Species Status Report

Canadian Toad, Western Toad, and Northern Leopard Frog

(Anaxyrus hemiophrys, Anaxyrus boreas, Lithobates pipiens = Rana pipiens)

IN THE NORTHWEST TERRITORIES

NORTHWEST TERRITORIES SPECIES AT RISK COMMITTEE

NOT ASSESSED – Canadian Toad

THREATENED – Western Toad

ENDANGERED – Northern Leopard Frog

May 2025

Species at Risk Committee status reports are working documents used in assigning the status of species suspected of being at risk in the Northwest Territories (NWT).

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This report was compiled and updated by Claire Singer under contract with the Government of the Northwest Territories, based on previous status reports for western toad and northern leopard frog prepared by Brian Slough, and edited by Michele Grabke, Species at Risk Implementation Supervisor, Species at Risk Secretariat.

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ABOUT THE SPECIES AT RISK COMMITTEE

The Species at Risk Committee was established under the *Species at Risk (NWT) Act*. It is an independent committee of experts responsible for assessing the biological status of species at risk in the NWT. The Committee uses the assessments to make recommendations on the listing of species at risk. The Committee uses objective biological criteria in its assessments and does not consider socio-economic factors. Assessments are based on species status reports that include the best available Indigenous knowledge, community knowledge, and scientific knowledge of the species. The status report is approved by the Committee before a species is assessed.

ABOUT THIS REPORT

This species status report is a comprehensive report that compiles and analyzes the best available information on the biological status of Canadian Toad, Western Toad, and Northern Leopard Frog in the NWT, as well as existing and potential threats and positive influences. Full guidelines for the preparation of species status reports, including a description of the review process, may be found at www.nwtspeciesatrisk.ca.

Government of Northwest Territories / Gouvernement des Territoires du Nord-Ouest

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CANADIAN TOAD – NOT ASSESSED

The Northwest Territories Species at Risk Committee (SARC) met on April 29-30, 2025, to assess the biological status of Canadian toad in the Northwest Territories. The assessment was based on this approved Species Status Report for Canadian Toad, Western Toad and Northern Leopard Frog. The Species at Risk Committee determined that there was not enough available documented Indigenous and community knowledge (ICK) to prepare an ICK component of the status report. Therefore, the status report is based mostly on scientific knowledge (SK), but ICK on amphibians is included where available.

The assessment process and objective biological criteria used by the Species at Risk Committee are based on SK and are available at: www.nwtspeciesatrisk.ca.

Assessment: Not Assessed

Investigation of the best available knowledge indicates that all known occurrences of Canadian toad are within Wood Buffalo National Park.

Canadian toad was initially scheduled for assessment in 2025 and included in the Species Status Report for Amphibians in the NWT because there was one observation recorded outside of the Wood Buffalo National Park. The specimen that suggested presence of Canadian Toad outside the Wood Buffalo National Park was collected 21 June 1901 and the record notes Fort Smith. However, under further investigation it was identified that this likely refers to a general location rather than a precise collection site.

Based on direction from the Conference of Management Authorities, SARC has decided not to assess Canadian toad as there are no verified occurrences outside of Wood Buffalo National Park. National Park lands are under the jurisdiction of the Government of Canada based on the *Canada National Parks Act* and, therefore, responsibility for the Canadian toad does not fall to the Conference of Management Authorities.

However, SARC does make the following recommendations on Canadian toad.

Recommendations:

- Investigate Canadian toad occurrences (observations, breeding sites, and hibernacula sites) beyond the boundary of Wood Buffalo National Park, along Highway 5 towards Fort Smith.
- Prioritize the assessment of Canadian toad in the Northwest Territories if observations are made outside of Wood Buffalo National Park.

- Document Indigenous and community knowledge on Canadian toad, including their habitat, and threats.
- Encourage researchers to fill knowledge gaps on all aspects of Canadian toad biology (i.e., range, breeding sites, abundance, population trends), habitat and threats.
- Encourage continued implementation of best practices for studying/researching amphibians to avoid disease transmission and for working in areas important for Canadian toad.
- Encourage COSEWIC to assess Canadian toad. Currently, Canadian toad is included as a high priority candidate under Part 3: species specialist subcommittees' candidate list of COSEWIC's candidate wildlife species.
- Encourage Parks Canada to continue the Canadian toad emergent hole surveys and to follow the recommendations outlined in the Parks Canada unpublished survey reports. These include: 1) putting in place habitat signage and/or marking areas for protection, and 2) developing and/or implementing a Canadian toad and/or Amphibian Monitoring Program.
- Continue to educate the public to raise awareness of Canadian toad (and all amphibians), their habitat, and threats.
- Encourage sharing Canadian toad observations on iNaturalist.ca and/or reporting observations to WildlifeObs@gov.nt.ca.

WESTERN TOAD ASSESSMENT

The Northwest Territories Species at Risk Committee (SARC) met on April 29-30, 2025, and reassessed the biological status of western toad in the Northwest Territories. The assessment was based on the approved Species Status Report for Canadian Toad, Western Toad and Northern Leopard Frog. The Species at Risk Committee determined that there was not enough available documented Indigenous and community knowledge (ICK) to prepare an ICK component of the status report. Therefore, the status report is based mostly on scientific knowledge (SK), but ICK on amphibians is included where available.

The assessment process and objective biological criteria used by the Species at Risk Committee are based on SK and are available at: www.nwtspeciesatrisk.ca.

Assessment: Threatened in the Northwest Territories

Threatened – The species is likely to become Endangered in the NWT if nothing is done to reverse the factors leading to its extirpation or extinction.

Reason for the assessment: Western toad fits criteria SK (D2) for Threatened.

Status Category	**Criterion**	
Threatened	SK (D2)	The species has a restricted number of locations in the NWT. There are fewer than 5 locations for this species, therefore western toad is prone to the effects of human activities or stochastic events within a very short time period (1-2 generations) in an uncertain future, and is thus capable of becoming Extinct, Extirpated or Critically Endangered in a very short period of time.

Main factors:

- The population of western toad in the Northwest Territories is restricted to three locations based on known breeding sites; therefore, it is vulnerable to stochastic events within a very short period of time.
- The number of locations depends on the most serious plausible threat to a species. The most serious plausible threat to western toad is disease and pathogens. Therefore, the number of locations is based on the number of breeding areas where amphibians gather and may spread pathogens. A breeding area may contain overlapping sites or breeding

ponds within close proximity. In this context, there are three locations based on 11 known breeding sites.

- In the NWT, chytridiomycosis has been found in western toads and there is evidence of ranavirus within the range of western toad. A disease outbreak could decimate the western toad population within a breeding area, particularly if coupled with additional stressors (e.g., drought, wildfire) or threats that reduce immunity to diseases.
- Additional threats include habitat degradation, drought, wildfires, roadkill, and increased UV-B radiation. These threats can have complex interactions with each other and are challenging to manage.
- Life-history characteristics (e.g., long lifespan, delayed maturity of females, and females breeding only once a lifetime) make populations especially vulnerable to threats and declines.

Additional factors:

- Currently, there is not enough information or data on abundance to determine population trends for western toads in the Northwest Territories.
- Although there are healthy populations of western toads in British Columbia and the Yukon that could contribute to a rescue effect, these populations may be subject to similar threats that are faced by the population in the NWT, particularly if there is not enough good habitat for re-establishing the population.
- Western toads in the NWT appear to be at or near the northern limit of species distribution, where they may be particularly vulnerable to stochastic events like drought and wildfire.

Positive influences on western toad and their habitat:

- Progress has been made to achieve objectives for amphibian management including developing and implementing the *Western Toad Best Management Practices* for work on roadways in the Liard River valley, and publishing a *Field Guide to Amphibians and Reptiles of the Northwest Territories*.
- Researchers in the NWT are required to follow decontamination protocols, as a condition of research permits, to help prevent human-caused spread of disease in wetlands and ponds.
- Western toad is listed as a species of Special Concern under the federal *Species at Risk Act (SARA)* and a national management plan was published in 2020.

Assessment History:

- The NWT Species at Risk Committee met in December 2014 and assessed western toad as Threatened in the NWT because of its limited range and vulnerability to threats.
- Western toad was listed as Threatened in the NWT in 2016 under the *Species at Risk (NWT) Act*.
- A Management Plan for Amphibians in the NWT was completed in 2017 and a progress report was released in 2022.

Recommendations:

- Document Indigenous and community knowledge on western toads, including their habitat, and threats.
- Encourage researchers to fill knowledge gaps on all aspects of western toad biology (i.e., breeding sites, abundance, population trends), habitat and threats.
- Encourage continued monitoring of breeding sites.
- Encourage continued implementation of best practices for studying/researching amphibians to avoid disease transmission and for working in areas important for western toads.
- Encourage the implementation and enforcement of protection measures for known breeding sites.
- Continue participating in the regulatory process to provide advice regarding amphibian habitat as appropriate.
- Continue to educate the public to raise awareness of western toads (and all amphibians), their habitat, and threats.
- Encourage sharing western toad observations on iNaturalist.ca and/or reporting observations to WildlifeObs@gov.nt.ca.

NORTHERN LEOPARD FROG ASSESSMENT

The Northwest Territories Species at Risk Committee (SARC) met on April 29-30, 2025, and reassessed the biological status of northern leopard frog in the Northwest Territories. The assessment was based on the approved Multispecies Status Report for Canadian Toad, Western Toad and Northern Leopard Frog. The Species at Risk Committee determined that there was not enough available documented Indigenous and community knowledge (ICK) to prepare an ICK component of the status report. Therefore, the status report is based mostly on scientific knowledge (SK), but ICK on amphibians is included where available.

The assessment process and objective biological criteria used by the Species at Risk Committee are based on SK and are available at: www.nwtspeciesatrisk.ca.

Assessment: Endangered in the Northwest Territories

Endangered – The species is facing imminent extirpation from the NWT or extinction.

Reason for the assessment: Northern leopard frog fits criteria SK (B2) and meets conditions (a) and (b) (iii, iv, v) for Endangered.

Status Category	Criterion	
Endangered	SK(B2) The area of occupancy is <500 km²	The index area of occupancy is approximately 116 km^2.
	(a) The number of locations is ≤5	The number of locations is three with disease/pathogens as the most plausible threat.
	(b) Continuing decline, observed, estimated, inferred, or projected, in any of: (iii) area, extent, or quality of habitat, (iv) number of locations or subpopulations, (v) number of mature individuals.	

<u>Main factors</u>:

- In the Northwest Territories (NWT), northern leopard frog is at the northern-most limit of its range in the world and is limited to the southern NWT where suitable overwintering sites exist.

- Using all observations in the NWT, the extent of occurrence is estimated to be 14,247 km^2 and the index of area of occupancy (IAO) is an estimated 116 km^2.
- The number of locations depends on the most serious plausible threat to a species. The most serious plausible threat to northern leopard frogs is disease and pathogens. Therefore, the number of locations is based on the number of breeding areas where amphibians gather and may spread pathogens. In this context, there are three locations based on three known breeding sites.
- Knowledge holders have indicated that northern leopard frogs have been present in the area north of Trudel Lake towards Fort Resolution likely since the 1980s, possibly even the 1950s. They are currently present in the Fort Resolution area and the Slave River delta based on multiple reports and local knowledge. One observation of northern leopard frog in Fort Resolution was recorded in 2016. Northern leopard frogs have not been reported in the area between the Slave River Delta and 64.7 degrees north since before 2000. This knowledge suggests an inferred decline in the area, extent, and/or quality of habitat, number of locations or subpopulations, and in the number of mature individuals.
- Other threats to northern leopard frogs include drought, wildfire, and the proposed Taltson Hydroelectric Expansion project. A decline in the quality of habitat, number of locations, and number of individuals is projected from the threats.
- The population of northern leopard frog that occurs in the NWT, northern Alberta and northern Saskatchewan is geographically disjunct from the main distribution of the species in North America. Northern leopard frogs in the NWT were found to be genetically distinct from other populations in western Canada; they also have low genetic diversity, and a high incidence of inbreeding. This increases their vulnerability to stochastic events.
- Populations of northern leopard frog in northern Alberta and Saskatchewan could contribute to a rescue effect. However, these populations are small and are subject to similar threats as northern leopard frogs in the NWT reducing the likelihood of rescue.

Positive influences on northern leopard frog and their habitat:

- Progress has been made to achieve objectives for amphibian management including publishing a *Field Guide to Amphibians and Reptiles of the Northwest Territories*.
- Researchers in the NWT are required to follow decontamination protocols, as a condition of research permits, to help prevent human-caused spread of disease in wetlands and ponds.
- Northern leopard frog is listed as a species of Special Concern under the federal *Species at Risk Act (SARA)* and a national management plan was published in 2013.

Assessment History:

- The NWT Species at Risk Committee met in December 2013 and assessed northern leopard frog as Threatened in the NWT because of its small, shrinking range and declining population.
- In 2015, northern leopard frog was listed as Threatened in the NWT under the *Species at Risk (NWT) Act*.
- A Management Plan for Amphibians in the NWT was completed in 2017 and a progress report was released in 2022.

Recommendations:

- Document Indigenous and community knowledge on northern leopard frog, including their habitat and threats.
- Encourage researchers to fill knowledge gaps on all aspects of northern leopard frog biology (i.e., range, breeding sites, abundance, population trends), habitat and threats.
- Encourage continued implementation of best practices for studying/researching amphibians to avoid disease transmission and for working in areas important for northern leopard frog.
- Encourage the implementation and enforcement of protection measures for known breeding sites.
- Encourage the collection of information on climate change impacts including monitoring the effects of drought and collecting data on changes to the hydrological regime (i.e., water levels, flow and precipitation).
- Continue participating in the regulatory process to provide advice regarding amphibian habitat as appropriate.
- Revisit the status of northern leopard frog in the Northwest Territories if the Taltson Hydroelectric Expansion Project moves forward.
- Continue to educate the public to raise awareness of northern leopard frog (and all amphibians), their habitat, and threats.
- Encourage sharing northern leopard frog observations on iNaturalist.ca and/or reporting observations to WildlifeObs@gov.nt.ca.

Executive Summary

About the Species
There are many similarities in the life cycles of amphibians in general, including the three species that are the focus of this report. Canadian toad, western toad, and northern leopard frog all start life as larvae (tadpoles) in the water, undergo metamorphosis, and then continue developing into mature adults over the course of time, which can take several years depending on the species. **Canadian Toad** The Canadian toad is the smaller of the two toads found in the NWT, ranging from 40-80 mm in snout-vent length at maturity with males typically smaller than females. Colouring is brown to grey green with a pale belly spotted grey. The body is covered with somewhat rust-coloured bumps, including sometimes between the eyes, over the shoulders, and on its back feet. There is a single parotoid gland behind each eye. The Canadian toad is characterized primarily by the presence of two cranial crests (ridges) on its head ‑ lacking in the western toad - and two rounded projections on the back feet that facilitate burrowing activity. Canadian toad eggs are laid in long, spiralling strings. The call is a repeated trilling sound. **Western Toad** The western toad is a relatively large toad with small round or oval glandular protuberances or 'warts' on the back, sides, and upper potions of the limbs. Large oblong parotoid (skin) glands are situated behind the eyes. Colour is typically brown or green but varies from olive green to almost reddish-brown or black. There is a creamy or white vertebral stripe running from snout to vent, which is sometimes broken or nearly absent. Adult western toads in the north tend to be smaller than elsewhere, with males reaching about 65 to 92 mm in snout-vent length and weights up to 71 g, and females reaching 82 mm and 55 g. Western toad eggs are black and are laid in long, intertwined paired strings in shallow margins of lakes and ponds. Tadpoles are jet-black or charcoal in colour and range from nine to 42 mm total length. Male western toads in the NWT produce a release call - a quiet series of chirps like the peeping of a chick **Northern Leopard Frog** The northern leopard frog is a slender, medium-sized frog that is predominantly green, but may be brown, tan, or a combination of brown and green. It has conspicuous solid dark brown or olive oval-shaped spots on the back that are bordered with light halos. Two cream-coloured ridges extend the length of the back. The underside is creamy white. Juveniles have the same

colouration as adults. Adults are 50-110 mm in snout-vent length (large relative to the other two frogs in the NWT), with males rarely exceeding 80 mm in length. Eggs are laid in a spheroid or ovoid-shaped mass, about 75-150 mm long and 50-75 mm wide. Tadpoles are normally about 25 mm snout-vent length (total length 90 mm), dark brown or grey dorsally and speckled with gold spots.

Place

Amphibians are reliant on aquatic environments, often wetlands, for breeding and foraging, and terrestrial environments for foraging and overwintering. Within these environments, three primary habitats are required for all three species considered in this report: (1) aquatic habitat for breeding, egg laying, and tadpole development, (2) foraging and shelter habitat, and (3) overwintering habitat. Each of these habitats must be connected by routes suitable for dispersal. Pond breeding amphibians such as Canadian toad, western toad, and northern leopard frog are assumed to have strong breeding and overwintering site fidelity, high vagility (ability to move) within home ranges, limited dispersal abilities, and spatially disjunct breeding sites.

Canadian Toad

The range of the Canadian toad extends from Alberta, east through much of Saskatchewan and southern Manitoba, south into the northcentral continental United States, and north into a small portion of the NWT. In the NWT, the range of the Canadian toad is limited to the Taiga Plains Slave Upland Mid-Boreal Ecoregion, which occurs in the eastern portion of Wood Buffalo National Park, north to the southern shore of Great Slave Lake. All known hibernation areas for Canadian toad in the NWT occur in sandy banks along or near Highway 5.

Although the area of the range (Taiga Plains Slave Upland Mid-Boreal Ecoregion) is 6,561 km^2, the extent of occurrence (EO) for Canadian toad within the NWT is estimated as 529 km^2 based on observations, breeding locations and hibernacula. The index area of occupancy (IAO) is an estimated 56 km^2.

Western Toad

The western toad is a species of western North America, with a range that includes the Pacific northwestern area of the United States, western Canada, and southeast Alaska. The range extends from coastal Alaska and northwestern Canada in the north to Baja California, Mexico in the southwest and northern New Mexico, Colorado, and Wyoming in the east. This range includes most of British Columbia to the Yukon border, southeast Yukon, southwest NWT in the Liard River basin, and Alberta.

In the NWT, all confirmed observations of western toads are along the Liard Highway and Liard River, largely south of Nahanni Butte, in the Dehcho region. This population is likely continuous with upstream populations in the Yukon and British Columbia. There are over 40 confirmed observations of mature western toads from 15 localities in the NWT. Several of the locations are within close proximity of one another near the Muskeg River. Breeding sites have been confirmed at the Muskeg River gravel pits, the eastern and western portions of an oxbow waterbody previously part of the Muskeg River, and in the Liard River floodplain about 36 km north of Fort Liard. It is likely other breeding sites exist in the area.

The extent of occurrence (EO) for western toad within the NWT is estimated to be 37,314 km^2 in the NWT, while the index of area of occupancy (IAO) is an estimated 92 km^2.

Northern Leopard Frog

The northern leopard frog occurs throughout most of central and northeastern North America from Labrador, James Bay, and the NWT in the north, south to Virginia, Nebraska, and Arizona. Disjunct populations occur in the west, including southern British Columbia and the western United States, where recent range contractions have been observed. Northern leopard frogs in the NWT belong to the Western Boreal population of the Prairie/Western Boreal Designatable Unit (DU), which extends from western Manitoba through Saskatchewan and Alberta. This DU is supported by the high degree of genetic uniformity of southern and northern Alberta and NWT populations.

Northern leopard frogs in the NWT are known to occur in the South Slave region, primarily east of the Slave River, near the Slave, Taltson, and Tethul rivers. The most northerly record is from the Slave River delta on Great Slave Lake and the eastern-most record is from the Taltson River. The most recent sightings of northern leopard frog include a single adult frog near Jackfish Lake (west of Pilot Lake) and a likely sighting by Bienentreu in 2016 at Fort Resolution of a frog that looked like a northern leopard frog based on its colours and movements. Northern leopard frogs have not been reported in the area between the Slave River Delta and 64.7 degrees north since before 2000.

The extent of occurrence (EO) for northern leopard frog, is estimated to be 13,707 km^2 in the NWT, while the index of area of occupancy (IAO) is an estimated 108 km^2, including both recent and historical observations. There have been only 14 occurrences reported since 1995, and there is a total of 31 recent and historical occurrences.

Locations

Disease/pathogens considered the most serious plausible threat for each of these three species. For Canadian toad, there are fewer than five locations based on eight known breeding sites for Canadian toads in the NWT. For western toad, there are three locations based on 11 known breeding sites. For northern leopard frog, there are three locations based on known breeding sites for northern leopard frogs in the NWT.

Population

Canadian Toad

Abundance cannot be estimated for Canadian toads in the NWT. Some population abundance information is known based on surveys of hibernacula. All known hibernation areas for Canadian toad in the NWT occur in sandy banks along or near Highway 5. Emergence counts have been conducted by Parks Canada, to greater or lesser degrees, between 1989 and 2024. In addition, eight breeding sites have been recorded. Therefore, estimates of abundance are considered uncertain given interannual variations in search effort, the possibility of asynchronous survey/emergence timing, holes being obscured by rain, and different levels of staff experience during surveys.

Western Toad

The western toad is apparently widespread, abundant, and persistent across most of its Canadian range, but little information is available on population sizes or densities, and few populations have been systematically monitored. That said, the population of mature western toads in the NWT is unknown. Between 1983-2024, a total of 51 adult western toads have been recorded in the NWT, perhaps 54 if western toads heard calling on acoustic recordings were also mature, across an estimated 15 site occurrences (up from 6 site occurrences in the 2014 assessment of western toads). Based on expert opinion (Carrière pers. comm. 2025) and biological information in this report, the number of mature individuals in the NWT may range from 1,100 to 7,000 if females have small to average clutches, egg survival is poor to average, and there are 8-20 breeding sites.

Western toad populations in Canada are believed to be stable or increasing. Much of the data from the Canadian range of the western toad, including the NWT, are short-term and insufficient to detect population trends. The only repeated survey of breeding sites in the NWT occurred in man-made habitats

Northern Leopard Frog

The adult northern leopard frog population in the NWT is unknown. Based on expert opinion, a broad population estimate for the number of mature individuals was reported in 2013 as probably less than 10,000 and conceivably less than 2,500. Due to the little new data available on abundance there has not been an update to the last population estimate for northern leopard frog in the NWT.

Threats and Limiting Factors
In the NWT, chytridiomycosis has been found in western toads and ranaviruses have been confirmed in Canadian toads. The presence of these pathogens has not been assessed in northern leopard frogs in the NWT. However, chytrid fungus and ranavirus have been found in northern leopard frogs in Alberta. Unfortunately, clearly linking diseases and pathogens to trends in amphibian populations is often difficult, given that amphibian populations display large fluctuations naturally. Long term monitoring is thus necessary to tease out the effects of disease and pathogens versus normal population fluctuations Since 2022, the NWT has experienced severe drought conditions including historically low water levels and flows. Drought has the potential to cause loss or degradation of breeding and overwintering habitat for amphibians. Although declining amphibian populations have been associated with drought conditions elsewhere, in the NWT the impact to amphibian populations is uncertain. Wildfires are linked to drought and have the potential to impact amphibian populations. There is little information on the impact of wildfires on Canadian toad, western toad and northern leopard frog or on impacts more generally to amphibians in the NWT. More broadly, amphibian vulnerability to fire is likely species- and life stage-specific, reflecting habitat preferences, dispersal capacity, and the vulnerability of the life stage at which exposure to fire occurred. The impact to amphibians populations in the NWT as a result of drought and fire is uncertain but consideration of cumulative effects is essential, as is long-term monitoring to better identify changes in populations and their causes. Changes to amphibian habitat through human disturbances can have negative effects on populations. Linear infrastructure can impact habitats and disrupt landscape connectivity. Hydroelectric/power transmission lines are present in the range of northern leopard frogs in the NWT. However, with limited knowledge of current northern leopard frog breeding and overwintering sites, impacts of hydroelectric project expansion on habitats in the NWT cannot be adequately assessed. Roads represent barriers to dispersal and migration for amphibians, and can result in roadkill events, genetic isolation, and maladaptive habitat selection. Mortality in association with roads has been documented in the NWT and Highways 5 and 7 are prominent features in the ranges of Canadian toad and western toad in the NWT, with observations of both species clustered around these highways. Although the NWT range of northern leopard frogs overlaps Highway 5 to some degree, the threat the road poses is likely less than that for Canadian toads and western toads.

Exposure to ultraviolet (UV-B) radiation is considered a current and increasing threat to Canadian toads, western toads, and northern leopard frogs in the NWT. The intensity of UV-B radiation has increased due to stratospheric ozone depletion, climate change, and deforestation, and is thought to play a critical role in the worldwide decline of amphibian populations. UV-B radiation has been shown to reduce the survival of embryos, tadpoles, and juveniles; cause tadpoles to metamorphosize at smaller sizes and in poorer condition; and can induce telomere shortening during egg development. The magnitude of the impact is believed to be low but may be higher in combination with other environmental stressors. Natural (fire) or anthropogenic (clearcutting) deforestation could increase the threat of UV-B exposure in the NWT.

Pollution, both aerial and waterborne, is a threat to amphibian populations in the NWT. Specifically, areas within the NWT that are downstream of Alberta's oilsands region appear to be at a greater risk of water pollution because of accidental wastewater spillages upstream. It is not conclusively known whether contamination from the Alberta oil sands is having downstream and downwind effects on northern leopard frogs in the NWT, but there is a high level of community concern about water contamination and airborne pollutants in general. Oil sand process-affected substrates and water were shown to have negative effects on wood frog egg and tadpole survival, growth, and development. Studies are underway to screen amphibians for diseases, malformations, organic chemicals, and heavy metals. However, effects of pollution on amphibian populations are unknown.

Pesticides, herbicides, and fertilizers may also impact amphibian populations by reducing plankton that tadpoles feed on, immunosuppression, and/or disruption to sexual development. Pesticides have been used to control mosquitoes and their larvae along with biting flies. Herbicides have been used along railway corridors and at certain locations along the Enbridge pipeline as well as at or around electric and/or hydroelectric facility substations. Pesticide and/or herbicide application permits have been requested and/or issued for areas around Yellowknife, Nahanni Butte, along with many of the Northwest Territories Power Corporation electric and/or hydroelectric facility substations including Fort Smith, Pine Point, Jackfish Lake (~Yellowknife), Ingraham Trail (~Yellowknife), Snare Rapids, Snare Falls, Snare Cascades, Snare Forks, Bluefish Lake, and Sand Hills. Other forms of pollution or contamination potentially impacting amphibians include road salts and fire retardants.

Impact from climate change on amphibians in the NWT are considered to be fairly low with benefits as well as drawbacks including potentially greater reproductive success, a longer developmental period, range expansion, and disease resistance but, conversely, increased vulnerability to drought and extreme temperatures and weather conditions, and conditions that may facilitate disease expansion. Phenological shifts may also impact the timing of the breeding season for amphibians, which may result in a subsequent range expansion.

Other potential threats to amphibians include collection and harvest, introduction of non-native species and invasive plant species. Impacts from these other threats are considered low to date and are not expected to impact amphibian habitat or populations.

The Canadian toad, western toad, and northern leopard frog all occur at the northern edge of their range in the NWT and are thus affected by several key limiting factors, including short summer breeding and foraging seasons, long winters requiring extensive periods of hibernation, and a limited number of suitable overwintering sites. Populations of animals at the limits of their range are likely more vulnerable to stochastic events like wildfire or other habitat losses.

In addition, during life stages where aggregation is high (i.e., breeding, movement and overwintering), these species can be vulnerable to mass mortality events, either human-caused (e.g., hibernacula disturbance) or natural (e.g., freezing temperatures).

Positive Influences

COSEWIC assessed northern leopard frog as a species of Special Concern in Canada in 1998, 2002 and 2009. The species was listed as Special Concern in Canada under the federal *Species at Risk Act* (SARA) in 2005. COSEWIC assessed western toad as Special Concern in Canada in 2002 and again in 2012. Western toad was listed as Special Concern in Canada under the federal *Species at Risk Act* (SARA) in 2005.

In 2013, the SARC assessed northern leopard frog as Threatened in the NWT because of its small range, shrinking range and declining population. In 2015, northern leopard frog was listed as Threatened in the NWT under the territorial *Species at Risk (NWT) Act*. In 2014, SARC assessed western toad as Threatened in the NWT because of its small range and concern about threats. In 2016, western road was listed as Threatened in the NWT under the territorial *Species at Risk (NWT) Act*.

After northern leopard frog and western toad were listed under the *Species at Risk (NWT) Act*, an NWT Amphibian Management Plan was completed in 2017. The management plan set a goal of maintaining healthy and viable populations for each amphibian species across their ranges in the NWT. The actions taken from 2017 to 2021 to implement the management plan, and progress made towards achieving its objectives, are summarized in a progress report. Some key highlights include: raising awareness of NWT amphibians and the threats they face, development of educational material, development and implementation of Western Toad

Best Management Practices for work on roadways in the Liard River valley, encouraging people to slow down and watch out for western toads in the Muskeg River area, publishing a Field Guide to Amphibians and Reptiles of the Northwest Territories, participating in regulatory processes and providing advice regarding amphibian habitat to avoid and reduce negative impacts on amphibians and their habitats, and implementing decontamination protocols as a condition of research permits, to help prevent human-caused spread of disease in wetlands and ponds.

The only known hibernacula for Canadian toads in the NWT and some of the habitat for northern leopard frog occur within Wood Buffalo National Park, which offers some protection from industrial development and human disturbance. The range of the western toad overlaps with areas of habitat currently under negotiation with land use plans.

Technical Summary

Question	Scientific Knowledge
Population Trends	
Generation time (average age of parents in the population) (indicate years, months, days, etc.).	**Canadian Toad:** Seven years (seven for males; 7.75 for females). **Western Toad:** Seven years (7.25 years for males; 7 years for females). **Northern Leopard Frog:** Three years (range is 2-4 years of age).
Number of mature individuals in the NWT (or give a range of estimates).	**Canadian Toad:** Unknown. **Western Toad:** number of mature individuals in the NWT may range from 1,100 to 7,000. **Northern Leopard Frog:** In 2013, it was estimated that there were probably less than 10,000 and conceivably less than 2,500 mature individuals. This estimate has not been updated due to limited recent information.
Percent change in total number of mature individuals over the **last** 10 years or 3 generations, whichever is longer.	**Canadian Toad:** Unknown; a decreasing trend is possible. Annual hibernacula surveys indicate that numbers are much lower than they were in the early 1990s, numbers have been extremely low since 2017, and Indigenous and community knowledge holders have observed a general decline in amphibian calling activities over the past 20-30 years. **Western Toad:** Insufficient to detect population trends in the NWT. More breeding sites have been confirmed in recent years. Populations in Canada are believed to be stable or increasing. **Northern Leopard Frog:** Insufficient data are available to determine northern leopard frog population trends.
Percent change in total number of mature	**Canadian Toad:** Unknown. **Western Toad:** Unknown.

individuals over the **next** 10 years or 3 generations, whichever is longer.	**Northern Leopard Frog:** Unknown.
Percent change in total number of mature individuals over any 10 year or 3 generation period that includes **both the past and the future**.	**Canadian Toad:** Unknown. **Western Toad:** Unknown. **Northern Leopard Frog:** Unknown.
If there is a decline in the number of mature individuals, is the decline likely to continue if nothing is done?	**Canadian Toad:** Unknown. **Western Toad:** Unknown. **Northern Leopard Frog:** Unknown.
If there is a decline, are the causes of the decline reversible?	**Canadian Toad:** Unknown. **Western Toad:** Unknown. **Northern Leopard Frog:** Unknown.
If there is a decline, are the causes of decline clearly understood?	**Canadian Toad:** No. **Western Toad:** No **Northern Leopard Frog:** No.
If there is a decline, have the causes of the decline been removed?	**Canadian Toad:** No. **Western Toad:** No. **Northern Leopard Frog:** No.
If there are fluctuations or declines, are they within, or outside of, natural cycles?	**Canadian Toad:** Unknown. **Western Toad:** Unknown. **Northern Leopard Frog:** Unknown.
Are there 'extreme fluctuations' (>1 order of	**Canadian Toad:** Unknown. **Western Toad:** Unknown. **Northern Leopard Frog:** Unknown.

magnitude) in the number of mature individuals?	
Distribution	
Estimated extent of occurrence in the NWT (in km^2).	**Canadian Toad:** 529 km^2 based on observations, breeding locations and hibernacula. Extent of occurrence is within the Taiga Plains Slave Upland Mid-Boreal Ecoregion (which has an area of 6,561 km^2). **Western Toad:** 37,314 km^2 **Northern Leopard Frog:** 14,248 km^2
Index of area of occupancy (IAO) in the NWT (in km^2; based on 2 x 2 grid).	**Canadian Toad:** 56 km^2 **Western Toad:** 92 km^2 **Northern Leopard Frog:** 116 km^2 (using all occurrences) Note that in SARC (2013), the IAO for northern leopard frog was reported using only occurrences reported between 1995 and 2013 to yield 52 km^2 (from 13 occurrences). Using the same method, the updated IAO for northern leopard frog would be 56 km^2 (from 16 occurrences).
Number of extant locations[1] in the NWT.	Disease/pathogens considered the most serious plausible threat for each of these three species. **Canadian Toad:** There are fewer than five locations based on eight known breeding sites for Canadian toads in the NWT. **Western Toad:** There are three locations based on 11 known breeding sites. **Northern Leopard Frog:** There are three locations based on known breeding sites for northern leopard frogs in the NWT.

[1] Extant location - The term 'location' defines a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the species present. The size of the location depends on the area covered by the threatening event and may include part of one or many subpopulations. Where a species is affected by more than one threatening event, location should be defined by considering the most serious plausible threat.

Is there a **continuing decline** in area, extent, and/or quality of habitat?	**Canadian Toad:** Unknown. The effect of the ongoing and prolonged drought and severe 2023 wildfire season is unknown. **Western Toad:** Landscape changes are occurring; but there is no evidence that habitat has been lost in the NWT. **Northern Leopard Frog:** There is no evidence that habitat has been lost in the NWT.
Is there a **continuing decline** in number of locations, number of populations, extent of occupancy, and/or IAO?	**Canadian Toad:** Unknown. **Western Toad:** No. Note that the difference in 2014 and 2025 IAO reflects targeted and wider search efforts, rather than an increase in distribution. **Northern Leopard Frog:** Knowledge holders have indicated that northern leopard frogs have been present in the area north of Trudel Lake towards Fort Resolution likely since the 1980s, possibly even the 1950s. They are currently present in the Fort Resolution area and the Slave River delta based on multiple reports and local knowledge. One observation of northern leopard frog in Fort Resolution was recorded in 2016. Northern leopard frogs have not been reported in the area between the Slave River Delta and 64.7 degrees north since before 2000. This knowledge suggests an inferred decline in the area, extent, and/or quality of habitat, number of locations or subpopulations, and in the number of mature individuals.
Are there 'extreme fluctuations' (>1 order of magnitude) in number of locations, extent of occupancy, and/or IAO?	**Canadian Toad:** Unknown. **Western Toad:** No. **Northern Leopard Frog:** No.
Is the total population 'severely fragmented' (most individuals found within	**Canadian Toad:** Unknown. Roads have the potential to fragment populations.

small and isolated populations)?	**Western Toad:** Breeding habitat (ponds) are naturally patchy and fragmented. Habitat fragmentation is not believed to be a major issue. **Northern Leopard Frog:** Breeding habitat (ponds) are naturally patchy and fragmented. Road corridors and hydropower transmissions lines may change or block migration and dispersal, however the impact is likely negligible.
Immigration from Populations Elsewhere	
Does the species exist elsewhere?	**Canadian Toad:** Yes. **Western Toad:** Yes. **Northern Leopard Frog:** Yes; however genetic evidence suggests the northern distribution that includes part of NWT shows separation from larger and separate distributions further south.
Status of the outside population(s)?	**Canadian Toad:** • Not at Risk in Canada (COSEWIC 2003) • Vulnerable (S3) in Alberta (NatureServe Canada 2025) • Apparently Secure to Secure (S4S5) in Saskatchewan (NatureServe Canada 2025) • Apparently Secure (S4) in Manitoba (NatureServe Canada 2025) **Western Toad:** • Special Concern in Canada (Assessed by COSEWIC 2012 and listed under the Species at Risk Act in 2005) • Sensitive (S3) in Yukon (NatureServe Canada 2025) • Apparently Secure (S4) in British Columbia (NatureServe Canada 2025) • Vulnerable to Apparently Secure (S3S4) in Alberta (NatureServe Canada 2025) **Northern Leopard Frog:**

	• Special Concern in Canada (Assessed by COSEWIC 2009 and listed under the *Species at Risk Act* in 2005) • Imperiled to Vulnerable (S2S3) in Alberta (NatureServe Canada 2025) • Vulnerable (S3) in Saskatchewan (NatureServe Canada 2025) • Apparently Secure (S4) in Manitoba (NatureServe Canada 2025)
Is immigration known or possible?	**Canadian Toad:** Yes, immigration from Alberta is possible. However, populations in northern Alberta may be subject to similar threats as the population in the NWT. **Western Toad:** Yes, immigration from upstream sources in northern British Columbia and Yukon, along Liard River corridor is possible. However, these populations may be subject to similar threats as the NWT population. **Northern Leopard Frog:** Populations of northern leopard frog in northern Alberta and Saskatchewan could contribute to a rescue effect. However, these populations are small and are subject to similar threats as northern leopard frogs in the NWT reducing the likelihood of rescue.
Would immigrants be adapted to survive and reproduce in the NWT?	**Canadian Toad:** Yes. **Western Toad:** Yes. **Northern Leopard Frog:** Yes.
Is there enough good habitat for immigrants in the NWT?	**Canadian Toad:** Yes. **Western Toad:** Yes. **Northern Leopard Frog:** Yes.
Is the NWT population self-sustaining or does it depend on immigration for long-term survival?	**Canadian Toad:** Metapopulation dynamics suggest some degree of ongoing immigration and emigration between populations in close proximity to one another. Possibility of rescue from Alberta is therefore high.

	Western Toad: The possibility of rescue of western toads in the NWT from populations upstream in British Columbia and the Yukon is high, considering the healthy populations there, the similar habitats, the relatively high dispersal ability of the species, and the ability of the toad to tolerate relatively wide range of habitat conditions. **Northern Leopard Frog:** The populations are likely connected (metapopulation dynamics) with other western boreal populations in northern Alberta and Saskatchewan. However, this northern distribution is separate from other distributions and shows genetic separation from southern distributions.
Threats and Limiting Factors	
Briefly summarize negative influences and indicate the magnitude and imminence for each.	Major global threats to amphibians include habitat loss, habitat fragmentation, traffic mortality, collection for food, bait, medicine, and education, acid rain, chemical contaminants and pesticides, introduction of exotic species of competitors and predators, disease and pathogens, ultraviolet radiation (UV-B), and global climate change. A 2023 global status report indicated that about 40% of the world's amphibian species are threatened. In the NWT there is less habitat loss and fragmentation, fewer roads, and fewer industrial impacts (e.g., agriculture) relative to other parts of Canada. As a result, the most serious plausible threat to amphibians in the NWT is likely related to disease and pathogens, particularly chytrid fungus and ranaviruses, which are already present in the territory. Other potential threats in the NWT include habitat loss, degradation, or fragmentation, road-related mortalities, and drought, and wildfire. The Canadian toad, western toad, and northern leopard frog all occur at the northern edge of their range in the NWT and are thus affected by several key limiting factors, including short summer breeding and foraging seasons, long winters

	requiring extensive periods of hibernation, and a limited number of suitable overwintering sites. In addition, during life stages where aggregation is high (i.e., breeding, movement and overwintering), these species can be vulnerable to mass mortality events, either human-caused (e.g., hibernacula disturbance) or natural (e.g., freezing temperatures).
Positive Influences	
Briefly summarize positive influences and indicate the magnitude and imminence for each.	Western toad was assessed by COSEWIC (2002 and 2012) as Special Concern and it has been listed as Special Concern in Canada under the federal *Species at Risk Act* (SARA) since 2005. In 2014, the SARC assessed western toad as Threatened in the NWT. In 2016, western toad was listed as Threatened in the NWT under the territorial *Species at Risk (NWT) Act*. Northern leopard frog was assessed by COSEWIC (1998, 2002, and 2009) as Special Concern. The species was listed as Special Concern in Canada under the federal Species at Risk Act (SARA) in 2005. After northern leopard frog and western toad were listed under the *Species at Risk (NWT) Act*, an NWT Amphibian Management Plan was completed in 2017. The management plan set a goal of maintaining healthy and viable populations for each amphibian species across their ranges in the NWT. The actions taken from 2017 to 2021 to implement the management plan, and progress made towards achieving its objectives, are summarized in a progress report. The only known hibernacula for Canadian toads in the NWT and some of the habitat for northern leopard frog occur within Wood Buffalo National Park which offers some protection from human distrubances. The range of the western toad overlaps with areas of habitat currently under negotiation with land use plans.

Glossary

Term	Explanation
Amplexus	Breeding embrace
Anuran	Frogs and toads
ARUs	Autonomous recording units
Bd	*Batrachochytrium dendrobatidis* (chytrid fungus)
Bufonidae	Family, toads
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EC	Environment Canada
ECC-GNWT	Environment and Climate Change (GNWT)
ECCC	Environment and Climate Change Canada
Ectotherm	Organisms that exchange heat with their surroundings rather than producing body heat internally
EO	Extent of occurrence
GBIF	Global Biodiversity Information Facility
GNWT	Government of the Northwest Territories
Graminoids	Grasses, sedges, and rushes
IAO	Index of area of occupancy
IUCN	International Union for the Conservation of Nature
Juvenile	A frog or toad that has lived through at least one winter but is not yet a mature adult
Metamorph	A small frog or toad (froglet or toadlet) that has recently developed from a tadpole
Metamorphosis	Transformation from tadpole to metamorph, juvenile, and adult frog or toad
Poikilotherm	Organisms that have an internal temperature reflecting that of their surroundings
Ranidae	Family, true frogs
SARC	Northwest Territories (NWT) Species at Risk Committee
Snout-vent length	Length of a frog or toad from the nose to the cloacal vent (excretory opening)
Thermal tolerance	The upper and lower temperatures that will cause mortality in the species
UV-B	Ultraviolet radiation
Vagility	Ability to move

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Place Names

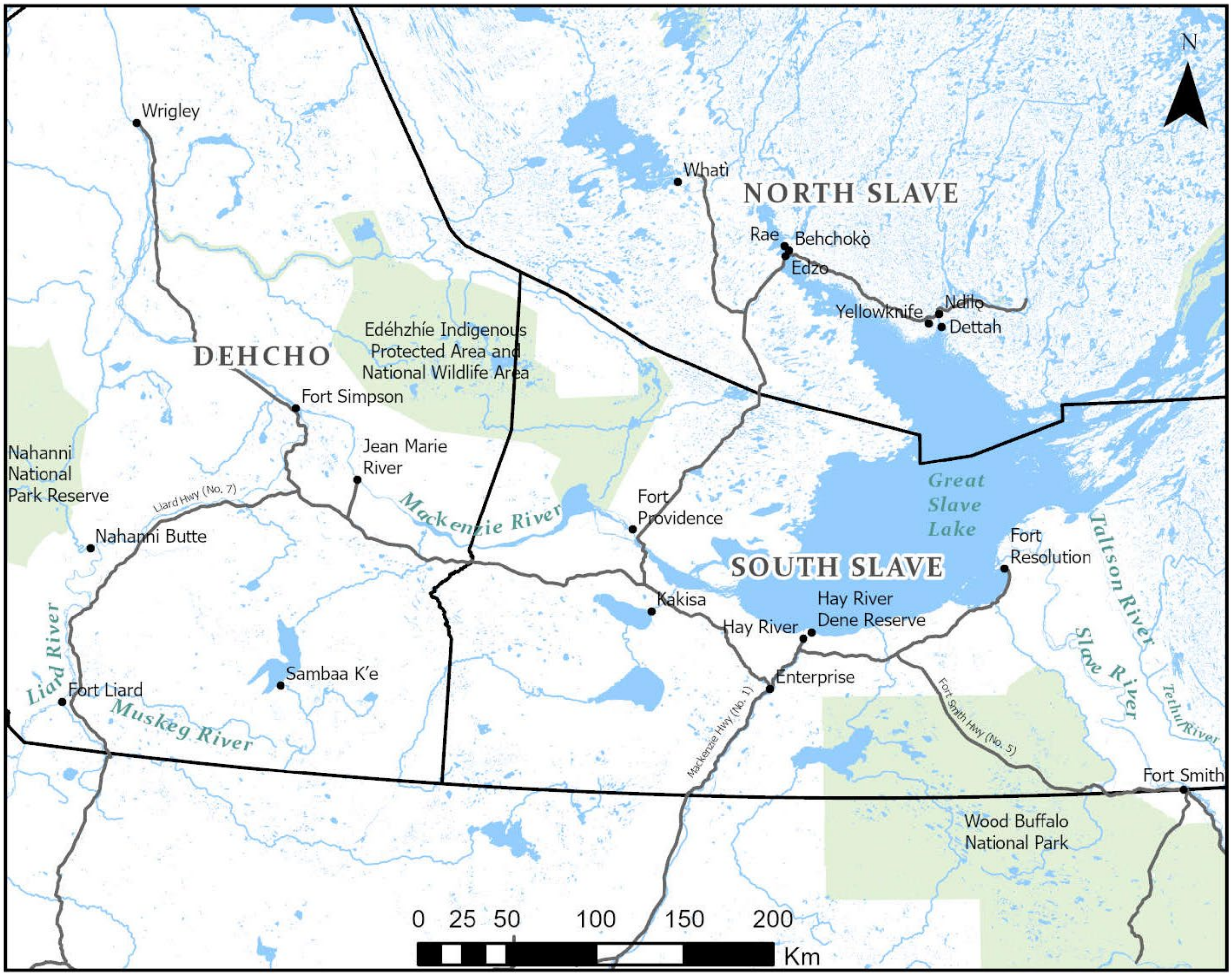

Figure 1. Map of place names in the Northwest Territories (NWT) and northern Alberta showing features mentioned in the report including communities, protected areas, and highways. Map courtesy N. Wilson, ECC-GNWT.

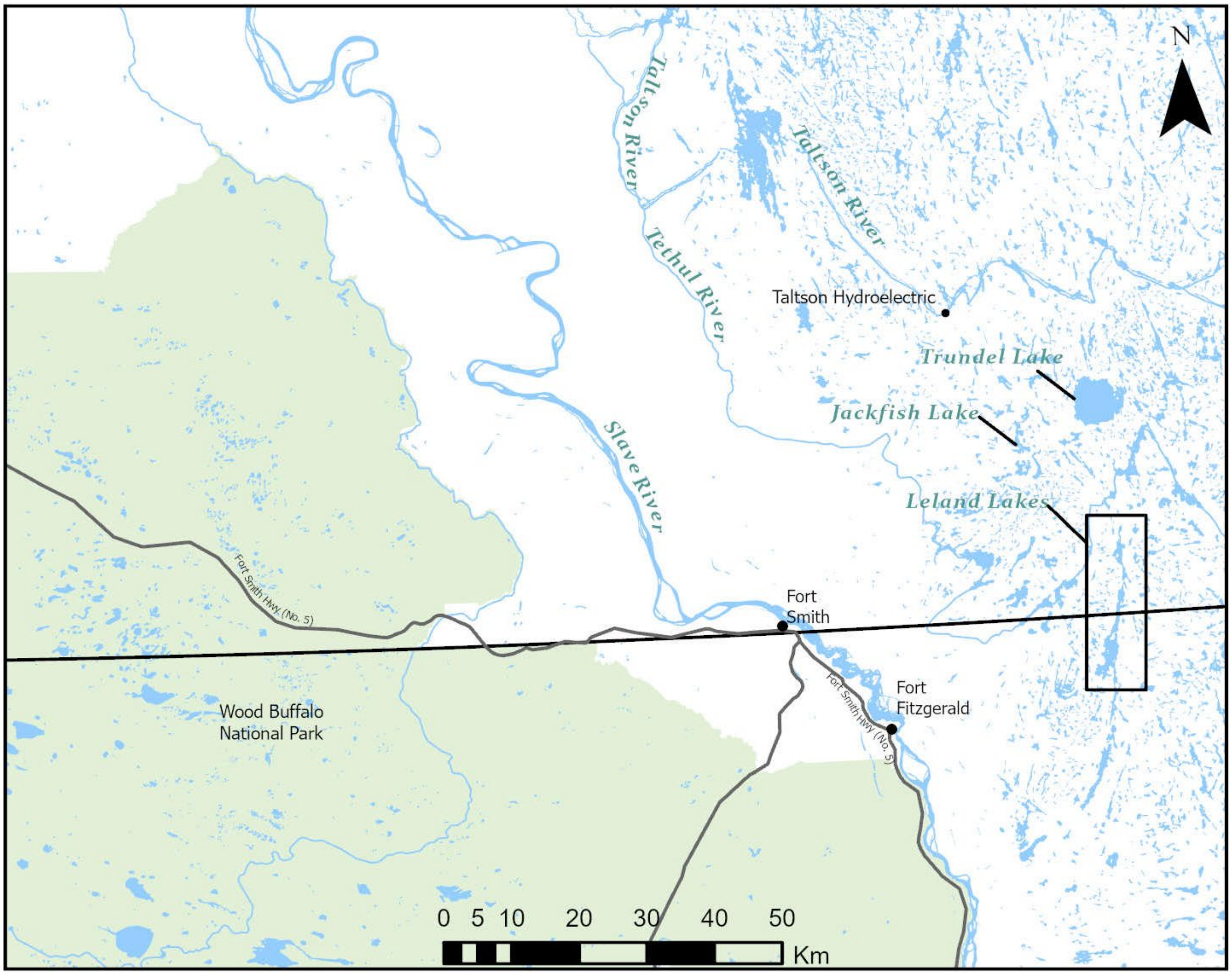

Figure 2. Map of place names in the southern NWT and northern Alberta showing features mentioned in the report including communities, protected areas, and highways. Map courtesy N. Wilson, ECC-GNWT.

Preface

In the preparation of this report, an effort was made to find documented and available sources of Indigenous knowledge, community knowledge, and scientific knowledge of Canadian toad, western toad and northern leopard frog in the NWT. At this time, little Indigenous and community knowledge of amphibians has been documented, and while this should not imply that no information from these sources exist, this report is, by consequence, primarily based on scientific knowledge sources.

ABOUT THE SPECIES

Names and Classification

Common name (English):	Canadian toad	Western toad	Northern leopard frog
Scientific name:	*Anaxyrus hemiophrys* (Cope 1886)	*Anaxyrus boreas* (Baird and Girard 1852; Frost 1985)	*Lithobates pipiens* (Schreber 1782; Frost 1985) *Rana pipiens* (Nicholson 2025)
Synonyms:	Dakota toad (iNaturalist 2025); Manitoba toad (Tester and Breckenridge 1964); *Bufo hemiophrys* (Frost 1985)	Boreal toad (ENR 2021); *Bufo boreas* (Baird and Girard 1852; Frost 1985)	Meadow frog (ENR 2021); *Rana pipiens* (Schreber 1782; Frost 1985)
French:	Crapaud du Canada (NatureServe 2025)	Crapaud de l'ouest (NatureServe 2025)	Grenouille léopard (NatureServe 2025)
COSEWIC Designatable Units		Non-calling population (COSEWIC 2012)	Western Boreal/Prairie population (Environment Canada 2013)
Dene Yatıé, Kátł'odehche dialect:	Ts'ahle or ts'ahli for frog, and ts'ahle cho or ts'ahli cho for big frog (SSDEC 2009)		
Chipewyan:	Ts'ɛli (frog; Redish and Lewis 1998)		
Cree:	Ayikis, ayîkis, ayîk (frog; Online Cree Dictionary 2011)		
Class:	Amphibia		
Order:	Anura (frogs and toads)		
Family:	Bufonidae (true toads)		Ranidae (true frogs)
Life form:	Vertebrate, amphibian, toad		Vertebrate, amphibian, frog

Amphibians are divided into three major groups: (1) anurans - the frogs and toads; (2) caudates or urodeles - the salamanders and newts; and (3) gymnophiones - the limbless caecilians (worm-like amphibians; Wake and Koo 2018; Russell and Bauer 2000). The majority of amphibians globally (88%) fall into the anuran group (Wake and Koo 2018; Russell and Bauer 2000).

In the NWT, there are five known anuran species (ENR 2021): two from the family Ranidae (true frogs): northern leopard frog (*Lithobates pipiens = Rana pipiens*; Nicholson 2025) and wood frog (*Lithobates sylvaticus = Rana sylvatica*; Nicholson 2025); one from the family Hylidae (tree frogs): boreal chorus frog *(Pseudacris maculata)*; and two from the family Bufonidae (toads): western toad *(Anaxyrus boreas*; Nicholson 2025*)* and Canadian toad *(Anaxyrus hemiophrys)*. In addition, the long-toed salamander (*Ambystoma macrodactylum*), an amphibian from the caudates group (order Caudata), is suspected to occur in the NWT, but there are no confirmed records of this species as of 2025.

This status report focuses on northern leopard frog, western toad, and Canadian toad. Northern leopard frog and western toad, which were listed as Threatened under the *Species at Risk (NWT) Act* (2009) in 2015 and 2016. Canadian toad is ranked as Sensitive under the NWT's General Status Ranking Program and is also scheduled for assessment in 2025 (Working Group on General Status of NWT Species 2021). The remaining amphibians in the NWT are ranked as either Secure or Presence Expected under the General Status Ranking Program and do not require a detailed assessment at this time (see also the *Status and Ranks* section of this report; Working Group on General Status of NWT Species 2021).

Systematic/Taxonomic Clarifications

The Canadian toad (*Anaxyrus* (formerly *Bufo*) *hemiophrys*) and western toad (*Anaxyrus* (formerly *Bufo boreas*) are part of the cosmopolitan family of Bufonidae or 'true toads'. Frost *et al.* (2006) proposed that North American toads of the genus *Bufo* be placed in the genus *Anaxyrus*, allowing better groupings of Bufonidae species based on evolutionary origin. This proposal was challenged by Pauly *et al.* (2009), who suggested that the change was unnecessary and destabilizing as no new clades were identified (a clade refers to species derived from a common ancestor). They instead recommended that the previous genus of *Bufo* be restored. However, the *Anaxyrus* nomenclature has since largely been accepted (Crother 2017).

The Canadian toad has no known subspecies, but it is a close relative to the American toad (*Anaxyrus americanus*; NatureServe 2025) and.

Two subspecies of western toad have been inconsistently recognized despite the substantial need for additional taxonomic work: (1) *Anaxyrus boreas boreas*, the boreal or western toad, ranging from northern California, Nevada, Utah, Colorado, and New Mexico north through British Columbia, Alberta, Yukon, Alaska, and the NWT, and (2) *A. b. halophilus*, the California toad, ranging from southern California to Baja California (Mexico) and western Nevada (iNaturalist 2025; Nicholson 2025). Genetic evidence supporting this distinction is lacking (Goebel 2005; Pauly 2008; COSEWIC 2012). Gordon *et al*. (2020) identified two new cryptic species in Nevada that would have previously been captured under the umbrella of the western toad (*Bufo monfontanus* and *B. nevadensis*).

In Canada, COSEWIC (2012) recognizes two discrete and evolutionarily significant units (Designatable Units): a 'Calling Population' in much of Alberta, entering British Columbia in the Rocky Mountains, and a 'Non-calling Population' in northern Alberta, British Columbia, the

Yukon, and NWT. Pauly (2008) described behavioural and morphological uniqueness of western toads in Alberta, where males possess a vocal sac and give loud advertisement calls. Males without vocal sacs may make a 'chirp' sound during amplexus (breeding embrace) (see *Life Cycle and Reproduction*), but this is not considered a true courting call in this context (Lannoo 2005). A zone of overlap between males with and without vocal sacs occurs in western and northwestern Alberta (Pauly 2008). Sounds closer to true calls have been recorded in this species in areas designated as 'non-calling' (Schock pers. comm. *in* SARC 2013). The boundary between these two Designatable Units is not well-understood (COSEWIC 2012). Designation as 'calling' or 'non-calling' is therefore controversial. It is worth noting that while vocal sacs, that provide a resonating space and thus sound amplification, are absent in some western toad males, all members of the Class Amphibia posses a larynx, which permits the production of sound (Russell and Bauer 2000).

The taxonomy of ranids is controversial within the clade of North American 'true frogs' of the genus *Rana.* This group was partitioned into two clades called *Rana* and *Lithobates* (Frost *et al*. 2006), which were recognized in the standard list of amphibians (Frost *et al.* 2008). The northern leopard frog, formerly *Rana pipiens*, was placed in the *Lithobates* clade. Hillis (2007) and Pauly *et al.* (2009) considered this change unnecessary, since it was not based on phylogenetic findings. Hillis (2007) and Pauly *et al.* (2009) recommended that the New World Clade of ranids (true frogs) *sensu* Hillis and Wilcox (2005), which includes *Lithobates*, be returned to their previous binomial names (i.e., *Rana pipiens*). The official nomenclature of amphibians describes the controversial generic taxonomy of American ranids with three nomenclatural arrangements: a single-genus arrangement, a three-genus model, and a seven-genus model (Nicholson 2025). The single-genus arrangement places all Eurasian *Rana* and *Pseudo-rana* as well as all American ranids into *Rana* (Yuan *et al.* 2016). The three-genus model recognizes *Pseudorana* in Asia, *Rana* in Eurasia and western North America, and *Lithobates* in the Americas (Frost *et al.* 2006; Che *et al.* 2007). The seven-genus model presented by Dubois *et al.* (2021) recognizes *Pseudorana*, *Rana*, and *Liuhurana* in Eurasia and *Amerana* (the Pacific Coast ranids of North America), *Aquarana* (for the bullfrogs and allies), *Boreorana* (a monotypic genus for Wood Frog, *L. sylvaticus*), and *Lithobates* (for the leopard frogs and allies).

There are no subspecies recognized for northern leopard frog. COSEWIC (2009) recognized three discrete and evolutionarily significant units (Designatable Units (DUs); *sensu* Green 2005) of northern leopard frogs in Canada; the Rocky Mountain DU, the Prairie/Western Boreal DU, and the Eastern DU. Northern leopard frogs in the NWT belong to the Western Boreal population of the Prairie/Western Boreal DU. The boundaries were based on evidence for genetic distinction between western and eastern northern leopard frog populations (Hoffman and Blouin 2004) and evidence of distinctiveness of the Rocky Mountain DU (Wilson *et al.* 2008).

Description

Throughout this document, the term 'metamorph' refers to a small toad or frog (toadlet or froglet) that has recently developed from a tadpole. Tadpoles are the aquatic larval form of frogs and toads; they are characterized by short oval bodies with broad tails, small mouths (Encyclopedia Britannica 2025). A 'juvenile' has lived through at least one winter but is not yet a mature adult. Adult anurans (frogs and toads) lack tails, have short hind limbs with five digits, and longer forelimbs with four digits (Wake and Koo 2018). Both the Canadian toad and western toad are classified as 'true toads' and as such, display some level of morphological and behavioural similarity. Although physical descriptions are provided below, it should be noted that there is variation in colour and pattern for these three species – including static variation as well as in response to changing environmental conditions (e.g., temperature) (Gustafson *et al.* 2019; Russell and Bauer 2000; Randall 2025).

Canadian Toad

The following morphological description is based upon field guides and status reports (Canadian Herpetological Society n.d.; Hamilton *et al.* 1998; ACA 2002; ENR 2021). The Canadian toad is the smaller of the two toads found in the NWT, ranging from 40 to 80 mm in snout-vent length at maturity (ENR 2021) with males typically smaller than females (ACA 2002). Canadian toads are typically brown to grey green with a pale belly spotted grey (Figure 3; ACA 2002; ENR 2021).

Figure 3. (a) Canadian toad at Clark Lake, central Alberta, July 2013 (photo courtesy of K. Kendell, Alberta Conservation Association). (b) Canadian toad, southern NWT at Whooping Crane Nesting Area, July 2022 (photo courtesy of D. Schock, iNaturalist.ca).

Males and females have slightly different throat colouration, with females' throats displaying the same colour as their bellies and males having a darker coloured throat (ACA 2002). The body is covered with somewhat rust-coloured bumps, including sometimes between the eyes, over the shoulders, and on its back feet. There is a single parotoid gland behind each eye (Canadian

Herpetological Society n.d.). Both the bumps and the glands produce a toxin unpalatable to predators (ACA 2002). The Canadian toad is characterized primarily by the presence of two cranial crests (ridges) on its head (Hamilton *et al.* 1998; ACA 2002) – lacking in the western toad - and two rounded projections on the back feet that facilitate burrowing activity (Canadian Herpetological Society n.d.). Canadian toad eggs are laid in long, spiralling strings (Hamilton *et al.* 1998; ACA 2002). Their mating call is a repeated trilling sound (CMA 2017).

Canadian toads overwinter at hibernation sites located in areas of loose sandy soils in upland areas (Breckenridge and Tester 1961; Tester and Breckenridge 1964; Kuyt 1991; Hamilton *et al.* 1998). These hibernaculum sites often contain aggregations of many individuals occupying separate burrows or 'toad holes' within wintering sites (Breckenridge and Tester 1961; Hamilton *et al.* 1998; Kuyt 1991; Timoney 1996).

Western Toad

The western toad is a large toad with small round or oval glandular protuberances or 'warts' on the back, sides, and upper potions of the limbs (Figure 4; Russell and Bauer 2000; Matsuda *et al.* 2006). Large oblong parotoid glands are situated behind the eyes. They are typically brown or green, but colour varies from olive green to almost reddish-brown or black. There is a creamy or white vertebral stripe running from snout to vent, which is sometimes broken or nearly absent. The warts and parotoid glands are often reddish-brown and may be encircled by a ring of dark pigment. These structures are poison glands that excrete a noxious liquid to deter predators. The throat and belly are pale with dark mottling. There is a grey pelvic patch in the groin area that is used to absorb moisture from the ground. The pupil is horizontal, and cranial crests are weakly developed. The limbs are relatively short, and the hind toes are partially webbed. Toads move on land by walking and hopping. Horny projections on the hind feet are used for digging backwards into the ground (Russell and Bauer 2000; Matsuda *et al.* 2006).

Adult western toads in the north tend to be smaller than elsewhere, with males reaching about 65 to 92 mm in snout-vent length and weighing up to 71 g, and females reaching 82 mm and 55 g (Slough 2004; Slough unpubl. data 2004, 2007, 2010; Schock 2009).

Male western toads are distinguished from females by the presence of nuptial pads on their thumbs and first two toes of the forefeet during the breeding season (usually in late May-early June), longer forelimbs, narrower heads, and less prominent or discontinuous mid-dorsal stripes (Carstensen *et al*. 2003; Matsuda *et al.* 2006).

Western toad eggs are black and are laid in long, intertwined paired strings in shallow margins of lakes and ponds. Tadpoles are jet-black or charcoal in colour and range from nine to 42 mm total length. Recent metamorphs are about 12 to 22 mm snout-vent length and weigh up to 0.5 g (Slough unpubl. data 2012).

Figure 4. (a) Western toad adult 20 km southwest of Fort Liard, near the Liard River, NWT, 24 September 2009 (photo courtesy of Floyd Bertrand). (b) Western toad adult, Muskeg River, NWT, 19 August 2024 (photo courtesy Yannick Letailleur).

Male western toads will produce a release call to signal when it is inappropriately clasped by another toad; it is a quiet series of chirps like the peeping of a chick (Mângia *et al.* 2019; Russell and Bauer 2000). This call can be elicited by gently grasping the thoracic region behind the forelimbs. The release call prevents prolonged amplexus with other males, but it may also be emitted without tactile stimulation. It is not known whether the latter call is a signal to other males or if it has some other purpose such as advertisement to females. True advertisement calls consist of relatively long and high-amplitude pulsed trills and have been documented throughout much of Alberta (Pauly 2008; Long 2010), in what is classified as the 'calling' population of western toads (although see previous note regarding controversy surrounding the distinction between the 'non-calling' and 'calling' populations in *Systematic and Taxonomic Clarifications*).

Northern Leopard Frog

The following morphological description is based upon field guides (Russell and Bauer 2000; Jones *et al*. 2005; Matsuda *et al*. 2006; ENR 2021).

The northern leopard frog is a slender, medium-sized frog that is predominantly green, but may be brown, tan, or a combination of brown and green (Figure 5 and cover photo). It has conspicuous solid dark brown or olive oval-shaped spots on the back that are bordered with light halos. Two cream-coloured ridges extend the length of the back. The underside is creamy white. Juveniles have the same colouration as adults. There are rare colour morphs (see COSEWIC 2009), one of which ('*burnsi*', lacking dorsal spots) may have been locally propagated through the release of laboratory animals. Although there are reports of rare colour morphs elsewhere in Canada, there are no reported observations of them in northern Alberta or the NWT (Prescott pers. comm. *in* SARC 2013; Kendell pers. comm. *in* SARC 2013). Adults are 50 to 110 mm in snout-vent length (large relative to the other two frogs in the NWT), with males rarely exceeding 80 mm in length.

Figure 5. (a) Northern leopard frog, Benna Thy Lake, NWT at site SV25, 21 July 2008 (photo courtesy of Leslie Bol, Rescan *in* Rescan 2008). (b) Northern leopard frog, south of Benna Thy Lake, NWT, June 2009 (photo courtesy of D. Schock, iNaturalist).

Eggs are laid in a spheroid or ovoid-shaped mass, about 75 to 150 mm long and 50 to 75 mm wide. Tadpoles are normally about 25 mm snout-vent length (total length 90 mm), dark brown or grey dorsally and speckled with gold spots. There are documented cases of tadpoles approaching 120 mm in length; however, tadpoles greater than 90 mm are assumed to be quite rare (Kendell pers. comm. *in* SARC 2013). The central underbelly is creamy white. The eyes are bronze-coloured.

Life Cycle and Reproduction

There are many similarities in the life cycles of amphibians in general, including the three species that are the focus of this report. Canadian toad, western toad, and northern leopard frog all start life as larvae (tadpoles) that hatch from eggs in the water, undergo metamorphosis, and then continue developing into mature adults over the course of time, which can take several years depending on the species (Russell and Bauer 2000). This reflects the etymology of the word 'amphibian'; where 'amphi' means double and 'bios' means life, referencing the transitional nature of amphibian development (Russell and Bauer 2000; AmphibiaWeb 2025).

Generally, these species emerge from hibernation sites in the spring to breed at communal sites where amplexus takes place facilitating external fertilization. Breeding must take place early enough to allow time to maximize the probability that tadpoles can undergo metamorphosis within the brief summer period and before ponds dry up. Another benefit of breeding early (spring, early summer) is to reduce the exposure to predators (Waldman 1982). Communal breeding provides benefits for reproductive success: it reduces energy costs associated with pair-bonding, ensures genetic mixing, makes use of limited breeding site availability, provides protection from predation, and communal egg masses provide an insulating benefit that enhances the growth and survival of embryos (Waldman 1982; Olson 1988; Myers and Zamudio 2004). Amplexus is a term roughly synonymous with mating, referring specifically to the mating embrace, where a male grasps a female from behind firmly. External fertilization takes place whereby the female releases eggs into the water that the male then fertilizes (Kelleher and Tester 1969; Tester and Breckenridge 1964; ENR 2021).

A description of life cycle and reproduction for each species follows; however, it is important to note that life history characteristics of wide-ranging species often vary from one part of a species' range to another, affecting interpretation and extrapolation of information from one region to another (Eaton *et al*. 2005; Constible *et al.* 2010). In amphibians in particular, life history traits are generally understood to vary latitudinally, reflecting differences in factors such as growing season length (Eaton *et al*. 2005). For information on fecundity, population structure, age at maturity, and survival, refer to *Population Dynamics*. For information on site fidelity, refer to *Movements*.

Canadian Toad

Spring emergence from individual burrows or 'toad holes' at overwintering hibernation sites begins in early May in the NWT (Kuyt 1991), with males typically emerging before females, and adults emerging before juveniles (Tester and Breckenridge 1964; Kelleher and Tester 1969; Hamilton *et al.* 1998). This emergence date is comparable to that in Minnesota, where first emergence occurred between 25 April and 12 May and emergence peaked between 12-18 May (1960-1962). In Minnesota, the onset and peak of emergence from burrows are associated with warmer daytime temperatures (greater than 21°C) and precipitation (Tester and Breckenridge 1964); which allows the ground and burrows to thaw completely (Kelleher and Tester 1969).

Emerging males move immediately to breeding habitats in the shallow edges of waterbodies to begin courtship (Hamilton *et al.* 1998; Tester and Breckenridge 1964; ACA 2002). Courtship activities are characterized by calling behaviours, with calling in the boreal forest occurring between mid-May and early June (Hamilton *et al.* 1998). In Alberta, calling starts at temperatures around 5°C (ACA 2002; Russell and Bauer 2000) while in Manitoba, Tamsitt (1962) suggested that temperatures above about 21°C inhibited calling activity (noted in July). In northern Alberta, Annich *et al.* (2019) recorded Canadian toad calling from 14 May and 6 July (2012 to 2015). Breeding congregations are typically male-biased (Leonard *et al.* 1993).

Breeding season for Canadian toads lasts approximately two months (Hamilton *et al.* 1998). Females depart shortly after mating and laying eggs (Hamilton *et al*. 1998); whereas males remain behind for a time to pursue further mating opportunities (Roberts and Lewin 1979; Breckenridge and Tester 1961). After breeding Canadian toads relocate to upslope areas where they remain until the following breeding season (Hamilton *et al.* 1998).

Metamorphosis from larvae to metamorph usually takes six to nine weeks. Metamorphs begin to emerge between late June and mid-August in the boreal forest (Hamilton *et al*. 1998). Tamsitt (1962) recorded the first appearances of metamorphs on 23 June in Manitoba.

Overwintering appears to extend over approximately two thirds of the calendar year in the NWT, with Kuyt (1991) reporting 1 September as the toads' return to the overwintering site and, as noted above, a subsequent spring emergence not until early May.

Western Toad

Western toads congregate to breed in the spring in explosive breeding periods lasting one to two weeks (in Oregon; Olson *et al.* 1986), with males either arriving first or together with females emerging from hibernation (Blaustein *et al*. 1995). In British Columbia's Okanagan Highlands, toads congregate when minimum and maximum temperatures rise above 0°C and below 10°C, respectively (Gyug 1996). While in northwestern British Columbia and the Oregon Cascade Mountains, breeding congregations typically occur shortly after ice breakup, particularly along shorelines, in late April to late May in British Columbia (Olson 1988; Slough and Mennell 2006).

As with Canadian toad, breeding aggregations are generally male-biased but not always (Olson *et al.* 1986; Olson 1988). Males are not selective when choosing a breeding partner (ENR 2021). With respect to courtship behaviours following emergence and arrival at breeding ponds, toads in central Alberta began calling on a hot, windless day in mid-May (Long pers. comm. *in* SARC 2014). At Elk Island National Park, they began calling in mid- to late May and this may extend into June (Browne pers. comm. 2012 *in* SARC 2014). Western toad calling was observed 19 April to 14 May in Jasper National Park (Shepherd and Hughson 2012). In Alaska, breeding takes place between May and July of each year (Lannoo 2005). Toads at the Atlin Warm Springs of northwestern British Columbia breed in late February – early March (Slough and Mennell 2006). Thompson (2004) also reported early breeding at warm springs in Utah. In the Alberta Rocky Mountains breeding activity usually occurs when the temperature is greater than 9°C but may happen at temperatures as low as 7.5°C (Salt 1979). The length of the breeding period may be affected by temperature and weather conditions; cold weather may pause breeding (Olson 1988). There are no data on breeding dates for the western toad in the NWT but based on the relatively advanced stage of tadpole development observed 25-26 June 2007 and 18-19 June

2008 in ponds in the Muskeg River gravel pit (Schock 2009) and 10-11 July 2018 at the nearby oxbow wetland (Dulisse 2019), breeding likely occurred in late May or earlier.

Eggs are laid communally in long, intertwined paired strings (ENR 2021). Development time from egg to tadpole and tadpole to metamorph depends on water temperature; colder temperatures may delay development (Lannoo 2005). However, in general, tadpoles hatch in 3 to 12 days (Hengeveld 2000; Jones *et al*. 2005; Lannoo 2005). The period from tadpole to metamorphosis takes four to seven weeks (Lannoo 2005). Tadpoles have been observed into the late summer and fall at some northern sites, but their survival is doubtful (Slough pers. comm. *in* SARC 2014). There are no reports of overwintering of tadpoles (Lannoo 2005).

By mid-summer, transforming individuals aggregate on the water's edge, potentially for thermoregulation (Black and Black 1969) or to mitigate the possibility of desiccation (Lannoo 2005). Metamorphosis is usually complete by late July or early August in Alaska, although metamorphosis may not be complete until shortly before snowfall at some high elevation sites across their range, which may impact survival (Lannoo 2005). In the NWT, metamorphosis was nearly complete in June 2007 (Schock 2009), so an early July metamorphosis date can be extrapolated. Return to hibernation sites in the fall occurs in late August to early September (Lannoo 2005).

Northern Leopard Frog

Northern leopard frogs emerge from overwintering sites early in the spring as the ice begins to melt and temperatures warm (Wagner 1997; Sommers *et al.* 2018). In Manitoba, emergence takes place mid-April to early May (Eddy 1976). Migration from overwintering sites has been observed at water temperatures of 9 to 12°C (Pace 1974) and 7 to 10°C (Licht 1991) in the United States. Merrell (1977) observed that frogs did not leave overwintering sites until the air temperature exceeded 13°C in Minnesota. The frogs move from deeper water to shallow, warmer water and in some cases made overland migrations if different wetlands were used for overwintering and breeding (Wagner 1997). Migration may be at night (Dole 1967a) or during the day if nighttime temperatures are cool (Merrell 1977).

Sexually mature adult males arrive first at the breeding sites and begin calling, with females arriving a few days to a few weeks later (Hine *et al.* 1981). Seburn (Alberta; 1992a) found that male northern leopard frogs called at water temperatures of greater than 10°C and air temperatures of at least 15°C. Sommers *et al.* (2018) found that male northern leopard frogs began calling at water temperatures between 5 and 8°C in southern Alberta and ceased when water temperatures reached 16.3 to 19.3°C. Calling in northern leopard frogs is typically concentrated in the evening, but may take place during the day if temperatures overnight are cool. In southern Alberta, calling took place across both the daytime and nighttime (between

10:00pm and 2:00am, 10:00am and 2:00pm, and 7:00am and 9:00am, at different sites; Sommers *et al*. 2018).

Breeding is usually communal and explosive (occurring over just a few warm, calm days), but the period may be extended if air and water temperatures are less suitable (Alberta Northern Leopard Frog Recovery Team 2010). This may result in several size classes of tadpoles (Merrell 1977; Hine *et al.* 1981). In southern Alberta, breeding generally takes place mid-April through late May (Sommers *et al*. 2018), and between mid-April and late June in Manitoba with new clutches being deposited throughout that period (Eddy 1976). Observations are not available for the NWT, but mid- to late May breeding is typical for amphibians at the same latitude in the Yukon (Slough and Mennell 2006) and mid- to late May is thought to likely capture the breeding period in the NWT as well (ENR 2021). Wood frogs have been observed breeding in the South Slave region in mid-May or as soon as ponds are ice free (Moore pers. comm. *in* SARC 2013; Langlois pers. comm. *in* SARC 2013; Bienentreu pers. comm. 2025).

Male northern leopard frogs may mate with more than one female and multiple males may try to mate with the same female (Eddy 1976). Males demonstrate little selectivity in choosing a mate (Wright 1914 *in* Merrell 1977) but do display territoriality during the breeding season (Russell and Bauer 2000).

The time of egg hatching is dependent on water temperature, and usually occurs in five to nine days, but may be extended to more than two weeks in cool weather (Hine *et al*. 1981). Hatching success is highly variable (Corn and Livo 1989; Gilbert *et al*. 1994), ranging from 50 to 99% (Eddy 1976; Hine *et al*. 1981) and depends on several factors affecting embryo mortality including physical breakup of egg masses, parasitism, and disease (Eddy 1976; Hine *et al*. 1981). Tadpoles metamorphose after two to three months, a process that is temperature dependent, and possibly also density dependent (DeGraaf and Rudis 1983; Wershler 1991; Seburn 1993). Transformation was reported to be complete by late July to early August in Alberta, although cool weather can delay development into September (Seburn 1993). In the NWT, Northern leopard frog tadpoles with all four limbs were observed by the Taltson River on 18 July 2008; wood frog tadpoles observed at a similar latitude were not as advanced developmentally (Rescan 2008). Early drying of semi-permanent sites leads to increased tadpole density, accelerated development, and metamorphosis at a reduced size (Merrell 1977).

Overwintering begins one to two months prior to freeze-up (DeGraaf and Yamasaki 2001). In Manitoba, northern leopard frogs begin their return to hibernation sites in early August, peaking in early September, although overwintering itself does not appear to begin until October. Movement back to hibernacula appeared to be tied to moisture availability, with most activity occurring during or after rain events (Eddy 1976).

Physiology and Adaptability

There are several key traits in amphibians that define their physiology and necessitate behavioural adaptations. They are ectotherms and poikilotherms (see below), have skin as one of their primary respiratory organs in addition to lungs and the species in this report are unable to tolerate freezing temperatures. Given significant overlap among the focal species in this report, this section will present information for all three species together, rather than individually.

All amphibians are ectotherms, meaning they exchange heat with their surroundings rather than producing body heat internally. They are all also poikilotherms, with their internal temperature reflecting that of their surroundings (Russell and Bauer 2000). These traits influence their behaviour, such as basking in the sun for warmth, seeking cool, moist areas to avoid overheating, moving among habitats or microsites with suitable ambient temperatures, and by engaging in evaporative cooling from the skin and lungs (Brattstrom 1963; Stebbins and Cohen 1995).

For amphibians, internal temperatures must be sufficient to allow for biological functioning. Failure to stay within the range of optimal body temperature will result in sluggish behaviour, or relative stillness, or cessation of some biological functions. For example, feeding activities tend to cease when air temperatures begin to dip below 5°C (Russell and Bauer 2000). Western toads are not normally active if their body temperatures are below 3.0°C or above 29.5°C (Brattstrom 1963; Davis 2000); the lower temperature determined to be lethal is -2.0°C (Mullally 1952 *in* Brattstrom 1963). This wide thermal tolerance allows western toads to exploit a wide range of habitats.

Thermal tolerance limits in Canadian toad are not known specifically but are likely similar to those of the western toad. For the closely related American toad, optimum body temperature range is between 26.5°C and 31.0°C, with a voluntary minimum and maximum range between 17.5°C and 32.3°C (Brattstrom 1963). Schmid (1965) found that water temperatures of 38°C over 40 minutes were sufficient to result in mortality of Canadian toads (on average). Beiswenger (1978) reported upper lethal water temperature ranges for tadpoles between 37 and 40°C for the western toad and between 37 and 42°C for the Canadian toad. Although adverse effects of high temperatures began to appear at 35.5°C for some individuals, but with preferential selection of water temperatures in the range of 28 and 34°C for both western and Canadian toad tadpoles (Beiswenger 1978). Lower temperature thresholds were not considered in this study, but the author noted observation of western toad tadpoles were active at water temperatures as low as 4°C.

Lethal minimum and maximum temperatures for northern leopard frogs are -1.6°C and 35°C, respectively (Brattstrom 1968), although body temperatures of up to 34.7°C have been reported. This may suggest that northern leopard frog use of evaporative cooling to avoid overheating (Brattstrom 1963). The ability to maintain high levels of activity (such as migration to breeding sites, breeding, and foraging) increases with temperature and peaks between 20°C and 29°C (Putnam and Bennett 1981). However, considering leopard frogs (*Lithobates*) more broadly, the northern leopard frog exhibits the greatest tolerance of cold (Russell and Bauer 2000).

The thermal tolerance of a species can also be influenced through plasticity and local adaptation. For instance, when individuals mature at higher temperatures, they are better able to tolerate higher temperatures (Pottier *et al*. 2022). Relative to other toads (e.g., the southern Great Plains toad *Bufo cognatus*), the Canadian toad has a lower tolerance to heat (Schmid 1965).

Body temperatures are maintained behaviourally by seeking shelter (typically burrowing), basking, remaining inactive, or selectively shifting between diurnal and nocturnal habits (Blaustein *et al.* 1995, Black and Black 1969, Russell and Bauer 2000; Lannoo 2005). Shelter seeking behaviours may simply mean selection of microsites with suitable temperatures; for instance, northern leopard frogs sheltering in small depressions near waterbodies overnight (Brattstrom 1963). Toads may also burrow to avoid adverse conditions, for example Canadian toads often burrow overnight for shelter (Russell and Bauer 2000; ACA 2002).

Basking is most commonly observed early in the morning. Later in the day, as their body temperatures rise, toads disperse elsewhere for foraging (Black and Black 1969). Reports of diurnal versus nocturnal activity vary among sources. For instance, western toads are generally diurnal but, in some areas, they switch to nocturnal activities in June (Lannoo 2005). Meanwhile, in South Dakota both western toads and Canadian toads are primarily nocturnal (Davis 2000, 2020; Lannoo 2005). At higher elevations (montane elevations between 3,000 and 3,355 m) and higher latitudes (e.g., Colorado versus California) where nights are cooler in summer, they are reportedly diurnal (Carey 1978). This is consistent with reports of diurnal amphibian behaviour in Alberta (Russell and Bauer 2000). These kinds of activity patterns are likely behavioural adaptations to ambient temperatures (Sullivan 1994) or the habits of available prey (Carey 1978). It is unknown whether western toads, Canadian toads and/or northern leopard frogs in the NWT are diurnal or nocturnal.

Maintenance of appropriate moisture levels is also necessary for amphibians. Amphibians in general have moist, permeable skin that functions as the primary respiratory organ (Wake and Koo 2018) and requires that moisture be obtained through the skin (Lannoo 2005). Metamorphs and smaller juveniles have a higher surface area to volume ratio than adults, making them more vulnerable to desiccation (Livo 1998). Behavioural adaptations assist in mitigating the risk of desiccation including burrowing, appropriate selection of microhabitats, along with the ability to stop excreting urine (Dole 1976b; Russell and Bauer 2000). Western toads are moderately resistant to desiccation with relatively dry, thick, warty skin on their back (Stebbins and Cohen 1995). They also possess a patch of skin on their undersides that permits moisture absorption from the ground (Russell and Bauer 2000). When western toads become dehydrated to 41.1% of their initial hydrated body mass, they are unable to right themselves (Hillman 1980). Northern leopard frogs have smooth, moist skin, making them vulnerable to desiccation. They can survive losing up to 50% of total body water (~40% of body mass) at 5°C (Churchill and Storey 1995).

Unlike some amphibians (e.g., wood frog), the species considered in this report are not freeze-tolerance (Churchill and Storey 1995; Browne and Paszkowski 2010a). The length and severity of the winter season represents the greatest limiting factor for these species in the north (Russell and Bauer 2000). Adaptations to prevent freezing are therefore important, including the selection of appropriate overwintering sites that protect them from freezing and mitigate the risk of desiccation (Annich *et al*. 2019; Lannoo 2005). Requirements of overwintering sites are discussed in *Habitat Requirements*.

These species also have adaptations that reduce the risk of predation. Flee and freeze represent the first responses to perceived threats, and fleeing from land to water is common in amphibians (Russell and Bauer 2000). For example, Canadian toads may stay near bodies of water to maintain escape routes from predators (Tester and Breckenridge 1964). Toxic secretions from the glands on their backs also assist both Canadian toads and western toads in deterring predators (Olson 1988; Davis 2020). This toxin is also present on the eggs when laid and may provide some protection from vertebrate predators for a time (Brodie *et al.* 1978; Lannoo 2005). Western toad tadpoles also show the capacity for chemoreception, where smell and taste cues may alert them to the presence of a predator and be communicated through the group (Lannoo 2005). Toads may also inflate their bodies to appear larger (Russell and Bauer 2000). Uttering alarm calls or sounds and urinating on predators are other ways of deterring predation among many toads and frogs (Russell and Bauer 2000; Davis 2020).

Interactions

As described in the *Management Plan for Amphibians in the NWT* (CMA 2017), amphibians are an important part of our local ecosystems, functioning as both predators and prey, across both aquatic and terrestrial habitats, and thus acting as consistent components in the NWT's food web in regions where they are present. The presence of adult and tadpoles in typically fishless or ephemeral waterbodies means that amphibians are often important factors in invertebrate population control (Hocking and Babbitt 2014). Their biomass on the landscape is often easily underestimated (Russell and Bauer 2000).

Intraspecific and interspecific interactions that are known to occur (Blaustein and Margalit 1994, 1996) include predation, competition, and hybridization. These are described in more detail below.

Prey and Forage

All three species considered in this report forage upon a wide range of arthropods and other invertebrates as adults. These may include worms, beetles, bees and ants, spiders, moths and butterflies, grasshoppers, flies, true bugs, as well as slugs and snails, caddisflies, and leafhoppers (Moore and Strickland 1954; Rittschof 1975; Hine *et al*. 1981; Olson 1988; Sullivan 1994; Collier *et al*. 1998; Russell and Bauer 2000; ACA 2002; Davis 2020; Jones *et al*. 2005; Bull 2006; Bull and Hayes 2009). Many toad species, including the Canadian toad (western toad not noted but presumably similar) are able to consume noxious and armoured insects as well (Cook and Cook 1981). Northern leopard frog foraging excursions may be made in response to rain and drops in barometric pressure (Dole 1965, 1971; Collier *et al*. 1998).

Generally, amphibians are agreed to be restricted in their prey choices by size, preferring small prey items and thus rarely consuming vertebrates. In Manitoba, however, a 62 mm Canadian toad was recorded trying to consume a young red-winged blackbird (*Agelaius phoeniceus*; Cook and Cook 1981). Russell and Bauer (2000), noted that northern leopard frogs in Alberta have been known to consume birds, garter snakes, small frogs, and fish if they are available and are of a sufficiently small size; the frequency of this behaviour is unknown. Cannibalism of juveniles by adults has been documented among northern leopard frogs (Eddy 1976, Merrell 1977).

Tadpoles consume a variety of material in their aquatic environments, including algae (pond scum) and organic detritus (decomposing animal waste and the bodies of insects and other small organisms), and will opportunistically scavenge carrion (Sullivan 1994; Merrell 1977; McAllister *et al.* 1999; Jones *et al*. 2005; Lannoo 2005; Bull 2006; Bull and Hayes 2009). Heavy predation by *Bufo* tadpoles on midge species has also been documented (Blaustein and Margalit 1996). Western toad tadpoles have been known to prey on other frog tadpoles as well, including their own species, during times of high tadpole densities and scarce food resources associated with low water levels (Jordan *et al*. 2004).

Predators

Predators of adult toads and frogs (relevant to the NWT) may include birds, including ravens and magpies, Canada jay (*Perisoreus canadensis*), owls, shrikes, gulls, and red-tailed hawks (*Buteo jamaicensis*), as well as predatory fish, mustelids, bears, foxes, and coyotes (Tester and Breckenridge 1964; Merrell 1977; Emery *et al*. 1972; Hayes and Jennings 1986; Oldfield and Moriarty 1994; McAllister *et al.* 1999; Harding 1997; Russell and Bauer 2000; Hannon *et al*. 2002;

Smith and Keinath 2007; Prescott pers. comm. *in* SARC 2013). The red-sided garter snake (*Thamnophis sirtalis parietalis*) occurs in the same area as Northern leopard frog and Canadian toad in the NWT (Larsen 1987; SARC 2024b). Based on dissections of red-sided garters snakes and visual observations of stomach contents, red-sided garter snakes are known predators of amphibians in the NWT (Bienentreu pers. comm. 2025). (see *Other Interspecific Interactions*).

Eggs, tadpoles, and metamorphs may be taken by predaceous diving beetle larvae (*Dytiscus* spp.), dragonfly larvae, caddisfly larvae, mosquito larvae, leeches, fish, garter snakes, spotted sandpipers (*Actitis macularia*), mallard ducks (*Anas platyrynchos*), American robins (*Turdus migratorius*), and red foxes (*Vulpes vulpes*; Olson 1989; Blaustein *et al.* 1995, McAllister *et al*. 1999; Russell and Bauer 2000; Mokany and Shine 2003; Lannoo 2005; Jones *et al.* 2005; Hocking and Babbitt 2014). However, western toad tadpoles were found to be unpalatable to most, but not all, to fish in Quebec (El Balla and Blouin-Demers 2011).

Large mortality events tied to predators, like ravens, have been documented (Olson 1988; Blaustein *et al.* 1995). Predation by ravens on a western toad breeding aggregation has been recorded where mortality of breeding adults was 20% (Olson 1988). Predation has the potential to impact the success of breeding, in that males are more likely to release their partners during amplexus when predators are present (Olson 1988). Kelleher and Tester (1969) noted a 62.5% loss of the closely related American toad (adult females) to predation and posited that males may be more vulnerable to predation pressure than females as they are more immediately visible during the spring calling period. In this context, low numbers of bird and mammalian predators may be a key feature of breeding sites (Ultsch *et al.* 1999), as are fishless or ephemeral waterbodies. The highest predation pressure on adult toads occurs at breeding aggregations when they are exposed in shallow water, and when transforming or are newly metamorphosed (Olson 1988; Gyug 1996). As noted in *Life Cycle and Reproduction*, aggregation and synchronous metamorphosis may be anti-predator adaptations during this vulnerable period. Devito *et al.* (1998) found that metamorphosis of western toads occurred more synchronously in the presence of a predator.

Adult and juvenile Canadian and western toads (toadlets) excrete bufotoxin, among other amines and alkaloids, from their parotoid glands (warts) to deter predators (Formanowicz and Brodie 1982; Kats *et al.* 1988; see *Physiology and Adaptability*). However, predators may eviscerate toads to avoid their toxic skin (Olson 1989; Jones *et al.* 2005).

Although amphibians are consumed by humans as food and used as medicine elsewhere in the world (Hocking and Babbitt 2014), there is no evidence that harvest of wild populations occurs for these purposes in the NWT.

Other Interspecific and Intraspecific Interactions

Competition between amphibians and mosquitoes occurs (tadpoles preying upon mosquito larvae and vice versa, competition for food resources; Hocking and Babbitt 2014), but the degree to which this might occur is not clear in the NWT. The effects of competition may be tied, in part, to the degree of niche overlap, specifically, the period of activity and the diets of co-occurring mosquito and amphibian species in aquatic environments. In Australia, co-occurring mosquito and amphibian larvae depressed each others' growth rates, even in cases with no food limitations, suggesting other competitive factors may be at play; this study did not consider amphibian species that occur in the NWT (Mokany and Shine 2003). Similar results were reported in Israel between *Bufo viridis* tadpoles and *Culiseta longiareolata* larvae, in addition to predation of tadpoles by late-stage mosquito larvae and vice versa (i.e., predation occurred when there was a noticeable size difference). Neither species is known to occur in the NWT, but species of both genera do occur in the NWT (*Culiseta alaskaensis, C. impatiens, C. incidens, C. inornate, C. minnesotae, C. morsitans;* Working Group on General Status of NWT Species 2021). Given the need for rapid development in amphibians (to mitigate risks in using ephemeral pools and short active seasons), reduced growth rates are likely to impact overall survival (Blaustein and Margalit 1994). The degree of predation on newly hatched, immobile tadpoles was very high in this study (up to 100% *Bufo* tadpole mortality in an experimental setting when *Culiseta* larvae were present, versus 0% mortality in their absence). Mortality of tadpoles several days after hatching was not observed once they were fully mobile. The population level impact from mosquito larvae predation in the wild is unclear, although it may be considerable. Whether this level of predation may extend to *Bufo* species, whose eggs and larvae are imbued with toxins (like Canadian and western toad), is also unclear (Blaustein and Margalit 1994).

Western toad abundance was not affected by the presence of native or non-native fish in lakes in the foothills of Alberta (Schank 2008); however, McGarvie Hirner and Cox (2007) found higher western toad abundance in lakes with rainbow trout (*Oncorhynchus mykiss*) than in lakes without trout in the southern interior of British Columbia. The presence of fish may help to depress the abundance of invertebrate tadpole predators (Eaton *et al.* 2005; McGarvie Hirner and Cox 2007).

The American bullfrog (*Lithobates catesbeianus*), native to eastern North America, was introduced to western North America. It is classified as a priority invasive species in British Columbia, because it competes with and preys upon native amphibians, and is subject to regional containment and control (Government of British Columbia n.d., 2024). This generalist species is highly fecund, with strong dispersal abilities. To date, its distribution is limited to the southern portions of the province. The American bullfrog is a known carrier of the amphibian chytrid fungus (*Batrachochytrium dendrobatidis* [Bd]) and ranaviruses (see *Threats and Limiting Factors*; Hossack *et al*. 2023). The risk of intentional, accidental, or human-caused movement of the American bullfrog to the NWT is unknown. Furthermore, the habitat in the NWT may not be suitable because of low temperatures (Hossack *et al.* 2023; Bienentreu pers. comm. 2025).

Hybridization of Canadian toads with American toads is known to occur where the distributions of these two species overlap in southeastern Manitoba. However, the range of the American toad does not extend into the NWT and hybridization between the two is therefore not a factor in the territory (Cook 1983; Hamilton *et al.* 1998; Eaton *et al*. 1999). Breeding between Canadian toads and western toads is also known to occur in areas of overlap; however, as with American toads, no such zones of overlap exist in the NWT (Eaton *et al*. 2005).

Little is known about interactions among amphibians in the NWT. In the NWT, wood frogs and boreal chorus frogs have been encountered in areas with northern leopard frogs and Canadian toads; but they have never all been encountered at the same site together (Bienentreu pers. comm. 2025; Schock pers. comm. 2025). Northern leopard frog tadpoles are known to be capable of suppressing the growth of co-occurring wood frog tadpoles (Relyea 2000) and grow faster under good conditions (Schiesari *et al.* 2006). Tadpole density is known to affect growth rates of some toads, with growth rates depressed in pools with a high density of tadpoles (Blaustein and Margalit 1996).

In areas with higher amphibian diversity, the risk of disease and pathogen load in the environment increases (Bienentreu 2019). Diseases, parasites, and invasive species are discussed in more detail under *Threats and Limiting Factors*.

PLACE

The presence of amphibians has been confirmed on every continent with the exception of Antarctica (Russell and Bauer 2000; Wake and Koo 2018; ENR 2021). In the NWT, amphibians are largely limited to the southern and southwestern portion of the territory; however, breeding populations of boreal chorus frogs have been confirmed in Norman Wells and observations of wood frogs extend north towards the Arctic coast (Kuyt 1991; CMA 2017; GNWT 2021).

As described previously (see *Life Cycle and Reproduction*), amphibians, including the three amphibians considered herein, rely on aquatic environments, often wetlands, for breeding, foraging and overwintering, and terrestrial environments for foraging and overwintering (Kuyt 1991). Within these environments, three primary habitats are required for all three species considered in this report: (1) aquatic habitat for breeding, egg laying, and tadpole development, (2) foraging and shelter habitat, and (3) overwintering habitat. Each of these habitats must be connected by habitat suitable for dispersal (SARC 2013, 2014; ENR 2021). Pond breeding amphibians such as Canadian toad, western toad, and northern leopard frog are assumed to have strong breeding and overwintering site fidelity (Waye and Cooper 2001; Smith and Green

2005; ENR 2021), high vagility (ability to move) within home ranges, limited dispersal abilities, and spatially disjunct breeding sites (Smith and Green 2005).

For reference in the sections that follow, wetland classification is defined by water table, water movement, nutrient levels, and acidity, and includes fens, marshes, and bogs. Fens are very wet, alkaline, nutrient-rich areas with slow moving water. Graminoid fens are a subtype of fen, with vegetation weighted towards graminoids (grasses, sedges, and rushes) and other low growing plants. Shrubby and treed fens are similar but are drier and have a vegetation community characterized more by shrubs and trees. Marshes are wet areas with open vegetation. Unlike fens and marshes, bogs are low in nutrients and acidic (Annich *et al*. 2019).

Search Effort

Most search effort for Canadian toads, western toads, and northern leopard frogs in the NWT has occurred in the context of broader surveys focused on amphibians in general, or targeted surveys focusing on a single species that also record all other species of amphibians located during field work. As such, search effort is described for amphibians in general in the NWT, noting portions of work that focused on Canadian toads, western toads, and/or northern leopard frogs.

Until recently, most records of amphibians from the NWT have been recorded opportunistically. Since the publication of the *Management Plan for Amphibians in the NWT* (CMA 2017), more concerted efforts have been made to survey amphibian populations in the territory.

When western toad and northern leopard frog were assessed in 2013 and 2014, respectively (SARC 2013, 2014), formal studies conducted on NWT amphibians numbered five: Kuyt (1991), Timoney (1996), Rescan (2008), and Schock (2009 and 2010). Kuyt (1991) discovered and surveyed a large overwintering site for Canadian toads near the Little Buffalo River in Wood Buffalo National Park, providing details about life history, environment, habitat, and abundance. Timoney (1996) presented observations of the Little Buffalo River Canadian toad hibernaculum, the same hibernaculum surveyed by Kuyt (1991), plus new records of Canadian toads at Klewi Lake and at the nesting area of whooping cranes in Wood Buffalo National Park. Note that whooping crane nesting areas are considered sensitive habitat and are therefore not included on maps in this report.

Prescott (pers. comm. *in* SARC 2013) visited Leland Lake in July 2005 and found a total of 29 northern leopard frogs at six out of 10 sites searched on both the Alberta and NWT sides of the border. The observations were from the east side of the lake, roughly one mile north of the provincial border. Incidental observations of all amphibians are recorded by the Government of the Northwest Territories. Rescan (2008) examined the presence of northern leopard frogs and the availability of suitable wetland breeding habitat in the Taltson Basin Hydroelectric

Expansion Project area. The northern leopard frog was detected at two sites on Trudel Creek (August 2007) and upstream of Elsie Falls (early July 2008). Frogs were not detected at these sites in late July 2008. Northern leopard frogs were observed at six sites along the Taltson River, while tadpoles were observed at one site (site SV5). Rescan (2008) also found northern leopard frogs at Kozo Lake (Taltson River), where the species was found in 1994 (Fournier 1997). Schock (2009) conducted amphibian population and pathogen surveys in the Dehcho (28 sites surveyed in 2007, 40 sites surveyed in 2008) and Sahtú (19 sites surveyed in 2007) regions in 2007 and 2008. These studies focused on wood frogs, western toads, and boreal chorus frogs – the three amphibian species that occur in those regions. The Dehcho sites visited in 2007 ranged from Fort Liard to Fort Simpson, and west to Nahanni Butte and Nahʔą Dehé (Nahanni National Park Reserve) in the Yohin Lake area. The 2008 Dehcho surveys were in the areas of Fort Liard, Fort Simpson, Jean Marie River, and Wrigley, and the South Nahanni River from Kraus Hot Springs to the park boundary. In the Sahtú region, surveyed sites were all in the Norman Wells area. Western toads were found at two sites near Fort Liard, with tadpoles at one of these sites. Surveys of the Yohin Lake area did not locate any western toads despite reports of toads in the area. Results related to pathogens in Schock (2009) are discussed further in *Threats and Limiting Factors* and were separately published in Schock (*et al.* 2010). Schock (2010) surveyed 32 sites in the South Slave region in the NWT and northern Alberta in 2009. Nineteen sites were in the NWT, including seven that were in Wood Buffalo National Park. Canadian toads were observed at four of these sites, all in Wood Buffalo National Park, and three of these constituted verifications of previously recorded breeding sites. Northern leopard frogs were found at two sites (six and five adults) where the species had been found in 2008. In 2009 and again in 2012 (Schock 2010, updated by Schock pers. comm. *in* SARC 2013), the northern leopard frog was not found at other sites surveyed in the NWT (Fort Smith, Tsu Lake, Taltson River, Klewi River, Slave River, Slave River delta, and Wood Buffalo National Park) and in northern Alberta (Fort Chipewyan area).

Parks Canada also had an amphibian monitoring program in Nahʔą Dehé (Nahanni National Park Reserve) that included autonomous recording units (ARU) at amphibian breeding habitats (Sadinski pers. comm. *in* SARC 2014; Tate pers. comm. *in* SARC 2014). Recordings detected wood frogs and boreal chorus frogs; additional wetland surveys would be required to determine the status of Western Toads in Nahʔą Dehé (Murchison pers. comm. 2025).

Parks Canada has also been deploying autonomous recording units (ARU) in Wood Buffalo National Park, in the Peace-Athabasca Delta as well as in forested sites of the park that have the potential to record amphibian calling (Wilson pers. comm. 2025). ARUs were set to record for about a month, approximately from the beginning to the end of June. Analysis of the first five years of recordings is still underway; so far, no Canadian toad or northern leopard frog sounds have been found (Comerford pers. comm. 2024).

In 2024, a graduate student with Thompson Rivers University (J. Stewart) similarly deployed ARUs at four of at least six wetlands in the Wood Buffalo National Park where Canadian toads are known to regularly call (Stewart pers. comm. 2025). However, no toads have been recorded calling to date (Stewart pers. comm. 2025).

Parks Canada also conducts surveys of Canadian toad in Wood Buffalo National Park. These surveys are done in the spring. When toads emerge from overwintering burrows at hibernacula they leave behind holes that can be counted. These surveys have taken place periodically at hibernation sites since 1989, with surveys expanding over the years as additional hibernation sites were located (Parks Canada 2023; see also Canadian Toad – Distribution, Canadian Toad – Abundance, Table 1 and Appendix A – Table A2). Canadian toad emergent hole data can be used as an indicator for abundance; however, this is done with caution due to variation in survey methods including number of sites visited, time spent searching for holes, human error, the possibility of asynchronous survey/emergence timing, holes being obscured by rain, and weather conditions (Parks 2022, 2023). J. Stewart also visited some of the previously documented hibernacula for Canadian toad in May 2024 and counted toad burrow holes (Stewart pers. comm. 2025). This work complements ongoing efforts by Parks Canada to monitor Canadian toad emergence in Wood Buffalo National Park (Wilson pers. comm. 2025).

In the approximately 10 years that have passed since the assessments of western toad and northern leopard frog, several additional studies focused on amphibians have been conducted in the NWT or using NWT data. Dulisse (2019) conducted systematic and opportunistic surveys in the known and suspected range of the western toad in the NWT. During these surveys he recorded other amphibian species, recorded descriptions of habitat where amphibians were found, estimated abundance in the area, conducted eDNA analysis, and collected local knowledge about amphibians. Results from eDNA analysis suggested limitations in our ability to detect western toads effectively using this technique; for instance, there were negative results in areas where western toads were known to be present. Studies have also been conducted on the spread of ranaviruses in wood frogs, boreal chorus frogs, and Canadian toads (no northern leopard frogs were encountered during the studies) in the NWT (along Highway 5 near Fort Smith) and northeastern Alberta (along Pine Lake Road into Wood Buffalo National Park and along Highway 48 on the western side of the Slave River; Bienentreu 2019; Bienentreu *et al*. 2020, 2022). During the study, 235 surveys were completed among 91 sites and a total of 2,168 individuals at 20 sites were sampled between 2015 and 2017 (152 of which were Canadian toads; Bienentreu 2019; Bienentreu *et al*. 2020, 2022; Bienentreu pers. comm. 2025). Two die-off events were recorded in the study area in 2017, affecting wood frogs and boreal chorus frogs.

Forzán *et al*. (2019) examined these die-off events in more detail, using histopathology (microscopic examination of tissue) as well as Polymerase Chain Reaction based (PCR-based; using genetic material) tools for pathogen diagnosis and confirming the lethal impact of ranaviruses in the die-off. This work included observations of 30 Canadian toad tadpoles at one of two die-off sites (Bienentreu 2019; Bienentreu pers. comm. 2025). Kalilzadeh *et al.* (2024), using samples collected by Schock (2010) among others, conducted an analysis of genetic diversity of northern leopard frogs in western Canada. A short survey for western toads was conducted near Nahanni Butte in 2023 but did not detect any toads (Wilson pers. comm. 2025)

In areas neighbouring the NWT, Slough (unpubl. data 1999, 2004) conducted amphibian surveys in the La Biche River valley in British Columbia and Yukon, immediately west of the NWT border. No western toads were observed during this time (other species not noted). Slough (2005) and Slough and Mennell (2006) found western toads on the Beaver River and on more westerly Liard River tributaries in British Columbia and Yukon.

These studies have provided valuable information about amphibians in the NWT, including Canadian toad, western toad, and northern leopard frog, but knowledge gaps persist (ENR 1998; Schock 2009). In particular, most data collected on northern leopard frog took place pre-2010, suggesting a temporal gap in search effort (Figure 6). A great deal of effort is required to survey uncommon species beyond accessible sites (e.g., away from roads) and studies conducted outside of breeding season can be difficult, affecting population estimates (Blaustein *et al.* 1995). Single surveys can greatly bias apparent trends (Skelly *et al*. 2003) and restricting surveys to historic breeding sites does not distinguish between population losses and site-switching (Petranka *et al.* 2004; Pearl *et al.* 2009a) or the occupation of new habitats (Wente *et al*. 2005). Detecting trends in amphibian abundance requires long-term data, since amphibian populations are characterized by inherent fluctuations and are vulnerable to stochastic events (Marsh and Trenham 2001). There are likely more breeding sites than have been documented to date for all three species (Timoney 1996; Schock 2009; Didiuk pers. comm. *in* SARC 2013, Kendell pers. comm. *in* SARC 2013). That said, these species are also likely constrained to relatively narrow ranges, given limiting habitats. For northern leopard frog in particular, relatively few sites have been revisited to determine population persistence or trends. Bienentreu revisited all accessible historic sites in Wood Buffalo National Park and in the South Slave region of the NWT. There was no indication of the presence of northern leopard frog at all, except in the Slave River Delta (Bienentreu pers. comm. 2025). Most of the amphibian search effort for this species has been limited to the area west of the Slave River. In 2022, ARUs were deployed east of the Slave River as part of the NWT Biodiversity Monitoring Program. The ARUs were recording from winter 2022/23 until the following winter and were deployed at 19 sites at or near wetlands; to date, no northern leopard frogs have been recorded at these 19 sites (Wilson pers. comm. 2025).

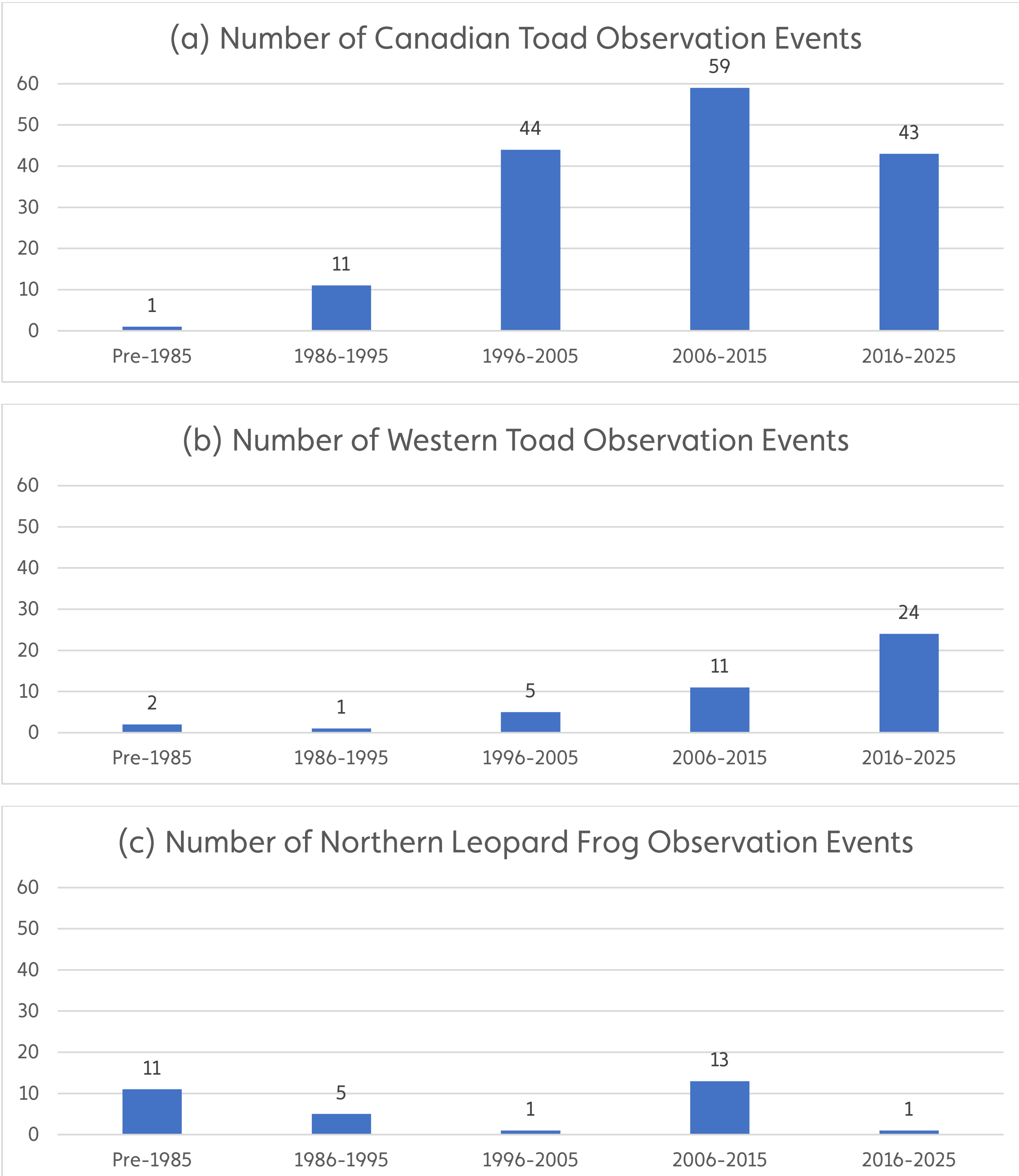

Figure 6. Number of observation events for (a) Canadian toad, (b) western toad, and (c) northern leopard frog in the NWT. Each bar represents the number of observation events over a 10-year period. Observation events include individuals, breeding sites, and overwintering/hibernacula sites (toad holes in the case of Canadian toad). Observation events are not a sum of abundance and do not account for number of individuals observed during an event. Data from various sources (see Appendix A), Parks Canada unpubl. data (2018, 2024), and Stewart pers. comm. 2025.

Canadian Toad

Distribution

The range of the Canadian toad extends from Alberta, east through much of Saskatchewan and southern Manitoba, south into the northcentral United States, and north into a small portion of the NWT (Figure 7; Hamilton *et al.* 1998; Russell and Bauer 2000; ACA 2002).

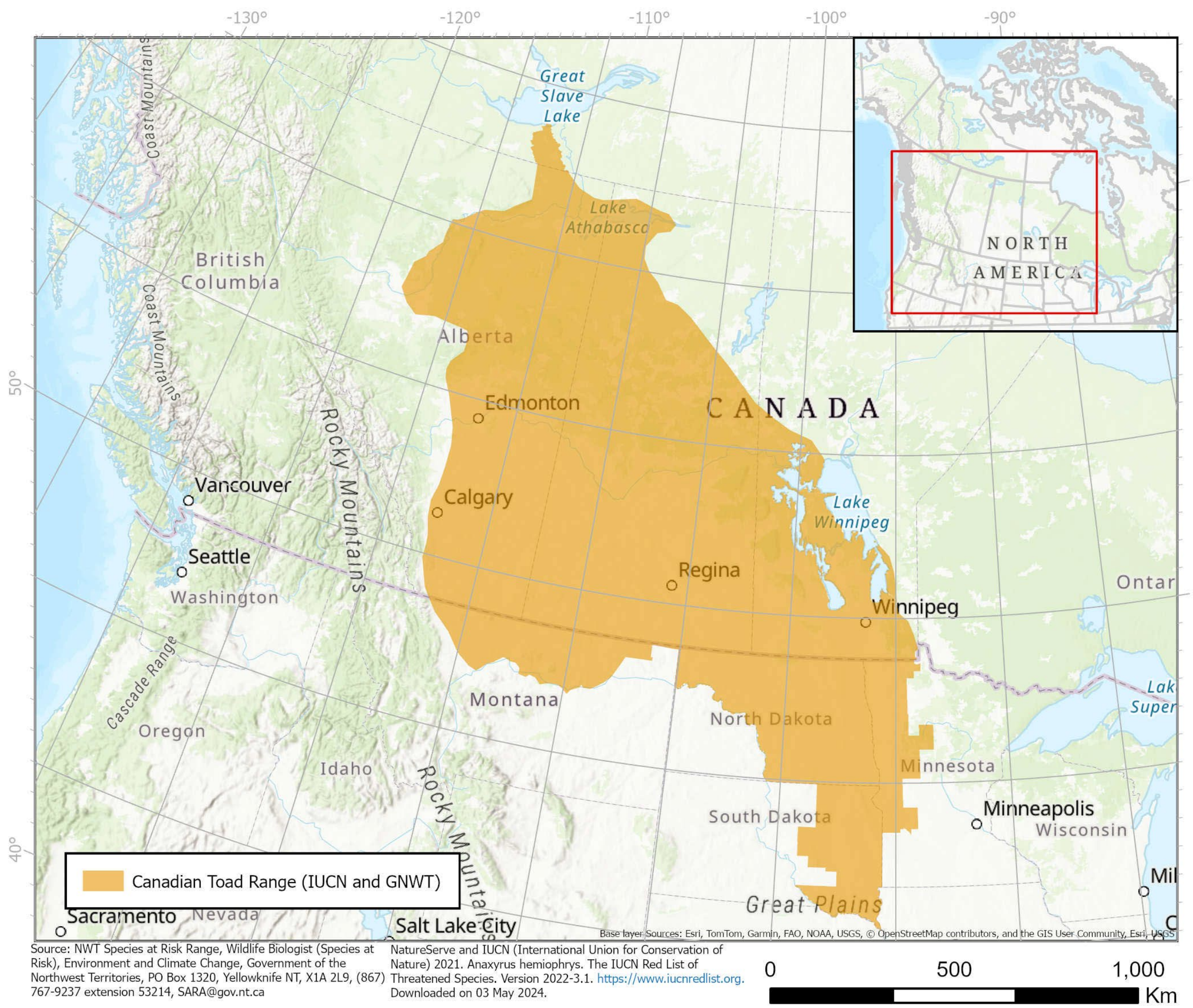

Figure 7. Current known distribution of the Canadian toad in North America. Range outside the NWT is modified* from International Union for the Conservation of Nature (IUCN 2021). Range inside the NWT depicted using the Ecosystem-based Automated Range (EBAR) mapping method (ECG 2013) with species observations, breeding sites and hibernacula sites from NWT Wildlife Management Information System (WMIS 2024), and modified* from NWT Species and Habitat Viewer (2025). *One Canadian toad specimen from 1901 (GBIF 2025; NMNH 2025) is not shown on the map because its location (recorded as Fort Smith) may be geographically imprecise. Details from NWT records are presented in Appendix A. Map courtesy N. Wilson, ECC-GNWT.

Based on a combination of observation data and the Ecosystem-based Automated Range (EBAR), the range of the Canadian toad is limited to the Taiga Plains Slave Upland Mid-Boreal Ecoregion; which occurs in the eastern portion of Wood Buffalo National Park, north to the southern shore of Great Slave Lake (Figure 8; ECG 2013; ENR 2021). Previously, the Taiga Plains Slave Lowlands Mid-Boreal ecoregion was included in the range of Canadian toad. However, there is only one record of Canadian toad in this ecoregion–a specimen that has a collection date of 1901 but an unknown collection location. This specimen sample was submitted to the National Museum of Natural History, Smithsonian Institution occurrence dataset as well as the Global Biodiversity Information Facility (NMNH-Smithsonian Institution 2025; GBIF 2025); Fort Smith is noted in the record, but this likely refers to a general location rather than a precise collection location.

All known hibernation areas for Canadian toad in the NWT occur in sandy banks along or near Highway 5 (see Description – Canadian Toad; Population – Canadian Toad, Abundance and Table 1; Bienentreu pers. comm. 2025). In 1989, the Little Buffalo River hibernaculum (also referred to as Toad West) was the first overwintering site surveyed for Canadian toads in the NWT (Kuyt 1991). The Toad East hibernaculum was added in 1994 by Timoney (1996). The Toad South hibernaculum was located in 1999, the Crane West, Crane East, and Trail hibernacula in 2000, and Crane Far West in 2001. Additional overwintering sites have been found but are not included in surveys including three unnamed sites found in 2002, and two sites in 2013 (NewToad01 and NewToad02) (Parks Canada 2023). Other Canadian toad hibernacula sites in Wood Buffalo National Park include Sharon1, Sharon2, Sharon3, km190, Preble Pond, NoName, DnP Wetland, Joe1, and Crane South (Parks Canada unpubl. data 2018). Hibernacula were also observed at the back end of the Klewi Lake Fuel base (also known as 99 Mile Lake or Mile 99) in 2017 and 2022; it is likely that a larger hibernaculum is in this area (on a sandy slope near the western part of the lake) based on the number of adults and tadpoles (young of year) observed (Timoney 1996; Bienentreu pers. comm. 2025).

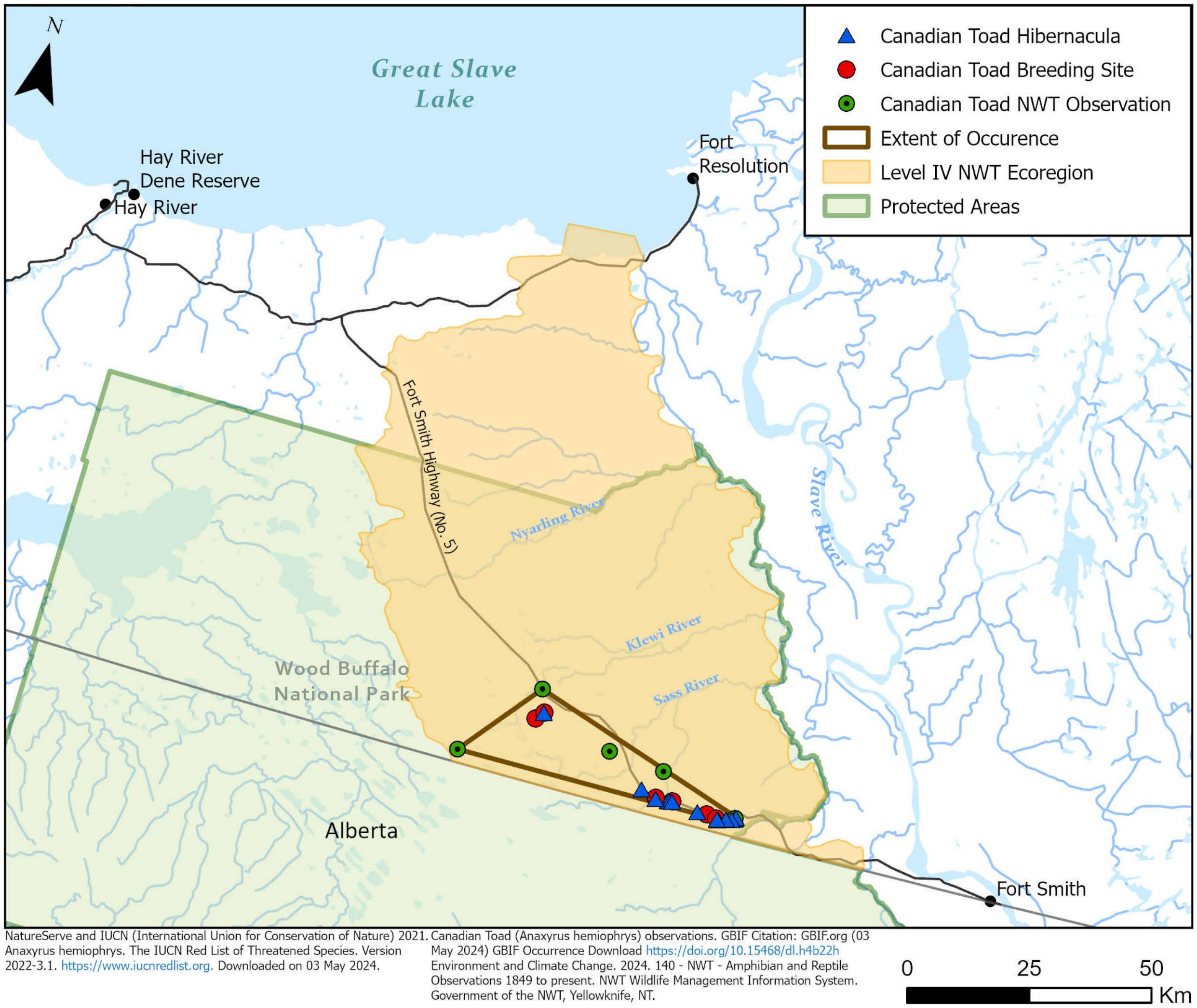

Figure 8. Canadian toad observations, breeding sites, and hibernacula sites depicted within the Level IV Ecoregion where Canadian toad is found. Data from IUCN (2021) and modified* from NWT Species and Habitat Viewer (2025). Observations and breeding sites are from NWT Wildlife Management Information System (WMIS 2024) including data from Kuyt (1991), Timoney (1996), Schock (2010), Bienentreu and Schock (unpubl. data 2020), the Global Biodiversity Information Facility (GBIF 2025), and other incidental observations compiled by GNWT-ECC. Approximate hibernacula location data are from Parks Canada (unpubl. data 2018), Kuyt (1991), Timoney (1996), and Bienentreu (pers. comm. 2025). The extent of occurrence in the NWT is estimated to be 529 km^2. *One Canadian toad specimen from 1901 is not shown on the map because its location (recorded as Fort Smith) may be geographically imprecise. Details from NWT records are presented in Appendix A. Map courtesy N. Wilson, ECC-GNWT.

Extent of Occurrence and Area of Occupancy

'Extent of occurrence' is defined by the Species at Risk Committee (SARC) as the area included in a polygon without concave angles that encompasses the geographic distribution of all known populations of a species in the NWT (SARC 2024a). Area of occupancy is the area within the extent of occurrence that is occupied by a species, excluding cases of vagrancy. This measure reflects the fact that the extent of occurrence may contain some unsuitable or unoccupied habitats. The area of occupancy is measured both as an estimate of the actual area occupied (the 'biological occupancy') and as an index of area of occupancy (IAO), which uses a scale-correction factor to standardize this estimate across different spatial scales (SARC 2024a). Although the area of the range (Taiga Plains Slave Upland Mid-Boreal Ecoregion) is 6,561 km^2, the extent of occurrence (EO) for Canadian toad within the NWT is estimated as 529 km^2 based on observations, breeding locations and hibernacula. The index area of occupancy (IAO) is an estimated 56 km^2. Although the possible range of the Canadian toad in the NWT on ecoregions is substantial, the area of occupancy based on actual observations is much smaller.

Locations

Location is defined as a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the species present. The size of the location depends on the area covered by the threatening event and may include part of one or many subpopulations. Where a species is affected by more than one threatening event, location should be defined by considering the most serious plausible threat (SARC 2024a).

Although Canadian toads may be adversely affected by a number of threats, including pathogens and disease, droughts, wildfires, and mass mortality during aggregation events, pathogens such as chytridiomycosis and ranaviruses represent the most serious plausible threat to Canadian toads in the NWT, given their capacity to spread rapidly across the landscape, use multiple host species, and affect whole populations simultaneously. The small range of Canadian toads in the NWT (based on area of occupancy) and the capacity for disease to act synergistically with other threats is also concerning (see *Threats and Limiting Factors*). In this context, there are fewer than five locations based on eight known breeding sites for Canadian toads in the NWT.

Distribution Trends

There are insufficient data to comment on distribution trends in the Canadian toad in the NWT. All known hibernation areas for Canadian toad in the NWT occur in sandy banks along or near Highway 5 in Wood Buffalo National Park (see *Distribution* for Canadian toad).

Movements

Distances between breeding habitat, foraging habitat, and overwintering habitat used by Canadian toad range from 0.6 to 1.5 km in northern Alberta (Annich *et al.* 2019). Constible *et al.* (2010) recorded single event movements of Canadian toads generally under 50 m in northern Alberta, with occasional longer distance movements over 100 m. Single event movements were typically of greater length across water, but large terrestrial movements were also recorded. These movements occurred across different times of day, including through daytime and nighttime (Constible *et al*. 2010). The total distance moved in a season, or in a single direction in total, was not known or estimated by Constible *et al*. (2010). For other species of this genus, movements up to 2 km away from the waterbodies from which they emerged has been recorded for both metamorphs and adults (Constible *et al.* 2010). In Minnesota, Canadian toad [*A. hemiophrys;* referred to as Manitoba toad (*B. hemiophrys)* in Breckenridge and Tester 1961; which was published prior to the taxonomic split of the genus *Bufo]* daily movements ranged from 0 to 225 m (Breckenridge and Tester 1961). Despite the range of daily movements reported, only a few individuals undertook daily movements over 60 m (Breckenridge and Tester 1961). Most of these movements occurred along the edges of waterbodies, but several long movements were undertaken over dry upland areas as well (Breckenridge and Tester 1961). In the NWT, Kuyt (1991) observed that permanent waterbodies were several hundred meters away from the Little Buffalo River hibernaculum.

Fidelity to overwintering sites appears to be strong, ranging from 88 to 95% in Minnesota Canadian toads. Even those not returning to the same exact overwintering site each year tend to return to a site in close proximity to the one in which they previously wintered (Kelleher and Tester 1969). The means by which a 'home' overwintering site is relocated year to year are not clear, but smell and sight cues have been postulated (Kelleher and Tester 1969). Conversely, fidelity to summer habitats appears to be low (Breckenridge and Tester 1961).

Habitat Requirements

The Canadian toad is broadly considered a habitat generalist, with a large North American range extending across various ecoregions (Hannon *et al*. 2002). In the NWT though, it occurs at the northern limit of its range and uses habitat that is comparatively rare here; particularly, shallow waterbodies in close proximity to sandy areas used for hibernacula (Bienentreu 2019).

In northern Alberta breeding habitat was found along edges bordering wetlands and uplands at low elevations, particularly nutrient-rich graminoid fens (the wettest kind of fen) and open water areas with vegetation under 1.37 m in height (Annich *et al.* 2019). This may reflect the importance of breeding and foraging habitat being close together. In this context, marshes are also likely to constitute suitable habitat, although they occur less common on the landscape in the northern boreal forest. Limited occurrences of Canadian toads in bogs indicated that this habitat type is unsuitable for breeding likely due to low nutrient levels and high acidity (Annich *et al*. 2019). Hamilton *et al.* (1998) reported use of meadows and willow bogs primarily, as well as wetlands with moving water and little to no vegetation in Alberta. Roberts and Lewin (1979), in northeastern Alberta, recorded Canadian toads using a wide variety of breeding habitats, including bogs, although with a clear preference for lakes and streams. Results from Constible *et al.* (2010), also in northern Alberta, suggested significant time spent in or near wetlands, relative to forested areas. In the NWT, limited information on breeding sites exists, but Bienentreu (2019) reported use of shallow waterbodies and Forzán *et al*. (2019) recorded water temperatures of 23.5°C at one site in the NWT where Canadian toad tadpoles were present. Breeding site fidelity has been recorded for many amphibians, although it is not known the degree to which Canadian toads display breeding site fidelity (Constible *et al*. 2010).

Eggs may be laid in association with vegetation in aquatic breeding sites. Eggs laid in strings by this species (versus globular egg masses in wood frogs and boreal chorus frogs) may mitigate the risk of evaporation to some degree, with some eggs likely to stay submerged even if water levels drop (Roberts and Lewin 1979). Eggs that are not laid in association with vegetation are likely more vulnerable to predation and physical disruption (Roberts and Lewin 1979; Hamilton *et al*. 1998).

Roberts and Lewin (1979) found Canadian toads (terrestrial stage, all ages) in grass meadows and willow bogs within 50-60 m of either a river or lake, with toad density declining consistently beyond that distance. Vegetation communities at these sites were dominated by willows (*Salix* spp.), graminoids, horsetails (*Equisetum* spp.), and trembling aspen (*Populus tremuloides*). No Canadian toads were found in areas characterized by jack pine (*Pinus banksiana*).

Canadian toads overwinter in upland areas away from permanent wetlands (Breckenridge and Tester 1961; Tester and Breckenridge 1964; Hamilton *et al.* 1998). Overwintering hibernacula may contain many individual Canadian toads (ACA 2002). Individuals burrow into the ground below the frost line to avoid freezing (Hamilton *et al.* 1998). Compared to other toads, Canadian toads are considered poor burrowers (K. Larsen pers. comm. *in* Hamilton *et al.* 1998); therefore, overwintering areas must have loose, sandy soil where burrowing is easier (Figure 9; Hamilton *et al.* 1998; Annich *et al.* 2019).

In the NWT, Timoney (1996) recorded environment and community associations near the Little Buffalo River (Toad West) Canadian toad hibernaculum, including loose, sandy substrate with either no overlying vegetation or limited vegetation. Recorded vegetation consisted of *Artemisia canadensis* (Canada wormwood) and *Festuca brachyphylla* (short-leaved fescue). Overwintering burrows were notably absent at sites that were subject to regular disturbance (i.e. road maintenance activities) or areas with non-native *Melilotus* species (e.g., sweet clover; Timoney 1996). Tester and Breckenridge (1964), in Minnesota, indicated that the characteristics of suitable overwintering sites had not yet been well-defined but hypothesized that they may relate to the profile of the feature or the vegetation community in the area. They recorded overwintering Canadian toads in unique soil mound features, as well as areas where wind had shifted soil to form ridges. Both types of overwintering sites were characterized by raised soil features (possibly created by pocket gophers), relative to the surrounding landscape and were located in dry, upland areas (Breckenridge and Tester 1961; Tester and Breckenridge 1964). Annich *et al.* (2019) showed Canadian toad overwintering areas tended to feature coarse, rather than fine, soils, while Constible *et al.* (2010), also in northern Alberta, observed sandy soils.

Figure 9. Canadian toad overwintering burrows (hibernacula), Wood Buffalo National Park, n.d. (left and middle photos courtesy of Parks Canada; Parks unpubl. report 2023) and May 2024 (third photo courtesy Johanna Stewart; Stewart pers. comm. 2025).

Several Canadian toad hibernacula have been reported in the NWT (see *Distribution*). The Little Buffalo River (Toad West) hibernaculum is thought to have been used by Canadian toads since the 1960s and may have been created when highway construction formed sandy, cut-banks (Kuyt 1991). Toad holes at this site, each having hosted one overwintering toad (Hamilton *et al.* 1998), were measured at approximately 8 cm in depth in May 1989 and were concentrated in the western portion of this south-facing slope. On 30 August 1989, several newly dug toad holes were excavated by Kuyt (1991). These toads were all located at a depth of around 10 cm from the surface, although the toads likely deepen the holes as temperatures get colder, although note the 8 cm depth reported from spring 1989 (Kuyt 1991; Hamilton *et al*. 1998). In Minnesota, Canadian toad burrows have been recorded to vertical depths of 117 cm (46 inches; Breckenridge and Tester 1961), while in northern Alberta, toads excavated from their holes were found at depths of between 42 cm and 50 cm in September 1997 (Constible *et al*. 2010). Soil temperatures measured at this same northern Alberta site over the winter suggested that toads would need to burrow to a minimum depth of 1.25 m to avoid freezing temperatures (Constible *et al*. 2010).

Habitat Availability

Wetland habitat is not generally considered limiting in the boreal forest (Annich *et al.* 2019). However, as noted in *Habitat Requirements*, suitable habitat for Canadian toads in the NWT requires the combination of suitable breeding sites located near overwintering sites with loose, sandy soil to burrow below the frost line. These sites are not common (Bienentreu 2019).

Habitat Trends and Fragmentation

Given limited search effort and knowledge of Canadian toads in the NWT, it is not possible to comment on habitat trends specific to the species. However, as noted previously, wetland and open water sites are common in the boreal forest and are unlikely to represent limiting habitat characteristics (Annich *et al.* 2019). All confirmed records of the Canadian toad in the NWT to date are also within the boundaries of Wood Buffalo National Park (Figure 8), which provides protection from many forms of potential habitat disturbance or fragmentation (see *Positive Influences*). The effect of the ongoing, multi-year drought (2022 to current) and the severe 2023 wildfire season is unknown and can only be speculated upon (GNWT 2025a). Currently, research is being conducted in and around Wood Buffalo National Park to assess the post-fire status of red-sided garter snakes, this might also provide insight to impacts on Canadian toads (Stewart pers. comm. 2025). Toad population declines in response to prolonged droughts have been documented, although the effects have not been long-term (Hamilton *et al*. 1998). Roads are known causes of habitat fragmentation for many amphibians, including Canadian toads, resulting in mortalities when individuals disperse between seasonal habitats. Road mortality of Canadian toads has been recorded in Wood Buffalo National Park (see *Threats and Limiting Factors* for additional information.

Western Toad

Distribution

As is suggested by their common name, the western toad is a species of western North America, with a range that includes the Pacific northwest, western Canada, and southeast Alaska (Figure 9; Lannoo 2005). The range extends from coastal Alaska and northwestern Canada in the north to Baja California, Mexico in the southwest and northern New Mexico, Colorado, and Wyoming in the east.

Figure 10. Current known distribution of the western toad in North America. Range data from NWT Species and Habitat Viewer (2025) and International Union for the Conservation of Nature (IUCN 2021. Map courtesy N. Wilson, ECC-GNWT.

This range includes most of British Columbia to the Yukon border (Matsuda *et al.* 2006; Friis and Leaver unpubl. data 2007), southeast Yukon (Slough and Mennell 2006), southwest NWT in the Liard River basin (Figure 11; ENR 2006; Schock *et al.* 2010; Wilson and Haas 2012; Dulisse 2019), and Alberta (Russell and Bauer 2000). Apparent gaps in distribution occur in northeast British Columbia (Matsuda *et al*. 2006) and much of northern Alberta (Russell and Bauer 2000). In Alberta, the western toad ranges from the forested regions of the southwest to the central and northern parts of the province. Based on widely separated occurrence records, the distribution in northern Alberta may be more extensive than currently documented, but lack of access has hindered survey efforts (Russell and Bauer 2000; Paszkowski pers. comm. *in* SARC 2014).

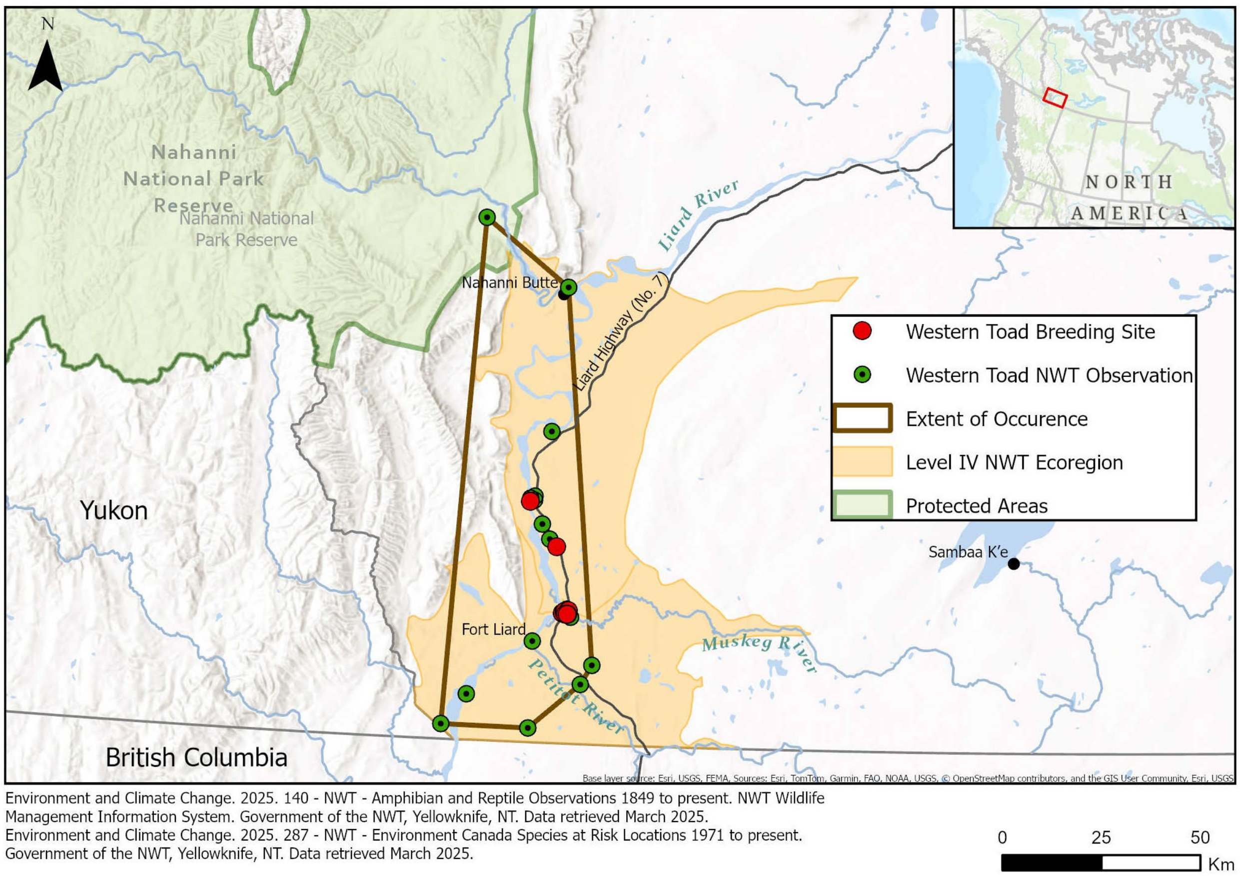

Figure 11. Western toad observations, and breeding sites depicted within the Level IV NWT Ecoregion where western toad is found. Data from IUCN (2021) and modified* from NWT Species and Habitat Viewer (202). Observations and breeding sites are from WMIS (2024) including data from Schock (2009), Dulisse (2019), the Global Biodiversity Information Facility, and other incidental observations compiled by GNWT-ECC. The extent of occurrence in the NWT is estimated to be 37,314 km^2. *One western toad specimen from 1897 is not shown on the map because its location (recorded as Fort Simpson) may be geographically imprecise. One observation from Yohin Lake, Nahʔą Dehé (Nahanni National Park Reserve) recorded pre-1984 has been included but occurs outside of the Level IV NWT Ecoregion (Parks Canada 1984). Details of NWT records are presented in Appendix A. Map courtesy N. Wilson, ECC-GNWT.

In the NWT, all confirmed observations of western toads are in the Liard Valley. Most are along the Liard Highway and Liard River, largely south of Nahanni Butte, in the Dehcho region (Figure 11), which act like transects through potentially suitable western toad habitat. There is little doubt that more occurrences and breeding sites exist in the NWT than are shown in the figures (Russell and Bauer 2000; COSEWIC 2012). This is the warmest area of the NWT and is considered biologically very productive relative to other areas of the NWT (Ecosystem Classification Group 2007; rev. 2009). This population is likely continuous with upstream populations in the Yukon and British Columbia.

There are over 40 confirmed observations of mature western toads from 15 localities in the NWT dating from 1983 onward (see *Appendix A* and Figure 10). Several of the observations are within close proximity of one another near the Muskeg River; others are more widely separated. There have been reports of western toads at Yohin Lake in the southeast corner of NahʔąDehé (Nahanni National Park Reserve) and at Nahanni Butte (Parks Canada 1984; Tate pers. comm. *in* SARC 2014). A western toad specimen (USNM 48057) is recorded as having been collected by Preble in 1897 at Fort Simpson; however, for the various reasons given by Fournier (1997), the information for date, locality, and/or collector appears to be somewhat suspect. Fort Simpson is ~180 km downstream from the nearest confirmed toad observation.

According to Jim Deneron, local Indigenous knowledge holders first noticed western toads in the Dehcho region in the 1980's and it is thought they may have migrated to the area in association with flooding events (J. Deneron, pers. comm. *in* Dulisse 2019). A local family that lived in the vicinity of the Muskeg River Bridge, when interviewed by Jim Deneron (pers. comm. 2018), reported that they first observed western toads in the summer of 1989, and that since then, toad numbers had increased every summer. They started observing toads on the roads and around their camps in around 2013/2014 and noted that the toads have burrows along the bank of the river. They reported seeing a lot of young toads by the river's edge in 2018. They also mentioned toads up around Beaver River in the old days (J. Deneron pers. comm. 2018). Other sources have also reported western toads on the Beaver River (Frogwatch 1997 in Table A3; Slough 2005; Slough and Mennell 2006).

Prior to 2019, only one breeding site had been confirmed in the NWT for western toad; at the Muskeg River gravel pits. This site contained three small waterbodies in which breeding was taking place (Schock 2009). An additional three breeding sites were located in 2019 by Dulisse (2019), with help from local knowledge holders. Two of these constituted the east and west portions of an oxbow waterbody, previously part of the Muskeg River, and are located near the bridge about 350 m southeast of the Muskeg River gravel pits. Before the 2019 survey, this same oxbow area was identified by a local family as an area where the toads seem to occur more frequently, and where there are burrows along the Muskeg River (J. Deneron pers. comm. 2018). The third new breeding site documented in 2019 is located in the Liard River floodplain, about

36 km north of Fort Liard and 30 km north of the originally documented breeding site at the Muskeg River gravel pit (Dulisse 2019). According to the local family, the toads seem to travel a long distance on land so they could be found further up the Muskeg River (J. Deneron pers. comm. 2018). It is likely other breeding sites exist in the area (Dulisse 2019).

Figure 12. Western toad breeding pond at the Muskeg River gravel pit near Fort Liard in 2008, with clear evidence of vehicle use in the area (photo reproduced from Schock 2009).

Extent of Occurrence and Area of Occupancy

Extent of occurrence (EO), as defined previously (see *Distribution – Canadian Toad*), is estimated to be 37,314 km^2 in the NWT, while the index of area of occupancy (IAO) is an estimated 92 km^2. These figures represent substantial increases from the 2014 estimates (SARC 2014), essentially tripling the previous estimates used. This reflects recent search effort by Dulisse (2019), rather than an increase in distribution.

Locations

The most serious plausible threat to western toad is disease and pathogens; therefore, the number of locations is based on the number of breeding areas. A breeding area may contain overlapping sites or breeding ponds within close proximity. In this context, there are three locations based on 11 known breeding sites. (location defined previously, see *Distribution – Canadian Toad*).

Distribution Trends

Breeding sites for western toad change over time depending on environmental conditions. Western toads use human-made features as breeding ponds including clearcuts, ditches, and borrow pits (Gyug 1996; Stevens and Paszkowski 2006; COSEWIC 2013; CMA 2022). These sites are ephemeral meaning that, depending on conditions, these ponds are temporary and can dry up during periods of drought both within a season (before metamorphosis) and/or year to year. For instance, the Muskeg River gravel pit site was previously the only confirmed breeding location for western toads in the NWT (Figure 12). However, this breeding pond was dry during visits in both 2018 and 2019 (ENR unpubl. data 2018 *in* CMA 2022), and no longer constituted suitable breeding habitat. The degree of ephemerality across years of the Muskeg River gravel pit and other breeding sites for western toad in the NWT is unknown. The ephemerality of human-made breeding habitats may act as population sinks that could have negative effects on population persistence (COSEWIC 2013); however human-made breeding habitats may also have positive influences.

Occurrence reports and the identification of new breeding sites (see *Distribution – Western Toad*) reflect enhanced search effort and are not necessarily representative of any shifts in distribution.

The possibility of western toads moving northwards following the Liard River, similar to what happened in the 1980s does exist (Dulisse 2019).

Movements

Range sizes and movements of western toads vary widely across their distribution. Work conducted in the boreal plains ecozone of Canada found 'activity centres' (habitat most frequently used by the species) of 0.57 ± 0.06 ha (0.0057 km^2) for male western toads and 0.55 ± 0.07 ha (0.0055 km^2) for females (Long and Prepas 2012). In Colorado, mean home ranges of males were 0.58 km^2 (maximum 2.64 km^2) while those of females were 2.46 km^2 (maximum 7.02 km^2; Muths 2003). Summer home ranges were 0.01 km^2 or smaller on Vancouver Island (Davis 2000) and up to 0.43 km^2 in Washington (Palmieri-Miles 2012).

Long distance dispersal events have been recorded, including up to 7.2 km in 24 hours along watercourses in spring on Vancouver Island (Davis pers. comm. *in* SARC 2014) and up to 13 km over six weeks in Montana (Schmetterling and Young 2008). In Montana, maximum in-stream movement rates were recorded at over 500 m/day (Adams *et al*. 2005). In Alberta, overland movement rates over two days were over 782 m (Browne *et al.* 2004), while in Washington, maximum movement rates were 1.4 km in a week and 2.0 km in a month (Palmieri-Miles 2012).

Adult western toads are frequently found across the landscape, often far from known breeding sites. In studies in northwestern British Columbia (Mennell and Slough 1998, Slough 2004, 2005), adult toads were found along lake and stream corridors and in upland sites throughout the region up to 30 km from known breeding sites. Females tend to travel further to reach foraging grounds (Muths 2003; Bartelt *et al*. 2004; Bartelt *et al*. 2010; Bull 2006; Browne 2010). Males are more closely associated with water and move shorter distances (Bull 2006).

In Alberta, larger toads arrived at hibernation sites later and along straighter routes than smaller toads, suggesting that they had superior navigation skills or sufficient energy or water reserves to accomplish rapid and longer movements (Browne and Paszkowski 2010b). Navigation appears to be olfactory (scent based) in adults, and celestial (e.g., the sun) in juveniles (Lannoo 2005).

Studies show that western toads display strong site fidelity (up to 90%) to sites used seasonally and/or annually for breeding, summer foraging, and hibernation (Browne and Paszkowski 2010a; Palmieri-Miles 2012; Bull and Carey 2008; Blaustein *et al*. 1995). In contrast, Olson (1988), working in the Oregon Cascade Mountains, showed breeding habitat fidelity ranging from 2-76% in males and around 5-31% in females.

Barriers to movement have not been documented in detail but recently clearcut areas in British Columbia. under 0.05 km^2 in size, did not impede movements by western toads in the spring (Deguise and Richardson 2009). However, larger clearcuts, and smaller clearcuts later in summer when temperatures are relatively high, may be inhospitable to western toads (Deguise and Richardson 2009). Western toads in Alberta have been observed using grass/dirt roads and seismic lines which facilitate movements (Long pers. comm. *in* SARC 2014).

Movements and habitat use by juvenile western toads remain a large gap in knowledge. Bull (2009) studied dispersal by metamorphs and juvenile western toads in Oregon and found that metamorphs travelled up to 2.7 km from breeding sites within eight weeks of metamorphosis at an average rate of 84 m/day. Drainages were used as dispersal corridors. Juveniles were found 1.1 to 2.7 km from breeding sites. Dispersal distances were limited by the availability of moist habitats and by time between metamorphosis and hibernation. Davis (2000) found metamorphs within 300 m of breeding sites on Vancouver Island.

Adults and toadlets also undergo mass movement events to/from hibernation and/or breeding sites (Carr and Fahrig 2001; Browne and Paszkowski 2010b). These movements are significantly related to temperature and/or day length (Browne and Paszkowski 2010b). When such movement events intersect roads or highways, this could lead to mass mortality events as a result of roadkill (see examples in COSEWIC 2012).

Habitat Requirements

The western toad, like the Canadian toad, is broadly considered a habitat generalist (Blaustein *et al*. 1995; Hannon *et al*. 2002) and is at the northern limit of its range in the NWT.

In northern Alberta, western toads show the greatest relative abundance at moraine sites (landforms related to glacial activity; Browne and Paszkowski 2009). Western toads were associated most strongly with deciduous and mixed forests with closed canopies and areas with tall shrubs. Abundance was lower at recently burned areas, areas with pine trees, and sites with a high density of wetlands. Unlike wood frogs and boreal chorus frogs, which appear to use all terrestrial habitat in close proximity to breeding sites fairly equally, western toads demonstrate more selectivity and may move longer distances away from breeding sites. Wetlands used for breeding need to be fairly shallow, with high dissolved oxygen levels (Browne and Paszkowski 2009). In the boreal mixed wood forest of Alberta western toads were more abundant in forests less than 100 m from lakes than they were 400-1,200 m away (Macdonald *et al*. 2006). Open, warm areas with abundant prey were selected in Alberta during the pre-hibernation season in boreal forest and aspen parkland sites (Browne 2010). Low shrub cover was avoided during the foraging season (Browne *et al*. 2009). Clearcuts and edges of clearcuts are used by western toads depending on the seasonal risk of desiccation (Ward and Chapman 1995; Gyug 1996; Davis 2000; Deguise and Richardson 2009). Juveniles and adults are thought to use the same general habitat through the active season, but juveniles may show increased use of wetlands given higher vulnerability to moisture loss (Lannoo 2005).

Generally, breeding habitat for western toads is found in small, shallow, and still, or near still, waterbodies. Ephemeral pools formed by snowmelt are also used (Lannoo 2005). Typical breeding sites include shallow, sandy, or silty margins of lakes, ponds, streams, rivers, stream deltas, river backwaters, floodplain marshes, and geothermal springs. Human-made habitats such as ditches, road ruts, tailings ponds, and borrow pits are also commonly used (Jones *et al*. 2005; COSEWIC 2012). Beaver (*Castor canadensis*) ponds are used extensively for breeding in the northern part of the western toad's range in British Columbia, Yukon, and Alberta (Slough and Mennell 2006; Stevens *et al.* 2007). Water depths up to two meters may be used for laying eggs (Olson 1989), but shallow water (10 cm to one meter) is preferred (Corn 1998). Browne *et al*. (2009) found a positive correlation between western toad abundance and locally higher water temperatures, as well as a very weak correlation between western toad abundance and local sites with higher dissolved oxygen. Although Browne *et al.* (2009) did no include specific temperatures for reference, their finding is consistent with Holland (2002), who noted a difference in local mean water temperature between breeding and non-breeding sites, with non-breeding sites being consistently cooler than breeding sites. Given that egg and larval development are dependent upon water temperature (Herreid and Kinney 1967 in Holland 2002), this is to be expected.

Although ephemeral pools may be used for breeding, permanent water bodies are usually preferred, as ephemeral pools may dry up in times of drought before metamorphosis is complete. Breeding sites must also be near suitable hibernation and foraging sites. Breeding ponds may be clear or silty (Storer 1925; Slough and Mennell 2006) and sites are sometimes extremely open and unprotected by vegetation, woody debris, rocks, or undercut banks (Stevens and Paszkowski 2006).

At a smaller scale, western toads seek overhead cover, such as shrubs, dense herb layers, coarse woody debris, boulders, or mammal burrows for protection from desiccation and predation (Davis 2000; Bartelt *et al*. 2004; Bartelt *et al*. 2010). They may also dig shallow scrapes or their own burrows in loose soils such as sand (Bull 2006). If temperatures drop too much (below 3°C), toads will seek warmer shelters, such as animal burrows (Lanno 2005). Unlike Canadian toads that create their own burrows for overwintering, western toads use existing features for overwintering, including animal burrows or remnant cavities left by plant roots (Annich *et al.* 2019). Microsites providing thermal or protective cover and moist soil patches are repeatedly used (Carpenter 1954; Jones and Goettl 1998; Davis 2000, Bartelt *et al*. 2004; Bartelt *et al*. 2010; Long and Prepas 2012). These microsites act like refugia and likely represent habitat critical to the western toad (Long and Prepas 2012). In northern Alberta boreal forest sites, woody debris offering moist shelter constituted the most used type of microhabitat/shelter by western toads, with particularly strong selection for moist, woody tunnels (Browne and Paszkowski 2018). The range of average air temperatures at these sites was 9 to 21°C. Proximity to water also appeared to be an important factor in habitat selection, although females sometimes moved further from water sources while foraging (Browne and Paszkowski 2018).

Following breeding, adults may remain to forage in the marshy or riparian edges of breeding sites, or they may disperse up to several kilometers to other wetlands, riparian areas along streams, or upland sites such as forests, meadows, shrub lands, or subalpine or alpine meadows (Muths 2003; Bartelt *et al*. 2004; Bull 2006; Bartelt *et al*. 2010; Browne 2010).

Tadpoles are also largely considered habitat generalists (Blaustein *et al*. 1995). Tadpoles tend to stay in warm and shallow waters during the day (Lannoo 2005), permitting their dark bodies to absorb heat from the sun (Blaustein *et al.* 1995) and accelerating development (Browne *et al.* 2009); shifting to deeper and colder places overnight (Livo 1998; Lannoo 2005).

Prior to the work of Dulisse (2019), there was only one confirmed breeding location for western toads in the NWT – at the Muskeg River gravel pit near Fort Liard (Figure 12; Schock 2009). Dulisse (2019) identified an additional three significant western toad breeding sites within their survey area. The originally discovered site was in a gravel pit and encompassed three separate ponds, all in close proximity to one another (Schock 2009). This site is subject to regular use by all-terrain vehicles (Figure 12) and may not be used year-to-year (see *Habitat Fragmentation – Western Toad*).

Two of the newly discovered breeding sites are located on the east and west portions of an oxbow waterbody (no connecting waterflow between the two) near the Muskeg River. These sites featured water depths greater than 2 m over 2.2-5.7 ha (in east and west portions of oxbow, respectively), water temperatures of 23.6 and 21.9°C (east and west portions, respectively), a vegetation community characterized by common cattail (*Typha latifolia*) and pond-lily (*Nuphar* sp.), and the presence of fish and beavers. During the 11 July 2019 survey of these sites, western toads at all stages of life were recorded, included late-stage larvae (tadpoles), thousands of metamorphs, and several toadlets and adults. The third newly discovered breeding site lies about 30 km north of the Muskeg River gravel pit site. This area was surveyed following local reports of many small frogs in the area in 2017 and 2018. This site is a side channel of the Liard River and is located within the river floodplain with a maximum water depth that is 2 m deep and approximately 1.2 ha in area Water was either still or very slowly moving due to a partial upstream flow blockage, the water temperature was 16.8°C, and fish were present. Willow (*Salix* spp.), alder (*Alnus* spp.), balsam poplar (*Populus balsamifera*), and horsetails (*Equisetum* spp.) dominated the vegetation community (Dulisse 2019).

The western toad is not freeze-tolerant (Browne and Paszkowski 2010a). Western toads overwinter underground, in features such as small animal burrows, in rocky cavities near waterbodies, beneath tree roots, and even in beaver dams (Lannoo 2005). They may also dig burrows (Russell and Bauer 2000). In Alberta, western toads used cavities in peat channels, cavities under spruce trees, abandoned beaver lodges, and muskrat (*Ondatra zibethicus*) tunnels for hibernation (Browne and Paszkowski 2010a). These sites were in a wide variety of forested and unforested (shrub lake, marsh, and meadow) habitats, but there was strong selection for spruce forests. In Oregon, hibernation sites were up to 6.2 km from breeding sites and were in rodent burrows, under large rocks, logs or root wads, or under stream or lake shore banks (Bull 2006). Montane populations in Colorado used upland areas near seeps, stream banks, and mammal burrows (Jones *et al.* 1998). Browne and Paszkowski (2018) observed western toads using moist, woody tunnels for shelter in a northern Alberta boreal forest and postulated that they may have been exploring these as potential overwintering sites. The new metamorphs may hibernate near the shores of the waterbody from which they emerged, in small spaces like cracks in the ground (Lannoo 2005). Overwintering burrows must be deep enough to protect western toads from freezing temperatures. Temperatures in hibernacula in Washington remained above freezing despite air temperatures of -21°C (Palmieri-Miles 2012). In Alberta, overwintering burrows are up to 1.3 m deep to accomplish escape from freezing temperatures (Russell and Bauer 2000). Increased snowpack provides insulation for hibernation sites, whereas a diminished snowpack may lead to increased depth of ground freeze, endangering overwintering individuals (Cook 1977; Alaska Department of Fish and Game 2006; Slough and Mennell 2006; COSEWIC 2013).

Western toads are not known to display territoriality (Lannoo 2005).

Habitat Availability

The availability of suitable habitat for the western toad in the NWT has not been quantified. Natural breeding sites are expected to be common in the Liard valley, however, the ephemerality of breeding sites should be considered in assessments of habitat availability (Dulisse 2019). Frost-free hibernation sites with adequate early snow cover may be a limiting factor for western toads at the northern edge of their range. The northern extent of their range in British Columbia and the Yukon corresponds with early deep snow accumulation, and with geothermal springs (Slough and Mennell 2006). The availability of summer habitats is likely not limiting western toads in this highly productive region. The boreal forest does not usually lack for moist microsites (Browne and Paszkowski 2018), therefore this selection preference is not considered normally limiting for western toads.

Habitat Trends

There is no evidence that the overall quantity of western toad habitat has been lost in the NWT. Breeding sites change year to year depending on environmental conditions – particularly ephemeral human-made features (see *Distribution Trends)*. Landscape changes are occurring however, and cumulative impacts from activities such as forestry, roads, seismic lines, and other linear features, and active oil and gas and coal development have the potential to degrade and fragment western toad habitats in the NWT (see *Threats and Limiting Factors*). The ability of toads to resist desiccation and adapt to thermal extremes mitigates some of the potential negative impacts of linear features and deforested lands. Global climate change may have both negative and positive impacts on western toad habitats (see *Threats – Climate Changes*).

Habitat Fragmentation

Terrestrial and aquatic habitats of pond-breeding amphibians in general, including those of western toads, tend to be naturally patchy and fragmented (Marsh and Trenham 2001). Suitable habitats are often isolated from one another. The western toad is at the northern edge of its range in the NWT, where separation of breeding, hibernation, and foraging sites might limit population stability and the northern extent of the range.

Roads, trails, and seismic lines alter toad habitats and can represent obstacles to dispersal and migration (Fahrig *et al*. 1995; Eigenbrod *et al*. 2008). However, western toads are able to forage in and cross open areas (Long and Prepas 2012), so western toad habitat fragmentation is not believed to be a major issue. Mass mortality from roadkill is a more serious threat caused by roads, trails, and seismic lines (see *Threats and Limiting Factors*). Man-made ponds may be used for breeding but since they are typically near roads, they can result in the roadkill of large numbers of breeding adults or dispersing metamorphs. Some human-made habitats may attract breeding individuals but can result in wasted reproductive effort and a negative effect on population persistence (Stevens and Paszkowski 2006).

Browne and Paszkowski (2018) showed some avoidance of linear corridors (gravel roads, seismic and utility corridors, ditches) in northern Alberta by male western toads during the breeding and foraging seasons, whereas female toads showed a stronger selection for open habitat and did not avoid linear corridors. This may be reflective of choosing habitats with good foraging opportunities post-breeding and/or females being less susceptible to desiccation due to their larger size (Bartelt *et al.* 2004; Bartelt *et al*. 2010; Browne and Paszkowski 2018). Similar results were reported in an earlier study by the same authors in the same region, with toads not using linear disturbances offering no cover such as railroads, gravel roads, paved roads, or generally exposed areas (Browne and Paszkowski 2014). In contrast, in a northern Alberta study site with little road traffic, boreal chorus frogs (but not wood frogs or western toads) did select for roads and ditches (Browne and Paszkowski 2009).

Clearcuts and edges of clearcuts are used by western toads depending on the seasonal risk of desiccation (Ward and Chapman 1995; Gyug 1996; Davis 2000; Deguise and Richardson 2009).

Northern Leopard Frog

Distribution

The northern leopard frog occurs throughout most of central and northeastern North America from Labrador, James Bay, and the NWT in the north, south to Virginia, Nebraska, and Arizona (Figure 13; Stebbins 2003). The northern leopard frog was introduced to Newfoundland and Vancouver Island, but they are now believed to be extirpated. Disjunct populations occur in the west, including southern British Columbia and the western United States, where recent range contractions have been observed (Stebbins 2003). In northeastern Alberta, Roberts and Lewin (1979) considered northern leopard frogs a possible glacial relict.

As mentioned in *Systematic/Taxonomic Clarifications*, COSEWIC (2009) recognized three discrete and evolutionarily significant units (Designatable Units (DUs); *sensu* Green 2005) of northern leopard frogs in Canada. Northern leopard frogs in the NWT belong to the Western Boreal population of the Prairie/Western Boreal DU, which extends from western Manitoba through Saskatchewan and Alberta. This DU is supported by the high degree of genetic uniformity of southern and northern Alberta and NWT populations (Wilson *et al.* 2008).

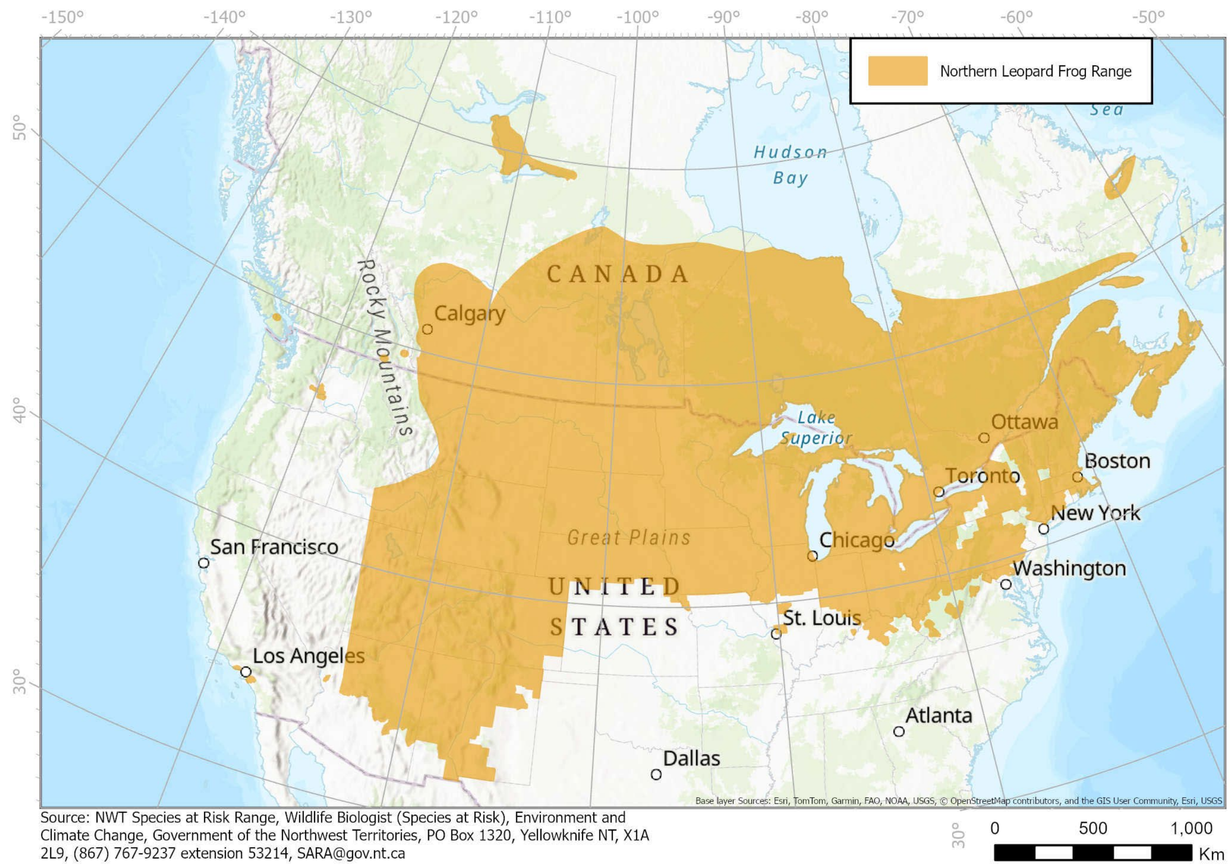

Figure 13. Distribution of the northern leopard frog in North America. Range data from NWT Species and Habitat Viewer (2025) and International Union for the Conservation of Nature (IUCN 2021. Map courtesy N. Wilson, ECC-GNWT.

Northern leopard frogs in the NWT are known to occur in the South Slave region (Figure 14), primarily east of the Slave River, near the Slave, Taltson, and Tethul rivers (see also Figure 1 and 2). It should be noted that some historic reports cannot be confirmed, and some specimens may have been misidentified wood frogs (Kendell pers. comm. *in* SARC 2013; Schock pers. comm. *in* SARC 2013). Furthermore, released or escaped bait frogs (frogs used by fishers for bait) may be responsible for some occurrences (Schock pers. comm. *in* SARC 2013). The most northerly record is from the Slave River delta on Great Slave Lake and the eastern-most record is from the Taltson River (ENR 1998).

The most recently reported occurrences of northern leopard frog in the NWT were of a single adult frog photographed in 2016 near Jackfish Lake (west of Pilot Lake; WMIS 2024) and a likely sighting by Bienentreu in 2016 at Fort Resolution of a frog that looked like a northern leopard frog based on its colours and movements (Bienentreu pers. comm. 2021; see *Appendix A*).

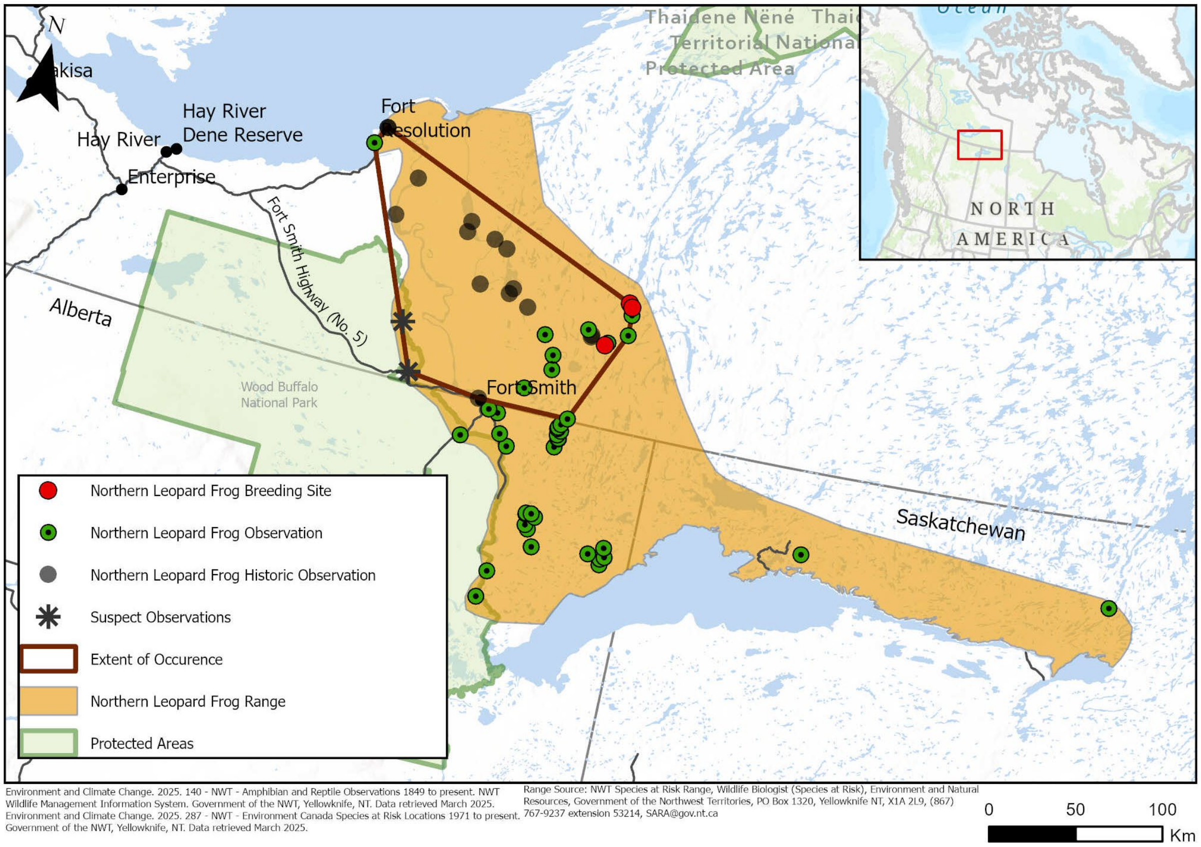

Figure 14. Current known distribution of the northern leopard frog in the NWT, Alberta, and Saskatchewan based on species observations and breeding sites. Observations are included outside of the NWT as this population (NWT, AB and SK) are geographically disjunct from the greater North American population. Breeding sites are identified for NWT records only. Species observations from before 1995 are indicated with a grey dot. Records that are considered suspect are indicated with a grey Asterix. Range data was modified from NWT Species and Habitat Viewer (2025) through the removal of the distinction between historical and recent ranges. Species observations and breeding sites in the NWT from WMIS (2024) including data from Schock (2010), RESCAN (2008), GBIF (2025), and other incidental observations compiled by GNWT-ECC. Data from outside the NWT are from Saskatchewan Conservation Data Centre (unpubl. data 2025) and Alberta Fish and Wildlife Information System (FWMIS unpubl. data 2024). The extent of occurrence in the NWT is estimated to be 14,248 km^2. Details for NWT records are presented in Appendix A. Map courtesy N. Wilson, ECC-GNWT.

There are unconfirmed acoustic observations of northern leopard frogs near Fort Liard (Schock 2009) and in the Edéhzhíe Candidate Protected Area along the Gathsaday River near Fort Simpson (EBA and CWS 2006). However, these observations are separated by more than 400 km from the known range in the NWT, and both Moore (pers. comm. *in* SARC 2013) and Schock (pers. comm. *in* SARC 2013) remain uncertain about the identity of the species heard there. Similar sounds made by ravens, woodpeckers, muskrats can sometimes be misidentified as northern leopard frogs, so reports based only on sound should be interpreted with caution (Bienentreu pers. comm. 2025; Randall pers. comm. 2025; Schock pers. comm. 2025).

Extent of Occurrence and Area of Occupancy

Using all observations of northern leopard frog from the NWT, the EO is estimated to be 14,248 km^2 and the IAO is an estimated 116 km^2. There have been only 31 occurrences reported, 16 of them since 2000.

In SARC (2013), the IAO for northern leopard frog was reported using only occurrences reported between 1995 and 2013 to yield 52 km2 (from 13 occurrences). Using the same method, the updated IAO for northern leopard frog would be 56 km2 (from 16 occurrences).

Locations

As with Canadian toads and western toads, the most serious plausible threat to northern leopard frogs in the NWT is disease and pathogens. In this context, there are three locations based on known breeding sites for northern leopard frogs in the NWT (location defined previously, see *Distribution – Canadian Toad*).

Distribution Trends

Available data and search effort in the NWT are insufficient to document broad distribution trends, since recent search effort has only partly overlapped sites of historical (before 1995) occurrences, and it is also possible that some older observations of northern leopard frogs could have been misidentified wood frogs (Bienentreu 2019).

Range maps of northern leopard frog in the NWT distinguish between "recent" and "historic" range; with observations before 1995 informing the historic range (e.g. NWT Species and Habitat Viewer 2025). The historic range is along the Slave and Taltson Rivers (and deltas), and around Tsu Lake (see Figure 2 and Figure 14). Indigenous and community knowledge holders have observed northern leopard frogs in this area north of Trudel Lake towards Fort Resolution likely since the 1980s, possibly even the 1950s (Beaulieu pers. comm. *in* SARC 2013; Beck unpubl. data 2011 *in* SARC 2013). Since 2000, there has only been one record of northern leopard frog (see Appendix A; 9 June 2016 in Fort Resolution) within this historic range north of Trudel Lake along the Slave and Taltson Rivers and surrounding deltas (Bienentreu pers. comm. 2021). The most recent sightings of northern leopard frog include a single adult frog near Jackfish Lake (west of Pilot Lake) and a likely sighting by Bienentreu in 2016 at Fort Resolution of a frog that looked like a northern leopard frog based on its colours and movements. Northern leopard frogs have not been reported in the area between the Slave River Delta and 64.7 degrees north since before 2000.In addition, multiple people in the region spoke to Bienentreu about northern leopard frogs in the Fort Resolution area, and in 2016-2017 Elders in Fort Resolution told Bienentreu that they regularly see and hear northern leopard frogs around the community, in grass fields toward the lakeshore, and in the Slave River delta. When photos and audio recordings of calls of the different amphibian species in the area were shared, they clearly pointed to northern leopard frog (Bienentreu pers. comm. 2021).

Although the northern leopard frog range extending southeast into northern Saskatchewan was previously mapped as "historical" range in SARC (2013), one additional observation was recorded of a northern leopard frog in this area (e.g. from 2002 near Lake Athabasca, Saskatchewan; Saskatchewan Conservation Data Centre, unpubl. data 2025).

In contrast, both historical and recent northern leopard frog sites were surveyed in and around Wood Buffalo National Park closer to Fort Smith, between 2015 and 2017 Bienentreu (pers. comm. 2021). No evidence of northern leopard frogs was found at these sites. These sites were located along Highway 5 near Fort Smith and into northeastern Alberta along Pine Lake Road into Wood Buffalo National Park and along Highway 48 on the western side of the Slave River (Bienentreu 2019; Bienentreu *et al*. 2020, 2022. He proposed that past sightings in the area could have actually been wood frogs with similar coloration (Bienentreu 2019).

As part of the NWT Biodiversity Monitoring Program, autonomous recording units (ARU) were deployed in 2022 near Fort Smith and east of the Slave River, overlapping with northern leopard frog range. Recordings from 19 sites at or near wetlands were analyzed and no northern leopard frog vocalizations were found (Wilson pers. comm. 2025). Although areas with past northern leopard frog records were prioritized for ARU deployment, other factors also influenced site selection, so ARU locations did not precisely match species occurrence locations. Caution should be used interpreting these data, for example, as evidence of northern leopard frog absence (Wilson pers. comm. 2025).

The distribution of northern leopard frog appears to be stable in the other areas where recent searches overlap the historic range (e.g., Rescan 2008). Overall, there is insufficient information to determine whether the range of northern leopard frog has changed. Further study is required to understand how much of the NWT range is currently occupied by the species.

Movements

The size of adult northern leopard frog home ranges reported varies from very small seasonal movements to quite long movements. In Alberta, seasonal dispersal distances may be 6-10 km (Wershler 1991; Seburn *et al.* 1997; Alberta Northern Leopard Frog Recovery Team 2010; Romanchuk and Quinlan 2006). In contrast, Wagner (1997) noted cases of northern leopard frogs breeding and overwintering in the same ponds in Alberta, suggesting much less seasonal movement. In Michigan, adult northern leopard frogs occupy summer home ranges that are 15 to 600 m^2 in size and usually near the breeding sites (Dole 1965). Dispersal from the breeding sites by adults of up to 3.2 km has been reported in Minnesota (Merrell 1970). In Wisconsin, breeding sites may be up to 6 km from overwintering sites (Hine *et al.* 1981). Dole (1971) found that metamorphs could move up to 800 m per night in Michigan and were found as adults up to

5 km from natal ponds. Northern leopard frogs are known to disperse in all directions overland or along riparian corridors (Dole 1971; Seburn *et al*. 1997).

When considering capacity for movement, it is important to note that dispersal distances of northern leopard frogs and other amphibians may be underestimated in the literature, given limitations associated with study site boundaries (Smith and Green 2005). For example, Seburn *et al*. (1997) reported a yearling dispersing 8 km in Alberta, but this was also the longest possible distance that could have been recorded given the size of the study area.

Habitat Requirements

Northern leopard frogs are considered habitat generalists broadly but use some key habitats that may be limiting; in particular, overwintering sites may represent a limiting factor for this species in the NWT (Singer and Lee 2021).

Breeding takes place in a wide variety of permanent and semi-permanent wetlands that contain a combination of open water and emergent vegetation (Wershler 1992; Wagner 1997). Breeding activities and overwintering typically take place at separate locations, however, use of a single site for both purposes has also been documented (Wagner 1997). Breeding ponds are usually shallow (less than 1.5 m), pH neutral, and fishless. Prescott (pers. comm. *in* SARC 2013) recorded a pH of 7.8 in Leland Lake in July 2005, and the Calgary Zoo has recorded pH values in-situ that include a range of 7.0 to over 10.0 (Kendell pers. comm. *in* SARC 2013). Warm water is required for rapid embryo and tadpole development. Suitable breeding sites include beaver ponds, springs, oxbows, quiet backwaters of streams, lake edges, flooded meadows, swamps and marshes, and man-made habitats such as roadside ditches and borrow pits (reviewed in COSEWIC 2009). Emergent vegetation at Alberta breeding sites often includes cattail (*Typha latifolia*), bulrush (*Scirpus* spp.), and/or sedges (*Carex* spp.; Wershler 1991). A northern leopard frog breeding site along the Taltson River in the NWT was in a shallow riparian floodplain marsh vegetated with variegated pond lily (*Nuphar variegata*), horsetail (*Equisetum arvense*), and Northwest Territory sedge (*Carex utriculate*; Rescan 2008). Northern leopard frogs show strong fidelity to breeding sites, returning to the same sites year after year (Waye and Cooper 1999).

Summer feeding areas are frequently found along the margins of water bodies (Wagner 1997), including breeding ponds and stream banks. Northern leopard frogs often remain perched near the water where they can escape from predators. Preferred areas are open and semi-open with short vegetation (Merrell 1977; Werschler 1992). Heavily forested areas and areas with dense aquatic vegetation, tall grass, or shrubs are avoided (Merrell 1977). Adults may move some distance from water if sufficient moisture and cover are available (Hine *et al*. 1981; Seburn *et al*. 1997).

Unlike some species of frog, northern leopard frogs go dormant (become inactive) underwater to overwinter (Waye and Cooper 2001). They usually overwinter on the sand or mud bottoms of water bodies to escape freezing temperatures above ground. Suitable water bodies must be well oxygenated and be deep enough to not freeze to the bottom (Hine *et al.* 1981; Russell and Bauer 2000; Waye and Cooper 2001; Alberta Northern Leopard Frog Recovery Team 2010). Streams, creeks, rivers, lakes, deep ponds, and springs may all provide appropriate overwintering conditions (Cunjak 1986; Wershler 1991). Springs that do not freeze may be important if deep water is not available. Telemetry results in Alberta show that northern leopard frogs can remain active under ice and can sometimes move several hundred meters in a day, though it is not clear how normal such movements are (Prescott pers. comm. *in* SARC 2013). In the NWT, there is an overwintering site on the Taltson River named 'Frog Hole' (Figure 15). Frog Hole is in the middle of an island and on 1 June 1972 five to eight frogs were observed underwater (ENR unpubl. data 2011). The site was checked in the fall of 2009, but no frogs were observed (Beaulieu pers. comm. *in* SARC 2013).

Figure 15. Frog Hole on Taltson River, 2009. Photo courtesy of Susan Fleck, GNWT.

Terrestrial overwintering may occur in small mammal burrows (Waye and Cooper 2001), caves or under rocks, woody debris, or leaf litter (Emery *et al*. 1972; Wagner 1997). Moisture must be present to prevent desiccation, and burrows must be below the frost line (Waye and Cooper 1999).

Habitat requirements during dispersal are not well known. Since they require moisture to prevent desiccation, moist habitats along streams, wetlands, and seepages are preferred (Seburn *et al*. 1997). Rainfall may facilitate overland travel through drier habitats (Dole 1971).

Habitat Availability

The availability of suitable habitat for the northern leopard frog in the NWT has not been quantified. At the very least, areas of both current and historic occurrence are assumed to contain suitable habitat. It is likely that suitable habitats adjacent to this range have not been adequately surveyed. The unconfirmed acoustic observations of northern leopard frogs in the Fort Liard and Edéhzhíe areas suggest the possibility that suitable habitat and populations may exist elsewhere in the boreal forest of the southern NWT (EBA and CWS 2006; Schock 2009).

Habitat limitations that likely determine the species' distribution in the NWT include the availability of overwintering sites. Wetland isolation (separation of wetlands by large distances) may also limit distribution, although the importance of this factor in the NWT is not known.

Habitat Trends

There is no scientific evidence or documented Indigenous knowledge that northern leopard frog habitat has been lost in the NWT. There has been hydroelectric power generation on the Taltson River since 1965 (Dezé Energy Corporation 2009). The proposed Taltson Hydroelectric Expansion Project would add to the existing infrastructure and may have significant impacts on northern leopard frog habitats and populations in the NWT, if the project moves forward. With limited knowledge of current northern leopard frog breeding and overwintering sites, impacts of this project on habitats cannot be adequately assessed.

The flow regime of the Slave River has been affected by the upstream Bennett Dam since 1968 (GNWT 2022) and by climate change (Dagg 2016a and b; AANDC and ENR 2012). Dampened flows from mid-May through the summer months may have had an impact on the available breeding and rearing habitats for northern leopard frogs along formerly flooded shorelines. Participants at a community workshop in Fort Smith indicated that the decline in water levels in the Slave River and delta ecosystem has led to drying of wetlands, fens, channels, and lakes, and cited this drying of frog habitat as one possible reason for the decline in frogs they had observed (Dagg 2016b).

Habitat Fragmentation

Habitats of pond-breeding amphibians in general, including those of northern leopard frogs, tend to be naturally fragmented (Marsh and Trenham 2001). Species at the edges of their range and habitat suitability, like the northern leopard frog in the NWT, may face even greater separation of breeding sites.

Northern leopard frogs are somewhat limited by dispersal abilities; therefore, seasonal habitats and habitats used by metapopulations must be in relatively close proximity to each other and may be vulnerable to disruption of movement and dispersal corridors by habitat fragmentation caused by land clearing (Pope *et al.* 2000). The degree of isolation of breeding ponds affects the ability of amphibian populations to interact and maintain stability (Marsh and Trenham 2001). Ponds that are isolated naturally or become isolated by disturbance are less likely be recolonized after extinction.

Habitat may be further fragmented if road corridors and transmission lines change habitat characteristics or block migration and dispersal. The actual impact of these features on northern leopard frog habitat in the South Slave region of the NWT is likely negligible since most dispersal occurs along riparian corridors and wetlands and there are few roads within their range.

POPULATION

Wetlands typically occur in discrete patches surrounded by non-wetland habitat. Many wetland-dependent species therefore live in multiple local populations sustained through occasional migration – that is, in metapopulations[2] (Gibbs 2000). In a metapopulation, recolonization from neighbouring populations balances extirpations. Four conditions are necessary for the metapopulation effect (Hanski 1999): 1) habitat patches support local breeding populations, 2) no single population is large enough to ensure long-term survival, 3) patches are not too isolated to prevent recolonization, and 4) local dynamics are sufficiently asynchronous to make simultaneous extinction of all local populations unlikely. Pond breeding amphibians, such as those considered here, typically have strong breeding site fidelity, high vagility (ability to move) within home ranges, limited dispersal abilities, and spatially disjunct breeding sites (Smith and Green 2005). As a result, the breeding subpopulations exchange migrants, may be subject to local extinction and recolonization, and form metapopulations (Marsh and Trenham 2001; Smith and Green 2005).

[2] A metapopulation is a group of spatially separated populations that interact genetically at some level.

Canadian Toad

Abundance

Abundance cannot be estimated for Canadian toads in the NWT due to limited search effort and variation in hibernacula emergent toad hole count surveys over the years. Large fluctuations in interannual abundance are expected in Canadian toad populations, given environmental constraints (Tester and Breckenridge 1964).

As described previously, all known hibernation areas for Canadian toad in the NWT occur in sandy banks along or near Highway 5. (see *Description – Canadian Toad, Search Effort*, and *Distribution – Canadian Toad*). Nine hibernacula sites have been the subject of emergence counts led by Parks Canada, to greater or lesser degrees, between 1989 and 2023 (Table 1; Kuyt 1991; Timoney 1996; Parks Canada unpubl. data 2024). Stewart (pers. comm. 2025) also visited some of these previously known hibernacula and counted toad burrow holes in May 2025 (Table 1). As noted earlier (see *Search Effort),* Canadian toad emergent hole data can be used as an indicator for abundance; however, this is done with caution due to variation in survey methods. Sources of variation include number of sites visited, time spent searching for holes, human error, the possibility of asynchronous survey/emergence timing, holes being obscured by rain, and weather conditions (Parks 2022, 2023).

In addition to these sites, eight breeding sites have been recorded, including one by Kuyt (1991) where toads at the site were considered to be abundant (no specific number), one by Timoney (1996) where toads were heard trilling, two by Schock (2009), which contained just a few toads, and four by Bienentreu (2019), which contained a total of at least 77 young of year. Other species occurrence records totalled at least 1,328 adult toads between 1901 and 2017; most (~1,200) of these approximate counts are from Kuyt (1991) and Timoney (1996) including two occurrences where the count was only noted as *abundant* (see *Appendix A;* WMIS 2024).

Density of Canadian toads is noticeably lower in the South Slave relative to wood frogs and boreal chorus frogs, with Bienentreu (2019) catching only one adult Canadian toad per hour (compared to 3-37 wood frogs/hour and 1-9 boreal chorus frogs/hour) and 8-10 Canadian toad tadpoles/metamorphs per hour (compared to 4-60 wood frog tadpoles/metamorphs per hour and 2-41 boreal chorus frog tadpoles/metamorphs per hour). In neighbouring northeastern Alberta, Roberts and Lewin (1979) reported maximum Canadian toad densities as lower than those of wood frog, but greater than those of the boreal chorus frog (12, 19.6, and 2.3 per 1,000 m^2, respectively).

Table 1. Canadian toad hibernacula surveys (emergent toad hole count) in Wood Buffalo National Park between 1989-2024 (Kuyt 1991; Timoney 1996; Parks Canada unpubl. data 2018; Parks Canada 2022; Parks Canada 2023; Parks Canada unpubl. data 2024; Stewart pers. comm. 2025). Coordinates and details on hibernation sites are omitted to protect sensitive habitat. Values represent the sum of total toad holes counted during spring emergence at each hibernacula site. Note that cells with N/A indicate that survey data is not available as the year pre-dates the first record of the hibernacula site; cells with N/S indicate that the known hibernation site was not surveyed. Additional hibernacula sites that do not have survey data include: three unnamed sites found in 2002 (found in sandy cutbanks; Parks Canada 2023); Sharon2, Sharon3, km190, Preble Pond, NoName, DnP Wetland, Joe1, and Crane South (Parks Canada unpubl. data 2018). See Appendix A for additional details.

Year	Toad West[1, 2]	Toad East[3]	Klewi Lake[4]	Toad South	Crane East	Crane West	Trail	Crane Far West	Sharon1[5]	NewToad 01	NewToad 02	Yearly Total
2024[6]	-	-	-	*see note[6]	-	-	-	-	-	~70		**-**
2023	0	0	N/A	0	389	0	0	0	N/S	N/S	N/S	**389**
2022[7]	0	0	?	0	0	0	0	0	N/S	N/S	N/S	**0**
2021[8]	0	0	N/A	0	0	0	0	0	N/S	N/S	N/S	**N/S**
2020[9]	N/S	N/S	N/A	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**N/S**
2019	5	0	N/A	0	4	1	0	3	N/S	2	0	**15**
2018	105	7	N/A	85	24	0	110	19	N/S	48	0	**398**
2017	569	19	?	122	505	292	170	45	N/S	107	16	**1,845**
2016	948	0	N/A	151	334	7	138	55	N/S	124	0	**1,757**
2015	695	2	N/A	120	287	31	131	12	N/S	89	1	**1,368**
2014	776	4	N/A	41	40	16	122	162	N/S	55	1	**1,217**
2013	400	7	N/A	75	424	110	155	42	N/S	86	5	**1,304**
2012	N/S	N/S	N/A	N/S	N/S	N/S	N/S	N/S	N/S	N/A	N/A	**N/S**
2011	145	1	N/A	84	0	0	0	0	N/S	N/A	N/A	**230**
2010	141	12	N/A	20	194	7	0	10	N/S	N/A	N/A	**384**
2009	329	19	N/A	79	84	6	26	45	N/S	N/A	N/A	**588**
2008	N/S	N/S	N/A	N/S	N/S	N/S	N/S	N/S	N/S	N/A	N/A	**N/S**
2007	N/S	N/S	N/A	N/S	N/S	N/S	N/S	N/S	N/S	N/A	N/A	**N/S**
2006	465	6	N/A	26	116	18	100	6	N/S	N/A	N/A	**737**
2005	364	4	N/A	16	47	4	5	24	N/S	N/A	N/A	**464**

Year	Toad West[1, 2]	Toad East[3]	Klewi Lake[4]	Toad South	Crane East	Crane West	Trail	Crane Far West	Sharon1[5]	NewToad 01	NewToad 02	Yearly Total
2004	509	16	N/A	14	77	23	7	32	N/S	N/A	N/A	**678**
2003	594	107	N/A	35	104	46	23	33	N/S	N/A	N/A	**942**
2002	1,495	61	N/A	22	293	33	11	83	50	N/A	N/A	**2,048**
2001	1,421	24	N/A	110	424	47	12	151	N/A	N/A	N/A	**2,189**
2000	1,087	16	N/A	54	291	32	2	N/A	N/A	N/A	N/A	**1,482**
1999	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**0**
1998	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**0**
1997	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**0**
1996	0	0	?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**0**
1995	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**0**
1994	1,144	25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**1,169**
1993	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**0**
1992	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**0**
1991	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**0**
1990	600	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**600**
1989	500	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**500**

Notes:

1. ToadWest is referred to as the Little Buffalo River hibernaculum by Kuyt (1991) and Timoney (1996).
2. ToadWest was discovered in 1989 by E. Kuyt with approximate counts in 1989 and 1990 by Kuyt (1991), and in 1994 by Timoney (1996).
3. An approximate count of ToadEast was first completed in 1994 by Timoney (1996).
4. Hibernacula were suspected around Klewi Lake in 1996 by Timoney (1996) based on auditory observations (toads trilling/calling) and a few holes were found at Klewi Lake in 2017 and 2022 (Bienentreu pers. comm. 2025).
5. Sharon1 is included in Parks Canada unpubl. data 2018 with a note on the number of holes observed in 2002.
6. The status and results from Parks Canada 2024 surveys were not yet available. Approximately 70 toad holes were counted by Johanna Stewart and John McKinnon on 27 May 2024; these locations appear to be at or close to NewToad01, NewToad02 and/or Toad South (Stewart pers. comm. 2025)
7. In 2022 no toad holes were found. Three informal surveys and one formal survey completed.
8. In 2021 no toad holes were found potentially due to a late survey date, it is likely that the holes were too obscured by rainfall.
9. In 2020 the toad survey was not completed due to restrictions from the COVID19 pandemic.

Population Dynamics

A female Canadian toad can lay between 4,000 and 7,000 eggs in long, spiral strings at the bottom of a pond (ACA 2002; ENR 2021). The total number of surviving metamorphs relative to eggs laid is not known in the northern portion of their range in Canada (Constible *et al*. 2010). In Minnesota, the population structure between 1960 and 1962, recorded between 4.24 and 14.25 immature toadlets per adult (Tester and Breckenridge 1964), while analysis of sample results from the same site between 1960 and 1967 returned results of between 1.47 and 14.06 juveniles per adult (Kelleher and Tester 1969).

The age at maturity is one to three years for males and three to four years for females (Canadian Herpetological Society n.d.). In Alberta, Canadian toads generally reach their adult size in one to two years (Hamilton *et al.* 1998; Eaton *et al.* 2005), with age and size being largely positively associated, but with sufficient size variation across age classes limiting the ability to precisely estimate age based on size (Eaton *et al.* 2005). Tester and Breckenridge (1964) reported maturity by two years (45 mm) in Minnesota, but suggested this was an overestimate, given evidence of sexual maturity by 38 mm in males and 43 mm in females.

Sex ratios are unknown in the NWT. In Minnesota, Tester and Breckenridge (1964) considered sex ratios to be roughly equal, however, subsequent sampling at the same site indicated only 33-38% males in the adult population (Kelleher and Tester 1969).

Amphibians at higher latitudes often experience shorter growing seasons and slower annual growth than those at lower latitudes but reach older ages and larger sizes (Ashton 2002; Morrison and Hero 2003). Growth rates of Canadian toad appear to be lower in the northern portion of their range (Wood Buffalo National Park) than further south (Brooks, Alberta; Eaton *et al.* 2005). However, Eaton *et al.* (2005) recorded the largest individuals at their most southerly site (Brooks, Alberta), and the smallest individuals at mid-latitude sites (area of Lac La Biche, Alberta), suggesting factors other than latitude were at play.

Eaton *et al.* (2005) reported a maximum age of 12 years from Alberta (near Lac La Biche). This would provide an up to 10-year window for breeding. Generation time was estimated using IUCN guidelines as age of first reproduction + z* length of the reproductive period (IUCN Standards and Petitions Subcommittee 2024). Using 2 years for males and 3.5 years for females as average age of first reproduction and estimating z as 0.5 the generation time is estimated as 7 for males and 7.75 for females. We rounded to a generation time of 7 years. Survival rates are unknown in NWT.

In Minnesota, annual adult survival ranged from 24% to 44% in the 1960s, and the highest mortality rates were at egg and larval stages relative to older age classes (Kelleher and Tester

1969; Hamilton *et al.* 1998). Considering data only from 1966 and 1967, when there were favourable winter conditions and therefore likely low winter mortality, the survival estimate for adult males was 32.7%, 31.5% for adult females, and 35.9% for immature adults (Kelleher and Tester 1969).

Long reproductive lifespans and likely high egg production suggest that populations of Canadian toad may be able to persist through complete clutch failures across several years. However, this assumption should be weighed against the likelihood of intermittent breeding in northern populations (Eaton *et al*. 2005).

Movements between overwintering sites are known to occur among Canadian toad populations (Kelleher and Tester 1969). These inter-site movements are more common among immature toads than adults (Kelleher and Tester 1969).

Trends and Fluctuations

Canadian toad populations in Alberta have likely declined (Hamilton *et al*. 1998; Annich *et al.* 2019). Populations of Canadian toad in northern Alberta persist but are declining (Hamilton *et al*. 1998). Declines are more significant in the southern portion of the province, particularly around Medicine Hat (ACA 2002). In this area (prairie and parkland), over 90% of wetlands have been drained or modified (ACA 2002). Factors that may have contributed to the decline include habitat disturbance, disease, and climate change (Hamilton *et al*. 1998). Known use of upland areas in the northern boreal portion of this species' range, and habitat modification and fragmentation overlapping this area, suggests increasing pressure on Canadian toad populations in some parts of northern Alberta (Constible *et al*. 2010). Declines in Elk Island National Park in the 1970s and 1980s were considered significant and consistent with declines seen across central Alberta (Russell and Bauer 2000).

Population trends of Canadian toad in the Northwest Territories are highly uncertain (see *Abundance – Canadian Toad*) and should be interpreted with caution. Spring emergence counts conducted by Parks Canada are the only semi-consistent annual surveys of Canadian toads in the NWT (Table 1; Figure 16). Considering results of these counts across years, a high degree of interannual variability can be observed, which obscures long term population or abundance trend interpretation.

However, toad hole numbers seem to be much lower than they were when Kuyt (1991) and Timoney (1996) surveyed for Canadian toads in the early 1990s and numbers have been extremely low since 2017 (when surveys have taken place; Parks Canada unpubl. data 2018; Parks Canada 2022). Researchers (Bienentreu and Schock) who worked in Fort Smith/WBNP region from 2012-2017 reported Indigenous knowledge from local Elders who noticed a steady decline in amphibian calling activities in the region over the past 20-30 years (Bienentreu and Schock unpubl. data and pers. comm. *in* ENR 2022). Combined, this information suggests that a decreasing trend is possible (Figure 16; Parks Canada 2022).

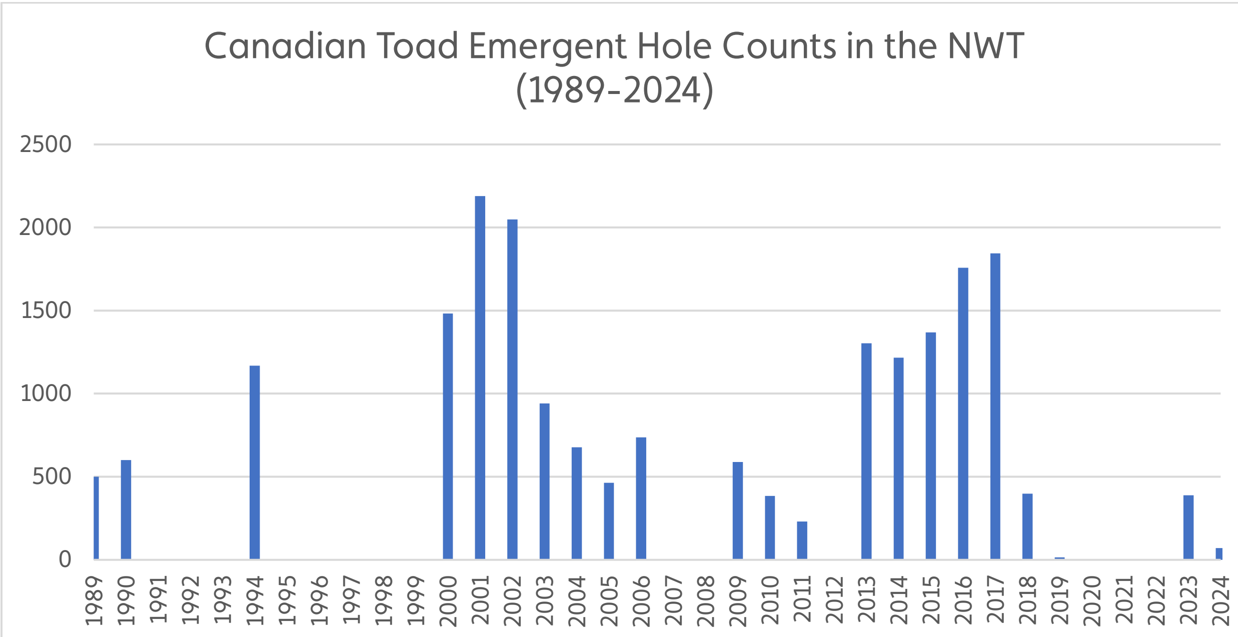

Figure 16. Results of annual Canadian toad emergent hole counts of burrows at hibernation sites in Wood Buffalo National Park between 1989 and 2024. Interpretation of emergent hole data as an indicator for abundance must be done with caution due to variation in survey methods, asynchronous emergence timing, and environmental conditions. Data from Kuyt 1991; Timoney 1996; Parks Canada unpubl. data 2018; Parks Canada 2022; Parks Canada 2023; Parks Canada unpubl. data 2024; Stewart pers. comm. 2025.

Possibility of Rescue

In southern Alberta, local extirpations or greatly reduced populations were observed in the late 1980s and for some of the 1990s following extended drought; this may have occurred in areas with highly fragmented habitat where immigration and recolonization takes considerable time (COSEWIC 2003). Canadian Toads may not be particularly successful in recovering from drought conditions, particularly in areas of intensive cultivation and habitat fragmentation (COSEWIC 2003).

Canadian toads in the NWT occur in a very small portion of the southern portion of the territory, straddling the border with Alberta. Metapopulation dynamics suggest some degree of ongoing immigration and emigration among populations located close to one another. Possibility of rescue from Alberta is therefore high; however, except for localized threats, Canadian toad populations in northern Alberta may be subject to similar threats as the population in the NWT.

Western Toad

Abundance

The western toad is apparently widespread, abundant, and persistent across most of its Canadian range (COSEWIC 2012), but little information exists on population sizes or densities, and few populations have been systematically monitored in the NWT. Large breeding populations, tadpole aggregations, and post-metamorphic aggregations are frequently reported. Aggregations of metamorphs are often reported in the tens to hundreds of thousands (e.g., Hawkes and Tuttle 2010; Hawkes *et al*. 2011). The western toad is not as abundant north of 58°N where aggregations of tadpoles and metamorphs have been reported in the 500 to 5,000 range (British Columbia and Yukon; Slough 2004, 2005, 2009).

Western toads were first observed in the Dehcho region of the NWT in the summer of 1989, and since then, the toads increased in numbers every summer (J. Deneron pers. comm. 2018). Toads were observed on the roads and around camps in around 2013/2014 (J. Deneron pers. comm. 2018). Burrows were noted along the bank of the Muskeg River along with a lot of young toads by the river's edge in 2018. Toads have also been mentioned up around Beaver River (in the "old days"; J. Deneron pers. comm. 2018).

Breeding western toads in the NWT were first confirmed in 2007 and 2008 at the Muskeg River gravel pit near Fort Liard; with reports of hundreds of tadpoles, and several juveniles or adults (Schock 2009). At the time of the last western toad assessment in the NWT (SARC 2014), aggregations of just 250 to 500 tadpoles had been reported in the NWT (Schock 2009) and no aggregations of metamorphs or breeding adults had been recorded. This was likely evidence of small breeding populations in the territory.

Since the 2014 assessment, additional observations have been recorded, included those associated with the targeted western toad survey completed by Dulisse (2019). As a result of this additional search effort, over 30,000 individual western toad observations have been recorded in the NWT to date, with an estimated two thirds of these consisting of metamorphs, and most of the remaining third consisting of tadpoles (Dulisse 2019), with small groups of adults also recorded (see *Appendix A*). Therefore, it is likely that western toads are more common in the NWT than was considered during the previous species at risk assessment and there may be larger breeding populations in the NWT than previously thought. However, we note that large numbers of tadpoles cannot be readily translated to the adult population, given the number of eggs per clutch and the likely low rate of survival from tadpole to adult (Schock 2009.

These results offer insight into the breeding populations of western toads in the NWT; however, the population of mature western toads in the NWT is unknown. Between 1983-2024, a total of 51 adult western toads have been recorded in the NWT (not including one observation event in July 2000 that only noted the number of adults as abundant) across an estimated 15 site occurrences (up from 6 site occurrences in the 2014 assessment of western toads). If western toads heard calling on autonomous recording units (ARU) were mature, then 54 have been recorded. Based on expert opinion (Carrière pers. comm. 2025) and biological information in this report, the number of mature individuals in the NWT may range from 1,100 to 7,000 if females have small to average clutches, egg survival is poor to average, and there are eight to 20 breeding sites. The population of the western toad in Canada was not estimated by COSEWIC (2012) but is believed to be well above the IUCN threshold of 10,000. Although abundance is uncertain, western toads certainly appear to be less abundant in the Dehcho region than wood frogs or boreal chorus frogs (Schock 2009) although local abundance can be higher at certain sites (Dulisse 2019). This is consistent with boreal northern Alberta, where Browne and Paszkowski (2009) caught, on average, 8.38 (range = 0-66) western toads per 10 hrs of searching, compared to 26.79 (range = 4-6) wood frogs and 9.29 (range = 0-70) boreal chorus frogs with the same search effort.

Population Dynamics

Observations in the north suggest that clutches of less than 3,000 eggs are laid, compared to clutch sizes of 1,200 to 20,000 reported in the south (Maxell *et al.* 2002; Slough 2004, 2005). Blaustein *et al*. (1995) reported egg production of 5,000 to 15,000 eggs per female in the Pacific northwest and up to 16,500 at other sites outside this region, while Lannoo (2005) reported a maximum clutch size of up to 12,000 eggs (5,200 average) in their consolidation of literature sources. Clutch size is believed to be correlated with female body size, which is related to age (Olson 1988).

Male western toads reach sexual maturity at three to four years of age and live up to 11 years (Olson 1988; Carey 1993; Blaustein *et al.* 1995; Matsuda *et al.* 2006). Male toads from pasture and forest populations in Alberta reached six years of age (Paszkowski pers. comm. *in* SARC 2014). Females reach sexual maturity at four to six years of age and live up to nine years (Olson 1988; Carey 1993; Blaustein *et al*. 1995; Matsuda *et al*. 2006). Female toads in Alberta reached eight years of age (Paszkowski pers. comm. *in* SARC 2014). These represent longevity in the wild; in captivity, longevity has been recorded at up to 36 years (Russell and Bauer 2000). Maturity may be more accurately expressed as size at maturity rather than age at maturity, with males 56-108 mm and females 60-125 mm at maturity (Lannoo 2005), although there is substantial variation in these sizes documented among breeding sites (Olson *et al.* 1986).

Males may mate more than once per season but may remain in the breeding population for just one to two and half years (on average) once sexual maturity is reached (Olson 1988). Five to 35% of males bred in consecutive years, resulting in a male-biased sex ratio at breeding sites that ranged from 1.5:1 (Olson *et al*. 1986) to 20:1 (although male-biased sex ratios at breeding sites is not always the case; Lannoo 2005; see also Olson 1988).

Breeding in females is strongly intermittent, likely reflecting the energetic costs of reproduction (Olson 1988). Olson (1988) observed females losing up to 60% of their body weight following egg laying. In the NWT, western toad females typically breed only once in their lifetimes (Olson 1988). This is consistent with Campbell (1970) and Carey (1993), who reported that only about five percent of females mate a second time in their lives, approximately 2-4 years after their first mating. Bull and Carey (2008) found that 8.5% of 844 females returned to a breeding site within five years, and 2.5% bred in two to three consecutive years in Oregon. There were no cases of consecutive-year breeding by females at high elevation sites in Oregon or Colorado (Carey *et al*. 2005; Bull and Carey 2008).

Western toads have their lowest survival rates during the egg, tadpole, and metamorph life stages. Nussbaum *et al*. (1983) estimated that mortality rates between egg deposition and the adult life stage were 99%. Predation is the primary mortality factor. Adult mortality rates are believed to be low. Tadpoles of this species release a growth-inhibiting compound that slows growth of smaller tadpoles. This functionally prevents mass simultaneous metamorphosis of entire clutches and lessens the likelihood of mass mortality events at this stage of life (Russell and Bauer 2000).

Breeding populations of western toads in the NWT likely exchange migrants, may be subject to local extinction and recolonization, and may form metapopulations (Marsh and Trenham 2001; Smith and Green 2005). Local and regional population persistence depends on breeding site distribution and connectivity (Pearl *et al.* 2009b).

'Generation time' is defined as the average age of parents of a cohort (SARC 2024a). It is greater than the age at first breeding and less than the age of the oldest breeding individuals, except in populations that only breed once. Generation time for western toads was estimated using IUCN guidelines as age of first reproduction + z* length of the reproductive period (IUCN Standards and Petitions Subcommittee 2024). Age of first reproduction was estimated as average age at maturity (3.5 years for males; five years for females), length of the reproductive period was estimated as the difference between maximum age and average age at maturity (11-3.5 = 7.5 years for males, 9-5 = 4 years for females), and z was estimated as 0.5. Using this formula, estimated generation time is 7.25 years for males and 7 years for females. This has been rounded off to seven years.

Trends and Fluctuations

Western toad populations in Canada are believed to be stable or increasing. Some apparent declines or fluctuations have been observed in southern British Columbia (COSEWIC 2012); however, this information is somewhat dated. Much of the data from the Canadian range of the western toad, including the NWT, are short-term and insufficient to detect population trends. The only repeated survey of breeding sites in the NWT occurred in the Muskeg River gravel pit (man-made habitat; Schock 2009; Dulisse 2019; ENR unpubl. data 2018 *in* CMA 2022). No Indigenous or community knowledge on population trends was available for this report.

Possibility of Rescue

The western toad has been assessed as a federal species of Special Concern (COSEWIC 2012) owing to population declines in southern British Columbia and the United States and combined threats and limiting factors. The species has been classified as sensitive in Alberta since the year 2000, with declines in the province noted as a possibility (Government of Alberta 2025). Western toad is sensitive in the Yukon and apparently secure in British Columbia (NatureServe 2025). The possibility of rescue of western toads in the NWT from populations upstream in British Columbia and the Yukon is high, considering the healthy populations there, the similar habitats, the relatively high dispersal ability of the species, and the ability of the toad to tolerate a relatively wide range of habitat conditions. However, western toad populations in British Columbia and Yukon may be subject to similar threats as the population in the NWT.

Northern Leopard Frog

Abundance

The population abundance of adult northern leopard frog in the NWT is unknown. The limited data that has been collected since northern leopard frogs were originally assessed in the NWT (SARC 2013) includes surveys of sites in and around Wood Buffalo National Park, near Fort Smith (Bienentreu 2019), records of community knowledge from Fort Resolution and the Slave River delta (Bienentreu pers. comm. 2021), and the data from the deployment of ARUs near Fort Smith and east of the Slave River (Wilson pers. comm. 2025; see also *Distribution Trends*).

Northern leopard frogs are not particularly abundant in the NWT (Schock 2010) and are rare in Wood Bufalo National Park (Kuyt 1991). Based on expert opinion, a broad population estimate for the number of mature individuals was reported in 2013 as probably less than 10,000 and conceivably less than 2,500 (these are threshold population sizes used by IUCN [IUCN Standards and Petitions Subcommittee 2024] to evaluate conservation status). Due to the little new data available on abundance there has not been an update to the last population estimate for northern leopard frog in the NWT.

COSEWIC (2009) concluded that there were insufficient data to provide an estimate for the number of adult northern leopard frogs within the Prairie/Western Boreal DU, or northern boreal disjunct population segment of the DU, which encompasses the NWT populations.

Population Dynamics

Northern leopard frog clutch size is associated with female body size, which is related to age (Corn and Livo 1989, Gilbert *et al.* 1994) and ranges from 600 to 7,000 eggs per clutch (Merrell 1977; Hine *et al*. 1981; DeGraaf and Rudis 1983; Corn and Livo 1989;).

Maturity is likely more reflective of size rather than age of the individual; females are considered mature when they reach 5.5-6 cm (snout-vent length), which likely takes about two years to reach (Hine *et al*. 1981; Merrell 1977; Gilbert *et al*. 1994). Males are mature when they reach 5.1 cm (snout-vent length), which takes one to two years (Gilbert *et al.* 1994). In less dense populations in Minnesota, sexual maturity was reached in one year, while in denser populations it may take up to three years to reach maturity (Merrell 1977). There is currently no evidence in Alberta that northern leopard frogs mature in less than two years, which also likely applies to NWT frogs (Prescott pers. comm. *in* SARC 2013). Lifespan is likely no more than four to five years (Eddy 1976; ENR 2021).

Survival rates are unknown for tadpoles from the NWT, but survival from egg to metamorphosis was reported as 1-6% in Minnesota (Merrell 1977; Hine *et al.* 1981). Young-of-the-year can make up 95-98% of the fall population (Eddy 1976; Merrell 1977), but mortality may be 93% during the first winter (Yaremko 1996). Adult mortality rates may reach 60% annually (Merrell and Rodell 1968). Sex ratios of juveniles and adults appear well balanced (Merrell and Rodell 1968; Hine *et al.* 1981).

Generation time, the average age of parents in the population, was estimated using IUCN guidelines as age of first reproduction + z* length of the reproductive period (IUCN Standards and Petitions Subcommittee 2024). Using 2 years as average age of first reproduction for both sexes, a maximum age of 5 years and estimating z as 0.5 the generation time is estimated as three and a half years.

Local and regional population persistence depends on breeding site distribution and connectivity. Northern leopard frogs must be able to maintain a stable metapopulation in the face of stochastic events, a short life span, and high site fidelity (Gibbs 2000). Stochastic events include floods, droughts, late spring freezing, or other factors that impact the short breeding season, communal breeding and over-wintering sites, or frogs that are aggregated at other times in their life history. The ability to migrate and/or disperse in response to such events is critical to ensuring metapopulation stability.

Connectivity between the Western Boreal population and Prairie population of northern leopard frog is uncertain, as local populations are likely isolated (Didiuk 1997; Alberta Sustainable

Resource Development 2003; Didiuk pers. comm. *in* SARC 2013; Kendell pers. comm. *in* SARC 2013).

There is possibly some movement of individuals within the Western Boreal population in the NWT, Alberta, and Saskatchewan. However, Kalilzadeh (2022) analyzed northern leopard frog specimens from across western Canada including from the NWT (Schock 2010) and showed that NWT northern leopard frogs were strongly genetically distinct from other populations in western Canada. Kalilzadeh (2022) also showed that the NWT population has low genetic diversity. This, coupled with genetic distinctness, may suggest geographic isolation. The small effective population size of NWT northern leopard frogs may also suggest inbreeding and genetic drift (Kalilzadeh 2022).

Trends and Fluctuations

There is not enough data to determine northern leopard frog population trends. Some historical sites in the NWT have been revisited over the years with evidence of population stability [i.e., 1994 and 2008 as reported by Rescan (2008); and two sites surveyed in both 2008 (Rescan 2008) and 2009 (Schock 2010)]. Surveys of the Slave River in 2015-2017 did not find any northern leopard frogs (Bienentreu 2019). A population decline cannot be inferred in this area because observations may well be misidentified wood frog (Bienentreu 2019). Indigenous knowledge holders shared that northern leopard frogs had not been observed in the area north of Trudel Lake to the Slave and Taltson River deltas likely since the 1980s, possibly even the 1950s (Beaulieu pers. comm. *in* SARC 2013; Beck pers. comm. *in* SARC 2013).

Indigenous knowledge holders have noticed declines in all species of amphibians in general in the southern NWT (Beaulieu pers. comm. *in* SARC 2013; Fraser pers. comm. *in* SARC 2013). At a community workshop in Fort Smith in 2012, many participants mentioned an observed decline in frog populations and a lack of frog songs in the spring in the Slave River and delta ecosystem (species not specified; Dagg 2016b). Similar concerns about an observed reduction in frogs were raised in 2022 (Slave River and Delta Partnership Workshop Meeting Notes 2022). Fraser (pers. comm. *in* SARC 2013) cites a decline in wood frogs and boreal chorus frogs at Frog Pond in Fort Smith, and states that Salt River First Nation Elders report fewer frogs in the stomachs of Northern Pike (*Esox lucius*). Researchers (Bienentreu and Schock) who worked in Fort Smith/WBNP region from 2012-2017 reported Indigenous knowledge from local Elders who noticed a steady decline in amphibian calling activities in the region over the past 20-30 years (Bienentreu and Schock unpubl. data and pers. comm. *in* ENR 2022). An individual who spends a lot of time on the land along the Taltson River also spoke to ECC about 'big green frogs with spots' and how he has been seeing fewer of them around than he used to (Wilson pers. comm. 2025).

Possibility of Rescue

Distribution of the northern leopard frogs in the Prairie/Western Boreal DU is often shown on maps as a single, continuous range polygon (Figure 3 in COSEWIC 2009; Saskatchewan range in Didiuk 2000); however, both historic and recent observations document a potentially discontinuous distribution north of 55°N (Figure 13). This is supported by Kalilzadeh (2022) who reported strong genetic distinctness of the NWT population. Recent observations of northern leopard frogs in the Western Boreal population of the north have been confined to an area in extreme northern Alberta and northwestern Saskatchewan, and the adjacent South Slave region of the NWT (NatureServe Canada 2025). Connectivity of northern (NWT, AB and SK) and southern populations is considered unlikely at this time (Didiuk pers. comm. *in* SARC 2013; Kendell pers. comm. *in* SARC 2013; Prescott pers. comm. *in* SARC 2013). There may be a connection along the Canadian Shield in Saskatchewan (Didiuk pers. comm. *in* SARC 2013) and major rivers/drainages in the north (Kendell pers. comm. *in* SARC 2013).

The northern leopard frog was once widespread and abundance in Alberta but has been on the province's 'Red List' since 1991 and was listed as a provincially endangered species in 1997 (Wagner 1997). Large scale declines in Alberta date back to the 1970s-1980s, and the species is now considered extirpated in most of the province (Russell and Bauer 2000). Remaining populations in Alberta are small, fragmented, and continue to decline (Kendell *et al.* 2007; COSEWIC 2009). In addition, many areas of high habitat quality that have supported northern leopard frogs in the past were noted as being devoid of the species around 2005 (Kendell *et al.* 2007).

Little is known about northern leopard frog populations in Saskatchewan and there is insufficient data on the status of the species (COSEWIC 2009). Northern leopard frog inhabits the extreme northwest corner of Saskatchewan, but with unknown abundance (COSEWIC 2009). There is anecdotal evidence that populations that declined in the 1970s are now recovering (Seburn 1992a; Seburn 1992b; Weller *et al.* 1994). A similar decline was noted in Manitoba in 1975 (Koontz 1992) followed by a recovery noted in 1983. The former range in Manitoba now appears to be re-occupied by healthy populations, but with unknown numbers and an unknown distribution of extant populations (Duncan pers. comm. *in* COSEWIC 2009).

Although populations of northern leopard frog in northern Alberta and Saskatchewan could contribute to a rescue effect; these populations are small (or unknown) and are likely subject to similar threats.

THREATS AND LIMITING FACTORS

Amphibians face many threats globally and are declining more rapidly than either birds or mammals at this scale (Stuart *et al.* 2004). Their reliance on aquatic and terrestrial environments and their permeable skin and exposed eggs contribute to their vulnerability. In Canada (as of April 2025) there are 47 known species of amphibians of which 30 have been assessed by COSEWIC as at risk (Special Concern, Threatened, Endangered, or Extirpated) and 22 that are listed under Schedule 1 of SARA (COSEWIC 2025; GC 2025). Major global threats include habitat loss, habitat fragmentation, traffic mortality, collection for food, bait, medicine, and education, acid rain, chemical contaminants and pesticides, introduction of exotic species of competitors and predators, disease, ultraviolet radiation (UV-B), and global climate change (Daszak *et al.* 1999). Threats in Canada are similar (Lesbarrères *et al.* 2014). Several of these threats reflect the concentration of amphibians in southern Canada, where human populations and therefore pressures on the environment are greatest. The situation in the NWT is somewhat different: less habitat loss and fragmentation, fewer roads, and fewer industrial impacts (e.g., agriculture) relative to other parts of Canada. The most serious plausible threat to amphibians in the NWT is likely related to disease and pathogens, particularly chytrid fungus and ranaviruses, which are already present in the territory (Schock 2009, Schock *et al*. 2010). Other prominent potential threats include drought and wildfire, habitat loss, degradation, or fragmentation, ultraviolet radiation, pollution and contaminants, climate change and other threats including road-related mortalities. These threats are discussed in more detail in the sections that follow, although note that it is often difficult to separate the effects of threats from the natural population fluctuations seen in amphibian populations (Hannon *et al.* 2002).

The Canadian toad, western toad, and northern leopard frog all occur at the northern edge of their range in the NWT and are thus affected by several key limiting factors, including short summer breeding and foraging seasons, long winters requiring extensive periods of hibernation, and a limited number of suitable overwintering sites (Kuyt 1991). Like other amphibian populations found at the northern edge of their range, these species in the NWT may be particularly sensitive to environmental change (Lesbarrères *et al*. 2014) and may have reduced genetic variability as is seen in the northern leopard frog population (e.g. Khalilzadeh 2022; Khalilzadeh et *al.* 2024). In addition, all three species have life history habits that result in aggregation events (e.g., breeding, movements between breeding sites and hibernacula). During each of these stages of life, these species can be vulnerable to mass mortality events, either human-caused (e.g., hibernacula disturbance) or natural (e.g., freezing temperatures; ACA 2002; COSEWIC 2012).

Disease and pathogens

General

Many amphibian species globally have faced unprecedented population declines associated with diseases, and emerging diseases are considered a primary threat to amphibians globally (Bienentreu 2019). Diseases like chytridiomycosis and ranavirosis have resulted in high mortality rates, population declines, and some extinctions globally (Daszak *et al.* 1999; Schock *et al.* 2010).

In the NWT, chytridiomycosis has been found in wood frogs, boreal chorus frogs, and western toads (Schock 2009; Schock *et al.* 2010; Bienentreu *et al.* 2022) and ranaviruses have been confirmed in wood frogs, boreal chorus frogs, and Canadian toads (Schock *et al.* 2010; Dulisse 2019; Bienentreu *et al.* 2022; Bienentreu and Schock unpubl. data and pers. comm. *in* ECC 2022). See Table 2 for a summary of pathogens present or detected in the NWT.

The correlation between increasing air and aquatic temperatures with the emergence of infectious diseases could result in increased exposure of amphibians to pathogens. Attiah *et al.* (2023) noted that up to 92% of their 535 studied lakes in the NWT showed significantly increasing trends in lake surface temperature (LST) across the region. With a steady increase in LST over time, conditions in the NWT may become more suitable for infectious agents and/or contribute to stress and therefore increased disease susceptibility of amphibian hosts (Crawshaw *et al.* 2022).

Unfortunately, clearly linking diseases and pathogens to trends in amphibian populations is often difficult, given that amphibian populations display large fluctuations naturally and trends in abundance in the NWT are poorly documented. Long term monitoring is thus necessary to tease out the effects of disease and pathogens versus normal population fluctuations (Schock 2009). The sections that follow discuss two groups of pathogens in detail – chytrid fungus and ranaviruses – which are considered potentially important drivers of amphibian declines globally and likely have the capacity to adversely impact amphibian populations in the NWT. Other diseases of note are also briefly discussed.

Table 2. Presence of pathogens and/or diseases in five NWT amphibians.

Disease / pathogen	NWT region	Wood frog	Boreal chorus frog	Northern leopard frog	Western toad	Canadian toad
Chytridiomycosis; chytrid fungus [*Batrachochytrium dendrobatidis* (*Bd*)]	Beaufort Delta	Not assessed	Outside of range	Outside of range	Outside of range	Outside of range
	Sahtú	Assessed 2007-2008; no *Bd* detected [1]	Not assessed	Outside of range	Outside of range	Outside of range
	Dehcho	Confirmed 2007-2008 [1, 2]	Confirmed 2007-2008 [1, 2]	Outside of range	Confirmed 2007-2008 [1, 2]	Outside of range
	North Slave	Not assessed	Not assessed	Not assessed	Outside of range	Outside of range
	South Slave	Confirmed 2009-2012/2015-2017 [3]	Confirmed 2009-2012/2015-2017 [3]	Not assessed	Outside of range	Assessed 2015-2016; no *Bd* detected [6]
Ranavirosis (*Ranavirus*, *RV*; frog virus 3, FV3)	Beaufort Delta	Not assessed	Outside of range	Outside of range	Outside of range	Outside of range
	Sahtú	Confirmed 2007-2008 [1, 2]	Not assessed	Outside of range	Outside of range	Outside of range
	Dehcho	Confirmed 2007-2008/2019 [1, 2, 4]	Not assessed	Outside of range	Assessed 2007-2008; no *RV* detected [1]	Outside of range
	North Slave	Not assessed	Not assessed	Not assessed	Outside of range	Outside of range
	South Slave	Confirmed 2009-2012 [3, 5]	Confirmed 2009-2012 [5]	Not assessed	Outside of range	Confirmed 2009-2012 [5]

[1] Schock *et al.* 2010.
[2] Schock 2009.
[3] Bienentreu and Schock unpubl. data and pers. comm. N.D. *in* ENR 2022.
[4] Dulisse 2019.
[5] Bienentreu *et al.* 2022.
[6] Bienentreu pers. comm. 2025

Chytridiomycosis

Chytridiomycosis has caused population declines in hundreds of amphibian species and numerous extinctions world-wide (Berger *et al.* 2016). Chytridiomycosis is a skin infection caused by the chytrid fungus *Batrachochytrium dendrobatidis* (Bd) or *Batrachochytrium salamandrivorans* (Berger *et al.* 2016). Globally, Bd occurs in 93 out of 134 countries (69%) and has been found in 1,375 of 2,525 amphibian species sampled (about 55%; Olson *et al.* 2021). Chytrid fungus is transmitted through contact with the spores the fungus releases into the environment and through direct contact with the infected skin tissue of host species (Berger *et al.* 2016).

Life stage affects disease outcomes and adults are impacted more than tadpoles. Tadpoles can carry infections (observed in mouthparts; Berger *et al.* 2016). The severity of infection is also influenced by environmental factors. Warm and dry environments are associated with less severe disease effects (Murphy *et al.* 2011). Consequently, amphibians that inhabit warmer and drier microclimates, or periodically warm up/dry off (basking as with toads), have higher survival rates compared to populations that are more often associated with water (Voyles *et al.* 2009; Murphy *et al.* 2011; Berger *et al.* 2016).

Infection causes immunosuppression, disrupts skin function, and impacts electrolyte homeostasis, which depletes plasma electrolytes potentially leading to cardiac arrest and death (Voyles *et al.* 2009; Berger *et al.* 2016). Chytridiomycosis infection is characterized by excessive shedding of off-coloured skin (which may appear opaque, gray/white/tan or even red), convulsions, abnormal feeding, lethargy, and low body condition (Cornell University College of Veterinary Medicine 2018).

Chytridiomycosis is widespread in North America, although its role in amphibian population declines is more apparent in western North America than it is in eastern North America (Ouellet *et al.* 2005; Slough 2009). The chytrid fungus in North America is a hypervirulent lineage that resulted from the anthropogenic mixing of two other lineages and subsequent anthropogenic spread (probably through global trade in amphibians; Farrer *et al.* 2011).

The growth of fungal spores is restricted to between ~4 and 26°C and they grow best in water that is between 17 and 25°C. The spores can overwinter at low temperatures (Berger *et al.* 2016; Cornell University College of Veterinary Medicine 2018). Initial habitat suitability models for Bd predicted low suitability in northern regions, but northern climates are now considered suitable habitat (Crawshaw *et al.* 2022) and the presence of Bd has been confirmed in the NWT since 2007 (Schock *et al.* 2010; Bienentreu *et al.* 2022). Schock (2009) proposed that Bd may be able to persist in northern locations by overwintering on species that avoid freezing, such as western toad.

Bd infections have been found in both the Dehcho (Fort Liard area) and South Slave (Wood Buffalo National Park and adjacent area) regions in wood frogs, boreal chorus frogs, and western toads (Schock 2009; Schock *et al.* 2010). Wood frogs in the Sahtú region were assessed in 2008 but Bd was not detected (Schock 2009). No amphibian die-offs attributed to Bd have been documented in the NWT. However, sublethal infections can have negative effects on overall fitness, therefore Bd is still considered an ongoing threat to amphibians in the NWT (Gahl *et al.* 2012; Campbell *et al.* 2019; ENR 2022). At the site near Fort Liard where Bd was detected in 2007 and 2008, Bd prevalence was estimated to be 14% (7/51 individuals) in 2007/2008, pooling data from wood frog, boreal chorus frog, and western toad adults; no gross signs of infection such as skin sloughing or abnormal mouth parts were observed (Schock 2009). Northern leopard frogs have not been assessed in the NWT for chytrid fungus; however, chytrid fungus has been found in northern leopard frogs in Alberta (Environment Canada 2013) and the pathogen does occur within their NWT range (Table 2). Stevens *et al.* (2012) found that Bd was detected in 30% or more sites in which boreal chorus frogs, western toads, or Canadian toads cohabitated throughout their study areas in Alberta.

The severity of chytridiomycosis varies with host susceptibility and strain virulence (Gahl *et al.* 2012; Eskew *et al.* 2018). While there is evidence that Bd is a spreading pathogen that can have negative consequences for amphibian populations (Skerratt *et al.* 2007), there is also evidence that Bd is widespread in areas where there is little evidence of harm (Longcore *et al.* 2007; Pearl *et al.* 2007), or where Bd has become endemic in apparently stabilized populations (Ouellet *et al.* 2005; Pearl and Bowerman 2006; Pilliod *et al.* 2010).

Studies have shown that some amphibian species are able to survive Bd epidemics either through increased immunity (which allows them to live with low-level fungal infections), the evolution of less pathogenic strains of Bd, favourable environmental conditions, low infection intensities (Briggs *et al.* 2010), or through adaptation and the evolution of better defences (such as anti-microbial peptides on their skin; Woodhams *et al.* 2003, 2010). In instances with less virulent strains, Bd can co-exist with amphibians with intermittent outbreaks (Kilpatrick *et al.* 2010; Crawshaw *et al.* 2022). In addition, some populations of northern leopard frogs in British Columbia appear to have evolved a level of resistance that allows them to co-exist with Bd (Voordouw *et al.* 2010). Savage *et al.* (2020) found that surviving frogs had significantly reduced immune gene expression compared to susceptible frogs, challenging the traditional view that a strong immune response is always beneficial for surviving infections.

Fungal and disease surveillance can help assess the potential emergence of more virulent strains (Piovia-Scott *et al.* 2015; Crawshaw *et al.* 2022). However, Bd has a high potential for rapid evolution of virulence, and this is concerning for conservation and the future of amphibians (Berger *et al.* 2016).

Ranaviruses

Ranaviruses are lethal pathogens that infect over 175 species of amphibians and reptiles in more than 30 countries around the world (Duffus *et al.* 2015; Bartlett *et al.* 2021). In temperate climates, including North America, ranaviruses are responsible for most amphibian die-offs associated with disease (Bienentreu 2019). In Canada, nine species of amphibians are known to be affected by ranaviruses in the wild and in captivity (Miller *et al.* 2011; Bartlett *et al.* 2021).

Ambient water temperatures during development likely plays a role as a potential driver favoring pathogens and viral replication and/or by stressing frogs and toads making them more susceptible to infection (Brand *et al.* 2016). However, the relationship between ranaviruses and temperature is not straightforward. Studies have found that ranaviral replication rates generally increase as temperature increases (Ariel *et al.* 2009). However, ranaviral infectivity declines at a faster rate at higher temperatures (Nazir *et al.* 2012; Munro *et al.* 2016; Youker-Smith *et al.* 2018). In a study of environmental drivers, high prevalence of ranavirus (Frog Virus 3; FV3) was best predicted by low temperature, high host density, low zooplankton concentrations, and developmental stage in metamorphosis (Youker-Smith *et al.* 2018).

In the NWT, ranaviruses are known to be widespread in amphibians, particularly wood frogs, across the Sahtú (Norman Wells area), Dehcho [Fort Liard, Blackstone, NahɁą Dehé (Nahanni National Park Reserve)], and South Slave regions (Schock *et al.* 2010; Bienentreu 2019; Dulisse 2019; Bienentreu *et al.* 2022;), with the first confirmed records from 2007 (Schock 2009). Genetic analyses of ranavirus in the South Slave region found at least two distinct virus variants (Grant *et al.* 2019; Vilaça *et al.* 2019).

One western toad adult and 61 tadpoles were assessed for ranavirus in the Dehcho region (Fort Liard area); however, diagnostic results did not detect ranavirus (Schock *et al.* 2010). Negative results were also reported for the boreal chorus frog (Schock *et al*. 2010), but this may be an artifact of a less sensitive diagnosis method, relative to methods used by Bienentreu (2019) and Forzán *et al.* (2019). Wood frog tadpole mortalities were observed during a 2019 survey in the Fort Liard area (Dehcho region) – laboratory results confirmed that the tadpoles (n = 2) had systemic ranavirus infections and that ranavirosis was the likely cause of death (Dulisse 2019). It is likely that these specimens represented only a subset of infection and mortality at the site (Dulisse 2019).

In the South Slave region, studies have found that ranavirus is widespread with high infection rates and prevalence in wood frogs and boreal chorus frogs and low infection rates in Canadian toads (Bienentreu 2019; Bienentreu *et al.* 2022). Across wood frogs, boreal chorus frogs, and Canadian toads, ranavirus was detected at 19 out of 20 sites sampled by Bienentreu (2019) in and around Wood Buffalo National Park and adjacent areas. Disease prevalence and viral load was positively associated with amphibian species richness at study sites, at both terrestrial and aquatic sites. In other words, prevalence and load increased from wood frog only sites, to wood frog/boreal chorus frog sites, to wood frog/boreal chorus frog/Canadian toad sites; no wood frog/Canadian toad or boreal chorus frog/Canadian toad sites were located. Presence of ranaviruses was not associated with amphibian population density (Bienentreu 2019). Two die-off events were also recorded in this area in 2017, separated by about 40 km but with only wood frog and boreal chorus frog mortality (no Canadian toad mortalities; Bienentreu 2019; Forzán *et al.* 2019; Logan *et al.* 2024). Infection rates totalled 56% of wood frogs and 93% of boreal chorus frogs at one site (no Canadian toads present), and 100% of both these species from the second site, but only 33% positive infection results for Canadian toads (Forzán *et al*. 2019). This follows a 2012 report from the Fort Chipewyan area, northern Alberta, of a likely ranavirus-caused die-off at one study site in wood frogs (Schock pers. comm. *in* SARC 2013). Overall, Canadian toads may be less susceptible than wood frogs and boreal chorus frogs to infection (Bienentreu 2019; Forzán *et al.* 2019). Negative results and lack of mortalities could indicate that sampling took place at either early or recovery stages of infection for that species (Forzán *et al.* 2019).

During laboratory exposure studies with tadpoles from Wood Buffalo National Park, infection prevalence and viral load decreased in individuals and at the species level over time, suggesting some capacity to clear the infection or to persist through a sublethal or asymptomatic infection (Bienentreu 2019; Bienentreu pers. comm. 2025). Ranaviruses are known to persist in populations via carrier species and individuals in this manner and can remain viable in wet conditions for quite some time (Bienentreu 2019). Therefore, caution is warranted in extrapolating this capacity to long-term survivability.

Northern leopard frogs have not been assessed in the NWT for ranavirus. However, the pathogen does occur within their NWT range (Table 2), the overall search effort for northern leopard frogs is low (see Search Effort), and infections and mortalities due to ranavirus have been reported for northern leopard frogs in captive and wild populations in Canada (Miller *et al.* 2011). Die-offs of northern leopard frog due to ranavirus have been reported in Ontario and Saskatchewan and ranavirus was detected in northern leopard frogs in Alberta in 2009 (Prescott pers. comm. *in* Environment Canada 2013). The results of Bienentreu (2019) are also worth noting; although Bienentreu did not sample any northern leopard frogs, the higher susceptibility of wood frogs (*Lithobates* sp.) relative to Canadian toads raises the question of susceptibility in other *Lithobates* species, such as northern leopard frog.

Ranaviruses can be transmitted between host species, and host populations may differ in their response to infection (Schock *et al.* 2010). Clinical signs of ranavirosis are non-specific and varied, and they can be similar to other diseases; therefore, pathology is often required to confirm infection (Bartlett *et al.* 2021). Tadpoles may exhibit erratic swimming, swelling, and hemorrhaging, similarly, adults may display lethargy, erratic swimming or loss of buoyancy, swelling, skin ulcerations, and hemorrhaging of the skin and mouth (Miller *et al.* 2015; Bartlett *et al.* 2021). Unlike chytridiomycosis, tadpoles are more likely to experience lethal ranavirus infections than adults (Bienentreu 2019; Bienentreu *et al.* 2022). The population level effects of ranaviruses can range from benign infections to local extirpation, and die-off events are characterized by a rapid onset and high mortality (Brunner *et al.* 2015).

Other diseases, pathogens and/or parasites

Schock (pers. comm. *in* SARC 2013) and Bienentreu (pers. comm. 2025) recorded malformed metamorph and adult Canadian toads, wood frogs, and boreal chorus frogs at a wetland that crosses Highway 5 at kilometer 190, which constitutes a repeated observation at this site. The cause of these malformations is not known.

Infection by the bacterium *Aeromonas hydrophila* are associated with mortality events (Densmore and Green 2007; Alberta Northern Leopard Frog Recovery Team 2010; Bienentreu pers. comm. 2025; Schock pers. comm. 2025). A significant northern leopard frog mortality event in Alberta in 1976 may have been associated with this bacterium (Roberts 1992). There have been no reports of these types of mortality events in the NWT to date.

An unknown infection was observed in a wood frog that displayed one malformed foot and wood frog tadpoles that had evidence of a fungal infection of water molds *Saprolegnia* sp. or *Achlya* sp. (Bienentreu pers. comm. 2025) in the Norman Wells area. The infectious agent has not yet been confirmed (Schock 2009). Overall, the rate of malformation in amphibians sampled by Schock (2009) was less than 1%, which is considered low. Malformations in amphibians were also recorded by Schock (2010), including three of 11 northern leopard frogs and a number of wood frogs and boreal chorus frogs. None of the four sampled Canadian toads had physical malformations. The cause of the malformations is currently unknown but is not species-specific; it is also important to note that malformations are not always caused by pathogens or infectious agents (Schock 2010).

Helminths are often detected in amphibians of all life stages, but the infection can be considered incidental since amphibians are normally not the target host (Miller *et al.* 2004). However, infestations may have severe consequences for infected hosts. In particular, the trematode *R. ondatrae* is known to induce severe limb malformations and mortality in developing amphibians (Johnson and McKenzie 2009; Roberts and Dickinson 2012). In Alberta, Canadian toads are known to host four species of helminth parasites, with 18-73% of individuals (n = 40 adults) acting as hosts (Russell and Bauer 2000). *Gorgodrerina simplex* was found infecting the bladders of 18% of the toads (7 of 40), *Cosmocercoides variabilis* was infecting the small and large intestines of 35% of the toads (14 of 40), *Ozwaldocruzia pipiens* was infecting the small intestines of 48% of the toads (19 of 40), and *Rhabdias americanus* was infecting the lungs of 73% of the toads (29/40). The 40 toads studied were museum specimens that had originally been collected between 1950 and 1979. Infection of this nature is not unique to Canadian toads; most frogs and toads are thought to harbour these kinds of parasites. The population level impact is unknown (Bursey and Goldberg 1998).

The infestation of living animals by fly (dipterous) larvae that feed on tissue is known as myiasis and there are records of western toad being infected in North America (Lannoo 2005; Thompson *et al.* 2021). In central British Columbia, fly larvae were removed from a deep lesion on one western toad (N = 388) collected on 9 July 2020 near Webberly Lake (124.292365°N, 55.138130°W; Thompson *et al.* 2021). There are no records of myiasis in western toads (or any amphibians) in the NWT. Amphibian myiasis is not well understood and more research is needed to understand epidemiology, relationship of dipteran parasites, species of flies that infect amphibians, and how these infections relate to population ecology (Thompson *et al.* 2021).

Drought and Wildfire

The NWT has experienced ongoing, multi-year drought (2022 to current; GNWT 2025a). Considering drought conditions at waterbodies sampled near the ranges of NWT Canadian toads, western toads, and northern leopard frogs, the Slave River at Fort Fitzgerald (Alberta) remained at historically low water levels and flows in the first half of 2024, with levels and flows rising somewhat in the second half of the year. The Hay River area near the NWT/Alberta border remained at historical low levels and flow rates through 2024. The Taltson River below the hydro dam and Great Slave Lake at Hay River showed historic to near historical lows in level and flow rates through 2024, with some improvement by late 2024. The Liard River at Fort Liard had water levels and flow largely below side normal through most of 2024, except in spring 2024, when they were average to somewhat above average. Water levels and flow in the Mackenzie River at Fort Simpson were largely historically low in 2024 (GNWT 2025a).

Extended drought conditions have the potential to adversely affect water and moisture dependent amphibians, such as those considered here. Extended drought can result in the loss or degradation of breeding and overwintering habitats, and adversely affect shelter and foraging habitat, leading to breeding failures, population isolation, and desiccation (Nolan 2023). Declining toad populations were reported in Manitoba and North Dakota in the 1980s in association with drought conditions, although those populations have since recovered (Hamilton *et al.* 1998). Drought in southern Alberta in the 1970s and 1980s was linked to some population extirpations (Alberta Northern Leopard Frog Recovery Team 2010), but not to widespread declines (Roberts 1981, 1987, 1992; Werschler 1991). While the effects of drought are not typically expected to extend long-term (Hamilton *et al.* 1998), it remains unclear whether drought conditions in the NWT may have caused population level impacts to amphibians.

Between 1969 and 2021, wildfire records indicate a high degree of interannual variability in the number of wildfires and the total area burned it the NWT (ENR 2022). Over this time, there was an average of about 249 fires and 500,000 hectares burning annually. The 2023 fire season was exceptional with a total of 303 wildfires and 4.16 million hectares burned in the NWT (Canadian Interagency Forest Fire Centre 2023; GNWT 2025c). Although there are no apparent long-term trends in the number of fires and area burned (Figure 17), variability is expected to increase over time with climate change (i.e., more extreme fire years, but also more years with conditions not conducive to fires; ENR 2022).

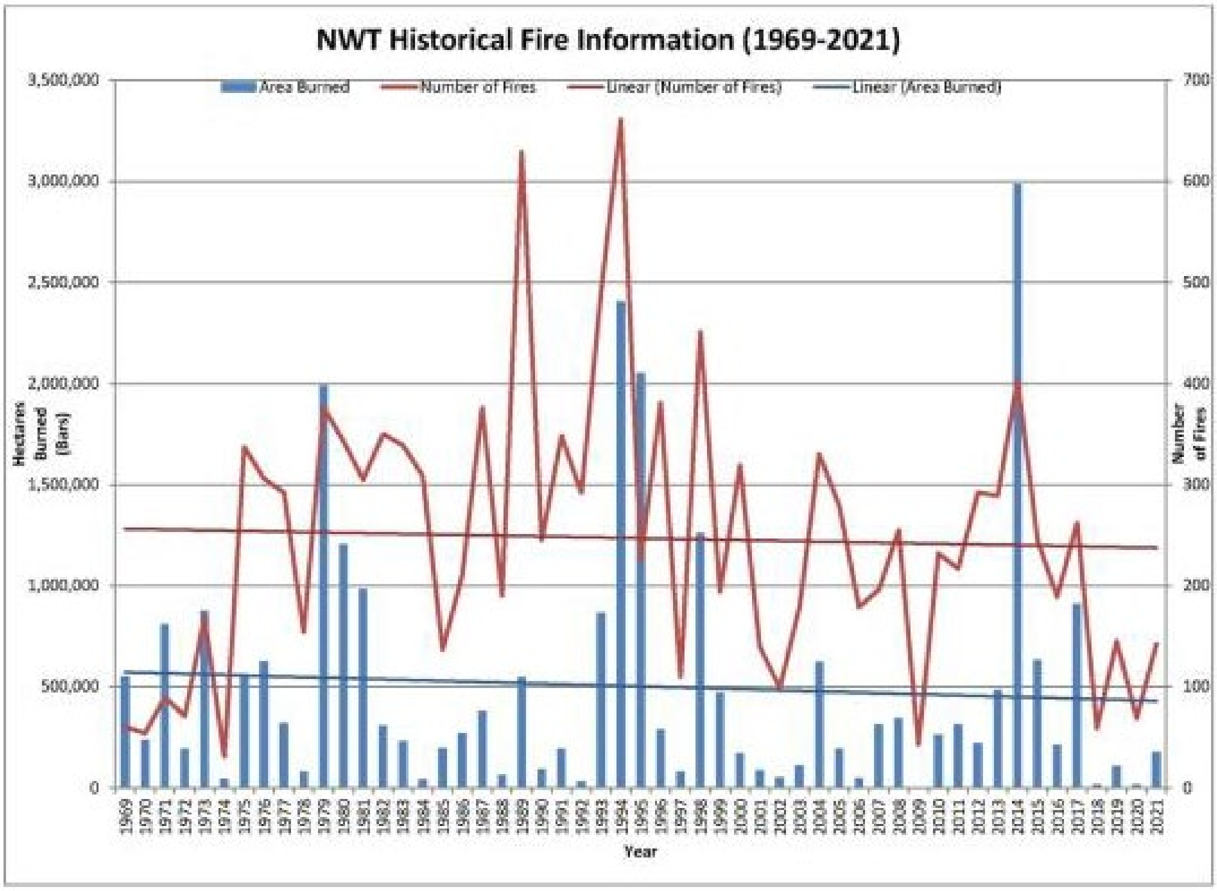

Figure 17. NWT historical fire information (1969-2021), including area burned, number of fires, and linear regressions (reproduced from ENR 2022).

Anurans have, in general, been poorly investigated in the field of fire ecology related to other vertebrates (Pastro *et al*. 2014). Where these investigations have occurred, a focus on low severity or prescribed burns may limit the generalizability of the conclusions (Hossack and Corn 2007; Guscio *et al.* 2008; Hossack and Pilliod 2011). There is literature on drought and wildfire for western toads, but very little on northern leopard frog and Canadian toad.

Broadly, amphibian vulnerability to fire is thought to reflect their ectothermic nature and habitat requirements, particularly microhabitat conditions, which are often defined by vegetation on the landscape (Wells 2007; Anjos *et al.* 2021). At a smaller scale, amphibian vulnerability to fire is likely species- and life stage-specific, reflecting habitat preferences, dispersal capacity, and the vulnerability of the life stage at which exposure to fire occurred (Guscio *et al.* 2008; Hossack and Corn 2007; Hunter 2022). Moreover, impacts to amphibians may be negative (population isolation, habitat changes, mortality or injury, failed breeding, loss of amphibian species richness), positive (habitat maintenance or creation), or neutral (Hossack and Pilliod 2011; Gomez Isaza *et al*. 2022; Beranek *et al*. 2023). Wetland habitats are expected to be the least affected by fire, while terrestrial habitats are expected to be the most affected. Depending on the parameter of interest (e.g., light, temperature), impacts may be either short term or long term (anywhere from months to years), reflecting species, fire severity, and the environment (Hossack and Pilliod 2011; Gomez Isaza *et al*. 2022).

Western toad has some traits that make them more resilient to fire (habitat generalist, can reproduce in almost any water body, rapid tadpole development) and can even benefit from burning (Dos Anjos *et al.* 2021). However, responses to fire depend on context (Hossack et al. 2013). Guscio *et al.* (2008) found that western toads in Glacier National Park, Montana, used severely burned areas more than expected (assessed following a severe, stand-replacing fire). This may reflect the life history of western toads, particularly a preference for quite open habitats and strong dispersal capacity. Shelter is still required to maintain sufficient access to moisture, and Guscio *et al.* (2008) also recorded a shift of western toads away from those severely burned areas by late summer, likely in deference to this requirement. Hossack *et al.* (2013) working in the same area of Glacier National Park, recorded a rapid increase in occupancy after fire as western toads colonized and bred in burned areas that were previously unoccupied. In that study, the toads in recently burned areas were significantly less likely to be infected with chytrid fungus, perhaps because the toads were choosing warmer drier conditions that limit growth of the pathogen (Hossack *et al.* 2013). Although the toads showed a large and rapid increase in occupancy in the first three years after wildfire, this was followed by a gradual decline seven to 21 years afterwards to near pre-fire levels. Initial colonization following fire does not necessarily result in robust breeding populations in the long term (Hossack *et al.* 2013). In Waterton Lake National Park, Alberta, Hunter (2022) found few immediate impacts associated with occupancy or species richness in amphibians associated with a severe wildfire. Western toads and boreal chorus frogs were observed to cease use of one of the sites affected by fire, but this is not beyond what might be expected as normal turn-over associated with metapopulations (Hunter 2022).

These occupancy studies post fire do not consider potential long-term population effects (Bailey *et al.* 2025). In a longer-term study of burned subalpine forests in the Rocky Mountains of the United States, wood frogs showed strong post-fire persistence as long as there were unburned areas around breeding sites. This likely reflects the life history of wood frogs, which tend to choose less open habitats (relative to western toads), have lower ability to withstand high temperatures or desiccation, and shelter near the surface of the soil, where they are potentially vulnerable to burning. Colonization of burned areas also appeared low in wood frog populations in this area (Bailey *et al.* 2025). In Australia, adverse impacts on amphibians were recorded even among those amphibians that were considered well-adapted to environments that regularly burn and to common species, reflecting the scale and the severity of the fires that had moved through the study area. Relative to the study by Hossack and Corn (2007) and Guscio *et al*. (2008), these Australian fires were considered much more severe and extensive (Beranek *et al.* 2023).

Ultimately, fire is a natural force of disturbance on the landscape, particularly in the boreal forest (Guscio *et al.* 2008; ECC 2022). Further, burns are not often uniform; the patchiness of burns can provide refugia, shelter, and source populations for recolonization (Hossack and Pilliod 2011), while connectivity between habitats may also provide refuges for species in the short term (Robinne 2024). However, the impact of interaction between, or at least overlapping of, pre-existing drought conditions and fire is uncertain. Severe wildfires are likely to be associated with drought conditions, and in this case, amphibians may be experiencing stress prior to the onset of the fire (Hossack and Corn 2007; Beranek *et al*. 2023). This interaction has the potential to cause longer term changes to habitat and thus longer-term impacts to populations (Hossack and Pilliod 2011). In Australia, a severe drought which preceded a severe fire season resulted in amphibian population declines (Beranek *et al.* 2023). The impact to amphibian populations in the NWT because of both drought and fire is uncertain but consideration of cumulative effects is essential, as is long-term monitoring to better identify changes in populations and their causes.

Impacts associated with runoff and the use of fire retardants to aquatic ecosystems have been raised in the NWT. This is addressed under *Threats and Limiting Factors – Pollution and Contamination*.

Habitat Loss, Degradation, and Fragmentation

The Taltson Hydroelectric Expansion Project proposes two transmission line routes from Twin Gorges to Yellowknife. The project is expected to cost well over $1 billion, and as of 2024, the GNWT continues to assess economic viability and technical feasibility (GNWT 2025b). If the expansion project goes ahead, impacts would include changes to the seasonal flows and water levels in the Taltson River system (Dezé Energy Corporation 2007), which could alter water flows and impact northern leopard frogs in the core of their range. The greatest impacts would result from changes to the existing hydrologic regime in the Taltson River, where summer flows would be reduced, and winter flows would be increased. Flows would also be reduced in the Trudel Creek spillway (Dezé Energy Corporation 2007). Additional information is needed to adequately assess the impacts of this proposed project on northern leopard frog breeding and overwintering sites.

Human footprint on the landscape can impact amphibians. Linear infrastructure, such as pipelines and power lines, can be responsible for loss of habitats and disruption of landscape connectivity (Richardson *et al.* 2018). For example, clear cutting for transmission lines is likely to negatively impact northern leopard frog habitat. Artificial ponds/borrow pits may be colonized by northern leopard frogs, but these ponds may only be population sinks that have a negative effect on population persistence, especially if they are semi-permanent or provide poor overwintering or foraging habitat (Seburn *et al.* 1997).

Roads represent barriers to dispersal and migration for amphibians and can result in roadkill events (Fahrig *et al.* 1995; Carr and Fahrig 2001; Eigenbrod *et al.* 2008), genetic isolation (Jochimsen *et al.* 2004), and maladaptive habitat selection. Adults and metamorphs are especially vulnerable near breeding, foraging, and overwintering sites, where mass movements may occur (Carr and Fahrig 2001).

Although there are fewer roads in the NWT compared to other parts of these species' ranges, road mortality of amphibians has been documented in the NWT. The Taiga Plains ecozone has the highest density of roads in the NWT, at 0.49 km of road per 100 km^2 (GNWT 2011). In contrast, the road density in parts of British Columbia where impacts on western toads (from habitat fragmentation and roadkill) are cumulative to other human-related impacts (such as pollution, introduced diseases, and competitors) is greater than 100 km/100 km^2 (COSEWIC 2012). The density of all semi-permanent linear features (including secondary roads, transmission lines, and pipelines but excluding seismic lines) in the Taiga Plains ecozone is 0.75 km/100 km^2.

In the NWT, road mortalities are a concern for Canadian Toads along Highway 5 into Fort Smith, and similarly south of Fort Smith to Fort Fitzgerald/Hay Camp in Alberta. Canadian toads have been observed clustered along Highway 5 and they burrow near roads. In Wood Buffalo National Park, Kuyt (1991) recorded multiple road-killed Canadian toads on Highway 5 near Little Buffalo River on 7 May 1989, coinciding with loud amphibian calling in wetlands in the area. In one study in northern Alberta, Canadian toads showed no tendency to avoid roads; in fact, occurrences near anthropogenic (man-made) areas were higher than the author predicted (Annich *et al.* 2019). This outcome may have been correlated with where the road was built (upland areas, crossing into fens), or due to the creation of suitable habitat (e.g., wet ditches with low vegetation, coarse soil for overwintering; Annich *et al.* 2019). Although Canadian toad occurrences can be high near roads, they will avoid roads with frequent disturbance activities. For instance, regular disturbance from road maintenance was associated with an absence of overwintering burrows in the NWT (Timoney 1996).

For western toad, road-kill mortalities are a concern along Highway 7 near the Muskeg River bridge. The first discovered breeding site was <100m from Highway 7 (Larter pers. comm. 2025), and Western toads have been observed clustered along Highway 7. In 2018, roadkill mortalities in the Muskeg River bridge area were reported. Six adult-sized western toads were found over an approximately 10-day period (4 May to 14 May), one was found 22 June, and one was found 1 August 2018. These eight carcasses represent a minimum count, and additional dead toads may have been present (J. Deneron pers. comm. 2018). A local family that lived in the area, when interviewed by Jim Deneron, reported that they noticed the toads started to get run over by vehicles in around 2014 or 2015 (J. Deneron pers. comm. 2018).For Northern Leopard Frogs, road-kill mortalities are a concern at the western edge of their range in the NWT along Highway 5 into Fort Smith, and similarly south of Fort Smith to Fort Fitzgerald/Hay Camp in Alberta. Although the NWT range of northern leopard frogs overlaps Highway 5 to some degree, the threat posed by the road is likely less than it is for Canadian toads and western toads.

Impacts from forestry are uncertain in the NWT. The amphibians most likely to be affected by forest clearing are those that depend on features of intact forests, including microclimates or small waterbodies that may be indirectly affected by forestry. Both Canadian toad and western toad make regular use of terrestrial and forested habitats (see previous sections), including for foraging, refuges, and overwintering (Hannon *et al*. 2002). In Hannon *et al*.'s (2002) study on riparian buffer widths in Alberta, neither Canadian toad nor western toad showed changes in abundance in response to reduced buffer width (200 m, 100 m, and 20 m buffers, relative to unlogged control sites) next to clearcuts in mixed-wood boreal forest. Further, both species were also found within the clearcuts themselves, including using temporary breeding ponds. Results suggest that for the purposes of amphibian conservation, narrow buffers were adequate. However, note that this study focused primarily on small lakes and streams, and did not consider other waterbodies or wetlands. In addition, although impacts to amphibians associated with reduced buffer width were not recorded, reduced buffer width did have an adverse impact on birds and mammalian carnivores, some of which may act as predators on NWT amphibians and may thus have an indirect effect on populations. Constible *et al.* (2010) also recorded Canadian toad use of cut blocks in northern Alberta, but they considered the species nonetheless vulnerable to forestry activities given their regular use of upland forested areas.

The population of northern leopard frog that occurs in the NWT, northern Alberta and northern Saskatchewan is geographically disjunct from the main distribution of the species in North America (Kalilzadeh 2022; Kalilzadeh *et al.* 2024). Northern leopard frogs in the NWT were found to be genetically distinct from other populations in western Canada; they also have low genetic diversity, and a high incidence of inbreeding (Kalilzadeh 2022; Kalilzadeh *et al.* 2024).

Ultraviolet Radiation

Exposure to ultraviolet (UV-B) radiation is considered a current and increasing threat to Canadian toads, western toads, and northern leopard frogs in the NWT. The intensity of UV-B radiation has increased due to stratospheric ozone depletion, climate change, and deforestation, and is thought to play a critical role in the worldwide decline of amphibian populations (Londero 2019).

Little research has been conducted on the impact of high UV-B radiation exposure on Canadian toads and northern leopard frogs. However, UV-B radiation has been shown to reduce the survival of western toad embryos, tadpoles, and juveniles in Oregon (Blaustein *et al.* 1994; Hays *et al.* 1996; Blaustein *et al.* 2005). Lundsgaard *et al.* (2022) observed that tadpoles that received higher doses of UV-B radiation metamorphosed at smaller sizes and in poorer condition when compared to those exposed to low or medium levels. Furthermore, the study provided empirical evidence suggesting that UV-B radiation exposure could induce telomere shortening (components of chromosomes; shortening is thought to impact lifespan and survival) during egg development, possibly explaining the reason behind the poor condition of amphibians exposed to higher doses of UV-B radiation.

Canadian toad, western toad, and northern leopard frog are considered vulnerable to UV-B radiation because they lay eggs in open, shallow water subjected to solar radiation and because their egg masses have a poor ability to repair UV-induced DNA damage (Blaustein *et al.* 1998). Other stressors may act in combination with UV-B to encourage infection by pathogens or to induce lethal and sublethal effects such as reduced anti-predator behaviour (Kiesecker and Blaustein 1995; Kats *et al.* 2000; Blaustein *et al.* 2003; Bancroft *et al.* 2008).

The magnitude of the impact is believed to be low but may be higher in combination with other environmental stressors. Natural (fire) or anthropogenic (clearcutting) deforestation could increase the threat of UV-B exposure in the NWT.

Pollution and Contamination

Pollution, both aerial and waterborne, is a threat to amphibian populations in the NWT. Specifically, areas within the NWT that are downstream of Alberta's oilsands region (the range of the Canadian toad and northern leopard frog) appear to be at a greater risk of water pollution because of accidental wastewater spillages upstream.

Oil sand process-affected substrates and water were shown to have negative effects on wood frog egg and tadpole survival, growth, and development (Gupta 2009). Naphthenic acids (NAs) occur naturally in petroleum (Brient *et al.* 1995). MacKinnon and Boerger (1986) identified NAs as the primary source of acute toxicity when aquatic life is exposed to oil sands effluent. Tailings ponds may increase concentrations of dissolved salts, minerals, trace metals, residual bitumen, and organics, including NAs given evaporation in those pools (Allen 2008). Mismanagement of tailings ponds containing high concentrations of NAs present a significant threat to any ecosystems downstream.

Robinson *et al.* (2023) found that by-products of naphthenic acid fraction compounds (NAFCs), reduce wood frog reproductive success through declines in offspring viability and therefore raise the concern that exposure to NAFCs during reproduction and development may affect future amphibian generations. Furthermore, the study identified that offspring exposed to 10 mg/L of NAFCs during development were less likely to survive and complete metamorphosis, grew at a reduced rate, and displayed more frequent morphological abnormalities. These abnormalities included limb anomalies at metamorphosis, described for the first time after NAFC exposure (Robinson *et al.* 2023). Very little research has been undertaken on the effects of naphthenic acid (Nas) and NAFCs on the Canadian toad, western toad, or northern leopard frog.

It is not conclusively known whether contamination from the Alberta oil sands is having downstream and downwind effects on northern leopard frogs in the NWT, but there is a high level of community concern about water contamination and airborne pollutants in general.

Environment Canada conducted water quality (metals and polycyclic aromatic compounds or PACs) and tissue (metals in wood frog) analyses at 21 wetland sites in the oil sands region including sites near Fort Smith and Fort Resolution from 2011 to 2018 (ECCC 2025). The wood frog was the primary indicator species in these studies; however, it is noted that northern leopard frog may represent an equally good indicator species, as it is a more aquatic species than the wood frog and part of its natural history life cycle involves over-wintering in aquatic environments. Because northern leopard frogs spend more time in and exposed to water, they could be more susceptible to water-borne contaminants. Compared to wood frogs, northern leopard frogs may be more sensitive to pollution, changes in habitat (induced by climate change or other), and disease (Kendell pers. comm. *in* SARC 2013).

The data show low concentrations of metals, with many below detection limits (ECCC 2025). Two water quality samples, one from 2011 (with an arsenic concentration of 8.27 µg/L) and one from 2012 (arsenic at 6.47 µg/L) from Galoot Lake, located in the Peace-Athabasca Delta, exceeded the guideline for arsenic established for the protection of aquatic life by the Canadian Council of Ministers of the Environment (5.0 µg/L; CCME; ECCC 2025). However, samples collected from this same location in 2013 (1.29 and 0.78 µg/L) and 2014 (2.21 µg/L) were below the CCME guideline (ECCC 2025). The highest concentrations of PACs were detected in SPMDs deployed within a 25 km radius of surface mining activity, consistent with the pattern revealed by snow deposition studies of PACs in the region (ECCC 2025). Field investigations continue to evaluate the health of wild amphibian populations at varying distance from oil sands operations. (ECCC 2025)

The acidification of wetlands from airborne sources of pollution may be a source of developmental abnormalities and increased mortality of embryos and tadpoles (Vertucci and Corn 1996). Acidification from airborne sulphur is associated with oil and gas extraction in northeastern British Columbia and Alberta (Austin *et al.* 2008). Heavy metals are also transported by air. Heavy metals and UV-B radiation (see previous section) may act synergistically with other environmental stressors to suppress the immune system of amphibians, making them vulnerable to pathogens (Carey 1993).

Bishop (1992) reported that amphibians are vulnerable to environmental contaminants including pesticides, herbicides, and fertilizers. The organophosphate pesticide malathion kills the plankton that tadpoles feed on (Relyea and Diecks 2008). Many compounds such as atrazine (chlorinated triazine herbicide), dichlorodiphenyltrichloroethane (DDT; insecticide), and dieldrin (insecticide) cause immunosuppression in amphibians in low concentrations. Atrazine can also disrupt sexual development (Hayes *et al.* 2006). In the NWT, permits are required for non-domestic pesticide or herbicide use (GNWT 2024). Pesticides have been used in the NWT to control mosquitoes and their larvae along with biting flies (see MVRB 2025). Herbicides have been used in the NWT along railway corridors and at certain locations along the Enbridge pipeline as well as at or around electric and/or hydroelectric facility substations (Martin pers. comm. 2013 *in* SARC 2013; MVRB 2025). Pesticide and/or herbicide application permits have been requested and/or issued for areas around Yellowknife, Nahanni Butte, along with many of the Northwest Territories Power Corporation electric and/or hydroelectric facility substations including Fort Smith, Pine Point, Jackfish Lake (~Yellowknife), Ingraham Trail (~Yellowknife), Snare Rapids, Snare Falls, Snare Cascades, Snare Forks, Bluefish Lake, and Sand Hills (MVRB 2025). In Alberta, speculation regarding the cause of northern leopard frog declines has included herbicide and pesticide contamination (Russell and Bauer 2000).

In a study in British Columbia, road salts produced lethal or sublethal effects in amphibians (Harfenist *et al.* 1989). Sublethal effects of road salts on wood frogs included reduced tadpole activity and weight, and physical abnormalities (Sanzo and Hecnar 2005). Karraker and Ruthig (2009) found no synergistic effects of road de-icing salt and water molds, two known sources of mortality for amphibian embryos, on three species of amphibians. There are demonstrated interactions between salt and stress hormones (Schock pers. comm. 2025). Road salt (sodium chloride, NaCl) use is planned and monitored in the NWT (Department of Transportation 2011) but impacts to amphibian populations have not been studied. More studies are needed to further understand the impact of salts and amphibians generally.

Concerns surrounding the potential impacts of fire retardants to aquatic ecosystems have been raised by NWT residents (e.g., CBC 2025). Fire suppressants can cause significant mortality of aquatic fauna (Gomez Isaza *et al*. 2022). Gould Environmental (2024) put forward information to the Sahtú Renewable Resources Board in 2024 about the two fire retardants used in the NWT. Long term adverse effects to the aquatic environment are considered possible for FireFoam WD881-C (Gould Environmental 2024). Liquid Concentrate 95-AMV is known to affect tadpole growth, development, and survival in striped marsh frog (*Limnodynastes* sp.) at 1 g/L concentration over 16 hrs, with mortality 83% and growth and development halted for the duration of the experiment. No significant effects related to survival were measured in tadpoles when concentrations of 0.25 g/L were applied over the same 16 hr timeframe, but the same halted development and growth were recorded. Effects are expected to be more pronounced in still water relative to moving water, with retardants reducing the amount of oxygen available in the water and contributing to eutrophication (ammonia and phosphates; Tunstill *et al.* 2022).

The GNWT has indicated that water quality monitoring to date indicates no issues with retardants in NWT waterways (CBC 2025). However, it is unclear whether water quality monitoring takes place in wetlands, or whether it is limited to larger waterbodies, nor what the resulting concentration of retardants in waterbodies may be in the NWT following application. Tunstill *et al.* (2022) suggest that the toxic concentrations of fire retardant examined in their study should not be reached if application is performed correctly (i.e., chemical is correctly diluted and applied), but that these concentrations could be unintentionally (i.e., accidental spill, runoff, dumping) reached in smaller waterbodies. Additional long-term studies are needed to see what the lasting impacts of these substances on amphibians may be (Gomez Isaza et al. 2022).

Runoff following fires (where rain washes material from the land into the water) can alter amphibian aquatic habitat (Gomez Isaza *et al.* 2022). Ash runoff is not known to immediately affect amphibians but may slow growth and development of tadpoles and may impact breeding site selection and fecundity in adults (Gomez Isaza *et al.* 2022) as well as having other impacts on the survival, health, physiological functions and microbiota of amphibians (Xu *et al.* 2024). Run-off from post-fire landscapes is common in some areas and may impact aquatic habitats used for breeding or overwintering. In Arizona, this was observed for the lowland leopard frog (*Lithobates* sp.) as well as the yellow-legged frog in California and resulted in population declines (Hossack and Pilliod 2011). Conversely, the increased nutrient levels in waterbodies post-fire may facilitate increases in productivity (Hossack and Pilliod 2011).

Climate Change

Climate change is becoming an increasingly important force to contend with in biodiversity conservation, with rates of warming greater in northern regions relative to southern regions owing to Arctic amplification. In the NWT, rates of warming are three times global rates, and temperatures (including average annual, maximum, and minimum temperatures) have gradually been increasing since the mid-20th century. Warming is most pronounced in winter, with winter warming in the Mackenzie District (encompassing most of the NWT, south of the treeline) greater than any other region in Canada. However, warming is visible across all seasons in the territory to varying degrees, including in the spring, which is most likely to affect emerging and breeding amphibians (Figure 18). These trends are expected to continue (GNWT 2022).

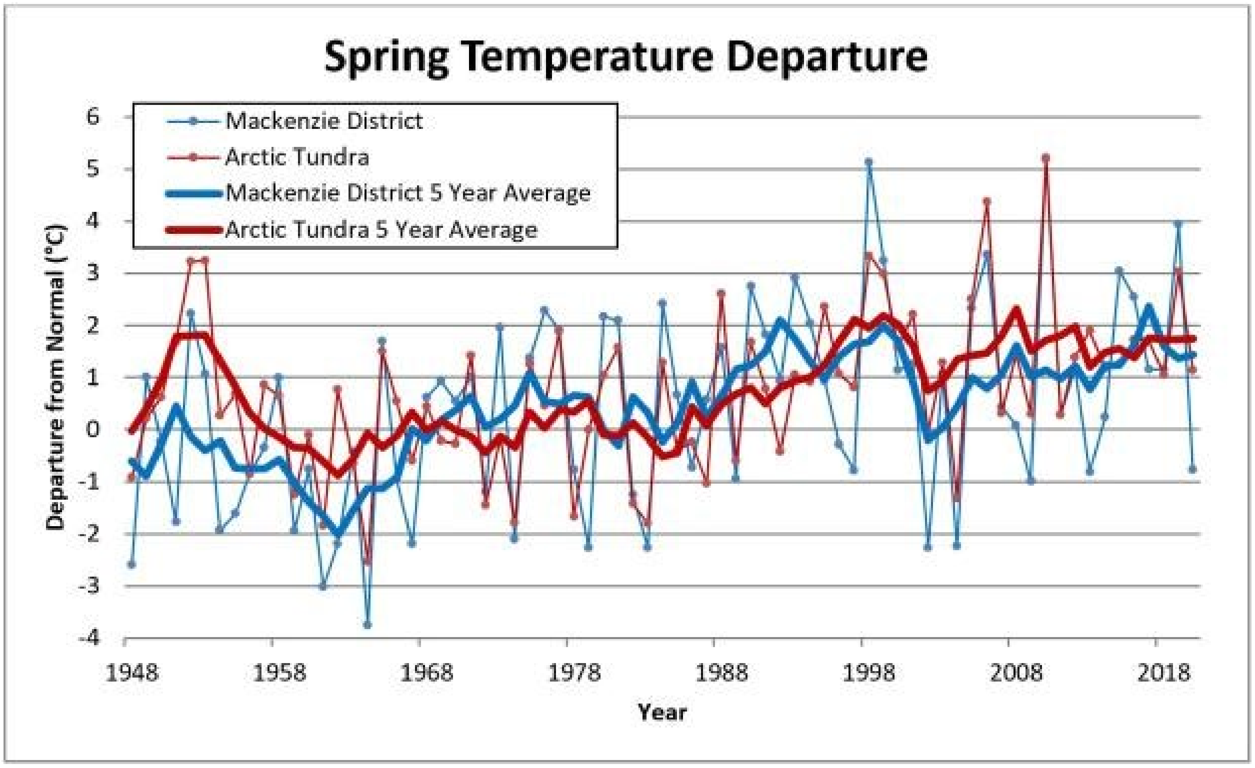

Figure 18. Spring temperature departures in the Mackenzie District (encompassing the forested portions of the NWT) and Arctic Tundra (encompassing coastal NWT, most of Nunavut, and most of the Arctic islands) regions, 1948-2020, relative to the 1961-1990 period. Temperature departure refers to the difference between a measured temperature and a reference or normal (long term average) temperature. Figure reproduced from GNWT (2022).

Precipitation is more difficult to track and predict in the NWT, given strong regional and local variability, limited numbers of stations collecting data, and issues with data quality. However, trends are available for 1950-2018 for Hay River, Yellowknife, and Inuvik. In Hay River, there has been no significant trend in either annual precipitation or total annual rain during that period. Snowpack water equivalent, however, declined gradually. In contrast, Yellowknife and Inuvik show either increasing or no change in annual precipitation, total annual rain, and snowpack water equivalent. Although uncertainty in precipitation projections must be accounted for, precipitation increases are expected for the whole NWT by 2100, particularly over the winter (GNWT 2022).

In the area of the Slave River, the effects of climate change are already being observed locally. There is less rain, less snow, and snow is melting faster and evaporating instead of entering the groundwater system (Dagg 2016a). Drying and shrinking of ponds, lakes, creeks, rivers, fens, and wetlands in the Slave River and delta ecosystem has been noticed by residents of the area (Dagg 2016a).

The impacts of climate change on northern leopard frog and western toad in the NWT are predicted to be fairly low. Both species may experience benefits and drawbacks associated with climate change, including potentially greater reproductive success, a longer developmental period, range expansion, and disease resistance (the result of potentially higher body temperatures). Conversely, extreme temperatures and weather conditions paired with vulnerability to drought may facilitate disease expansion. Adaptive capacity is moderate, reflecting short generation times, synchronous and communal reproduction, limited dispersal ability, and relatively high fecundity (Singer and Lee 2021). The same is likely true for Canadian toads as well.

Phenological shifts are likely to impact the breeding seasons of the spring breeding amphibians considered in this report. Shifts in the timing of spring thaw have a direct influence on the onset of courtship and breeding activity. Olson (1988) documented shifts in western toad breeding to earlier dates over time in the Oregon Cascade Mountains, reflecting commensurate shifts in spring thaw. Similar results were reported in southeastern Ontario between 1970 and 2010 in northern leopard frogs, associated with warming spring temperatures. Here, the first spring observation of northern leopard frogs advanced by 22 days between 1970 and 2010, while the first date of spring calling advanced by about 37 days over the same time period. With the exception of the American toad, none of the other seven amphibians studied showed this shift. The American toad spring calling advanced by about 19 days but showed no change in first date of observation. While the study was limited to date of first spring observation and date of first calling, the temporal shift seen in northern leopard frog likely also extends to breeding dates (Klaus and Lougheed 2013).

A decrease in summer precipitation might increase the frequency and duration of droughts, negatively affecting the persistence of smaller wetlands used for breeding and decreasing connectivity across the landscape (Seburn and Seburn 2000). Summer droughts during the breeding season could lead to reproductive failures (see *Drought and Wildfire*).

Thawing of permafrost will change patches of boreal forest habitat, especially in areas of discontinuous permafrost. Changes in permafrost underlying peat plateaus are causing mortality of overlaying vegetation, and a change from forest to bog-fen habitat (Quinton *et al.* 2010, 2011). Rates of permafrost reduction have been measured at 0.5% (area cover) per year (Chasmer *et al*. 2010). These changes in permafrost have been studied on a small scale in the Dehcho region but further investigation is needed to understand how these changes apply to the range of amphibians in the NWT.

Frost depth during the winter hibernation period may have the potential to affect large numbers of hibernating amphibians simultaneously. If immature toads are unable to burrow as deep as adults, this effect may be reflected in population structure the subsequent year. Frost depth is known to be affected by snow cover, with frost penetrating the ground more deeply in low snow years (Tester and Breckenridge 1964; Hamilton *et al*. 1998). It has been suggested that early deep snow accumulation, providing insultation for hibernating sites, is a requirement for survival of western toads in northern British Columbia (Cook 1977). The northern limit of the species in British Columbia and Yukon corresponds with deep snow regions of the coast and Rocky Mountains and the presence of geothermal springs (Slough and Mennell 2006). The same vulnerability to frost depths is also true for the Canadian toad (Tester and Breckenridge 1964; Hamilton *et al.* 1998). Climate modeling for the southern NWT suggests a likely increase in winter snow over time which would likely benefit Canadian toad and western toad and/or possibly allow northward range expansion (Alaska Department of Fish and Game 2006; GNWT 2022).

Global climate change may permit earlier breeding due to earlier snow and ice melt, and subsequent range expansion by amphibians, which are presently excluded from habitats beyond their northern limit by the brief ice-free period (Corn 2003). Davenport *et al.* (2016) investigated the capacity of wood frogs in the Canadian subarctic to adapt to anticipated environmental changes, i.e. warming and drying of wetlands. They found that wood frogs were able to increase tadpole growth rates in response to warmer water temperatures and accelerated wetland drying, but that drying had negative effects on survival and there was a lack of compensation between the two drivers. Overall, survival is negatively affected when wetlands dry so rapidly that growth rates cannot keep up, and their results suggested that the expected changes in the ecosystem will reduce the average fitness of wood frog populations across the landscape (Davenport *et al.* 2016).

Other Threats

The collection of amphibians in the NWT may occur. Although it is likely limited to low levels with a low impact at the population scale, this activity has the potential to impact local populations. Amphibians are classified as wildlife under the NWT *Wildlife Act*. In the NWT, a

Wildlife Research Permit is required for the study of amphibians, but they can be harvested without a permit for any use such as bait, pets, or food. Frogs (species not specified) have reportedly been used as bait by fishing guides in the NWT (Côté pers. comm. *in* Rescan 2008). The release or escape of bait frogs might lead to misleading occurrence records, the establishment of new populations, or disease transfer. Western toads are not typically used for bait or food. There is a record of people collecting western toad tadpoles at the Muskeg River gravel pit in 2008 (Schock 2009). These 'pets' may or may not be released back to the wild, and if they are it may be in unsuitable habitat. The loss of tadpoles at a low level would have much less of an impact on a population than the removal of breeding adults. Releasing individuals at novel ponds could result in the spread of pathogens. Similarly, although amphibians are consumed and/or used as medicine elsewhere in the world (Hocking and Babbitt 2014), there is no evidence that harvest of wild populations occurs for these purposes in the NWT.

Non-native species pose very little threat to amphibians in the NWT at the present time. There are no introduced predators, competitors, or diseases associated with fish stocking as there are elsewhere in the species' range in Canada (COSEWIC 2012). No fish stocking currently occurs in the NWT (Cott pers. comm. 2025). Polar Lake, south of Hay River, was stocked in 1971 and 1977, and several times subsequent to that, with brook trout and rainbow trout. In 1988 and 1991, it was stocked with Arctic char. Upper Cabin Lake, on the Ingraham Trail near Yellowknife, was stocked in 1982 and 1985 with rainbow trout, and again in 1990. Starting in 1988, several small lakes near the Ingraham were experimentally stocked with rainbow trout and Arctic char. These stocking efforts were determined to be successful at two of the stocked lakes. Rainbow Lake, near Prelude Lake on the Ingraham Trail, was stocked with rainbow trout in 1990 and 1992 (GNWT n.d.). In Alberta, stocked fish may act as predators on amphibians and may therefore represent a local threat (Russell and Bauer 2000). In the Rocky Mountains of the United States, introduction of predatory fish such as trout and subsequent predation on amphibian larvae has been identified as a threat for western toads and northern leopard frogs (Finch 1991).

The invasive plant species white and yellow sweetclover (*Melilotus alba* and *M. officinalis*) have invaded the NWT along every highway and along the shores of rivers (Carrière pers. comm. *in* SARC 2014; Larter pers. comm. *in* SARC 2014; Oldham and Delisle-Oldham 2017, Singer unpubl. data 2022) but are not expected to impact amphibian habitat or impede their behaviour.

POSITIVE INFLUENCES

COSEWIC assessed northern leopard frog as a species of Special Concern in Canada in 1998, 2002 and 2009. The species was listed as Special Concern in Canada under the federal *Species at Risk* Act (SARA) in 2005. COSEWIC assessed western toad as Special Concern in Canada in 2002 and again in 2012. Western toad was listed as Special Concern in Canada under the federal *Species at Risk Act* (SARA) in 2005. Canadian toad has not been assessed by COSEWIC; however, it is included as a high priority candidate under Part 3: Species Specialist Subcommittees' Candidate List of COSEWIC's Candidate Wildlife Species (GC 2025).

In 2013, the SARC assessed northern leopard frog as Threatened in the NWT because of its small range, shrinking range and declining population. In 2015, northern leopard frog was listed as Threatened in the NWT under the territorial *Species at Risk (NWT) Act*. In 2014, SARC assessed western toad as Threatened in the NWT because of its small range and concern about threats. In 2016, western road was listed as Threatened in the NWT under the territorial Species at Risk (NWT) Act.

The NWT Amphibian Management Plan (CMA 2017), completed in 2017, has made contributions to the conservation of the western toad, northern leopard frog, and Canadian toad in the NWT. The management plan set a goal of maintaining a healthy and viable population for each amphibian species across its NWT range, and recommended objectives and approaches to achieve this goal. The actions taken from 2017 to 2021 to implement the management plan, and progress made towards achieving its objectives, are summarized in a progress report (CMA 2022) and new progress is reviewed annually by the Conference of Management Authorities. Some key highlights include: raising awareness of NWT amphibians and the threats they face, development of educational material, development and implementation of Western Toad Best Management Practices for work on roadways in the Liard River valley, encouraging people to slow down and watch out for western toads in the Muskeg River area, publishing a Field Guide to Amphibians and Reptiles of the Northwest Territories, participating in regulatory processes and providing advice regarding amphibian habitat to avoid and reduce negative impacts on amphibians and their habitats, and implementing decontamination protocols as a condition of research permits, to help prevent human-caused spread of disease in wetlands and ponds.

Known Canadian toad hibernacula all occur within Wood Buffalo National Park and are therefore granted some level of protection (Kuyt 1991), although we note that the Little Buffalo River hibernaculum is subject to regular human disturbance, despite its presence in Wood Buffalo National Park (Timoney 1996). Some northern leopard frog habitats, representing a small portion of their known distribution in the NWT, also occur within Wood Buffalo National Park.

Surveys designed to enhance knowledge of amphibians and disease ecology in the NWT as well as work to understand the genetic structure of northern leopard frogs in western Canada have been completed (see *Search Effort*). A focus on public engagement and education has resulted in the installation of toad crossing road signs at the Muskeg River bridge, in an attempt to reduce roadkill where western toads are known to cross the road (Figure 19; CMA 2022).

Figure 19. NWT Road sign in the NWT cautioning drivers to watch for western toads on the Liard Highway near the Muskeg River bridge; signs installed in 2018. Photo courtesy J. Deneron, ECC.

Northern leopard frogs have been observed overwintering in the well oxygenated water in spillways below dams in Minnesota (Merrell 1970). The Nonacho Lake and South Valley spillways in the Taltson River basin have not been investigated for overwintering frogs, but these man-made habitats are likely beneficial. Similarly, western toads use human-made features as breeding ponds including clearcuts, ditches, and borrow pits (Gyug 1996; Stevens and Paszkowski 2006; COSEWIC 2013; CMA 2022). Although these habitats are ephemeral and may act as population sinks; they do offer breeding habitat for western toad.

As described previously, climate change may both challenge and benefit amphibians in the NWT (see *Threats and Limiting Factors – Climate Change*).

The NWT range of the western toad includes areas currently under negotiation in lands, resources, and self-government processes for the Dehcho First Nations and the Acho Dene Koe First Nation. It is possible that some protection of the western toad habitat, an ecological value, could be provided for through land use planning currently underway (Cumming pers. comm. *in* SARC 2014; McMullen pers. comm. *in* SARC 2014).

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Authorities Contacted in Past Reports:

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Claire Singer holds a BSc in Environmental Science, a MSc in Environment and Management, and is currently a PhD candidate in Applied Sciences at Saint Mary's University (Halifax, Nova Scotia). Among her work experiences, she was employed as the Species at Risk Implementation Supervisor with the Government of the Northwest Territories between 2013 and 2020. During this time, she oversaw the completion of the status reports for northern mountain caribou (2020), gypsy cuckoo, western, and yellow-banded bumble bees (2019), grizzly bear (2017), Porcupine caribou and barren-ground caribou (2017), big brown bat, little brown myotis, northern myotis, long-eared myotis, and long-legged myotis (2017), wood bison (2016), western toad (2014), wolverine (2014), Dolphin and Union caribou (2013), and northern leopard frog (2013). In this role, she also helped prepare the management plan for bats in the NWT (2020), recovery strategy for barren-ground caribou in the NWT (2020), and recovery strategy for wood bison in the NWT (2019). More recently, she prepared the status report for red-sided garter snakes in the NWT (2024). Her publications include *Guide to the Berries of the Northwest Territories* (2025), *Equalization of Indigenous and scientific known in species status assessments: a case study from the Northwest Territories* (2023), *Field Guide to Alien Plants in the Northwest Territories* (2022), and *NWT Climate Change Vulnerability Assessment: Species at Risk* (2021). Claire is the owner of a small ecological consulting firm in the NWT, Rubus Consulting. She grew up and continues to make her home in Yellowknife, NWT.

STATUS AND RANKS

CANADIAN TOAD (*Anaxyrus hemiophrys*)

Region	**Coarse Filter (Ranks)**[3] To prioritize	**Fine Filter (Status)** To provide advice	**Legal Listings (Status)** To protect under species at risk legislation
Global	G4 – Apparently Secure (NatureServe Canada 2025)	Least Concern (IUCN Red List 2021)	
Canada	N4N5 – Apparently Secure (NatureServe Canada 2025)	Not at Risk (COSEWIC 2003)	No Status
Northwest Territories	Sensitive (Working Group on General Status of NWT Species 2021) S3 – Vulnerable (NatureServe Canada 2025)	To be determined	No Status
Adjacent Jurisdictions			
Alberta	S3 (NatureServe Canada 2025)		
Saskatchewan	S4S5 (NatureServe Canada 2025)		
Manitoba	S4 (NatureServe Canada 2025)		

[3] All NatureServe codes are as defined in Definitions of NatureServe Conservation Status Ranks: http://help.natureserve.org/biotics/Content/Record_Management/Element_Files/Element_Tracking/ETRACK_Definitions_of_Heritage_Conservation_Status_Ranks.htm#NatureSe

WESTERN TOAD (*Anaxyrus boreas*)

Region	**Coarse Filter (Ranks)**[4] To prioritize	**Fine Filter (Status)** To provide advice	**Legal Listings (Status)** To protect under species at risk legislation
Global	G4 - Apparently Secure (NatureServe Canada 2025)	Least Concern (IUCN 2021)	
Canada	N4 - Apparently Secure (NatureServe Canada 2025)	Special Concern (COSEWIC 2012)	Special Concern (*Species at Risk Act* 2005)
Northwest Territories	At Risk (Working Group on General Status of NWT Species 2021)	Threatened (SARC 2014)	Threatened (*Species at Risk (NWT) Act* 2016)
Adjacent Jurisdictions			
Yukon	S3 - Sensitive (NatureServe Canada 2025)		
British Columbia	S4- Apparently Secure (NatureServe Canada 2025)		
Alberta	S3S4 - Vulnerable to Apparently Secure (NatureServe Canada 2025)		

[4] All NatureServe codes are as defined in Definitions of NatureServe Conservation Status Ranks: http://help.natureserve.org/biotics/Content/Record_Management/Element_Files/Element_Tracking/ETRACK_Definitions_of_Heritage_Conservation_Status_Ranks.htm#NatureSe

NORTHERN LEOPARD FROG (*Lithobates pipiens = Rana pipiens*)

Region	**Coarse Filter (Ranks)**[5] To prioritize	**Fine Filter (Status)** To provide advice	**Legal Listings (Status)** To protect under species at risk legislation
Global	G5 - Secure (NatureServe 2025)	Least Concern (IUCN 2021)	
Canada	N5 - Secure (NatureServe 2025)	Special Concern (COSEWIC 2009)	Special Concern (*Species at Risk Act* 2005)
Northwest Territories	At Risk (Working Group on General Status of NWT Species 2021)	Threatened (SARC 2013)	Threatened (*Species at Risk (NWT) Act* 2015)
Adjacent Jurisdictions			
British Columbia	S1 - Critically Imperiled (NatureServe 2025)		
Alberta	S2S3 - Imperiled to Vulnerable (NatureServe 2025)	At Risk (Alberta Endangered Species Conservation Committee 2003)	Threatened (Alberta *Wildlife Act* regulations)
Saskatchewan	S3 - Vulnerable (NatureServe 2025)		
Manitoba	S4 - Apparently Secure (Natureserve 2025)		

[5] All NatureServe codes are as defined in Definitions of NatureServe Conservation Status Ranks: http://help.natureserve.org/biotics/Content/Record_Management/Element_Files/Element_Tracking/ETRACK_Definitions_of_Heritage_Conservation_Status_Ranks.htm#NatureSe

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APPENDICES

APPENDIX A: NWT records of Canadian toad, western toad, and northern leopard frog

Table A1. Canadian Toad Observation Records

Observations and count data for **Canadian toad** in the NWT including breeding sites (cells highlighted) and species observations. The information is drawn from various sources, which are noted in the first column. Data and corresponding source references may be requested from the source contributors or from WMISTeam@gov.nt.ca. See Table A2 for information on hibernation sites.

Source	Observation Type	Date	Latitude	Longitude	Place Name	Count (life stage)	Notes
Preble (1908)	Species Observation	21 June 1901	See note	See note	Fort Smith	1 (adult)	Preble collected a specimen (USNM 47973) and indicated it was taken at Fort Smith; this may refer to a general location rather than a precise collection location. This record is not included in Figure 8.
Kuyt (1991)	Species Observation	07 May 1989	60.0333	-112.8833	Highway 5 in WBNP[6]	6 (adult)	Six road-killed toads
Kuyt (1991)	Breeding Site	16 May 1989	60.0333	-112.8833	Highway 5 in WBNP	abundant (adult)	Canadian toads were heard trilling (calling) from nearby wetlands, indicating breeding activity.
Kuyt (1991)	Species Observation	19 May 1989	60.0270	-112.9909	Highway 5 in WBNP	abundant (adult)	Location estimated from description
Kuyt (1991)	Species Observation	30 Aug. 1989	60.0333	-112.8833	Highway 5 in WBNP	3 (adult)	
Kuyt (1991)	Species Observation	02 Sept. 1989	60.0333	-112.8833	Highway 5 in WBNP	>200 (adult)	
Kuyt (1991)	Species Observation	05 May 1990	60.0333	-112.8833	Highway 5 in WBNP	16 (adult)	Includes five road-killed toads

[6] WBNP = Wood Buffalo National Park

Source	Observation Type	Date	Latitude	Longitude	Place Name	Count (life stage)	Notes
Timoney (1996)	Species Observation	07 May 1994	60.0270	-112.9909	Highway 5 in WBNP	1,169 (adult)	
Timoney (1996)	Breeding Site	29 May 1996	60.1167	-113.7	Klewi Lake, near Mile 99 fire base	Multiple (adults)	Canadian toads were heard trilling (calling) from the margin of the lake's northwestern cove about 1 km west of fire camp, indicating breeding activity.
Timoney (1996)	Species Observation	12 Aug. 1996	60.0836	-113.1869	Preble Creek	1 (adult)	
Timoney (1996)	Species Observation	13 Aug. 1996	60.0939	-113.4008	Between Sass and Klewi rivers	1 (adult)	
Schock (2010)	Breeding Site	07 July 2009	60.0244	-112.9523	Highway 5, km 200	3 (young of year) 2 (adult)	Amphibian survey
Schock (2010)	Breeding Site	07 July 2009	60.0344	-113.1266	Highway 5, km 190	3 (young of year)	Amphibian survey
D. Schock on iNaturalist.org	Species Observation	28 July 2010	60.0245	-112.9527	Highway 5, km 200	4 (adult)	https://www.inaturalist.org/observations/126311625
Bienentreu and Shock unpubl data (2020)	Species Observation	09 July 2012	60.0344	-113.1266	Highway 5, km 190	2 (adult)	Amphibian survey
Bienentreu and Shock unpubl data (2020)	Species Observation	15 July 2012	60.0344	-113.1266	Highway 5, km 190	32 (adult)	Amphibian survey
Bienentreu and Shock unpubl data (2020)	Species Observation	15 July 2012	60.1731	-113.7042	Klewi River	2 (adult)	Amphibian survey
Bienentreu and Shock unpubl data (2020)	Breeding Site	07 July 2015	60.0344	-113.1266	Highway 5, km 190	15 (tadpoles)	Amphibian survey
Bienentreu and Shock unpubl data (2020)	Species Observation	18 May 2016	60.0326	-113.1891	Preble Pond	3 (adult)	Amphibian survey
Bienentreu and Shock unpubl data (2020)	Species Observation	28 May 2016	60.0326	-113.1891	Preble Pond	2 (adult)	Amphibian survey
Bienentreu and Shock unpubl data (2020)	Species Observation	02 June 2016	60.0326	-113.1891	Preble Pond	2 (adult)	Amphibian survey
Bienentreu and Shock unpubl data (2020)	Species Observation	15 June 2016	60.0226	-113.9501	Highway 5, km 200	7 (adult)	'Alfred's marshlands'; amphibian survey

Source	Observation Type	Date	Latitude	Longitude	Place Name	Count (life stage)	Notes
Bienentreu and Shock unpubl data (2020)	Species Observation	16 June 2016	60.0226	-113.9501	Highway 5, km 200	7 (adult)	'Alfred's marshlands'; amphibian survey
Bienentreu and Shock unpubl data (2020)	Species Observation	03 May 2017	60.0326	-113.1891	Preble Pond	1 (adult)	Amphibian survey
Bienentreu and Shock unpubl data (2020)	Species Observation	24 May 2017	60.1321	-113.6739	Klewi Lake, near Mile 99 fire base	10 (adult)	Amphibian survey
Bienentreu and Shock unpubl data (2020)	Species Observation	29 May 2017	60.0326	-113.1891	Preble Pond	19 (adult)	Amphibian survey
Bienentreu and Shock unpubl data (2020)	Species Observation	02 June 2017	60.0344	-113.1266	Highway 5, km 190	4 (adult)	Amphibian survey
Bienentreu and Shock unpubl data (2020)	Species Observation	08 June 2017	60.0231	-112.9499	Highway 5, km 200	7 (adult)	'Alfred's marshlands', treeline; amphibian survey
Bienentreu and Shock unpubl data (2020)	Species Observation	09 June 2017	60.0344	-113.1266	Highway 5, km 190	3 (adult)	Amphibian survey
Bienentreu and Shock unpubl data (2020)	Breeding Site	13 June 2017	60.0326	-113.1891	Preble Pond	1 (adult) 2 (tadpoles)	Amphibian survey
Bienentreu and Shock unpubl data (2020)	Breeding Site	14 June 2017	60.0326	-113.1891	Preble Pond	1 (adult) 29 (tadpoles)	Amphibian survey
Bienentreu and Shock unpubl data (2020)	Breeding Site	29 June 2017	60.1321	-113.6739	Klewi Lake, near Mile 99 fire base	31 (tadpoles)	Amphibian survey
J. Stewart on iNaturalist.org	Species Observation	14 May 2024	60.0325	-112.8861	Highway 5 in WBNP	≥1 (adult)	https://www.inaturalist.org/observations/227627666

Table A2. Canadian Toad Hibernacula Observation Records

All known Canadian toad hibernacula in the NWT. The information is drawn from various sources, which are noted in the first column. Hibernation sites are considered sensitive therefore precise locations and certain place names are omitted or redacted. Data and corresponding source references may be requested from the source contributors or from WMISTeam@gov.nt.ca.

Source	Unofficial Site Name	Survey Years	Notes (including site description)
Kuyt (1991); Parks Canada unpubl. data 2018	ToadWest	1989 – present (not surveyed in 2007, 2008, 2012, 2020, 2021)	Discovered in 1989 by E. Kuyt with approximate counts in 1989 and 1990. Kuyt observed a large number of small oval holes in a low sandy hillside on the north side of the road; likely overwintering sites. Large sand bank on north side of road, most toads winter here
Timoney (1996); Parks Canada unpubl. data 2018	ToadEast	1994 – present (not surveyed in 2007, 2008, 2012, 2020, 2021)	smaller sand bank on north side of road, few toads winter here
Parks Canada unpubl. data 2018; Stewart pers. comm. 2025	ToadSouth	1999 – present (not surveyed in 2007, 2008, 2012, 2020, 2021)	smaller sand bank on south side of road, few toads winter here; area surveyed in 2024
Parks Canada unpubl. data 2018	CraneWest	2000 – present (not surveyed in 2007, 2008, 2012, 2020, 2021)	huge sandbank on north side of road close to pullout, few toads winter here
Parks Canada unpubl. data 2018	CraneEast	2000 – present (not surveyed in 2007, 2008, 2012, 2020, 2021)	huge sandbank on north side of road east of pullout, many toads winter here
Parks Canada unpubl. data 2018	Trail	2000 – present (not surveyed in 2007, 2008, 2012, 2020, 2021)	very few toads winter here There are plenty of toads hibernating in the area, but not right along the trail, but in a sandy slope facing towards the wetland (there are holes all along the slope all the way back). The ponds along this slope are normally also full of toad tadpoles in the spring. (Bienentreu pers. comm. 2025)
Parks Canada unpubl. data 2018	CraneFarWest	2001 – present (not surveyed in 2007, 2008, 2012, 2020, 2021)	small sandbank just west of CraneWest (the large one)
Parks Canada unpubl. data 2018	Sharon1	Not surveyed	about 50 holes, middle to top, seen in summer 2002
Parks Canada unpubl. data 2018	Sharon2	Not surveyed	first sandbank west of Sharon3
Parks Canada unpubl. data 2018	Sharon3	Not surveyed	100+ holes
Parks Canada unpubl. data 2018; Stewart pers. comm. 2025	NewToad01	2013 – present (not surveyed in 2020-2023)	north side of highway – started surveying in 2013; area surveyed in 2024
Parks Canada unpubl. data 2018; Stewart pers. comm. 2025	NewToad02	2013 – present (not surveyed in 2020-2023)	north side of highway – started surveying in 2013; area surveyed in 2024

Source	Unofficial Site Name	Survey Years	Notes (including site description)
Parks Canada unpubl. data 2018	**redacted name**	Not surveyed	all on north side, mostly on slope, close to treeline, few in sandy area on right side of stream. I found holes in every year, but always fairly low numbers (Bienentreu pers. comm. 2025)
Parks Canada unpubl. data 2018	**redacted name**	Not surveyed	40 holes in sandy area, also in rocky area around the pond there are more spots with holes at **redacted name** than just around the pond. There is a quite sandy area towards the big wetland in the back that always had holes (Bienentreu pers. comm. 2025)
Parks Canada unpubl. data 2018	NoName	Not surveyed	about a dozen holes on north side of highway
Parks Canada unpubl. data 2018	DnP Wetlands	Not surveyed	30 holes found on south side before wetlands start, also just east of this on north side close to treeline
Parks Canada unpubl. data 2018	Joe1	Not surveyed	No description available
Bienentreu pers. comm. 2025	Unnamed	Not surveyed	we found holes in a sandy bank adjacent to a shallow wetland (very small)
Parks Canada unpubl. data 2018	CraneSouth	Not surveyed	west of pullout on south side of highway, more on south facing aspects
Bienentreu pers. comm. 2025	Klewi Lake	Not surveyed	in 2017 and 2022 we found a few holes at the back end of the Lake. There must be a bigger hibernaculum somewhere in the area based on the numbers of toads (and tadpoles) observed. There is a big open sandy slope area on the other side of the lake that is potential habitat for hibernaculum. Timoney (1996) also suspected a hibernaculum in this area.
Parks Canada (2023)	Unnamed1 Unnamed2 Unnamed3	Not surveyed	Three additional overwintering sites (unnamed) are noted in Parks Canada (2023); found in 2002 but coordinates are not provided, and these sites have not been surveyed.

Table A3. Western Toad Observation Records

Observations and count data for **western toad** in the NWT including breeding sites (cells highlighted) and species observations. Breeding location indicates the observation was a tadpole, young of year or metamorph. The information is drawn from various sources, which are noted in the first column. Data and corresponding source references may be requested from the source contributors or from WMISTeam@gov.nt.ca.

Source	Observation Type	Date	Latitude	Longitude	Place Name	Count (life stage)	Notes
E.A. Preble *in* Fournier (1997)	Species Observation	1897	n/a	n/a	Fort Simpson	1 (adult)	A western toad specimen (USNM 48057) is recorded as having been collected by Preble in 1897 at Fort Simpson; however, for the various reasons given by Fournier (1997), the information for date, locality, and/or collector appears to be somewhat suspect.
Parks Canada (1984)	Species Observation	pre-1984	60.0493	-123.3649	Nahanni Butte	1 (adult)	Date unknown, but before 1984
Parks Canada (1984)	Species Observation	pre-1984	60.2023	-123.7669	Yohin Lake, Nahanni National Park Reserve	1 (adult)	Date unknown, but before 1984
B. Decker	Species Observation	01 July 1994	60.7167	-123.4167	Flett cutblocks, near Fort Liard	1 (adult)	Reference H174 in NWT Species Infobase
Frogwatch	Species Observation	10 June 1997	60.0333	-123.4722	lower Beaver River	1 (adult)	V. Loewen and J. Staniforth, Yukon Dept. of Renewable Resources
C. Machtans, CWS[7]	Breeding Site	05 June 1999	60.4530	-123.3733	Fort Liard area	>100 (young of year)	Seen in repeated years; Reference H161 in NWT Species Infobase
C. Machtans, CWS	Species Observation	27 June 1999	60.5032	-123.4436	Fort Liard area	1 (adult)	Seen in repeated years; Reference H161 in NWT Species Infobase

[7] CWS = Canadian Wildlife Service

Source	Observation Type	Date	Latitude	Longitude	Place Name	Count (life stage)	Notes
C. Machtans, CWS	Species Observation	13 July 1999	60.5574	-123.4849	Fort Liard area	1 (adult)	Seen in repeated years; Reference H161 in NWT Species Infobase
Local knowledge	Species Observation	21 July 2000	60.3051	-123.3050	Muskeg River	abundant (adults)	Local knowledge reported by C. Machtans, CWS; Reference H161 in NWT Species Infobase
Schock (2009)	Breeding Site	25 June 2007	60.3011	-123.3343	Muskeg River Gravel pit, north pond	250-500 (young of year)	Amphibian survey
Schock (2009)	Breeding Site	26 June 2007	60.3048	-123.3228	Muskeg River Gravel pit, north pond	250-500 (young of year)	Amphibian survey
Schock (2009)	Species Observation	27 June 2007	60.3018	-123.3350	Muskeg River Gravel pit, south of the south pond	1 (adult)	Amphibian survey
Schock (2009)	Species Observation	28 June 2007	60.138	-123.2385	Roadside pond 3, Liard Highway	1 (adult)	Amphibian survey
Local knowledge	Species Observation	01 July 2007	60.5667	-123.4833	Off Liard Highway, by 50 km road sign	1 (adult)	Member of public reported to D. Tate, Parks Canada
Schock (2009)	Breeding Site	19 June 2008	60.3036	-123.3276	Muskeg River Gravel Pit, pond 4	2 (adult) 3 (young of year)	Amphibian survey
Schock (2009)	Breeding Site	19 June 2008	60.3048	-123.3229	Muskeg River Gravel Pit, pond 1	250-500 (young of year)	Amphibian survey
Schock (2009)	Species Observation	19 June 2008	60.3021	-123.3339	Muskeg River Gravel Pit, pond 3	1 (adult)	Amphibian survey
Schock (2009)	Breeding Location	21 June 2008	60.3048	-123.3229	Muskeg River Gravel Pit, pond 1	31 (young of year)	Amphibian survey
F. Bertrand, GNWT	Species Observation	24 Sept. 2009	60.1057	-123.7619	Liard River	1 (adult)	In mature riparian forest; species confirmed by photographs
R. Leshyk, CWS	Species Observation	06 Aug. 2014	60.4692	-123.4062	Fort Liard area	1 (adult)	CWS Fort Liard Landbird Survey, near CM26-3
Fort Liard fire crew	Species Observation	20 July 2017	60.2334	-123.4682	Fort Liard	1 (adult)	confirmed by photograph

Source	Observation Type	Date	Latitude	Longitude	Place Name	Count (life stage)	Notes
toby_spribille on iNaturalist.org	Breeding Site	08 Aug. 2017	60.3069	-123.3077	Liard highway at Muskeg River Bridge	1 (young of year)	Toadlet; https://www.inaturalist.org/observations/7608469
J. Deneron, GNWT	Species Observation	10 May 2018	60.3008	-123.3293	Liard highway at Muskeg River Bridge	1 (adult)	Roadkill; date approximate
J. Deneron, GNWT	Species Observation	11 May 2018	60.3024	-123.3247	Liard highway at Muskeg River Bridge	1 (adult)	Roadkill; date approximate
J. Deneron, GNWT	Species Observation	12 May 2018	60.3038	-123.3195	Liard highway at Muskeg River Bridge	1 (adult)	Roadkill; date approximate
J. Deneron, GNWT	Species Observation	13 May 2018	60.3054	-123.3133	Liard highway at Muskeg River Bridge	1 (adult)	Roadkill; date approximate
J. Deneron, GNWT	Species Observation	14 May 2018	60.3061	-123.3107	Liard highway at Muskeg River Bridge	1 (adult)	Roadkill; date approximate
J. Deneron, GNWT	Species Observation	15 May 2018	60.3075	-123.3077	Liard highway at Muskeg River Bridge	1 (adult)	Roadkill; date approximate
Dehcho firefighting crew	Species Observation	01 June 2018	60.0345	-123.87313	NWT / B.C. border	2 (adult)	
J. Deneron, GNWT	Species Observation	22 June 2018	60.1829	-123.1885	Liard highway at Muskeg River bridge	1 (adult)	Roadkill
J. Deneron, GNWT	Species Observation	22 July 2018	60.3051	-123.3247	Access road for Muskeg River gravel pit	12 (adults)	
J. Deneron, GNWT	Species Observation	01 August 2018	60.3065	-123.3197	Liard highway at Muskeg River bridge	1 (adult)	Roadkill; on water access road parallel to highway

Source	Observation Type	Date	Latitude	Longitude	Place Name	Count (life stage)	Notes
Dulisse (2019)	Breeding Site	11 July 2019	60.2982	-123.3215	Oxbow wetland (western portion) near Muskeg River bridge	4 (subadults) 10,000 (young of year)	Amphibian survey
Dulisse (2019)	Breeding Site	11 July 2019	60.2982	-123.3103	Oxbow wetland (eastern portion) near Muskeg River bridge	1 (adult) 10,000 (young of year)	Amphibian survey
Dulisse (2019)	Breeding Site	11 July 2019	60.2983	-123.3105	Oxbow wetland (eastern portion) near Muskeg River bridge	25 (young of year)	Amphibian survey
Dulisse (2019)	Breeding Site	11 July 2019	60.2988	-123.3107	Oxbow wetland (eastern portion) near Muskeg River bridge	37 (young of year)	Amphibian survey
Dulisse (2019)	Species Observation	11 July 2019	60.2917	-123.2955	Oxbow wetland near Muskeg River bridge	1 (adult)	Amphibian survey
Dulisse (2019)	Species Observation	11 July 2019	60.2981	-123.3102	Oxbow wetland near Muskeg River bridge	1 (subadult)	Amphibian survey
Dulisse (2019)	Species Observation	11 July 2019	60.2993	-123.3108	Oxbow wetland near Muskeg River bridge	1 (subadult)	Amphibian survey
Dulisse (2019)	Species Observation	11 July 2019	60.3065	-123.3181	Cabin near Muskeg River gravel pit	2 (adult); 1 male and 1 female	Amphibian survey, aided by J. Klondike
Dulisse (2019)	Breeding Site	13 July 2019	60.554	-123.5057	Liard River	>10,000 tadpoles 100 metamorphs	Side channel of Liard River, approx. 30 km north of Muskeg River bridge; Amphibian survey, aided by J. Klondike
Dulisse (2019)	Species Observation	13 July 2019	60.5615	-123.5028	Liard River	1 (subadult)	Side channel of Liard River, approx. 30 km north of Muskeg

Source	Observation Type	Date	Latitude	Longitude	Place Name	Count (life stage)	Notes
							River bridge; Amphibian survey, aided by J. Klondike
M. Gast, GNWT	Species Observation	30 July 2024	60.309763	-123.313605	Muskeg River, near bridge	2 (subadults)	Toadlets about 2 cm in length; species confirmed by photographs
Y. Letailleur	Species Observation	19 Aug. 2024	60.3043	-123.3162	Muskeg River, near bridge	1 (adult)	edge of Muskeg River just upstream from Liard Highway bridge, estimate the body to be around 3 cm long; species confirmed by photographs

Table A4. Northern Leopard Frog Observation Records

Observations and count data for **northern leopard frog** in the NWT including breeding sites (cells highlighted) and species observations. Breeding location indicates the observation was a young of year. The information is drawn from various sources, which are noted in the first column. Data and corresponding source references may be requested from the source contributors or from WMISTeam@gov.nt.ca.

Source	Observation Type	Date	Latitude	Longitude	Place Name	Count (life stage)	Notes
Preble (1908)	Species Observation	01 July 1901	60.0081	-111.9155	Fort Smith	N/A	"Specimens of this frog were collected at Smith Landing in June 1901 and the species was observed also at Fort Smith" (Preble 1908)
Harper (1931)	Species Observation	05 Aug. 1914	60.5333	-111.6333	Taltson River at Natla rapids	Several	Several frogs observed, specimen collected
Harper (1931)	Species Observation	10 Aug. 1914	60.5932	-112.1840	Taltson River at a rapid about 14 km below Tsu Lake	Several	Several frogs observed
Harper (1931)	Species Observation	28 Aug. 1914	61.05	-113.11667	Slave River below McConnell Island	Several	Several frogs observed
ROM[8], ROMH7494, by J.P. Oughton	Species Observation	1944 (?)	60.8330	-113.24583	Slave River 120 miles downstream from Fort Smith	1 (adult)	Specimen, no date recorded
CMN[9], CMNAR 2167, by C.E. Law	Species Observation	20 July 1949	61.2646	-113.57668	Slave River Delta	1 (adult)	Specimen
UBCBBM[10], H000904, by C.E. Law	Species Observation	05 Sept. 1949	61.2646	-113.57668	Slave River Delta	1 (adult)	Specimen
R.P. Allen, National Audubon Society *in* Stewart (1966)	Species Observation *see note	26 May 1955	60.3	-112.8833	Near the mouth of Sass River	N/A	*Observation is mapped; however, species identification has been questioned.

[8] ROM = Royal Ontario Museum
[9] CMN = Canadian Museum of Nature
[10] UBCBBM = University of British Columbia, Beaty Biodiversity Museum

Source	Observation Type	Date	Latitude	Longitude	Place Name	Count (life stage)	Notes
							Stewart (1966) noted that Robert P. Allen reported seeing leopard frogs near the mouth of the Sass River on 26 May 1955. Recent review of the handwritten notes by Robert P. Allen (Allen 1955) indicates mention of frogs (perhaps *Rana sylvatica*; wood frogs) but no mention of leopard frogs.
R. Bromley	Species Observation	01 June 1972	60.8989	-112.4349	Frog Hole, Taltson River	58 (adults)	58 frogs visible underwater in perfectly round hole in middle of island. See Figure 14 for photograph of this location.
A. Bourque, GNWT	Species Observation	15 Aug. 1982	60.8034	-111.9960	Tapwe Bay, Tsu Lake	1 (adult)	
A. Bourque, GNWT	Species Observation	15 Aug. 1982	60.6085	-111.8283	Between Deskenatlata Lake and Tsu Lake	1 (adult)	
UAMZ[11], A2919, by R. Van Camp	Species Observation	29 Sept. 1986	60.8368	-112.1474	Taltson River where it flows into Deskenatlata Lake	1 (adult)	4 or 5 separate observations, specimen collected
A. Bourque, GNWT	Species Observation * see note	15 Aug. 1987	60.0532	-112.6946	Little Buffalo River, in small ponds that are	1 (adult)	*Observation is mapped, however species identification has been questioned.

[11] UAMZ = University of Alberta Museum of Zoology

Source	Observation Type	Date	Latitude	Longitude	Place Name	Count (life stage)	Notes
					near the river and connected to it		There are no other records in this area despite repeated surveys ~2015-2025, nor is there high quality habitat; therefore this may be a misidentification (Bienentreu pers. comm. 2025)
A. Bourque, GNWT	Species Observation	15 Aug. 1991	60.5805	-111.8609	Tsu Lake, near ENRTP camp	1 (adult)	
D. Walker *in* Fournier (1997)	Species Observation	07 July 1994	60.4697	-110.8999	Kozo Lake, near Tazin River	1 (adult)	
D. Walker *in* Fournier (1997)	Species Observation	15 Sept. 1994	60.4596	-110.9026	Kozo Lake, near Tazin River	1 (adult)	
D. Prescott, Government of Alberta	Species Observation	04 July 2005	60.0101	-110.953	Leland Lake, east side of lake about a mile or so north of the NWT border	29 (adults)	Over 285 minutes of searching (6.1 frogs/person-hour). Frogs were found at 6 of 10 sites searched, which were usually places where small creeks entered/left the lake. It was a marshy area in the back of a bay. The backwater pools were very clear.
J. Côté *in* RESCAN (2008)	Species Observation	19 Aug. 2007	60.3191	-111.2539	Trudel Creek, unnamed lake, low lying land bridge between island and mainland, SV14	1 (adult)	Incidental observation as part of Taltson Hydro EA[12]; photograph taken

[12] EA = environmental assessment

Source	Observation Type	Date	Latitude	Longitude	Place Name	Count (life stage)	Notes
J. Côté and J. Desjarlais *in* RESCAN (2008)	Species Observation	1 July 2008	60.417	-111.409	Trudel Creek at Elsie Falls, SV22	1 (adult)	Incidental observation as part of Taltson Hydro EA; frog seen within the tailrace of the existing hydro plant immediately downstream of riffle habitat; photograph taken
RESCAN (2008)	Breeding Site	18 July 2008	60.4309	-110.7435	Taltson River, pond along river upstream from Kozo Lake, SV5	10 (tadpoles) 6 or 7 (adults)	Tadpoles have 4 legs; Amphibian survey as part of Taltson Hydro EA
RESCAN (2008)	Species Observation	18 July 2008	60.6146	-110.5293	Taltson River, inlet area south of Benna Thy Lake, SV6	1 (adult)	Frog size >50cm; Amphibian survey as part of Taltson Hydro EA [13]
RESCAN (2008)	Species Observation	18 July 2008	60.4919	-110.9475	Kozo Lake edge, SV4	1 (adult)	Amphibian survey as part of Taltson Hydro EA
RESCAN (2008)	Breeding Site	21 July 2008	60.6740	-110.5815	Benna Thy Lake, pond alongside edge of lake, SV25	1 (metamorph) 1 (adult)	Amphibian survey as part of Taltson Hydro EA
RESCAN (2008)	Breeding Site	21 July 2008	60.6552	-110.5431	Benna Thy Lake shoreline, SV23	1 (subadult) 1 (adult)	Amphibian survey as part of Taltson Hydro EA
W. Brunham *in* RESCAN (2008)	Species Observation	05 Aug. 2008	60.4320	-110.7414	Taltson River, wetland TW19	1 (adult)	Incidental observation as part of Taltson Hydro EA; photograph taken
W. Brunham *in* RESCAN (2008)	Species Observation	06 Aug. 2008	60.5074	-110.5214	Taltson River, wetland TW21	1 (adult)	Incidental observation as part of Taltson Hydro EA; photograph taken
Schock (2010)	Species Observation	28 June 2009	60.6594	-110.5446	Benna Thy Lake, SV23	5 (adults)	Amphibian survey

[13] Environmental assessment

Source	Observation Type	Date	Latitude	Longitude	Place Name	Count (life stage)	Notes
Schock (2010)	Species Observation	28 June 2009	60.4459	-110.7152	Taltson River, SV5	6 (adults)	Amphibian survey
K. Cox on NWT Species Facebook site	Species Observation	03 Oct. 2013	60.1170	-111.4697	Tethul River	2 (adults)	Reported seeing one frog at specified location and another about a km downriver
I. Bourque on NWT Species Facebook site	Species Observation	07 Sept. 2014	60.50	-110.97	Kozo Lake, on Taltson River	1 (adult)	Reported seeing a few of these frogs over the years, but this one was the biggest; photographs taken; location approximate
J.F. Bienentreu	Species Observation	9 June 2016	61.1677	-113.673692	Fort Resolution (and Slave River Delta)	1 (adult)	Bienentreu saw a northern leopard frog in Fort Resolution; additionally, in 2016-2017 Elders told him that they regularly see and hear northern leopard frogs around the community, in grass fields toward the lakeshore, and in the Slave River Delta
B. Richard Mercredi on NWT Species Facebook site	Species Observation	16 Sept. 2016	60.2437	-111.2308	Jackfish Lake	1 (adult)	Photographs taken

Threats Assessment[14]

Threats have been classified each for Canadian toad, Western toad, and Northern leopard frog, insofar as those threats may be relevant to the status of these populations in the NWT. The threats assessment is based on whether threats are considered to be of concern for the sustainability of these three species over approximately the next 10 years.

This threats assessment was completed collaboratively by members of the NWT Species at Risk Committee, at a meeting on June 6, 2024. The threats assessment will be reviewed and revised as required when the status report is reviewed, in 10 years or at the request of a Management Authority or the Conference of Management Authorities. Parameters used to assess threats are listed in Table 1.

Table 3. Parameters used in threats assessment.

Parameter	Description	Categories
LIKELIHOOD		
Timing (i.e., immediacy)	Indicates if the threat is presently happening, expected in the short term (<10 years), expected in the long term (>10 years), or not expected to happen.	Happening now Short-term future Long-term future Not expected
Probability of event within 10 years	Indicates the likelihood of the threat to occur over the next 10 years.	High Medium Low
CAUSAL CERTAINTY		
Certainty	Indicates the confidence that the threat will have an impact on the population.	High Medium Low
MAGNITUDE		
Extent (scope)	Indicates the spatial extent of the threat (based on percentage of population or area affected)	Widespread (>50%) Localized (<50%)

[14] This approach to threats assessment represents a modification of the International Union for the Conservation of Nature's (IUCN) traditional threats calculator. It was originally modified for use in the Inuvialuit Settlement Region Polar Bear Joint Management Plan (Joint Secretariat 2017). This modified threats assessment approach was adopted as the standard threats assessment method by the Species at Risk Committee and Conference of Management Authorities in 2019.

Severity of population-level effect	Indicates how severe the impact of the threat would be at a population level if it occurred.	High Medium Low Unknown
Temporality	Indicates the frequency with which the threat occurs.	Seasonal Continuous
Overall level of concern	**Indicates the overall threat to the population (considering the above).**	**High** **Medium** **Low**

Overall Level of Concern

The overall level of concern for threats for Canadian toad, Western toad, and Northern leopard frog are noted below. Please note that combinations of individual threats could result in cumulative impacts to each for Canadian toad, Western toad, and Northern leopard frog in the NWT. Details be found in the *Detailed Threats Assessment*.

	Canadian Toad	Western Toad	Northern Leopard Frog
Threat 1 – *Batrachochytrium dendrobatidis* (*Bd*)	Low	Low	Low
Threat 2 – Ranaviruses (RV)	Low	Medium	Low – Medium
Threat 3 – Drought	Medium	Medium	Medium – High
Threat 4 – Wildfire	Medium - High	Medium - High	Medium
Threat 5 – Transportation Corridors	Low	Low – Medium	Low
Threat 6 – Pollution/Contamination	Low	Low	Low
Threat 7 – Ultraviolet Radiation	Low	Low	Low

Detailed Threats Assessment

Threat #1. Disease: *Batrachochytrium dendrobatidis* (*Bd*)			
Specific threat	Many amphibian species have faced unprecedented population declines associated with diseases. Canadian toads, western toads and northern leopard frogs are susceptible to chytridiomycosis, caused by the chytrid fungus *Batrachochytrium dendrobatidis* (*Bd*). *Bd* has resulted in high mortality rates and population declines elsewhere.		
Stress	Chytridiomycosis, caused by the chytrid fungus *Batrachochytrium dendrobatidis* (*Bd*), is widespread in amphibians across North America, including Canadian toads, western toads and northern leopard frogs. While there is evidence that Bd is a spreading pathogen that can have negative consequences for amphibian populations, there is also evidence that *Bd* is widespread in areas where there is little evidence of harm or where *Bd* has become endemic in apparently stabilized populations. *Bd* is transmitted through contact with zoospores in the environment and possibly through direct contact with diseased amphibians. Bd grows best in water that is between 17-25°C and most disease outbreaks occur at higher elevations during cooler months. In the NWT, the presence of *Bd* was confirmed in western toads along with wood frogs and boreal chorus frogs. The prevalence of *Bd* is lower in Canadian toads in comparison to other amphibians, suggesting lower disease susceptibility in toad species.		
Species:	**Canadian Toad**	**Western Toad**	**Northern Leopard Frog**
Extent	Widespread (>50%)	Widespread (>50%)	Widespread (>50%)
Severity	Unknown – low	Unknown – low	Unknown – low
Temporality	Continuous	Continuous	Continuous
Timing	Happening now	Happening now	Happening now
Probability	High	High	High
Causal certainty	Low	Low	Low
Overall level of concern	**Low**	**Low**	**Low**

Threat #2. Disease: Ranaviruses (RV)			
Specific threat	Many amphibian species have faced unprecedented population declines associated with diseases. Canadian toads, western toads and northern leopard frogs are susceptible to diseases like ranaviruses (RV) which have resulted in high mortality rates and population declines elsewhere. In the NWT, RV was found to be widespread in wood frogs across the Sahtú (Norman Wells area), Dehcho (Fort Liard, Blackstone, Nahanni National Park Reserve) and South Slave regions. In the South Slave region, studies have found that ranavirus is widespread with high infection rates and prevalence in wood frogs and boreal chorus frogs and low infection rates in Canadian toads. Across wood frogs, boreal chorus frogs, and Canadian toads, ranavirus was detected at 19 out of 20 sites sampled in and around Wood Buffalo National Park and adjacent areas. Two wood frog and boreal chorus frog die-off events were recorded in Wood Buffalo National Park area in 2017. Northern leopard frogs have not been assessed in the NWT for ranaviruses; however, the pathogen does occur within their NWT range, overall search effort for northern leopard frogs is low, and infections and mortalities due to ranavirus have been reported for northern leopard frogs in captive and wild populations in Saskatchewan and Alberta.		
Stress	Ranaviruses are lethal pathogens with higher prevalence in amphibian aquatic stages, suggesting that water bodies may serve as significant transmission routes for the virus. High prevalence of ranavirus (Frog Virus 3; FV3) was best predicted by low temperature, high host density, low zooplankton concentrations, and developmental stage in metamorphosis RV can be transmitted between host species; host populations may differ in their response to infection. The prevalence of RV is substantially lower in Canadian toads compared to other amphibians, suggesting lower disease susceptibility in toad species. The population level effects of ranaviruses can range from benign infections to local extirpation, and die-off events are characterized by a rapid onset and high mortality		
Species:	**Canadian Toad**	**Western Toad**	**Northern Leopard Frog**
Extent	Localized (<50%)	Widespread (>50%)	Localized (<50%)
Severity	Low	Unknown – Medium	Unknown – Low
Temporality	Continuous	Continuous	Continuous
Timing	Short-term future	Happening now	Short-term future

Probability	Medium – High	High	Medium – High
Causal certainty	Low	Medium	Medium – High
Overall level of concern	**Low**	**Medium**	**Low – Medium**

Threat #3. Drought			
Specific threat	The NWT experienced ongoing, multi-year drought (2022 to current). Many of the water bodies throughout the range of Canadian toad, western toad and northern leopard frog experienced historical low water levels and flow rates through 2024.		
Stress	Extended droughts can result in the loss or degradation of breeding and overwintering habitats and adversely affect shelter and foraging habitat, lead to breeding failures, population isolation, and desiccation. Furthermore, the development of eggs, tadpoles and post-metamorphic individuals is heavily dependent on the thermal conditions of their aquatic environments, as well as the effects of ambient temperature on their respiratory, thermoregulatory, and metabolic processes.		
Species:	**Canadian Toad**	**Western Toad**	**Northern Leopard Frog**
Extent	Widespread (>50%)	Widespread (>50%)	Widespread (>50%)
Severity	Medium	Medium	Medium – High
Temporality	Continuous	Continuous	Continuous
Timing	Happening now	Happening now	Happening now
Probability	High	High	High
Causal certainty	Medium	Medium	Medium – High
Overall level of concern	**Medium**	**Medium**	**Medium – High**

Threat #4. Wildfire	
Specific threat	The escalation of wildfire frequency and intensity poses a threat to amphibian populations in the NWT. Wildfires may also increase amphibian vulnerability to pathogens such as Bd.

	Although there are no apparent long-term trends in the number of fires and area burned, 2023 was an exceptional wildfire year and variability is expected to increase over time with climate change (i.e., more extreme fire years, but also more years with conditions not conducive to fires),
Stress	Amphibians are especially vulnerable to fire because they are ectothermic and almost all aspects of their physiology, lifecycle and behavior are directly affected by the microclimate conditions (temperature and humidity) and access to aquatic environments (breeding and early life stage development). Impacts of wildfire to amphibians may be negative (population isolation, habitat changes, mortality or injury, failed breeding, loss of amphibian species richness), positive (habitat maintenance or creation), or neutral. Wetland habitats are expected to be the least affected, while terrestrial habitats are expected to be the most affected. Depending on the parameter of interest (e.g., light, temperature), impacts may be either short term or long term (anywhere from months to years), reflecting species, fire severity, and the environment.

Species:	**Canadian Toad**	**Western Toad**	**Northern Leopard Frog**
Extent	Widespread (>50%)	Widespread (>50%)	Widespread (>50%)
Severity	Medium - High	Medium - High	Medium
Temporality	Seasonal	Seasonal	Seasonal
Timing	Happening now	Happening now	Happening now
Probability	High	High	High
Causal certainty	Medium - High	Medium - High	Medium
Overall level of concern	**Medium - High**	**Medium - High**	**Medium**

Threat #5. Transportation Corridors	
Specific threat	Roads represent barriers to dispersal and migration for amphibians, and can result in roadkill events, genetic isolation, and maladaptive habitat selection. Adults and metamorphs are especially vulnerable near breeding, foraging, and overwintering sites, where mass movements may occur.
Stress	In the NWT, road-kill mortalities have been recorded for Canadian toads along Highway 5 and for western toads along Highway 7. Canadian toads and western toads breed near roads; Canadian toad hibernacula (overwintering burrows) are

	found near roads. Although the NWT range of northern leopard frogs overlaps Highway 5 to some degree, the threat posed by the road is likely less than it is for Canadian toads and western toads. The total number of road-kill mortalities is unknown; therefore, the population level effects is unknown.

Species:	**Canadian Toad**	**Western Toad**	**Northern Leopard Frog**
Extent	Localized (<50%)	Localized (<50%)	Localized (<50%)
Severity	Unknown – Low	Low	Unknown – Low
Temporality	Seasonal	Seasonal	Seasonal
Timing	Happening now	Happening now	Happening now
Probability	Unknown	High	High – Medium
Causal certainty	Low	Low	Low
Overall level of concern	**Low**	**Low – Medium**	**Low**

Threat #6. Pollution and Contamination	
Specific threat	Pollution, both aerial and waterborne, is becoming an increasing threat to amphibian populations in the NWT. Areas within the NWT downstream of Alberta's oilsands region (the range of the Canadian toad and northern leopard frog) appear to be at a greater risk of water pollution because of accidental wastewater spillages upstream.
Stress	Naphthenic acids (NAs) are a primary source of acute toxicity to exposed aquatic life. Amphibians exposed to naphthenic acid fraction compounds (NAFCs) display reduced reproductive success through declines in offspring viability, as well as a reduced likelihood of surviving and completing metamorphosis, a reduced growth rate, and an increase in the frequency of morphological abnormalities. The acidification of wetlands from airborne sources may also be a source of developmental abnormalities and increased mortality of embryos and tadpoles. Acidification from airborne sulphur is associated with oil and gas extraction. Heavy metals are transported by air. Heavy metals and UV-B radiation may act synergistically with UV-B radiation may not be a serious threat to amphibians, but heavy metals and UV-B radiation and other environmental stressors to

	suppress the immune system of amphibians, making them vulnerable to pathogens. Amphibians are vulnerable to environmental contaminants including pesticides, herbicides and fertilizers. The organophosphate pesticide malathion kills the plankton that tadpoles feed on. Many compounds such as atrazine (chlorinated triazine herbicide), Dichlorodiphenyltrichloroethane (DDT; organochloride insecticide), and dieldrin (organochlorine insecticide), cause immunosuppression in amphibians in low concentrations. Atrazine can also disrupt sexual development. Road salts also produced lethal or sublethal effects on amphibians and may interact with stress hormones. Road salt (sodium chloride, NaCl) use is planned and monitored in the NWT.

Species:	**Canadian Toad**	**Western Toad**	**Northern Leopard Frog**
Extent	Widespread (>50%)	Widespread (>50%)	Widespread (>50%)
Severity	Unknown	Unknown	Unknown
Temporality	Continuous	Continuous	Continuous
Timing	Happening now	Happening now	Happening now
Probability	High	High	High
Causal certainty	Low	Low	Low
Overall level of concern	**Low**	**Low**	**Low**

Threat #7. Ultraviolet Radiation	
Specific threat	Exposure to ultraviolet (UV-B) radiation is considered a current and increasing threat to Canadian toads, western toads and northern leopard frogs in the NWT. The incidence of UV-B radiation increased due to climate change, and deforestation, and is thought to play a critical role in the worldwide decline of amphibian populations impacting survival.
Stress	Little research has been conducted on the impact of high UV-B radiation exposure on Canadian Toads and Northern Leopard Frogs. However, UV-B radiation has been shown to reduce the survival of Western Toad eggs, embryos, tadpoles, and juveniles.

	Other stressors may act in combination with UV-B radiation exposure to encourage infection by pathogens or to induce lethal and sublethal effects such as reduced anti-predator behaviour. Deforestation or natural wildfire could increase the threat of UV-B exposure in the NWT.			
Species:	**Canadian Toad**	**Western Toad**	**Northern Leopard Frog**
Extent	Widespread (>50%)	Widespread (>50%)	Widespread (>50%)
Severity	Unknown	Unknown	Unknown
Temporality	Seasonal	Seasonal	Seasonal
Timing	Happening now	Happening now	Happening now
Probability	High	High	High
Causal certainty	Low	Low	Low
Overall level of concern	**Low**	**Low**	**Low**