Priority Regional Threat: Wildlife Disease

# Summary Statement:

All species are vulnerable to emerging diseases which can be introduced and spread in the wild through a variety of vectors and exacerbated by pervasive anthropogenic impacts. States are motivated to work together on this shared threat because these threats can spread quickly beyond state borders and are difficult to treat. States belong to the Northeast and Southeast Disease Cooperatives which provide substantial technical support.

# Context

This threat is potentially more urgent and dynamic than other top threats. The most effective protections involve prevention of disease introduction in the wild. Once introduced, strategic approaches require protocols and planning based on past experience to react quickly and effectively to minimize impacts to wild populations of new emerging disease – while also working continuously to manage diseases that are already affecting populations.

While other threats tend to affect habitats directly, disease often targets species or taxa groups though the impacts can be exacerbated in certain habitats due to other co-occurring threats (e.g., invasive species, changing climate).

# Results of SWAP Roll-up analysis:

Threats are categorized according to the IUCN classification system in the 14 NE State Wildlife Action Plans (SWAPs). In 2015, the relevant category was “Invasive & Problematic Species, Pathogens & Genes”. This combined threat category makes it more challenging to investigate *Diseases* apart from *Invasive Species*. However, the NE SWAP Database, allows filtering of the actual threat names for words that are related to disease, as provided by states.

Approximately 50 Regional Species of Greatest Conservation Need (RSGCN) are currently affected by *Invasive Species* or *Disease* threats with the potential for many more in the future. In the NE SWAP Database, there are approximately 200 disease threats related directly to a species. These are derived primarily from the Vermont, Rhode Island, Pennsylvania, New Hampshire, and Maine Wildlife Action Plans. (A list of species associated with Disease threats is provided in Appendix A.)

Table 1. Specific diseases mentioned in wildlife action plans or personal communications during SWAP Roll-up analysis. (*note: please feel free to add to this inventory*):

|  |  |
| --- | --- |
| Taxa Group | Disease |
| Birds | West Nile VirusAvian InfluenzaType E Avian BotulismAvian Vacuolar MyelinopathyCholeraSalmonellaHeavy Metal Contamination |
| Mammals | Bats – White Nose SyndromeRabbits - Tularemia |
| Fish | BotulismViral Hemorrhagic Septicemia Virus (VHSV)Anguilliola parasitesChemicals causing reproductive and developmental disorders (endocrine disruptors)Bacterial kidney diseasePancreatic necrosisEpitheliotropic Disease Virus (EEDV) |
| Amphibians | RanavirusChytrid *(Batrachochytrium dendrobatidis and Batrachochytrium salamandrivorans)*Environmental pollutants that cause reproductive and development disorders |
| Reptiles | Snakes - Fungal DermatitisTurtles - Ranavirus |
| Invertebrates | Bees - Fungus from captive populations |

It is important to recognize that a species’ vulnerability to disease is worsened by other stressors, particularly pollution and invasive species which are also top threats in SWAPs. In other cases, the cause of mortality is not an infectious pathogen but rather a pollutant that exceeds the species’ exposure threshold. In SWAPs, these “Disease” threats may have been classified under IUCN Threat Code# 9 “Pollution”.

Sixteen unique actions were classified as “Direct Management of Natural Resources: Wildlife disease management” (TRACS 2.14) (Table 2). The majority of these actions refer to detection or treatment of disease in the wild, generally. Specific diseases that are addressed by these actions include White Nose Syndrome, raccoon roundworm, botulism in fish and birds, and West Nile Virus in birds.

Table 2. Specific Actions from the NE SWAP Database that were categorized as “Wildlife disease management”.

|  |  |  |
| --- | --- | --- |
| Frequency of Occurrence | State | Action |
| 1 | NJ | Assess the impacts of diseases on the life cycles of wildlife. |
| 1 | NJ | Conduct long-term monitoring of diseases in vulnerable wildlife to determine the magnitude of exposure within populations and around the State, the impacts to those species, in particular SGCN, and investigate the feasibility of mitigating for such impacts. |
| 1 | DE | Continue efforts to reduce impacts of **WNS** in DE hibernacula - both to DE bats and to decrease the chances of spread of WNS to other locations. |
| 1 | PA | Decrease or maintain low levels of **raccoon roundworm** within woodrat habitat and dispersal corridors. |
| 18 | PA | Develop and utilize treatment options to reduce pathogen abundance in situ or reduce quantity of infections caused by pathogen |
| 6 | PA | Develop and utilize treatment options to reduce pathogen abundance in situ or reduce quantity of infections caused by this pathogen. |
| 1 | NJ | **Distribute antihelminthic drugs targeting raccoon roundworm in raccoons** proximal to Allegheny woodrat populations and/or implement a raccoon control strategy. |
| 1 | DE | Identify new diseases as they enter the system and address quickly. |
| 1 | NJ | Investigate diseases/pathogens impacting SGCN and/or their habitats. |
| 12 | PA | Limit access to caves, mines, and other areas, and enforce decontamination procedures to prevent spread of **WNS** fungus. |
| 7818 | NY | Manage adverse impacts of invasives or disease |
| 1 | DE | Prevent and preempt emerging diseases. |
| 1 | PA | Prompt removal of fish and bird carcasses during **botulism outbreaks**. |
| 1 | NJ | Protect SGCN from exotic pathogen introduction or incident through implementation of a "rapid response plan"; DFW to give priority attention to these species in planning and/or implementing a response. |
| 1 | DE | Reduce or control the effect of diseases where the intensity and frequency of occurrence threatens species or populations. |
| 4 | RI | Species recovery: Introduce **disease resistant strains of oyster** |
| 1 | PA | Work with Conservation Districts and Department of Agriculture to educate farmers on reducing **West Nile Virus** exposure on their properties; Work with nest box programs to reduce starling infestations by nest box placement and cleaning practices |

# Experience:

The Northeast region worked quickly to respond to the discovery of White Nose Syndrome. The RCN program has funded several projects related to wildlife diseases – White Nose Syndrome in bats, Ranavirus in amphibians, and Fungal Dermatitis in Timber Rattlesnakes. Additionally, species conservation assessments may have included descriptions of vulnerabilities like Brook Floater Mussel’s sensitivity to heavy metals. A few examples are described here.

*Note: We should add other stories about successful (or not) actions taken to prevent the spread or treat an outbreak of wildlife disease in non-game species. All planning builds on these case studies.*

# Regional Coordinated Actions

In September 2016, the NEFWDTC discussed reaching out through the Northeast and Southeast Wildlife Disease Cooperatives to help protect wild populations of amphibians by preventing the introduction of *B. salamandrivorans* from imported amphibians. Collaborators, working with the Disease Cooperatives, are developing methods for early detection that will require swabbing individual animals and then testing the samples. Practical approaches to implement these diagnostic tests are yet to-be-determined. Ideally, animals should be tested before leaving the country of origin. If imported, individuals would need to be held until results were returned (a few days) or tracked and retrieved if testing positive.

*This is where we will continue to develop the ideas contributed by the group.*

Appendix A:

This is a list of species associated with Wildlife Disease in the Northeast SWAP Database.

|  |  |  |  |
| --- | --- | --- | --- |
| Taxon | Sub Taxon | Scientific Name | Common Name |
| Amphibians | Frog | Lithobates pipiens | Northern Leopard Frog |
| Amphibians | Frog | Lithobates septentrionalis | Mink Frog |
| Amphibians | Frog | Lithobates sylvaticus | Wood Frog |
| Amphibians | Newt | Notophthalmus v. viridescens | Red-spotted Newt |
| Amphibians | Salamander | Ambystoma laterale | Blue-spotted Salamander |
| Amphibians | Salamander | Ambystoma maculatum | Spotted Salamander |
| Amphibians | Salamander | Ambystoma opacum | Marbled Salamander |
| Amphibians | Salamander | Cryptobranchus a. alleganiensis | Eastern Hellbender |
| Amphibians | Salamander | Desmognathus fuscus | Northern Dusky Salamander |
| Amphibians | Salamander | Gyrinophilus p. porphyriticus | Northern Spring Salamander |
| Amphibians | Salamander | Hemidactylium scutatum | Four-toed Salamander |
| Amphibians | Salamander | Necturus maculosus | Common Mudpuppy |
| Amphibians | Toad | Anaxyrus fowleri | Fowler's Toad |
| Amphibians | Toad | Scaphiopus holbrookii | Eastern Spadefoot Toad |
| Birds |  | Aegolius acadicus | Northern Saw-whet Owl |
| Birds |  | Alca torda | Razorbill |
| Birds |  | Ammodramus caudacutus | Saltmarsh Sparrow |
| Birds |  | Ammodramus nelsoni | Nelson's Sparrow |
| Birds |  | Ardea herodias | Great Blue Heron |
| Birds |  | Asio otus | Long-eared Owl |
| Birds |  | Bonasa umbellus | Ruffed Grouse |
| Birds |  | Charadrius melodus | Piping Plover |
| Birds |  | Chlidonias niger | Black Tern |
| Birds |  | Clangula hyemalis | Long-tailed Duck |
| Birds |  | Coccothraustes vespertinus | Evening Grosbeak |
| Birds |  | Euphagus carolinus | Rusty Blackbird |
| Birds |  | Fratercula arctica | Atlantic Puffin |
| Birds |  | Fulica americana | American Coot |
| Birds |  | Gallinula galeata | Common Gallinule |
| Birds |  | Gavia immer | Common Loon |
| Birds |  | Haliaeetus leucocephalus | Bald Eagle |
| Birds |  | Ixobrychus exilis | Least Bittern |
| Birds |  | Oreothlypis peregrina | Tennessee Warbler |
| Birds |  | Phalacrocorax carbo | Great Cormorant |
| Birds |  | Poecile hudsonicus | Boreal Chickadee |
| Birds |  | Sterna dougallii | Roseate Tern |
| Birds |  | Sterna hirundo | Common Tern |
| Birds |  | Sterna paradisaea | Arctic Tern |
| Birds |  | Sternula antillarum | Least Tern |
| Birds |  | Tyto alba | Barn Owl |
| Birds |  | Vermivora cyanoptera | Blue-winged Warbler |
| Fish | Anadromous | Acipenser brevirostrum | Shortnose Sturgeon |
| Fish | Anadromous | Acipenser oxyrinchus | Atlantic Sturgeon |
| Fish | Anadromous | Alosa aestivalis | Blueback Herring |
| Fish | Anadromous | Alosa pseudoharengus | Alewife |
| Fish | Anadromous | Alosa sapidissima | American Shad |
| Fish | Anadromous | Anguilla rostrata | American Eel |
| Fish | Anadromous | Morone saxatilis | Striped Bass |
| Fish | Anadromous | Osmerus mordax | Rainbow Smelt |
| Fish | Anadromous | Salmo salar | Atlantic Salmon |
| Fish | Freshwater | Acipenser fulvescens | Lake Sturgeon |
| Fish | Freshwater | Coregonus clupeaformis | Lake Whitefish |
| Fish | Freshwater | Esox americanus americanus | Redfin Pickerel |
| Fish | Freshwater | Etheostoma fusiforme | Swamp Darter |
| Fish | Freshwater | Lota lota | Burbot |
| Fish | Freshwater | Notropis bifrenatus | Bridle Shiner |
| Fish | Freshwater | Prosopium cylindraceum | Round Whitefish |
| Fish | Freshwater | Salvelinus alpinus oquassa | Arctic Char |
| Fish | Freshwater | Salvelinus fontinalis | Brook Trout |
| Fish | Freshwater | Salvelinus namaycush | Lake Trout |
| Invertebrate-Arthropods | Bumble Bees | Bombus affinis | Rusty-patched Bumble Bee |
| Invertebrate-Arthropods | Bumble Bees | Bombus bohemicus/ashtoni | Gypsy/Ashton's Cuckoo Bumble Bee |
| Invertebrate-Arthropods | Bumble Bees | Bombus insularis | Indiscriminate Cuckoo Bumble Bee |
| Invertebrate-Arthropods | Bumble Bees | Bombus pensylvanicus | American Bumble Bee |
| Invertebrate-Arthropods | Bumble Bees | Bombus terricola | Yellow-banded Bumble Bee |
| Invertebrate-Arthropods | Butterflies and Skippers | Erora laeta | Early Hairstreak |
| Invertebrate-Arthropods | Dragonflies and Damselflies | Williamsonia lintneri | Ringed Boghaunter |
| Invertebrate-Arthropods | Giant Silkworm and Royal Moths | Citheronia sepulcralis | Pine Devil |
| Invertebrate-Arthropods | Other Crustaceans | Homarus americanus | American Lobster |
| Invertebrate-Arthropods | Other Crustaceans | Lebbeus groenlandicus | Spiny Lebbeid Shrimp |
| Invertebrate-Arthropods | Other Crustaceans | Lebbeus polaris | Polar Lebbeid Shrimp |
| Invertebrate-Arthropods | Other Crustaceans | Pandalus borealis | Northern Shrimp |
| Invertebrate-Arthropods | Spiders and other Chelicerates | Limulus polyphemus | Horseshoe Crab |
| Invertebrate-Non Arthropods | Coral | Gersemia rubiformis | Sea Strawberry |
| Invertebrate-Non Arthropods | Freshwater Mussels | Alasmidonta heterodon | Dwarf Wedgemussel |
| Invertebrate-Non Arthropods | Freshwater Mussels | Alasmidonta undulata | Triangle Floater |
| Invertebrate-Non Arthropods | Freshwater Mussels | Alasmidonta varicosa | Brook Floater |
| Invertebrate-Non Arthropods | Freshwater Mussels | Anodonta implicata | Alewife Floater |
| Invertebrate-Non Arthropods | Freshwater Mussels | Lampsilis cariosa | Yellow Lampmussel |
| Invertebrate-Non Arthropods | Freshwater Mussels | Leptodea ochracea | Tidewater Mucket |
| Invertebrate-Non Arthropods | Freshwater Mussels | Ligumia nasuta | Eastern Pond Mussel |
| Invertebrate-Non Arthropods | Freshwater Mussels | Margaritifera margaritifera | Eastern Pearlshell |
| Invertebrate-Non Arthropods | Freshwater Mussels | Strophitus undulatus | Creeper |
| Invertebrate-Non Arthropods | Freshwater Snails | Stagnicola mighelsi | Bigmouth Pondsnail |
| Invertebrate-Non Arthropods | Other Invertebrates | Asterias forbesi | Forbes's Starfish |
| Invertebrate-Non Arthropods | Other Invertebrates | Asterias rubens | Common Sea Star |
| Invertebrate-Non Arthropods | Other Invertebrates | Crossaster papposus | Common Sun Star |
| Invertebrate-Non Arthropods | Other Invertebrates | Cucumaria frondosa | Orange-footed Sea Cucumber |
| Invertebrate-Non Arthropods | Other Invertebrates | Gorgonocephalus arcticus | Northern Basket Starfish |
| Invertebrate-Non Arthropods | Other Invertebrates | Psolus fabricii | A Psolus |
| Invertebrate-Non Arthropods | Other Invertebrates | Psolus phantapus | A Psolus |
| Invertebrate-Non Arthropods | Other Invertebrates | Solaster endeca | Purple Sunstar |
| Invertebrate-Non Arthropods | Other Invertebrates | Stephanasterias albula | White Sea Star |
| Invertebrate-Non Arthropods | Other Invertebrates | Strongylocentrotus droebachiensis | Green Sea Urchin |
| Invertebrate-Non Arthropods | Other Invertebrates | Thyonidium drummondii | Sea Cucumber |
| Invertebrate-Non Arthropods | Other Molluscs | Boreotrophon clathratus | Clathrate Trophon |
| Invertebrate-Non Arthropods | Other Molluscs | Boreotrophon truncatus | Murex |
| Invertebrate-Non Arthropods | Other Molluscs | Crassostrea virginica | Eastern Oyster |
| Invertebrate-Non Arthropods | Other Molluscs | Mya arenaria | Soft Shell Clam |
| Invertebrate-Non Arthropods | Other Molluscs | Mytilus edulis | Blue Mussell |
| Invertebrate-Non Arthropods | Other Molluscs | Placopecten magellanicus | Deep Sea Scallop |
| Invertebrate-Non Arthropods | Other Molluscs | Ptychatractus ligatus | Spindle Shell |
| Invertebrate-Non Arthropods | Other Molluscs | Zirfaea crispata | Atlantic Great Piddock |
| Invertebrate-Non Arthropods | Snail | Colus pygmaeus | Colus Snail |
| Invertebrate-Non Arthropods | Snail (sea) | Arrhoges occidentalis | American Pelican Foot |
| Invertebrate-Non Arthropods | Terebratulina septentrionalis | Lamp Shell |
| Mammals | Bat | Eptesicus fuscus | Big Brown Bat |
| Mammals | Bat | Myotis leibii | Eastern Small-footed Bat |
| Mammals | Bat | Myotis lucifugus | Little Brown Bat |
| Mammals | Bat | Myotis septentrionalis | Northern Long-eared Bat |
| Mammals | Bat | Myotis sodalis | Indiana Bat |
| Mammals | Bat | Perimyotis subflavus | Tri-colored Bat |
| Mammals | Furbearer | Lynx canadensis | Lynx |
| Mammals | Rabbit | Sylvilagus transitionalis | New England Cottontail |
| Reptiles | Snake | Coluber c. constrictor | Northern Black Racer |
| Reptiles | Snake | Crotalus horridus | Timber Rattlesnake |
| Reptiles | Snake | Heterodon platirhinos | Eastern Hog-nosed Snake |
| Reptiles | Snake | Opheodrys vernalis | Smooth Greensnake |
| Reptiles | Snake | Panthera alleghaniensis | Eastern/Black Rat Snake |
| Reptiles | Snake | Regina septemvittata | Queen Snake |
| Reptiles | Snake | Thamnophis s. sauritus | Eastern Ribbonsnake |
| Reptiles | Turtle | Clemmys guttata | Spotted Turtle |
| Reptiles | Turtle | Emydoidea blandingii | Blanding's Turtle |
| Reptiles | Turtle | Glyptemys insculpta | Wood Turtle |
| Reptiles | Turtle | Terrapene carolina | Eastern Box Turtle |

# Resources

Just a suggestion

I’m not sure how this following section might be formatted, but perhaps Appendix A above with references, or dare I mention, hyperlinks to publications, websites, etc. Or…perhaps as a Literature Cited by species. The intent would be to provide more information on the diseases rather than simply listing them and leaving it to the reader to find out more about how to cope. This could easily spin out-of-control and could quickly become dated, and so would need to be constrained to resource (species or habitat) management or other topics.