



CLIMATE CHANGE & BIODIVERSITY IN MAINE: *Vulnerability of 442 Species*

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Wells National Estuarine Research Reserve
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Talk Overview



- Goals
- Approach and Methods
- Results
- Limitations
- Applications

Goals



- Identify Maine's high vulnerability species
- Identify life history traits linked to vulnerability
- Identify key habitats hosting high vulnerability species
- Help inform revision of the 2015 ME Comprehensive Wildlife Conservation Strategy
- Increase stakeholder awareness of climate change



Expert-opinion elicitation process:

- Climate Change exposure summary for Maine
- Online survey by regional experts
- Review by expert panels at a workshop
- Summary of key findings by taxa and habitat

Climate Change Exposure: Step 1



Natural Capital Initiative at Manomet

March 2010 NCI-2010-02



Natural Capital Science Report



CLIMATE CHANGE AND BIODIVERSITY IN MAINE:

A CLIMATE CHANGE EXPOSURE SUMMARY FOR PARTICIPANTS OF THE MAINE CLIMATE CHANGE SPECIES VULNERABILITY ASSESSMENT

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- Survey participants asked to review the climate change exposure document
- **Purpose:** reduce bias among participants due to lack of knowledge about CC and provide common set of climate assumptions

Online Survey: Step 2



Trait Categories	Definition (the degree with which a species...)
1) Habitat specificity	...is restricted to habitats with narrow or well-defined physical or biotic characteristics.
2) Edge of range or fragmented distribution	...is reaching the southern edge of its range in Maine, whose populations are highly fragmented, and/or occupy habitats highly vulnerable to climate change.
3) Environmental or physiological tolerance	...is restricted to a narrow range of temperature, hydrology, or snow pack conditions, including both edge-of-range species with distributions most likely determined by climate (as opposed to habitat) and specialists with narrow physical niche tolerance.
4) Interspecific or phenological dependence	...has high dependencies requiring special environmental cues (e.g., temperature, moisture) or interspecific interactions (e.g., predation, competition, mutualisms) that are likely to be disrupted by climate change.
5) Mobility	...has limited capacity for long distance migration or dispersal and/or high sensitivity to landscape matrix barriers (e.g., roads, development).
6) Exotic pathogens or invasive species	...is sensitive to exotic pathogens or invasive species that may increase or arrive with climate change.

Online Survey: Step 2



Alces Alces americana - Eastern Moose

Overall Score

Before completing this section, check at least one option for all the above criteria.

As you consider this species experiencing climate change impacts as described in the [exposure assessment](#) over the next 50 years, this species is likely to have low, moderate, or high vulnerability (select one)

	1	2	3
	Low	Moderate	High
📄 Calculated	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
✓ Your Score	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

Instructions

The criteria scores and overall scores are calculated automatically.

Please also make your own determination of overall score.

If you disagree with the calculated explain briefly.

Your score differs from the calculated score. Please explain.

- 1 Low Vulnerability:** Climate change is likely to have little negative impact (<33% loss) or positive impact on this species' range area and/or population size in Maine within **50 to 100 years**. *This is the auto-calculated score when there are no High and at most one Moderate score for the above criteria.*
- 2 Medium Vulnerability:** Climate change is likely to have intermediate negative impact (33% to 66% loss) in range and/or population size in Maine within **50 to 100 years**. *This is the auto-calculated score when there are no more than one High or two Moderate scores for the criteria above.*
- 3 High Vulnerability:** Climate change is likely to have large negative impact (>66% loss) on this species' range area and/or population size in Maine, including potential state level extirpation within **50 to 100 years**. *This is the auto-calculated score when there are two or more High, or three or more Moderate scores for the criteria above.*

Habitats

Check the SWAP habitats that are the primary habitats used by this species. Primary habitats are those required for successful survival and/or reproduction.

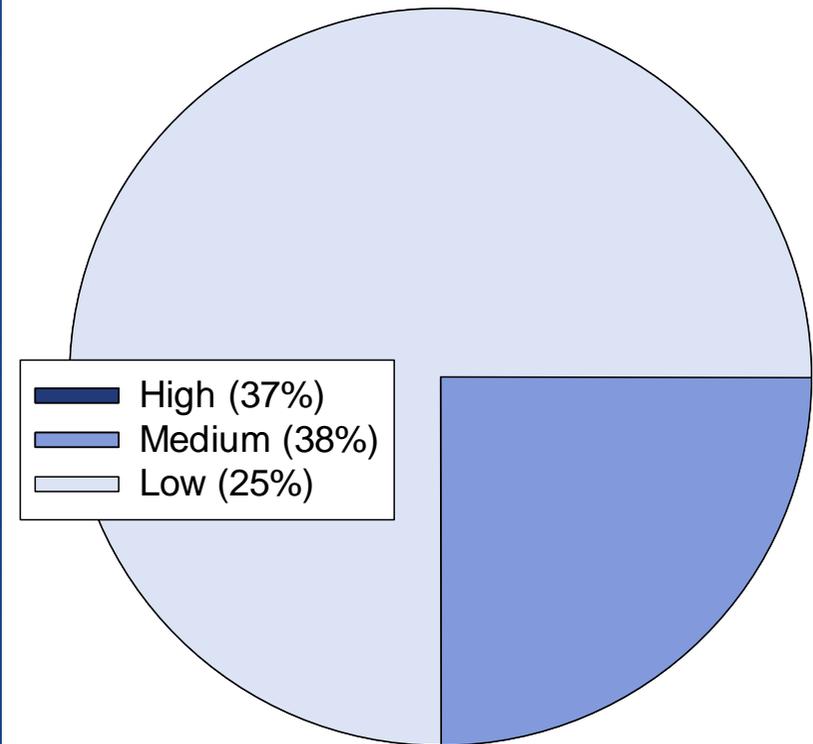
- Freshwater Lakes and Ponds
- Estuaries and Bays
- Estuarine Emergent Saltmarsh
- Deciduous and Mixed Forest
- Coniferous Forest
- Dry Woodlands and Barrens

Online Survey: Step 2



- Goal: assess all SGCN taxa (n= 206), T/E plant species (n=163), and other species of conservation interest (n=58)
- 81 participants
- 428 species \geq 1 reviews
- 131 species \geq 3 reviews

Species Vulnerability (number of species)



Expert Workshop: Step 3



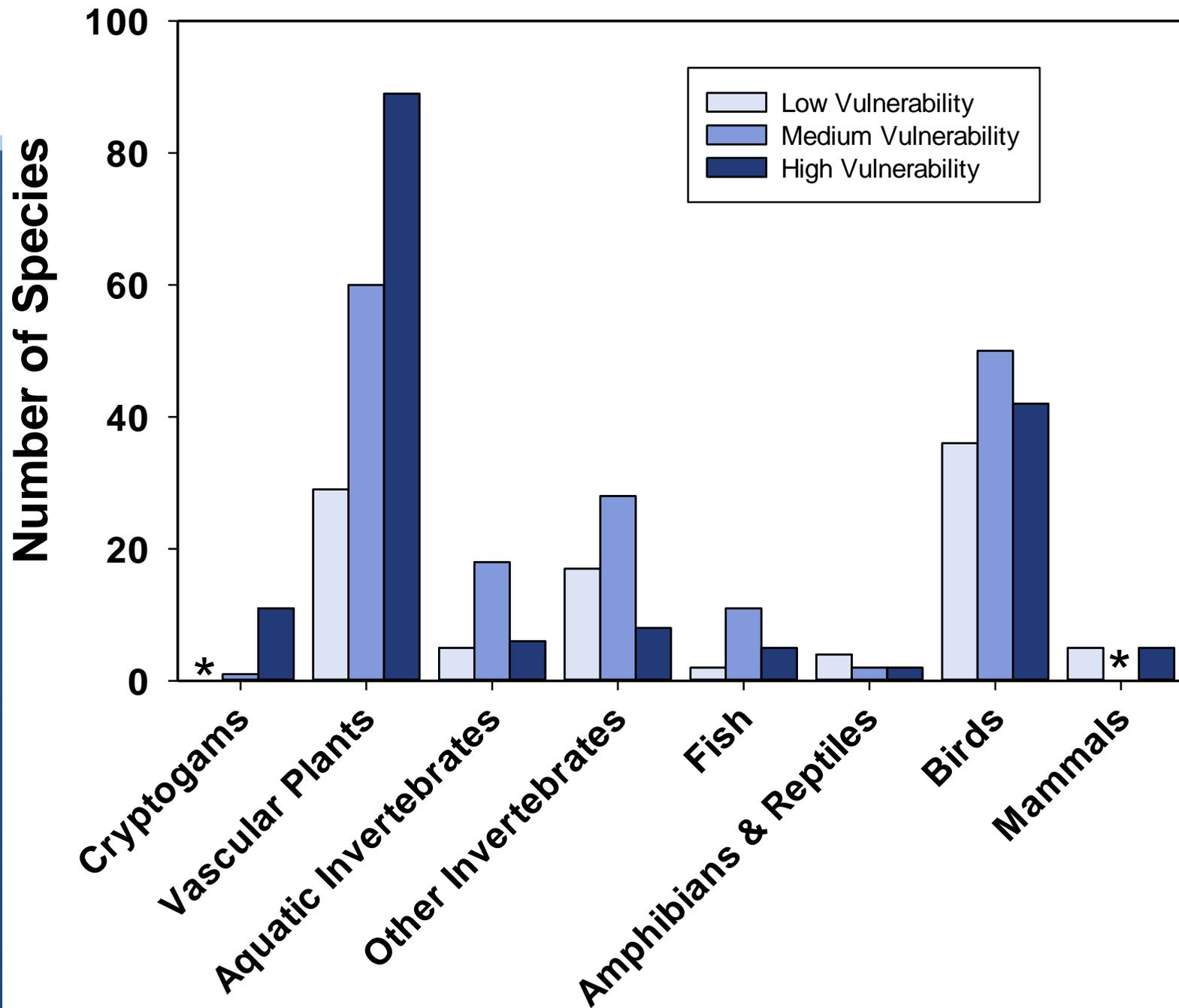
Workshop – May 2010

- 42 participants
- Species either: a) not assessed in online survey, b) high vulnerability and <2 reviewers, and c) ≥ 3 reviewers but different vulnerability scores



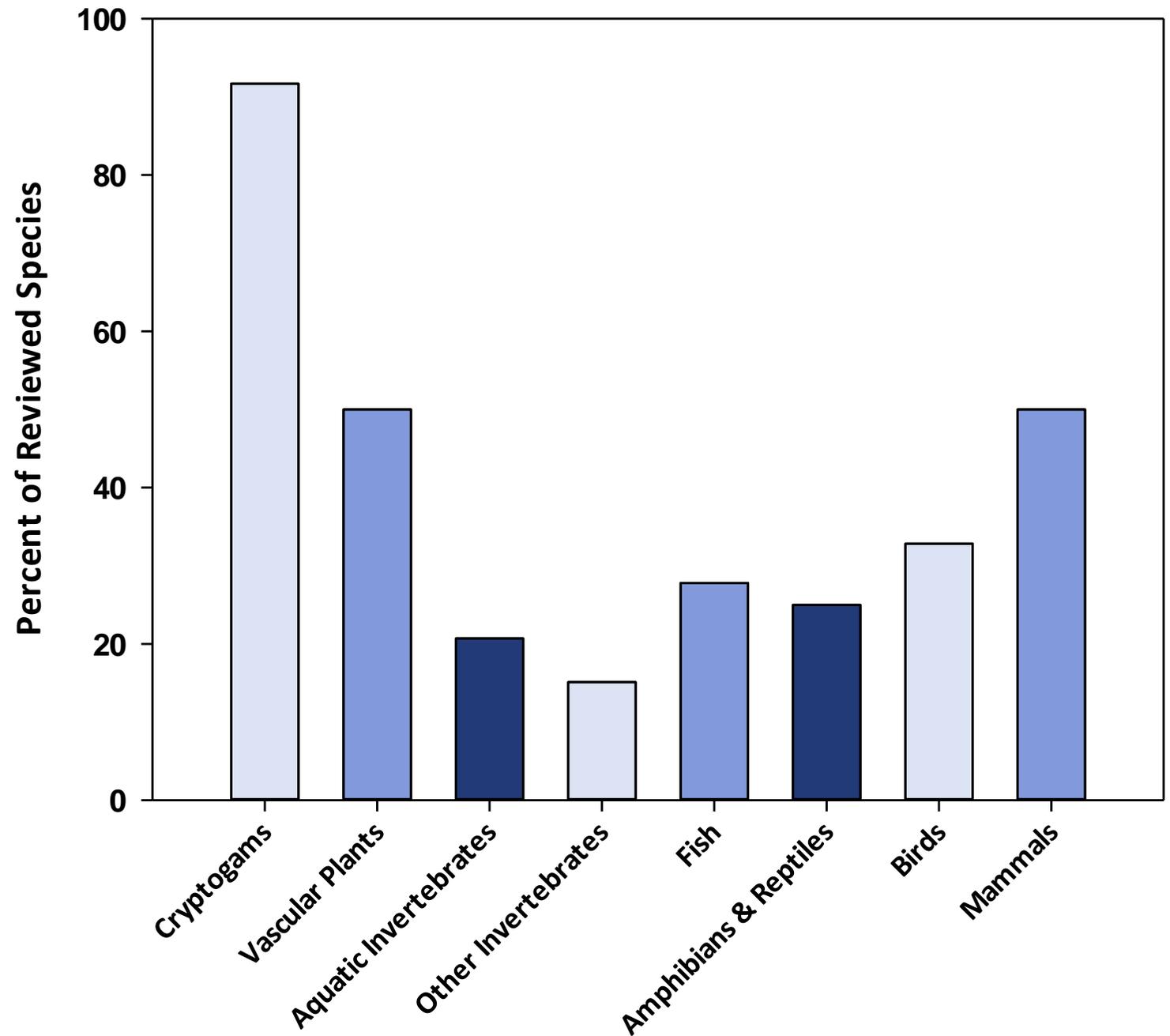
Results

All Taxa



Results

% Species with High Vulnerability by Taxa



55 Vertebrates with High Vulnerability to Climate Change



Inland Fish Species

Lake Whitefish (*Coregonus clupeaformis*)
 Rainbow Smelt (*Osmerus mordax*)
 Round Whitefish (*Prosopium cylindraceum*)
 Landlocked Salmon (*Salmo salar sebago*)
 Arctic Charr (*Salvelinus alpinus oquassa*)

Diadromous Fish Species

Atlantic Salmon (*Salmo salar*)

Amphibian and Reptile Species

Blanding's Turtle (*Emydoidea blandingii*)
 Mink Frog (*Lithobates septentrionalis*)*

Seabird Species

Razorbill (*Alca torda*)
 Black Tern (*Chlidonias niger*)
 Atlantic Puffin (*Fratercula arctica*)
 Least Tern (*Sterna abuttkarum*)
 Roseate Tern (*S. dougallii*)
 Arctic Tern (*S. paradisaea*)
 Common Murre (*Uria aalge*)

Waterbird Species

Yellow Rail (*Coturnicops noveboracensis*)
 American Coot (breeding) (*Fulica americana*)
 Common Moorhen (*Gallinula chloropus*)
 Common Loon (*Gavia immer*)
 Least Bittern (*Ixobrychus exilis*)

Waterfowl Species

Harlequin Duck (*Histrionicus histrionicus*)

Shorebird Species

Red Knot (*Calidris canutus*)
 Least Sandpiper (*C. minutilla*)
 Semipalmated Sandpiper (*C. pusilla*)
 Willet (*Catoptrophorus semipalmatus*)
 Piping Plover (*Charadrius melodus*)
 American Oystercatcher (*Haematopus palliatus*)
 Red-necked Phalarope (*Phalaropus fulicaria*)

Woodpecker and Other Species

Spruce Grouse (*Falcapennis canadensis*)*
 Black-backed Woodpecker (*Picoides arcticus*)
 Am. Three-toed Woodpecker (*P. dorsalis*)*

Passerine Species

Saltmarsh Sharp-tailed Sparrow (*Ammodramus caudacutus*)
 Nelson's Sharp-tailed Sparrow (*A. nelsoni*)
 American Pipit (breeding) (*Anthus rubescens*)
 Bicknell's Thrush (*Catharus bicknelli*)
 Swainson's Thrush (*Catharus ustulatus*)*
 Evening Grosbeak (*Coccothraustes vespertinus*)*
 Blackpoll Warbler (*Dendroica striata*)*
 Cape May Warbler (*D. tigrina*)*
 Yellow-bellied Flycatcher (*Empidonax flaviventris*)*
 Red Crossbill (*Loxia curvirostra*)
 White-winged Crossbill (*L. leucoptera*)*
 Lincoln's Sparrow (*Melospiza lincolni*)*
 Mourning Warbler (*Oporornis philadelphia*)*
 Northern Parula (*Parula americana*)
 Gray Jay (*Perisoreus canadensis*)
 Pine Grosbeak (*Pinicola enucleator*)*
 Boreal Chickadee (*Poecile hudsonicus*)*
 Ruby-crowned Kinglet (*Regulus calendula*)*
 Tennessee Warbler (*Vermivora peregrina*)*

Small Mammal and Bat Species

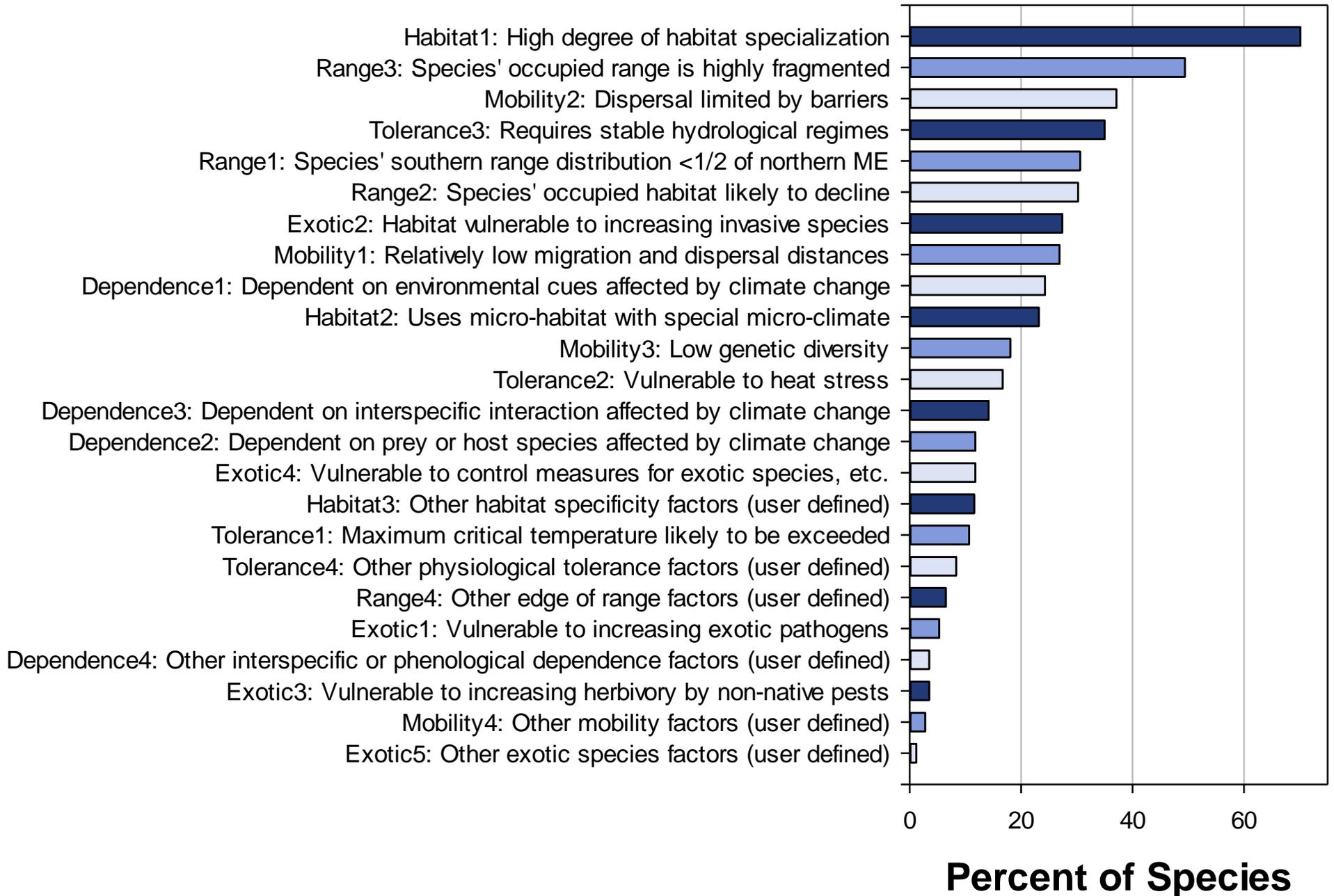
Northern Bog Lemming (*Synaptomys borealis*)

Medium and Large Mammal Species

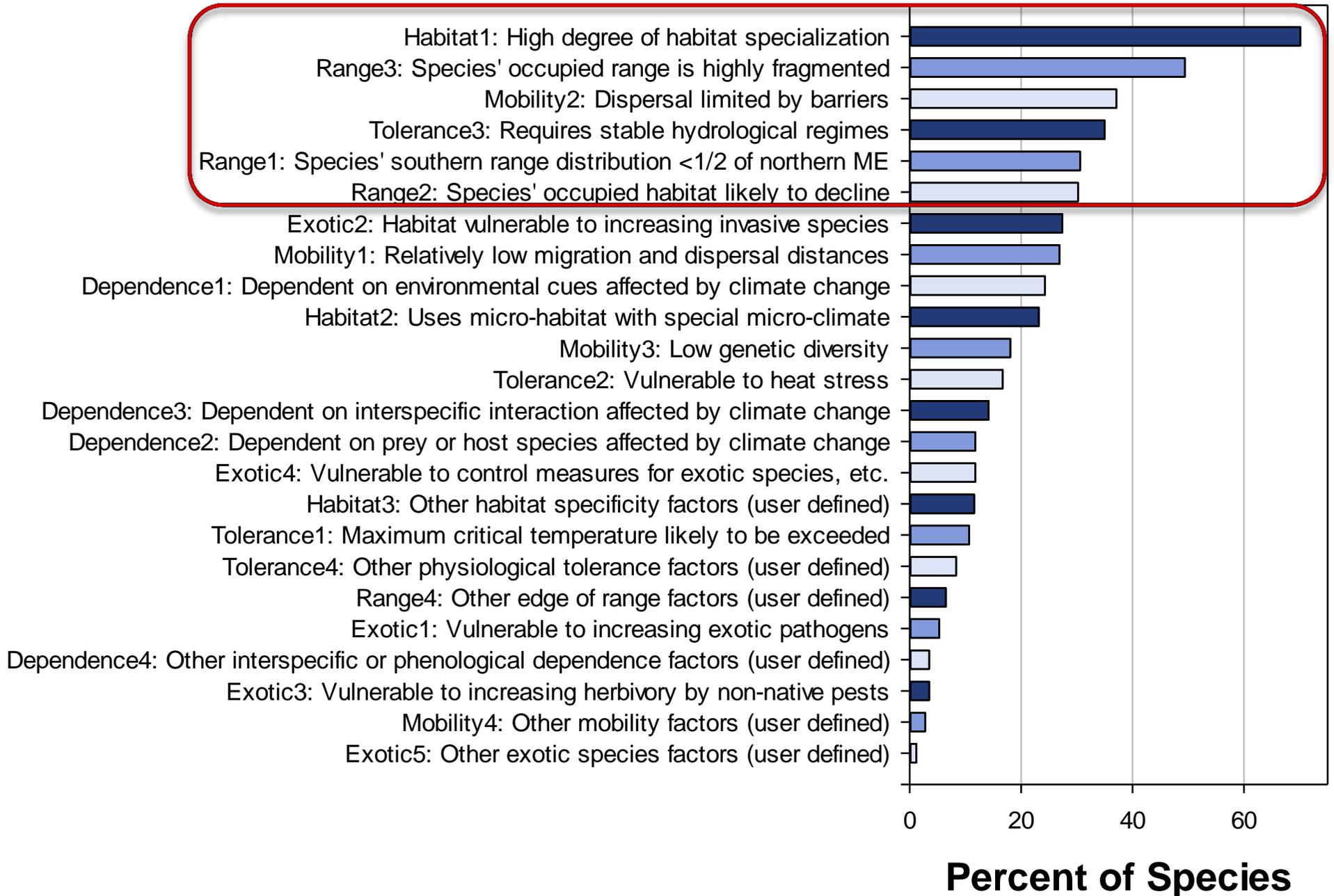
Eastern Moose (*Alces alces americana*)*
 Snowshoe hare (*Lepus americanus*)*
 Canada Lynx (*Lynx canadensis*)
 American marten (*Martes americana*)*



Species Vulnerability Traits



Species Vulnerability Traits



Key Habitat Name	Exposure	N	Vulnerability (Percent of spp.)		
			Low	Medium	High
Marine Key Habitats					
Marine Open Water	H	20	5	<u>50</u>	45
Rocky Coastline & Islands	M	31	10	<u>55</u>	35
Estuaries & Bays	M	34	9	<u>65</u>	26
Unconsolidated Shore	H	32	9	<u>56</u>	34
Estuarine Emergent Saltmarsh	H	40	18	<u>50</u>	33
Freshwater Key Habitats					
Rivers & Streams	H	104	15	<u>51</u>	34
FW Lakes & Ponds	H	66	17	<u>62</u>	21
Emergent Marsh & Wet Meadows	M	55	24	<u>51</u>	25
Shrub-scrub Wetland	M	38	21	61	18
Peatlands	H	47	9	40	<u>51</u>
Forested Wetland	M	72	28	46	26
Upland Key Habitats					
Alpine	H	35	3	9	<u>89</u>
Cliff Face & Rocky Outcrops (incl. talus)	M	34	24	32	44
Mountaintop Forest (incl. krummholz)	H	22	23	14	<u>64</u>
Coniferous Forest	M	66	23	39	38
Deciduous & Mixed Forest	M	110	37	43	20
Dry Woodlands & Barrens	L	67	<u>54</u>	36	10
Shrub / Early Succ. & Regen. Forest	L	46	<u>50</u>	33	17
Grassland, Ag., Old Field	L	52	<u>54</u>	40	6
Urban / Suburban	L	16	<u>50</u>	44	6
Caves & Mines	L	1	<u>100</u>	0	0



Participant Feedback & Limitations



- 90% of online survey participants indicated that the results would be useful or very useful
- Potential inconsistencies interpreting trait vulnerabilities: e.g. Mobility – relative to other taxa in group (dragonflies vs. snails) or relative to ALL taxa (dragonflies vs. peregrine falcons)?
- Too few expert reviewers for plants and invertebrates: 225 spp had < 2 reviewers (~50%)
- Emphasis on fine-filter species vulnerability analysis

Some Take Home Points



- **Consider two types of habitat vulnerability:**
 - Habitats hosting a disproportionate # of vulnerable priority spp: Alpine, Montane Forests, and Peatlands
 - Habitats inherently vulnerable (exposure & sensitivity) – Marine (mudflats, saltmarsh), Freshwater (cold streams, lakes, peatlands), and Montane
- **Conservation Strategies**
 - *Traditional approaches* still critical – large blocks, biodiverse parcels
 - *Novel approaches* also needed – enhanced riparian focus (buffers & aquatic connectivity), marsh migration, greater emphasis on connectivity, diverse physical landscapes beget diverse biota
- **Positive:** Intactness of ME's ecosystems may ameliorate climate change
- **Negative:** ME's vulnerability - lack of connectivity in states to the south

Acknowledgements



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Beginning with
HABITAT

