

Northern Leopard Frog

Lithobates pipiens

Federal Listing	N/A
State Listing	SC
Global Rank	G5
State Rank	S3
Regional Status	High



Photo by Michael Marchand

Justification (Reason for Concern in NH)

Northern leopard frogs have apparently declined throughout much of New England and are listed as a species of high regional concern in the northeast (NEPARC 2010, Weir et al. 2014). The decline is likely related to development of floodplains, conversion of grassland habitat and farm abandonment and forest regeneration. The current distribution and abundance of northern leopard frogs and the status of remaining populations in New Hampshire is poorly known.

Distribution

The northern leopard frog has a broad distribution in the United States and Canada. Northern leopard frogs range from New England to the mid-Atlantic to west of the Rockies, and in Canada, populations exist from southeastern British Columbia east to the Maritimes. The northern leopard frog is absent from most of the southeast. The recent description of a new leopard frog species, the Atlantic coast leopard frog (*Lithobates kauffeldi*), likely reduces the previously proposed range and distribution of the northern leopard frog. Feinberg et al. (2014) documented this new species centered in New York City as well as throughout Long Island, eastern Pennsylvania, southern Connecticut, and New Jersey. More research will likely improve the resolution of distribution maps and where overlap exists between the northern, Atlantic coast, and southern leopard frogs (*Lithobates sphenoccephalus*). Throughout its range, the northern leopard frog often has a spotty distribution, and is considered critically imperiled (S1) or imperiled (S2) in several states in the west and south and in British Columbia. In New England, the species is considered imperiled (S2) in Connecticut and Rhode Island, Vulnerable (S3) in New Hampshire and Maine, and apparently secure (S4) in Vermont and (S3S4) in Massachusetts (Nature Serve 2015). Throughout New England, the species has a very spotty distribution, and is strongly associated with grassy riparian floodplains. For example, in Connecticut, Klemens (1993) found that the species is restricted mainly to the Housatonic and Connecticut drainage basins and their tributaries.

In New Hampshire, records from the RAARP database indicate that northern leopard frogs were observed in the following counties and towns between 1992 and 2015: Coos (Errol, Pittsburg), Grafton (Lyme), Carroll (Chatham), Belknap (Gilford), Sullivan (Charlestown), Merrimack (Canterbury, Concord, Hopkinton), Hillsborough (Deering, Litchfield), and Rockingham (Newbury, Nottingham, Portsmouth, Stratham, Portsmouth, Windham). Most observations were from the Merrimack River, Connecticut River, Androscoggin River and associated floodplains.

Habitat

Northern leopard frogs require three distinct habitat types during their life cycle for breeding, foraging, and overwintering. Breeding (May to late June), egg deposition, and tadpole development

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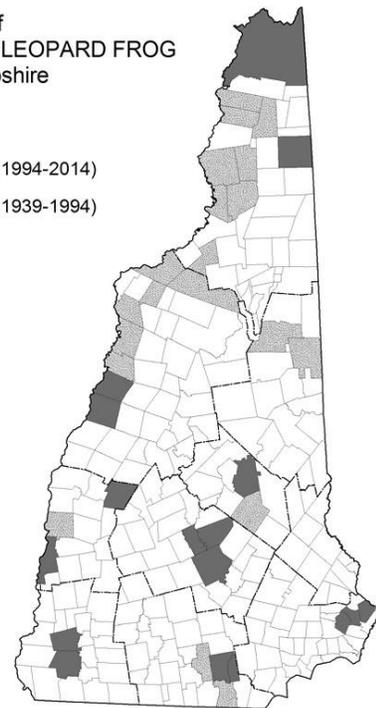
occur in areas of shallow standing water and emergent vegetation, such as lake inlets, slow streams, ponds, temporary wetlands holding water until at least July or August (i.e., long-hydroperiod vernal pools), overflows, or the backwater of rivers (Merrell 1977, Hine et al. 1981, Hunter et al. 1999, Kendell 2002, Alberta Sustainable Resource Development 2003). Vegetation and sites without fish predators provide the most suitable habitat for egg laying (Merrill 1977). During the summer adult (post-breeding), juvenile (non-breeding), and young-of-the-year (post-metamorphosis) frogs are typically found close to water (Kendell 2002, Alberta Sustainable Resource Development 2003). However, leopard frogs will travel a considerable distance away (1-2 km) from major waterbodies to areas that have some moisture, such as wet meadows, pastures, hay fields, scrub vegetation, sedge meadows, drainage/irrigation ditches, or damp wooded areas (Hunter et al. 1999, Kendell 2002). Leopard frogs must overwinter in permanent bodies of water or streams that do not freeze to the bottom because they cannot withstand prolonged freezing (Schmid 1982, Costanzo et al. 1992, Layne 1992, 1993, Hunter et al. 1999, Russell and Bauer 2000, Alberta Sustainable Resource Development 2003). Hibernacula are most often located in springs, streams, spillways below dams, or in deeper lakes and ponds (Emery et al. 1972, Merrell 1977, Cunjak 1986). Within waterbodies, leopard frogs have been found hibernating under rocks, logs, leaf litter or vegetation, or in depressions in sand or mud (Emery et al. 1972).

NH Wildlife Action Plan Habitats

- Floodplain Habitats
- Grasslands
- Coldwater Rivers and Streams
- Lakes and Ponds with Coldwater Habitat
- Large Warmwater Rivers
- Marsh and Shrub Wetlands
- Shrublands
- Warmwater Rivers and Streams

Distribution of
NORTHERN LEOPARD FROG
in New Hampshire

■ Current (1994-2014)
■ Historic (1939-1994)



Distribution Map

Current Species and Habitat Condition in New Hampshire

There are not sufficient data available from which to make assessments about population health or trends for this species.

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Population Management Status

There are no ongoing management efforts for any particular northern leopard frog population in New Hampshire at this time.

Regulatory Protection (for explanations, see Appendix I)

- NHFG Rule FIS 803.02. Importation.
- NHFG Rule FIS 804.02. Possession.
- NHFG Rule FIS 811.01 Sale of Reptiles.
- NHFG FIS 1400 Nongame special rules
- Fill and Dredge in Wetlands - NHDES
- Rivers Management and Protection Program - NHDES
- Comprehensive Shoreland Protection Act - NHDES
- Clean Water Act-Section 404
- Alteration of Terrain Permitting - NHDES

Quality of Habitat

Data are insufficient to determine relative quality of habitat patches.

Habitat Protection Status

There are insufficient data to assess protection status for this species.

Habitat Management Status

Northern leopard frog habitat is not specifically managed in New Hampshire.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a “medium” or “high” score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

Habitat conversion due to development (Threat Rank: Medium)

The loss of leopard frog habitat (breeding, overwintering, or foraging) to commercial or residential development will result in a population reduction. If habitat loss is extreme enough, extirpation of the local population will occur. Habitat fragmentation isolates (or separates by greater distances) northern leopard frog populations. As habitat is lost and becomes more fragmented, (re)colonization of the remaining habitat patches becomes increasingly difficult. This separation limits immigration from neighboring populations, which leads to reduced gene flow and increases the likelihood that the isolated population will become extirpated from environmental or demographic stochasticity (Alberta Sustainable Resource Development 2003, Blaustein et al. 1994, Corn 1994). In New Hampshire, the most significant habitat loss and fragmentation threat comes from development in riparian floodplain areas and conversion of farmland to suburban or commercial development.

Habitat loss is believed to be one of the causes of northern leopard frog declines in Washington, Oregon, Idaho and Montana (Alberta Sustainable Resource Development 2003). The extent to which wetland loss and alteration have affected northern leopard frog populations in New Hampshire is

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unknown; however, significant loss of early successional grassland habitat and farm land has been well documented in the state (see grassland habitat profile for details). The loss of wetlands and grassland communities reduces the amount of available leopard frog habitat. Northern leopard frogs are dependent on specific wetland habitats for breeding and overwintering and grassland habitats for summer foraging. The common requirement among amphibians for more than one habitat (i.e., landscape complementation) makes this group particularly vulnerable to the impacts of habitat loss. Reduction or removal of any one of the required habitats may render the landscape unsupportive of northern leopard frogs (Pope et al. 2000).

Northern leopard frogs require three distinct habitats to complete their life cycle: a breeding site, midsummer foraging habitat, and a stream or other suitable water body for overwintering. The impairment of movement between these habitat types could result in/extirpation of a local population (Alberta Sustainable Resource Development 2003). On a regional basis, many amphibian populations exist as metapopulations, represented by a set of linked but geographically discrete local populations occupying suitable habitats (Alberta Sustainable Resource Development 2003, Blaustein et al. 1994, Marsh and Trenham 2001). The size of local populations will fluctuate because of environmental factors, and natural stochastic mechanisms and local extinction may occur. Regionally, populations will be maintained through dispersal of individuals between populations and recolonization of vacant habitat. When the natural landscape processes are disrupted because of habitat fragmentation, (re)colonization often cannot occur. Thus, a local extirpation event may lead to the regional collapse of a species (Seburn and Seburn 2000).

Mortality from mowing and agricultural machinery & vehicles (Threat Rank: Medium)

Adult leopard frogs spend most of their time in grassy areas near water during the summer months of June to August (Hunter et al. 1999). Direct mortality of adult individuals from mowing and/or agricultural machinery/vehicles where waterbodies are in close proximity to farm fields is likely.

Haying fields may cause mortality, but can also maintain crucial foraging habitat that has been otherwise declining in New Hampshire. Mowing mortalities have not been documented in the state and the impact on leopard frog populations is currently unknown.

Mortality of individuals from vehicles on roadways (Threat Rank: Medium)

Direct mortality of northern leopard frogs caused by vehicle traffic can be a significant mortality agent, and may be particularly problematic for small populations. Roads fragment habitat and may act as partial barriers to migration. Thus, roads may decrease frog dispersal, resulting in decreased exchange of individuals among populations and consequently reduce colonization/recolonization and gene flow among local populations. This could disrupt (meta) population dynamics of the species and reduce the ability of the species to remain viable.

Amphibians are especially vulnerable to traffic mortality because their life histories often involve migration between wetland and upland habitats, and individuals are inconspicuous and sometimes slow-moving (Trombulak and Frissell 2000). Ehmann and Cogger (1985) estimated that more than five million amphibians and reptiles are killed each year on roads in Australia. Research conducted in the Ottawa area indicates that anuran populations decrease in size with increasing traffic volume (Fahrig et al. 1995). Even at high traffic sites Bouchard et al. (2009) found that northern leopard frogs show no behavioral avoidance of roads. Additionally, Carr and Fahrig (2001) found that traffic can influence leopard frog population abundance out to at least 1.5 km from the population and that more vagile species, such as northern leopard frogs, are more strongly affected by road traffic than less vagile species (for example, the green frog). Roads can be demographic barriers that cause habitat and population fragmentation (Trombulak and Frissell 2000). Northern leopard frog roadkill has been

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documented in Concord, New Hampshire (M. N. Marchand, personal observation).

Disturbance and mortality from agricultural pesticide use (Threat Rank: Medium)

Pesticide wetting agents can interfere with cutaneous respiration in metamorphosed and adult frogs and gill respiration in tadpoles, leading to indirect or direct mortality. Chemicals can suppress the immune system, cause endocrine disruption, developmental malformations, and alter behavior which may lead to decreased vigor, ability to fight off disease, reproduce, or escape predation, thereby increasing the chance of mortality.

The northern leopard frog is a frequent subject of toxicity experiments (e.g., see Hoffman et al. 2003). The evidence outlined in this section is meant to provide examples, as opposed to being an exhaustive review.

Leopard frogs are commonly found near agricultural areas where they are exposed to pesticides, herbicides, and nitrate and nitrite runoff from the widespread use of fertilizers. Low levels of nitrates can cause reduced activity, feeding, reproductive ability, and increases in deformities in tadpoles (Hecnar 1995). Allran and Karasov (2000) report that nitrate slowed the growth of leopard frog larvae. Such a decrease in growth as a larva can have a significant detrimental impact later in the life of a frog by decreasing survival, size as an adult, rate of sexual maturation, mate selection, and locomotion ability for predator evasion (Allran and Karasov 2000). Ouellet et al. (1997) found higher rates of limb deformities in northern leopard frogs in Ontario, Canada, at sites in agricultural areas compared to non-agricultural areas and suggested that contaminants were the likely causal agent. In addition, *Lithobates pipiens* tadpoles are also sensitive (e.g., have lower survival, experience paralysis, delayed growth, or abnormal behavior) to low concentrations of insecticides and herbicides commonly used in forest management (Berrill et al 1994, Berrill et al 1995).

It has also been demonstrated that, for leopard frogs, pesticides can act as immunosuppressive agents at sublethal doses that are present in wild frogs. The immunosuppressive effects of pesticides may be contributing to amphibian declines by rendering exposed populations susceptible to common pathogenic organisms (Gilbertson et al. 2003). Hayes et al. (2002) reported that very small doses (0.1 ppb) of the commonly used herbicide Atrazine can cause hermaphroditism in northern leopard frogs. Further research indicates that the immunosuppressant effects of Atrazine in northern leopard frogs may have a synergistic relationship with known amphibian pathogens such as trematode (*Ribeiroia ondatrae*) and lung worm (*Rhabdias ranae*) (Brodtkin et al. 2007). Two other common pesticides, endosulfan and mancozeb, have been shown to be lethal to northern leopard frog tadpoles at environmentally relevant doses and slowed growth rates at sublethal concentrations. Such slower growth rates in amphibians have been associated with increased predation risk and desiccation at ephemeral ponds (Shenoy et al. 2009).

Although fertilizer inputs and excretory products from farm animals (e.g., dairy cows) often increase water pH, because of the low buffering capacity of most water bodies in New Hampshire, northern leopard frogs in New Hampshire may be at risk from decreased environmental pH resulting from emissions of sulphur dioxide and nitrogen oxides through the burning of fossil fuels. Simon et al. (2002) demonstrated that frogs experimentally exposed to pH 5.5 had spleens colonized with both Gram-positive and Gram-negative bacteria whereas spleens of frogs exposed to pH 7.0 either were sterile or exhibited little bacterial colonization. Resulting systemic infections combined with decreased natural defenses may in part cause increased mortality in leopard frogs (Simon et al. 2002). In a laboratory experiment, leopard frogs collected early in the spring, immediately following hibernation, but prior to the breeding season, exhibited 100% mortality within the first four days of exposure to pH 5.5 (Vatnick et al. 1999). At this level of pH, exposed adult frogs suffer a 72% mortality

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rate over 10 days (Vatnick et al. 2006). Watkins-Colwell and Watkins-Colwell (1998) found that prolonged exposure to pH less than 4.0 was lethal for leopard frogs, and that bacterial infection, inhibition of yolk plug retraction, thoracic swelling and caudal curling occur at a pH less than 6.3 (Watkins-Colwell and Watkins-Colwell 1998).

In general, amphibians are particularly vulnerable to a variety of contaminants, including insecticides and herbicides (Alberta Sustainable Resource Development 2003, Bishop 1992, Harfenist et al. 1989). The extent of use of these chemicals in New Hampshire and their potential effects on amphibians is unclear and requires greater attention.

List of Lower Ranking Threats:

Mortality and degradation from fertilizers that cause eutrophication

Mortality and species impacts (decreased fitness) from various diseases (ranavirus, chytrid)

Mortality from subsidized or introduced predators

Mortality and habitat conversion from lake and river drawdowns during winter

Mortality and degradation from increased droughts

Actions to benefit this Species or Habitat in NH

Conserve habitat at known priority leopard frog sites.

Primary Threat Addressed: Habitat conversion due to development

Specific Threat (IUCN Threat Levels): Residential & commercial development

Objective:

Identify priority sites and conserve habitat at those sites.

General Strategy:

Population condition is not known for leopard frog sites in NH. Once that information is acquired, priority sites can be established and these areas can be included in land conservation priorities.

Political Location:

Statewide

Watershed Location:

Statewide

Location Description:

Populations are localized, usually along major river floodplains.

Monitor the distribution, condition, and risk to leopard frog populations

Objective:

Monitor the distribution, condition, and risk to leopard frog populations.

General Strategy:

Several potential threats have been identified for the species. However, there is minimal information available in NH to assess appropriate actions to implement at this time. NHFG will encourage reports through the reptile and amphibian reporting program to further refine the species distribution in NH. The condition of these sites needs to be determined. Leopard frogs should be considered an indicator for monitoring where appropriate (e.g., response to habitat management, effect of various pesticides,

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floodplain restoration projects).

Political Location:

Statewide

Watershed Location:

Statewide

Location Description:

Populations are localized, usually along major river floodplains.

References, Data Sources and Authors

Data Sources

Information relating to the distribution and status of this species was gathered through a literature review and from NatureServe, as well as from the RAARP database. Threat assessment conducted by a group of NHFG biologists.

Threat assessments were conducted by a group of NHFG biologists (Michael Marchand, Brendan Clifford, Loren Valliere, Josh Megysey).

Data Quality

No comprehensive survey has been conducted for this species in New Hampshire.

2015 Authors:

Joshua Megysey, NHFG

2005 Authors:

Kimberly Babbitt, UNH; Nicole A. Freidenfelds, UNH

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