. In general, we requested species experts review and update the list of SGCN threats identified in the 2015 Plan. Habitat threats from the 2015 Plan were similarly reviewed and updated, however recommendations were colligated through habitat focused work groups, in which expert opinion was largely solicited from the Maine Conservation Community, rather than agency staff. These parallel efforts for SGCN and habitats resulted in a revised and updated list of 2025 threats, which provided the foundational information in this chapter. Additional sources used to compile threats information can be reviewed in the Literature Cited and Reference Section at the end of this chapter.

Although we sought to identify the major, known threats to each SGCN and habitat, we know that there may be threats that we did not list. Also, our knowledge of some species is very limited, and consequently we may not clearly understand the threats they face.

3.1.3 Threat Classification and Characteristics

We identified threats using the IUCN Conservation Measures Partnership's Threat Classification Scheme (Scheme), similar to most other states in the Northeast. The IUCN developed this classification scheme to provide conservationists with consistent terminology to describe the "proximate human activities or processes that have impacted, are impacting, or may impact the status of the taxon being assessed" (IUCN 2015). The categories are customizable and may be expanded at each level in the hierarchy if necessary to adequately describe the impact being assessed. We modified the threats classification scheme, with input from the 2022 Northeast Lexicon, for the threats used in Maine's Plan (Crisfield et al. 2022). The modified IUCN classification scheme is hierarchical and includes 12 primary (Level 1) threat categories, 51 secondary (Level 2) categories, and 171 tertiary (Level 3) categories. Although some categories are not applicable to Maine (e.g. Volcanoes), our assessment of the IUCN hierarchy determined that the classification scheme included most factors that negatively impact SGCN in our state. Most threats are recognized as having potentially negative and positive impacts on different wildlife species. Table 3 - 1 contains a list of the IUCN Level 2 threat categories that were determined to negatively impact SGCN and their habitats in Maine, a brief description of those threats, and where applicable, examples of positive impacts that the threat may have for other wildlife.

While the IUCN scheme is useful for categorizing threats to SGCN and their habitats, its use enables multi-state summaries of threats information across the Northeast region, we found that the system lacks the resolution to clearly identify the specific issues that should be considered for conservation attention. Therefore, when assigning threats, we chose to adopt the primary and secondary IUCN categories (e.g., the first and second levels of the hierarchy), but replaced the tertiary category with a detailed narrative that describes the threat and its impact on the species or habitat being considered. This approach provided more detailed information on the threat than the IUCN scheme allows, which we ultimately found important when considering whether threats should be

addressed with conservation actions. In addition, it should be noted that for some threat categories, particularly those associated with natural resource use (e.g., aquaculture, wood harvesting, and fishing), it is not the presence of the activity itself that necessarily causes a threat, but rather the way in which it is practiced. Although we use the standard IUCN terminology to describe these threats, the narrative for each SGCN or habitat threat contains more detail on the actual practice being considered.

Table 3 - 1 Hierarchical threats classification structure assigned to Maine's wildlife, plants, and habitats. The threats nomenclature, descriptions, and examples of positive impacts on wildlife are based on the International Union for Conservation of Nature (IUCN) Conservation Measures Partnership threat classification system and The 2022 Northeast Lexicon (Crisfield et al. 2022).

IUCN Threat Category	Description	Example of Positive Impact on Wildlife
Residential and Commercial Development		
Housing and Urban Areas	Human cities, towns, and settlements including non-housing development typically integrated with housing	Some species are adept at utilizing human-food sources and habitats provided in residential areas
Commercial and Industrial Areas	Related to or integrated with commercial or industrial structures	Large commercial buildings may provide nesting habitat for some species (e.g., Peregrine Falcons)
Tourism and Recreational Areas	Tourist sites and recreation facilities with a significant ecological footprint	These areas often enhance the public's perceptions of wildlife and the outdoors, which is important to build support for conservation
Agriculture and Aquaculture		
Annual and Perennial Non-timber Crops	Crops planted for food, fodder, fiber, fuel, or other uses	Provides forage for a wide variety of wildlife species
Wood and Pulp Plantations	Wood plantations that produce timber, fibre or other non-timber products made from trees	
Livestock Farming and Ranching	Farming of various domestic (e.g., cows, pigs, chickens, etc.) or semi-domesticated animals (e.g., alpacas, etc.); also livestock reared and supported by natural habitats (pastures)	Maintains grassland habitat required by many wildlife species
Marine and Freshwater Aquaculture	Aquaculture that is conducted in facilities (i.e., finfish aquaculture in the ocean, in tanks, in pens, along the shoreline, etc.); also hatchery fish allowed to roam in the wild	Reduces reliance on wild-caught fish for human consumption
Energy Production and Mining		
Oil and Gas Drilling	Exploring for, developing, and producing petroleum and other liquid hydrocarbons	

IUCN Threat Category	Description	Example of Positive Impact on Wildlife
Mining and Quarrying	Exploring for, developing, and producing minerals, rocks and various other substrates (e.g., sand, gravel, etc.)	
Renewable Energy	Exploring and developing infrastructure for and producing renewable energy	Reduces reliance on non-renewable energy sources
Transportation and Service Corridors		
Roads and Railroads	Development, maintenance and presence of the surface transportation network	Maintained shoulders can provide habitat for SGCN invertebrates and other SGCN.
Utility and Service Lines	Linear networks for transporting energy and various resources, including their rights-of-way	Provides early successional habitat important for some wildlife (e.g., New England Cottontail)
Shipping Lanes	Transportation of people and goods on water (i.e., oceans, estuaries, rivers, etc.), as well as waterway development	
Flight Paths	Using air space to transport people and goods	
Biological Resource Use		
Hunting and Collecting Terrestrial Animals	Hunting animal species or collecting animal products for commercial, recreational, subsistence, cultural, research study or control purposes; includes accidental mortality/bycatch	Important wildlife management tool to help prevent overabundant wildlife populations
Gathering Terrestrial Plants	Harvesting and gathering wild plants, mushrooms or other non-animal/non-timber species for commercial, recreational, subsistence, cultural, research or control purpose	Can increase society's connection with wildlife, often leading to increased support for conservation
Logging and Wood Harvesting	Harvesting trees/other forest species in natural environments for timber, fibre, or fuel outside of plantations	Provides wildlife habitat for many species by altering forest structure and composition
Fishing and Harvesting of Aquatic Resources	Harvesting aquatic species (wild plants and animals) for commercial, recreational, subsistence, cultural, research or control/scaring purposes; includes accidental mortality/bycatch	Can increase society's connection with wildlife, often leading to increased support for conservation
Human Intrusions and Disturbance		
Recreational Activities	Activities with generally low ecological impact that are conducted in natural areas for recreational purposes away from road networks	Improves society's connection with wildlife, often leading to increased support for conservation

IUCN Threat Category	Description	Example of Positive Impact on Wildlife
War, Civil Unrest and Military Exercises	Military and paramilitary activities that do not have a permanent ecological footprint	
Work and Other Activities	Activities carried out in natural areas (undeveloped areas) for purposes other than recreational or military activities	
Natural System Modifications		
Fire and Fire Suppression	Suppression or increase in fire frequency, severity or scope, changes in the natural fire regime that are directly related to human activity	Fire (both natural and prescribed) can enhance some wildlife habitats and is required for regeneration in some forest types
Dams and Water Management/Use	Facilities or activities that alter the natural water regime (flow or water levels)	Can be used to enhance habitat for fish and wildlife species (e.g., waterfowl)
Other Ecosystem Modifications	Other activities that contribute to habitat alteration or loss by redeveloping natural systems to improve human welfare	
Removing/Reducing Human Maintenance	Changes to human input into natural systems (e.g., vegetation, hydrology, human disturbance, or predator control, or ceasing other management activities)	
Invasive and Other Problematic Species, Genes and Diseases		
Invasive Non-native/Alien Species/Diseases	Harmful plants and animals that were not originally present within an ecosystem, but were directly or indirectly introduced into or spread in the ecosystem as a result of human activities	
Problematic Native Species/Diseases	Plants and animals that were originally present in ecosystem(s), but whose populations have increased to a level where they are now overabundant as a direct or indirect result of certain human activities	
Introduced Genetic Material	Human modified or altered organisms/genes that pose a threat to biodiversity in natural environments by competing with wild populations or hybridizing with them and altering their gene pool	

IUCN Threat Category	Description	Example of Positive Impact on Wildlife
Problematic Species/Diseases of Unknown Origin	Harmful plants, animals, or pathogens and other microbes of unknown origin.	
Intrinsic Biological Limitations	Limitation due to either loss of genetic diversity or due to another species decline (e.g., host animal or plant, specialized forage, etc.)	
Pollution		
Domestic and Urban Waste Water	Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	
Industrial and Military Effluents	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries	
Agricultural and Forestry Effluents	Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities	
Garbage and Solid Waste	Garbage and solid waste, including materials that can intoxicate or entangle plants and animals (e.g., strangulation/asphyxiation from plastic bags, elastic materials, ropes, etc.)	
Air-Bourne Pollutants	Air contaminant emissions from a point or non-point source	
Excess Energy	Inputs of heat, sound or light that disturb wildlife or ecosystems	
Climate Change and Severe Weather		
Habitat Shifting or Alteration	Major changes in habitat composition or location	Changing habitat composition will benefit species that utilize the new habitat type
Changes in Geochemical Regimes	Large-scale changes in an ecosystem's physico-chemical makeup	
Changes in Temperature Regimes	Periods in which temperatures of the air, water or soil either exceed or fall below the normal range of variation	
Changes in Precipitation & Hydrological Regimes	Periods in which the amount and frequency of precipitation either exceeds or falls below the normal range of variation	

IUCN Threat Category	Description	Example of Positive Impact on Wildlife
Storms and Severe Weather	Strong winds and extreme weather events or a major change/shift in the storm season	Wind events can result in the creation of early successional habitats, benefiting some wildlife species
Other Options		
Other Threats	Unlisted or undescribed threat; category is intended for intrinsically unique or newly emergent threats	
Resource Needs	Additional allocation of personnel, equipment, or other materials is required	
Education & Outreach	Lack of knowledge or awareness	
Administrative Needs	Additional tasks or systems are necessary	
State Specific Issues	Threats unique to Maine	
Unknown	Investigations to date have been unable to describe or categorize the specific threat	
Lack of Knowledge	Additional information is necessary to describe and categorize the specific threat	

In addition to identifying threats using a modified version of the IUCN scheme, we adapted The Northeast Lexicon's - Threat Characteristics and Categorical Ratings, to identify characteristics for each threat assignment (Crisfield et al. 2013). Table 3 - 2 presents seven Threat Characteristics that biologists used to describe the specific nature of a particular threat: Severity, Actionability, Reversibility, Immediacy, Spatial Extent, Certainty, and Likelihood. Each characteristic can be identified as having a low, moderate, or high level of impact.

Table 3 - 2 Characteristics and rankings used to summarize threats associated to both Species of Greatest Conservation Need (SGCN) and Habitats. The 'severity' and 'actionability' threat characteristics were used to calculate prioritization ranks for threats (Figure 3-1). Table adapted from Crisfield et al. 2013.

Threat Characteristic	Low Impact	Moderate Impact	High Impact
Severity	**Slight Severity**: Degree of ecological change is minor	**Moderate Severity:** Degree of ecological change is substantial	**Severe:** Degree of ecological change is major
Actionability (Consider the likelihood of implementing conservation actions to begin reducing the impact of the threat within the next 10 years)	**Actionable with Difficulty:** Impacts of a threat can only be minimally reversed, prevented, or mitigated, and cost or logistics make solutions difficult to implement	**Moderately Actionable:** Impacts of a threat can be reversed, prevented, or mitigated, however solutions are only partially effective or may be difficult to implement	**Highly Actionable:** Impacts of the threat can be reversed, prevented, or mitigated with proven strategies, at relatively low costs and with few logistical difficulties

Threat Characteristic	Low Impact	Moderate Impact	High Impact
Reversibility (Consider the likelihood of reversing the impacts within 10 years)	**Reversible:** Effects of the threat can be reversed by proven actions	**Reversible with difficulty:** Effects of the threat may be reversed but costs or logistics make action impractical	**Irreversible:** Effects of the threat are irreversible
Immediacy (This characteristic assesses the time scale over which impacts of the threat will be observable)	**Long-term:** Effects of the threat are expected in 10-100 years given known ecosystem interactions or compounding threats	**Near-term:** Effects of the threat are expected within the next 1-10 years	**Immediate:** Effects of the threat are immediately observable (current or existing)
Spatial Extent (Consider the impact of threat within 10 years)	**Localized:** (<10%) A small portion of the habitat or population is negatively impacted by the threat.	**Dispersed or Patchy:** (10-50%)	**Pervasive:** (>50%) A large portion of the habitat or population is negatively impacted by the threat.
Certainty (This characteristic is used to assess the certainty surrounding the threat and its impacts)	**Low Certainty:** Threat is poorly understood, data are insufficient, or the response to threat is poorly understood	**Moderate Certainty:** some information describing the threat and ecological responses to it is available, but many questions remain	**High Certainty:** Sufficient information about the threat and ecological responses to it is available
Likelihood (Consider impact of the threat within 10 years.)	**Unlikely:** Effects of the threat are unlikely to occur (less than 30% chance)	**Likely:** Effects of threat are likely to occur (30-99% chance)	**Occurring:** Effects of the threat are already observable (100% chance)

We added the characteristic Actionability to the six characteristics listed in Crisfield et al. 2013, to explicitly indicate the relative ease with which the impact of the threat could be addressed through prevention, restoration, or mitigation. We determined that a threat is actionable if either the threat itself, or the impact of the threat, can be reversed, prevented, or mitigated in some way. Conceptually, Actionability is similar to but distinct from the concept of Reversibility. While Reversibility considers only whether the impact of the threat can be reversed once it occurs, Actionability incorporates the idea that preventing or mitigating the impact of a threat can be just as effective, and in some cases more desirable, than reversing the impact once it has already occurred. For example, expected shifts or changes in habitats due to sea level rise may not be reversible, but the impacts of sea level rise on a saltmarsh may be partially mitigated if space for the marsh to migrate inland is available. Similarly, the loss of habitat from existing residential and commercial development is not reversible, but some impacts of development, such as run-off, may be actionable.

3.1.4 Assigning and Prioritizing Threats for SGCN

We assigned threats to Priority 1 and Priority 2 SGCN and assigned Severity and Actionability characteristics for each threat – SGCN interaction (Table 3 - 2). We considered the concepts of Likelihood, Certainty and Spatial Extent implicit, and only assigned those threats that we believed had a moderate or high impact for each of these characteristics. In addition, we primarily assigned those threats with moderate or high severity to SGCN. Using this approach, we excluded those threats with low importance for a particular species from further consideration, in

recognition that these low-priority issues were not likely to be considered for conservation action if they only impacted a single SGCN or were not impacting a habitat.

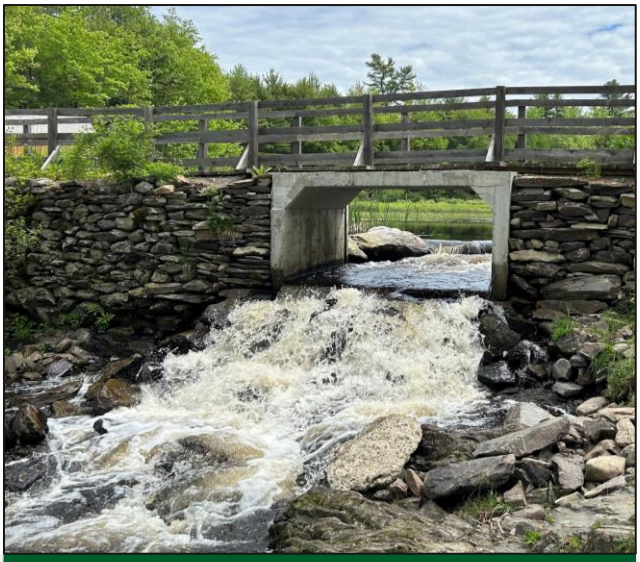
In addition, we developed a simple matrix to prioritize SGCN threats, using the combination of the impact scores for Severity and Actionability (Figure 3 - 1). We considered these priority rankings during the assignment of conservation actions (see Element 4).

		Severity	
		Moderate	**Severe**
Actionability	**Highly Actionable**	Medium-High	High
	Moderately Actionable	Medium	Medium-High
	Actionable with Difficulty	Low	Low

Figure 3 - 1 Threats for Species of Greatest Conservation Need were prioritized based on impact scores related to Actionability and Severity ranks assigned to each threat. Threats were prioritized from low to high, and all threats assigned a 'slight' severity were not assigned to a priority rank.

3.1.5 Assigning Threats for Habitats

We identified threats for terrestrial and freshwater aquatic habitats using Anderson et al. (2013) and through expert opinion by engaging with Maine's conservation community. Because no single comprehensive source is available that describes the state of marine habitats along Maine's coast, we used a wide variety of scientific publications, which are listed in the Literature Cited and References section, to compile information on threats. We assumed that the habitat systems within each terrestrial and marine macrogroup all faced similar conservation problems; therefore, we primarily assigned threats to each macrogroup and only assigned threats at the habitat system level when systems contained unique attributes (e.g., Vernal Pools, Coastal Islands, etc.). However, because we determined that the macrogroups for freshwater aquatic habitats (i.e, Lentic and Lotic) were too coarse for some threat assignments, we additionally assigned some threats at the habitat system scale. Unlike our approach for SGCN, we assigned all seven Threat Characteristics (Table 3 - 2) for each habitat – threat combination.



Dams can prevent movement of aquatic SGCN or invasive fish in Lotic habitats. © MDIFW

Although we acknowledge that there may be threats that we did not list, we attempted to assign all known threats for each habitat, regardless of severity or impact level for other characteristics. Our threat assignments for

Hemlock Wooly Adelgid is an invasive insect slowly expanding in Maine. © MDIFW

habitats were intended to be comprehensive, in recognition that over the long term, relatively minor problems within a habitat could have important implications for large numbers of SGCN. In addition, this approach increased the likelihood that a problem would be identified for potential conservation attention if it impacted a species' habitat, even if the threat was not assigned for a SGCN because it was of slight severity.

In contrast to our approach for SGCN, we did not use a formal ranking system to prioritize threats to habitats. Instead, we solicited experts to review the threat information for each habitat and determine which threats required attention (see Element 4). We considered threat characteristics during this qualitative process but did not use them to determine which threats required attention.

3.2 Threats to SGCN

We assigned 46 unique threats to 256 Priority 1 and Priority 2 SGCN species, for a total of 3,240 SGCN – threat combinations. Because of the complexity of species-specific threats and the sheer volume of information, we did not attempt to summarize and discuss all threats, but instead refer the reader to individual species reports (Element 1; Table 1 – 3). However, we do provide a broad summary of threat categories associated with SGCN, and identified broad trends for threats associated with SGCN in Maine. Climate Change and Severe Weather, Other Options (e.g., Lack of Knowledge), and Transportation and Service Corridors were the three threat categories associated with the most individual SGCN threats (Figure 3 - 2).

Many of Maine's grassland bird species rely on hayfields for breeding habitat. Delaying hay harvest until after grassland birds have fledged their young (i.e., mid July) can support these declining SGCN birds.

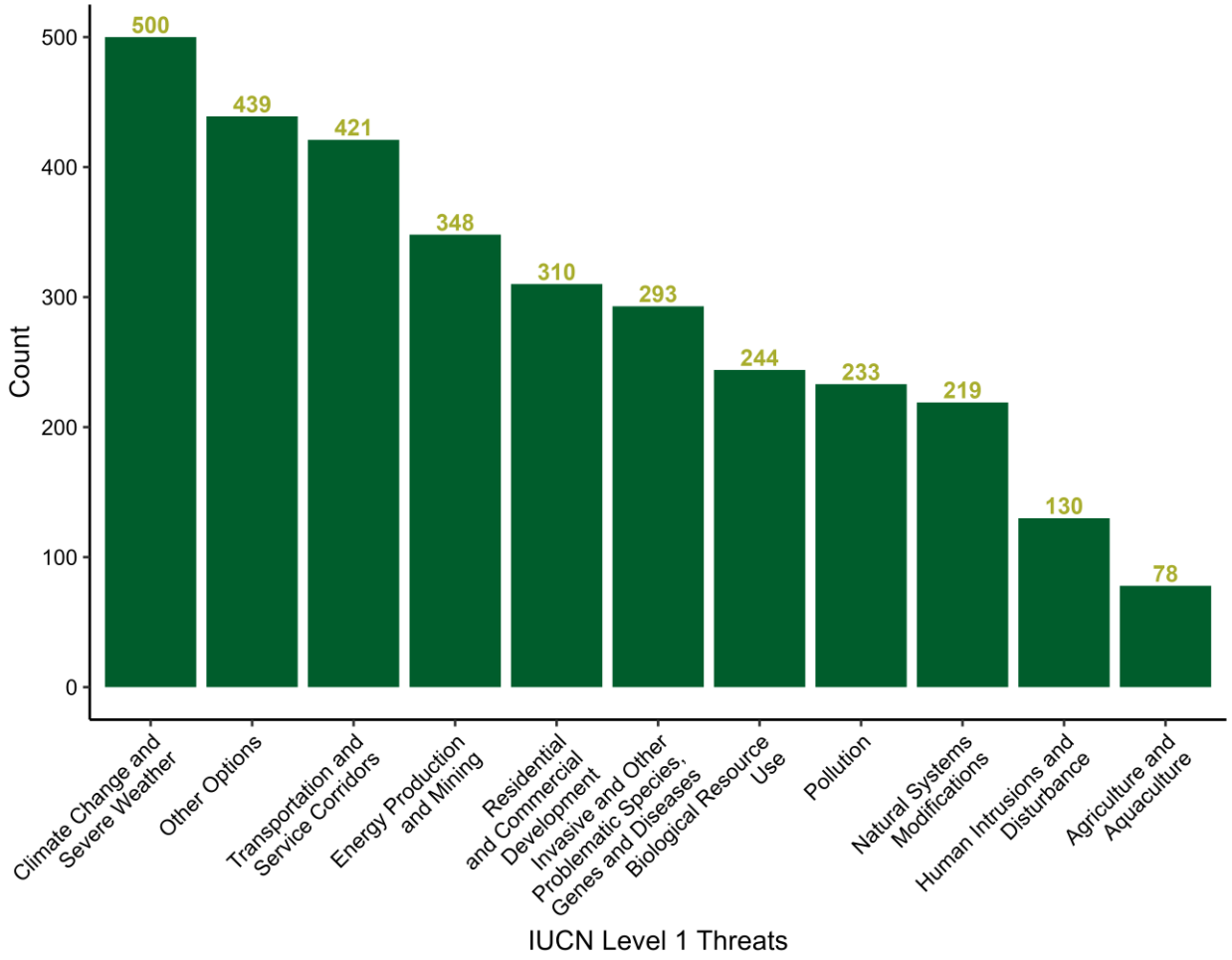


Figure 3 - 2 IUCN Level 1 Threats associated with Species of Greatest Conservation Need (SGCN) and the count of individual threats associated with SGCN. The category, Other Options, was primarily due to lack of knowledge associated with SGCN threats. If a SGCN was associated with multiple level 2 threats, it could be represented more than once in each category.

These trends are largely reflected in the IUCN second level threats, which for ease of reference, we developed Table 3 – 3 detailing the number of Priority 1 and 2 SGCN, as well as the number of habitat macrogroups, associated with each IUCN level 2 threat. While reading the notes associated with each threat – SGCN association is necessary to fully understand how these threat categories are impacting SGCN, Table 3 – 3 is an important reference tool to understand threat trends across taxa and habitats. Complete threat reports, including all threat – SGCN notes, can be downloaded by clicking on the hyperlinks embedded within the table. Given the magnitude and complexity of data contained, this table provides a convenient summary and informs additional investigation.

The top five IUCN Level 2 threats associated with Maine SGCN were 1) Lack of Knowledge, 2) Habitat Shifting and Alteration, 3) Roads and Railroads, 4) Invasive Non-native-Alien Species-Diseases, and 5) Renewable Energy (Table 3 - 3). Notably, these Level 2 threats are distributed across Level 1 threat categories, thereby underscoring the diversity of threats to Maine's SGCN. To best understand how these threats impact individual species, we

recommend readers review threat specific notes contained in Table 3 - 3 reports. While some IUCN threat categories, such as Pollution, were not included as a top threat, Pollution remains an important threat for groups of SGCN, e.g., aquatic species. Hence, if a threat category was not one of the most common across the state, it may still be a top threat for species groups with similar life histories or dependent on similar habitats.

Table 3 - 3 IUCN threat category and the number of Priority 1 SGCN, Priority 2 SGCN, and habitat macrogroups associated with each category. Complete threat reports can be downloaded by clicking on the hyperlinks within the table.

Threat Category	Priority 1 SGCN	Priority 2 SGCN	Total SGCN	Habitat Macrogroups
Residential and Commercial Development				
Housing and Urban Areas	59	83	**142**	14
Commercial and Industrial Areas	43	54	**97**	11
Tourism and Recreational Areas	39	14	**53**	5
Agriculture and Aquaculture				
Annual and Perennial Non-timber crops	17	30	**47**	3
Wood and Pulp Plantations	0	1	**1**	0
Livestock Farming and Ranching	13	12	**25**	4
Marine and Freshwater Aquaculture	2	0		2
Energy Production and Mining				
Oil and Gas Drilling	15	4	**19**	0
Mining and Quarrying	50	62	**112**	6
Renewable Energy	124	92	**216**	5
Transportation and Service Corridors				
Roads and Railroads	115	130	**245**	12
Utility and Service Lines	91	66	**157**	10
Shipping Lanes	8	0	**8**	3
Flight Paths	1	0	**1**	0
Biological Resource Use				
Hunting and Collecting Terrestrial Animals	9	3	**12**	0
Gathering Terrestrial Plants	1	2	**3**	1
Logging and Wood Harvesting	62	98	**160**	4
Fishing and Harvesting of Aquatic Resources	26	34	**60**	1
Human Intrusions and Disturbance				
Recreational Activities	79	38	**117**	10
War, Civil Unrest and Military Exercises	6	0	**6**	0
Work and Other Activities	2	0	**2**	0
Natural Systems Modifications				
Fire and Fire Suppression	16	31	**47**	5
Dams and Water Management-Use	60	62	**122**	6

Threat Category	Priority 1 SGCN	Priority 2 SGCN	Total SGCN	Habitat Macrogroups
Other Ecosystem Modifications	8	16	**24**	2
Removing or Reducing Human Maintenance	3	16	**19**	0
Invasive and Other Problematic Species, Genes and Diseases				
Invasive Non-native-Alien Species-Diseases	99	139	**238**	13
Problematic Native Species-Diseases	14	15	**29**	8
Introduced Genetic Material	1	0	**1**	0
Problematic Species-Diseases of Unknown Origin	1	9	**10**	0
Intrinsic Biological Limitations	5	4	**9**	0
Pollution				
Domestic and Urban Waste Water	20	20	**40**	4
Industrial and Military Effluents	32	27	**59**	6
Agricultural and Forestry Effluents	28	56	**84**	2
Garbage and Solid Waste	12	0	**12**	0
Air-Bourne Pollutants	10	6	**16**	2
Excess Energy	11	1	**12**	0
Climate Change and Severe Weather				
Habitat Shifting or Alteration	112	133	**245**	16
Changes in Geochemical Regimes	0	1	**1**	0
Changes in Temperature Regimes	87	81	**168**	0
Changes in Precipitation and Hydrological Regimes	42	23	**65**	4
Storms and Severe Weather	9	5	**14**	2
Other Options				
Other Threat	16	41	**57**	3
Resource Needs	21	40	**61**	1
Education & Outreach	15	38	**53**	0
Unknown	2	9	**11**	0
Lack of knowledge	120	135	**255**	1

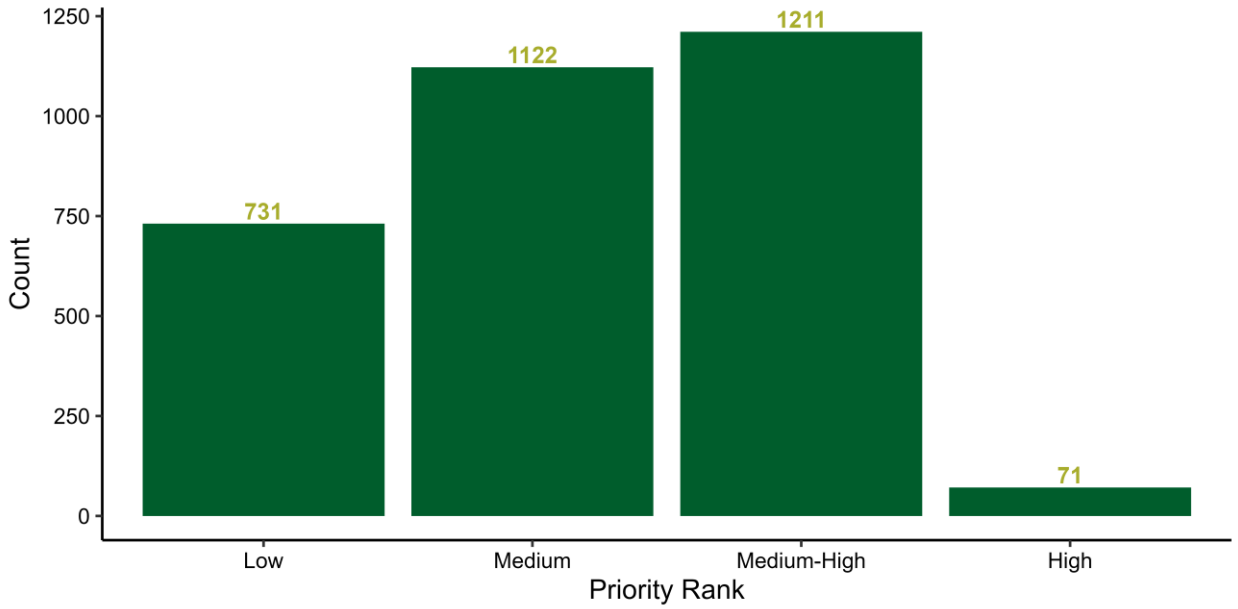


Figure 3 - 3 The number of Priority 1 and Priority 2 SGCN threat assignments categorized as low, medium, medium-high, and high priority. A subset of SGCN threats lacked consensus on Severity or Actionability rankings and subsequently did not have a priority rank assigned.

The five IUCN Level 2 threats with the greatest number of high priority threats (i.e., high or medium-high) were 1) Lack of Knowledge, 2) Roads and Railroad, 3) Renewable Energy, 4) Mining and Quarrying, and 5) a tie between Dams and Water Management Use and Recreational Activities (Table 3 - 4). Prioritization was calculated by combining index scores related to threat Severity and Actionability (Figure 3 - 1) and represent expert professional opinion. Only a small number of threats were classified as high priority (Figure 3 – 3).

Comparisons of the top associated threats with all Priority 1 and Priority 2 SGCN (Table 3 - 3) and highest priority SGCN threats (Table 3 - 4), had similarities with Lack of Knowledge, Roads and Railroads, and Renewable Energy all occurring in the top five list. However, threat categories associated with Climate Change and Severe Weather and Invasive and Other Problematic Species, Genes and Diseases were less likely to receive a high priority threat rank (Table 3 - 4), most likely due to actionability challenges inherent in addressing either threat. Instead, threats associated with Mining and Quarrying, Dams and Water Management, and Recreational Activities were ranked higher, likely due, at least in part, to a higher actionability score. Comparing threats in this manner can inform where limited conservation resources are most likely to have the greatest impact on SGCN. Similarly, it highlights the complexity of threats related to Climate Change and Severe Weather and Invasive and Other Problematic Species, Genes and Diseases, which may require action at multiple geopolitical levels to address.

Table 3 - 4 Secondary IUCN threat categories and the number of Priority 1 and Priority 2 SGCN assigned to each category, in which the threat was ranked as either high or medium-high priority for action. Complete threat reports can be downloaded by clicking on the hyperlinks within the table.

Threat Category	SGCN with High Priority Threats Assigned
Residential and Commercial Development	
Housing and Urban Areas	49
Commercial and Industrial Areas	35
Tourism and Recreational Areas	38
Agriculture and Aquaculture	
Annual and Perennial Non-timber crops	2
Livestock Farming and Ranching	1
Marine and Freshwater Aquaculture	1
Energy Production and Mining	
Mining and Quarrying	91
Renewable Energy	115
Transportation and Service Corridors	
Roads and Railroads	124
Utility and Service Lines	65
Biological Resource Use	
Hunting and Collecting Terrestrial Animals	4
Logging and Wood Harvesting	50
Fishing and Harvesting of Aquatic Resources	37
Human Intrusions and Disturbance	
Recreational Activities	89
Work and Other Activities	1
Natural Systems Modifications	
Fire and Fire Suppression	35
Dams and Water Management-Use	88
Other Ecosystem Modifications	12
Removing or Reducing Human Maintenance	17
Invasive and Other Problematic Species, Genes and Diseases	
Invasive Non-native-Alien Species-Diseases	75
Problematic Native Species-Diseases	11
Problematic Species-Diseases of Unknown Origin	2
Pollution	
Domestic and Urban Waste Water	18
Industrial and Military Effluents	16
Agricultural and Forestry Effluents	33
Air-Bourne Pollutants	1

Threat Category	SGCN with High Priority Threats Assigned
Excess Energy	2
Climate Change and Severe Weather	
Habitat Shifting or Alteration	16
Changes in Temperature Regimes	1
Changes in Precipitation and Hydrological Regimes	6
Other Options	
Other Threat	21
Resource Needs	60
Unknown	2
Lack of knowledge	204

Lack of Knowledge was associated with more SGCN than any other threat (Table 3 – 3) and had the largest number of high priority threats assigned (Table 3 – 4). This relationship indicates that Maine's conservation community could make significant progress in the coming decade by investing resources to better understand basic SGCN ecology. In particular, Maine's invertebrates, marine fauna, and plants are generally poorly studied, and limited information exists to describe distribution, trends in abundance, or limiting factors for these species. Surprisingly, many bird species were identified as having Lack of Knowledge, partly due to temporary residency during migratory stopovers, or due to limited insight into distribution across much of rural Maine. Gathering basic ecological information on these species is fundamental to advancing their conservation and comprehensively understanding the threats associated with these species.

Roads and Railroads can impact SGCN through fatal collisions, common in amphibians and reptiles, however the construction and maintenance of transportation corridors can also lead to habitat fragmentation. Fragmentation was commonly associated with plant and invertebrate species, as these SGCN species are more likely to be range-restricted and are often known from only a few locations. Impacts to these habitats can have an outsized effect on remaining populations. When roads intersect with aquatic habitats, installed culverts or bridges can lead to water-flow restrictions and prevent upstream movement of aquatic species. These movement restrictions are particularly impactful for migratory fish; however these same structures can limit freshwater fish access to thermal refugia or spawning locations dispersed throughout the watershed.

Renewable Energy development in Maine is instrumental in addressing the state's contributions to climate change and achieving mitigation goals; however, where these renewable energy sources are built can result in significant impacts to local flora and fauna populations. Treeless habitats are often considered for solar development; however, the limited abundance of these habitats results in conflict between open-habitat SGCN and solar development. Similarly, the proposed development of offshore wind has the potential to impact marine SGCN through habitat loss, displacement, vessel strikes, or a combination of temporary and persistent impacts of noise. Similarly, migrating bats and birds may collide with offshore or inland turbines or be displaced from habitats near construction sites. SGCN risks related to renewable energy development is a constantly emerging and dynamic topic in which state agencies and Maine's conservation community are highly engaged.

Case Study: Changing Precipitation Patterns due to Climate Change

Changes to precipitation patterns and the increasing of extreme weather events can impact both SGCN and the habitats they rely on. Increasing intensity of rain events can wash out culverts or cross-drains (left), causing infrastructure damage, and changes to water flows. Additionally, rising water levels associated with rain events can flood Black Terns nests (right), which sit on floating vegetation inches above the water. Rising water in June of 2023 caused nest failure due to flooding at all know breeding sites. © MDIFW

Threats related to Mining and Quarrying, Dams and Water Management Use, and Recreational Activities received high prioritization ranks likely due to their relatively high Actionability scores. Even though these threats were not associated with the most SGCN threats, they represent tremendous opportunities in which conservation organizations can address threats facing SGCN. These threats vary in their abundance on the landscape, with Mines and Quarries representing relatively discrete locations across the landscape and concerns primarily relate to habitat loss for plants and invertebrates (i.e., insects). Dams and Water Management primarily impact freshwater and migratory fish species, as well as plants residing in aquatic habitats or in floodplain forests. Dams and associated fish passage is generally evaluated at a site-by-site basis, as re-connected watersheds can facilitate movement of both native and invasive fish alike. Meanwhile threats related to Recreational Activities were associated with groups of birds, marine animals, plants, and bats. Specific threats include recreation on beaches important for shorebirds, recreational boating and/or whale watching in the Gulf of Maine, off road all-terrain vehicle use, and cave exploration can all negatively impact SGCN through disturbance, and displacement.

"Threats related to Mining and Quarrying, Dams and Water Management Use, and Recreational Activities received high prioritization ranks likely due to their relatively high Actionability scores. Even though these threats were not associated with the most SGCN threats, they represent tremendous opportunities in which conservation organizations can address threats facing SGCN."

Habitat Shifting and Alteration due to climate change, Changes in Temperature Regimes due to climate change, and Invasive Non-native-Alien Species-Diseases were each associated with a large number of SGCN, however these threats in general did not receive high priority ranks. Habitat Shifting and Alteration and Changes in Temperature Regimes associated with climate change are difficult to address without addressing the root cause(s) of climate change. Even if the causes of climate change were addressed, the entropy associated with a warmer climate is likely to continue to impact species and habitats for decades to come. However, non-action will have dire consequences for many SGCN, and in recognition of these threats we developed a variety of new climate related Conservation Actions discussed in Element 4. Similarly, most Invasive Non-native-Alien Species-Diseases threats were largely a result of previously introduced species, which once established, are almost impossible to remove. Many threats associated with these species are likely to be persistent, although targeted actions may be effective at addressing local threats. For example, targeted removal of non-native freshwater fish species in private ponds can prevent introduction and establishment into adjacent freshwater systems. Most Invasive Non-native-Alien Species-Diseases threats in Maine can be addressed through prevention measures, such as MDIFW's prohibited species list and investment in early detection and response. However, the uncertainty associated with which species have the potential to become invasive in Maine and their potential impact on SGCN makes identifying pre-emptive threats related to invasive species challenging.

Case Study: Replacing Undersized Culverts

Replacing undersized culverts (left) using Stream SMART methodology is a common technique to address aquatic threats. These larger culverts (right) allow for increased aquatic organism passage, which benefit SGCN such as Brook Trout and Atlantic Salmon. Both species need to move throughout Maine's watersheds to access thermal refugia and critical spawning habitat. © MDIFW

While we only briefly discuss a subset of threats most associated with SGCN or those with the highest priority, the threats to Maine's SGCN are diverse and often multifaceted. To comprehensively understand, digest, and begin addressing threats to Maine's SGCN, we recommend readers explore the threats identified in Table 3 - 3, and continue reading Element 4 focused on conservation actions, specifically proposed to address threats in the Plan.

While this information is only a snapshot of the complexities facing Maine's SGCN, it functions as an important snapshot in understanding the challenge facing Maine's at-risk species.

Recreation can disturb SGCN, such as the Piping Plover. Hence, respecting 'restricted area' signage and fencing can ensure we give birds the space then need during nesting season. © MDIFW

3.3 Threats to Habitats

We assigned 30 unique threats to 28 habitat macrogroups, for a total of 704 habitat – threat combinations. Similar to SGCN, we do not attempt to summarize and discuss all threats but instead refer the reader to reports for individual habitats, and to Table 3 - 3 which includes links to summary reports.

While reviewing IUCN threat categories (Level 1) information, Residential and Commercial Development was associated with more of Maine's habitats, compared to any other threat (Figure 3 - 4). The other top four threats were clustered and only differed by a few individual threat assignments; Transportation and Service Corridors, Climate Change and Severe Weather, Pollution, and Invasive and Other Problematic Species, Genes and Diseases. Similar to SGCN threats, the top threat categories (Level 1) are diverse and many of these top threats can amplify effects of other top threats. For example, Residential and Commercial Development can impact habitats directly through land conversion, but construction can directly or indirectly provide pathways for Invasive and Other Problematic Species, Genes, and Diseases introductions, and sources of Pollution (e.g., fertilizers, insecticides, or effluents). Hence, while these threats represent discrete categories, these threats can often be interrelated.

"…Residential and Commercial Development was associated with more of Maine's habitats, compared to any other threat (Figure 3 - 4). The other top four threats were clustered and only differed by a few individual threat assignments; Transportation and Service Corridors, Climate Change and Severe Weather, Pollution, and Invasive and Other Problematic Species, Genes and Diseases. Similar to SGCN threats, the top threat categories (Level 1) are diverse and many of these top threats can amplify effects of other top threats."

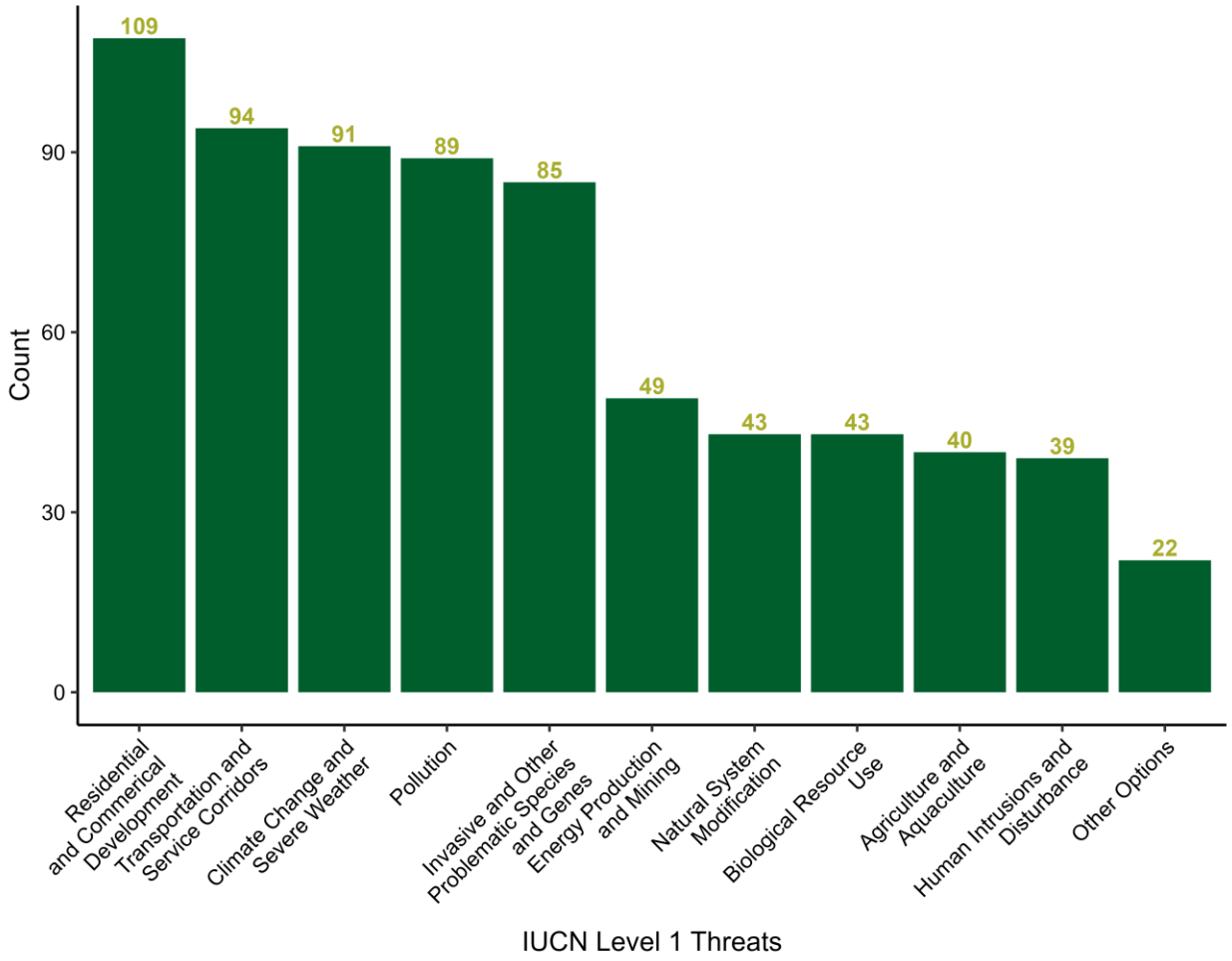
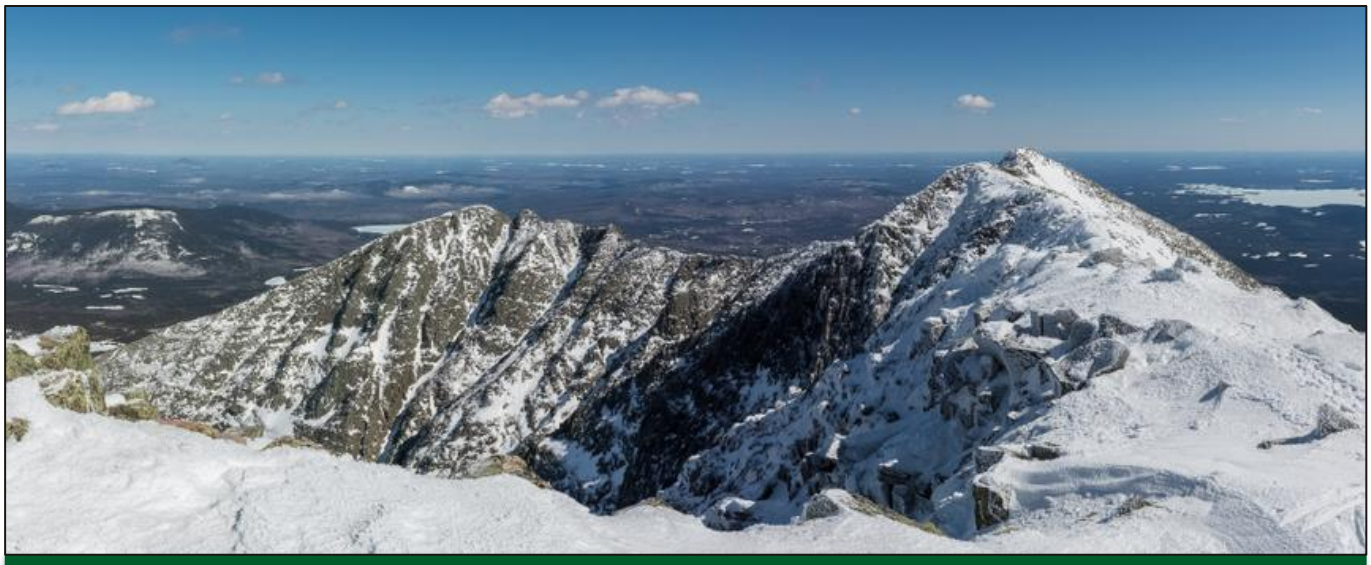


Figure 3 - 4 The number of IUCN Level 1 threats associated with Maine's habitats detail the relative impact of each category in Maine. The category Other Options was primarily due to either the Lack of Knowledge or Unknown threat categories associated with SGCN. Note, if a SGCN was impacted by multiple level 2 threats, it could be represented more than once in each category.

The IUCN threats (Level 2) most associated with Maine's macrogroups include Habitat Shifting and Alteration, Housing and Urban Areas, Invasive Non-native-Alien Species-Diseases, Roads and Railroads, and Commercial and Industrial Areas (Table 3 - 3). These five threats impact habitats across Maine and represent the greatest challenges to maintaining critical SGCN habitat. With the course-to-fine filter approach in mind, focusing conservation actions on these threat – habitat associations across Maine will have trickle down effects for Maine's SGCN. Notably, many of these threats were also associated with the most individual SGCN (Table 3 - 3), however there were slight differences between these two analyses, likely attributed to the habitat course filter approach.

Habitat Shifting and Alteration associated with Climate Change and Severe Weather was the threat associated with the most macrogroups (Table 3 – 3) and represents a profound threat. As the state warms, a combination of warmer temperatures, and changing precipitation are causing vegetation communities to shift their ranges. Some SGCN are able to shift with the habitats, such as mammals with large home ranges. Other species, such as high elevation specialists, or plants with limited dispersal ability, cannot adequately shift in space or adapt in place, and

may disappear from sites all together. Other areas, such as Maine's coastal beaches and saltmarshes, are contending with a combination of increased amount of precipitation, and frequency and intensity of storms. Storm surge causes damage and erosion to coastal habitats, and often, residential or commercial development adjacent to these habitats prevent habitat migration upland and reduce overall habitat resiliency. Similarly, increases in storm intensity inland can swell freshwater systems, damaging infrastructure and causing flooding and water quality impacts in rivers, streams, and creeks and adjacent habitats.

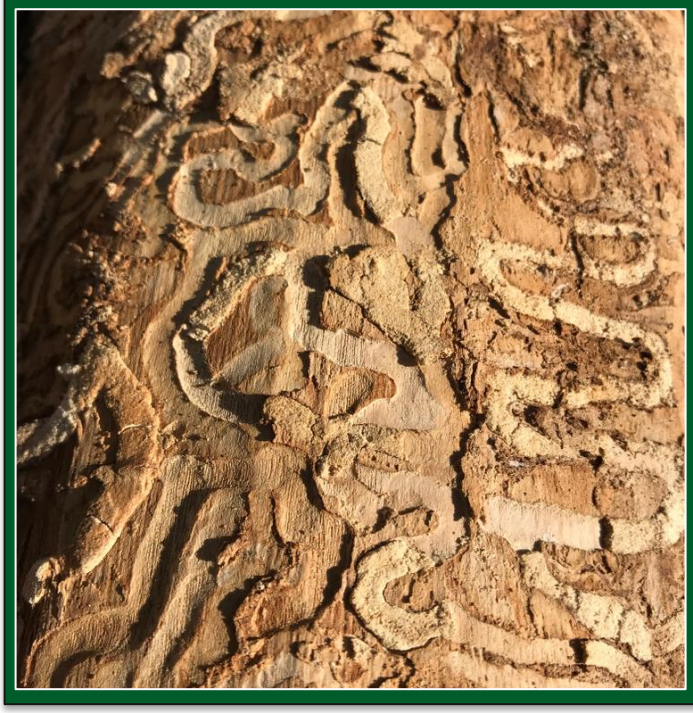


Climate change is impacting winter conditions in Maine. Many SGCN rely on snow depth throughout the winter (e.g., Canada Lynx), ice coverage for spawning (e.g., whitefish), or meltwater forming vernal pools (e.g., blue-spotted salamander, fairy shrimp). As Maine's winters become more mild, we anticipate negative impacts on snow dependent species.

Residential and Commercial Development related to Housing and Urban Areas and Commercial and Industrial Areas was a major threat for Maine's habitats but was not a top-ranking threat for SGCN. This difference is likely due in part to the development patterns in southern Maine where most of Maine's human population lives, and where human populations are expected to increase (Maine Office of State Economist 2023). Conversion of forest or agricultural land to residential or commercial areas causes a net loss of habitat for most species, although some SGCN are capable of adapting to development. In many cases, secondary impacts from development, such as increases in run-off, pollution, off-leash pets, traffic volumes, and even foot traffic, can have greater impacts on SGCN than the development itself. However, once habitat has been converted for residential or commercial development, it is unlikely to ever return to its natural state and is essentially removed from the landscape permanently. Outside of southern Maine, human populations are predicted to stabilize or decline over the next 20 years, so future impacts from new development are likely to be localized and are expected to have relatively minor impacts on SGCN.

Wind turbines pose a threat for both SGCN from either collisions, or through habitats loss and fragmentation. Yet, renewable energy development is important for addressing climate change, which was the most common threat for SGCN. Careful consideration is necessary when selecting development locations that minimize impacts to SGCN.

Impacts from Invasive Non-native-Alien Species-Diseases are most commonly related to invasive plant and animal species that degrade habitats or directly displace native species through competition or predation. These issues tend to be more prevalent in southern Maine, where higher human populations and a moderate climate facilitate expansion of non-native species. In the marine environment, Green Crabs (*Carcinus maenas*) are a prevalent invasive species with deleterious impacts on a variety of habitats and SGCN. In some cases, non-native diseases,



Case Study: Emerald Ash Borer

Emeral Ash Borer (*Agrilus planipennis*) is a non-native insect whose larva feed on the inner bark of Ash trees (Fraxinus spp.), typically leading to tree mortality.

Maine's Ash trees are listed as SGCN largely due to increased tree mortality. While species impacts are important, the large scale tree mortality is impacting forest communities and changing forest composition in Maine.

The long-term impacts of Emerald Ash Borer are still being realized and will impact Maine's forest habitats for decades to come. Yet, preventative measures, such as restricting movement of firewood, can prevent and reduce spread of this non-native species.

such as white-nose syndrome in bats, have also had devastating impacts on several SGCN bats with greater than ninety percent decline in cave-hibernating species. Similarly, plant and some forest communities are undergoing compositional shifts amid increasing tree mortality associated with invasive Emerald Ash Borer (*Agrilus planipennis*) and Hemlock Wooly Adelgid (*Adelges tsugae*), and unknown long-term effects of Beach Leaf Disease. Impacts from Invasive Non-native-Alien Species-Diseases can be severe, and in many cases, it is extremely difficult to reverse the spread of invasive species or diseases; prevention is often the only feasible solution.

In contrast, Roads and Railroads tend to impact habitats through fragmentation, especially for aquatic systems, and by altering hydrology. Improperly installed or under-sized culverts can prevent or reduce passage by many SGCN, reducing connectivity between available habitat. Both Roads and Railroads can also impede water flowage in seepage forests, tidal marshes, mudflats, and floodplains, reducing the function of these habitats. Construction of new Roads and Railroads is not prevalent in most of Maine, so addressing impacts from this threat typically involves partial reconstruction of existing infrastructure through installation of improved culverts and bridges. For the sake of terrestrial species such as turtles, installing signage to alert motorists to reduce speed or installing crossing structures can reduce collision-related mortality.

Maine's habitats face a variety of threats, with the greatest impacts related to Climate Change and Severe Weather, Residential and Commercial Development, and Invasive and Other Problematic Species, Genes and Diseases. Many habitat threats can be viewed as amplifiers of other threats. Invasive Non-native-Alien Species-Diseases in particular take advantage of disturbed ground near development and longer growing seasons due to Changes in Temperature Regimes, and can easily become established, thereby enabling additional spread nearby. In Marine Eelgrass (*Zostera marina)* beds, increased foraging by non-native Green Crabs in conjunction with Climate Change and Severe Weather has contributed to eelgrass bed degradation and in some cases die-offs. Eelgrass beds provide important nursery habitats for marine species and changes to these vegetation communities will have a cascading impact on other SGCN species. Hence, addressing habitat threats will have positive impacts for multiple SGCN species, and can be an important step to protecting Maine's biodiversity.

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