PROPOSED

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Timber Rattlesnake (*Crotalus horridus*) in Canada

Timber Rattlesnake

2009

Environment Canada Environnement Canada

Canada

About the *Species at Risk Act* Recovery Strategy Series

What is the *Species at Risk Act* (SARA)?

SARA is the Act developed by the federal government as a key contribution to the common national effort to protect and conserve species at risk in Canada. SARA came into force in 2003, and one of its purposes is *"to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity."*

What is recovery?

In the context of species at risk conservation, **recovery** is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of the species' persistence in the wild. A species will be considered **recovered** when its long-term persistence in the wild has been secured.

What is a recovery strategy?

A recovery strategy is a planning document that identifies what needs to be done to arrest or reverse the decline of a species. It sets goals and objectives and identifies the main areas of activities to be undertaken. Detailed planning is done at the action plan stage.

Recovery strategy development is a commitment of all provinces and territories and of three federal agencies — Environment Canada, Parks Canada Agency, and Fisheries and Oceans Canada — under the Accord for the Protection of Species at Risk. Sections 37–46 of SARA (www.sararegistry.gc.ca/approach/act/default_e.cfm) outline both the required content and the process for developing recovery strategies published in this series.

Depending on the status of the species and when it was assessed, a recovery strategy has to be developed within one to two years after the species is added to the List of Wildlife Species at Risk. A period of three to four years is allowed for those species that were automatically listed when SARA came into force.

What's next?

In most cases, one or more action plans will be developed to define and guide implementation of the recovery strategy. Nevertheless, directions set in the recovery strategy are sufficient to begin involving communities, land users, and conservationists in recovery implementation. Cost-effective measures to prevent the reduction or loss of the species should not be postponed for lack of full scientific certainty.

The series

This series presents the recovery strategies prepared or adopted by the federal government under SARA. New documents will be added regularly as species get listed and as strategies are updated.

To learn more

To learn more about the *Species at Risk Act* and recovery initiatives, please consult the Species at Risk (SAR) Public Registry (www.sararegistry.gc.ca).

Recovery Strategy for the Timber Rattlesnake (*Crotalus horridus*) in Canada [Proposed]

2009

Recovery of this species is considered not technically or biologically feasible at this time.

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Additional copies:

Additional copies can be downloaded from the SAR Public Registry (www.sararegistry.gc.ca).

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DECLARATION

This recovery strategy has been prepared in cooperation with the jurisdictions responsible for the timber rattlesnake. Environment Canada has reviewed and accepts this document as its recovery strategy for the timber rattlesnake, as required under the *Species at Risk Act* (SARA). This recovery strategy also constitutes advice to other jurisdictions and organizations that may be involved in recovering this species.

It was determined that the recovery of the timber rattlesnake in Canada is not technically or biologically feasible at this time. The feasibility determination will be re-evaluated as warranted in response to changing conditions and/or knowledge.

RESPONSIBLE JURISDICTIONS

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STRATEGIC ENVIRONMENTAL ASSESSMENT STATEMENT

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below.

Because the timber rattlesnake is extirpated and recovery is deemed to be not feasible, no further recovery action is considered appropriate at this time. Accordingly, this recovery strategy will have no effect on the environment.

RESIDENCE

SARA defines residence as: *a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating* **[Subsection 2(1)]**.

Residence descriptions, or the rationale for why the residence concept does not apply to a given species, are posted on the SAR Public Registry: www.sararegistry.gc.ca/sar/recovery/residence_e.cfm.

PREFACE

The timber rattlesnake (*Crotalus horridus*) was designated Extirpated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2001 and was officially listed under the *Species at Risk Act* (SARA) in June 2003. SARA (Section 37) requires the competent Minister to prepare a recovery strategy for all listed extirpated, endangered, or threatened species. The Canadian Wildlife Service – Ontario, Environment Canada, led the development of this recovery strategy, and it was developed in cooperation with the Government of Ontario. All responsible jurisdictions reviewed and acknowledged receipt of this strategy. The strategy meets SARA requirements in terms of content and process (Sections 39–41).

A group of experts, federal agency, and provincial agency representatives (including: OMNR, PCA, CWS, Halton Region Conservation Authority, Niagara Parks Commission, academics, species experts) discussed the feasibility of recovery the timber rattlesnake in Ontario and determined that at this time the recovery was not feasible.

EXECUTIVE SUMMARY

Timber rattlesnake (*Crotalus horridus)* is the only wide-ranging woodland rattlesnake of deciduous forests in eastern North America. It was designated as Extirpated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2001.

Historically, the species was reported in Essex, Halton, Kent, Elgin, Bruce, Peel, Niagara, Welland, Hamilton-Wentworth, and Manitoulin district (Fitzwilliam Island). Records from some areas including Manitoulin and Pelee Island are unverified. The last confirmed collection of the species in Canada was in the Niagara Gorge in 1941. There are a number of threats that face US populations and may face any reintroduced populations in Canada, including: indiscriminate killing, habitat loss/degradation, and the pet trade.

The recovery of the timber rattlesnake is deemed “not feasible” at this time. However, if individuals are rediscovered then this decision will be reexamined.

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1. BACKGROUND

1.1 Species Assessment Information from COSEWIC

Date of Assessment: May 2001

Common Name (population): Timber Rattlesnake

Scientific Name: *Crotalus horridus*

COSEWIC Status: Extirpated

Reason for Designation: The Timber Rattlesnake once occupied much of the Niagara Escarpment and other regions of southern Ontario, but has not been seen in the province since 1941 despite intensive searches and its easy identification.

Canadian Occurrence: Ontario

COSEWIC Status History: Designated Extirpated in May 2001. Assessment based on a new status report.

1.2 Description of the Species

The timber rattlesnake (*Crotalus horridus*) is the only wide-ranging woodland rattlesnake of deciduous forests in eastern North America (Smith 2001). The adult snakes are large, ranging from 887-1892 mm (34.92 – 74.49 inches) in total length (Collins and Knight 1980).

This species has a dorsal pattern consisting of 15 to 34 (mean 24) dark bands which become crossbands near the tail (Collins and Knight 1980). These markings are typically chevron-shaped but may break into a series of three transversely elongated blotches towards the front of the body. In some snakes, the pattern is obscured by the nearly black ground colour (Collins and Knight 1980). There are two common colour phases [1]observed in the timber rattlesnake, "yellow" and "black", which refer to the ground colour of the snake. Rowell [In Prep.] reports that both colour phases appear to have been present in Ontario, with dark "almost black" timber rattlesnakes reported in the Hamilton area (Galinee 1669), yellow phases reported in the Niagara Glen area (Logier 1939), and additional documentation provided by Gourlay (1822). This ground colour can also be brown, black, or grey (Collins and Knight 1980; Smith 2001). The top of the head varies from dark to pale, sometimes with round occipital spots (Collins and Knight 1980). A distinguishing characteristic of the timber rattlesnake from all other species of snakes found in Ontario is the presence of a number of small irregular scales on the top of the head, as opposed to 9 larger plates found on other species. The dorsal scales are keeled giving the snake a dull appearance (Collins and Knight 1980). Juveniles are similar to adults but may be a lighter shade.

[1] "Colour phases" refers to the different colouration types which are present within a species. These phases or types indicate the overall colour or background colour of the species.

Males tend to be larger than females. Sex may be determined by tail length which is greater in males (Brown 1993; Galligan and Dunson 1979). This is largely believed to be due to the slower growth rate in females once they reach maturity, and/or a longer lifespan in males (Galligan and Dunson 1979).

The timber rattlesnake is a pit viper and uses the pits on its head to sense heat and movement of prey. These pits along with the vertical nature of the pupils and the triangular head, which is distinct from its neck, distinguish it from non-venomous snakes (Harding 1997). Another distinguishing feature is the rattles on the snake's tail (Smith 2001). The snake will vibrate its rattles when threatened, making a distinct buzzing sound. The rattle consists of a series of articulated keratinized segments, with a new segment added with each shedding. The number of segments varies depending on the amount of wear and the rattle may be missing altogether (Rowell, In Prep).

1.3 Populations and Distribution

Considered 'apparently globally secure' (G4)[2], the timber rattlesnake is found throughout eastern and the mid-western United States (NatureServe 2006). While it has a large range, occurrences are spotty in some regions (NatureServe 2006). The species ranges from central New England to northern Florida, west to eastern Texas, central Oklahoma, eastern Kansas, southeastern Nebraska, southern and eastern Iowa and southeastern Minnesota (NatureServe 2006).

At the time of European settlement, the timber rattlesnake inhabited 30 states as well as Ontario and was known to be abundant within its North American range. However, by the 1970s, the species had been nearly extirpated from all but a few locations in the United States (Morris 1974). In the United States, the species is listed as apparently secure nationally (N4). However, out of the 19 states in which timber rattlesnake populations are found, it is critically imperiled (S1) in 5 states, imperiled (S2) in 3 states, and vulnerable in 9 while it is extirpated from 2 states (NatureServe 2006). In Canada, it is designated as extirpated by COSEWIC (Nature Serve 2006; COSEWIC 2001; Figure 1). Timber rattlesnake is designated as Endangered-Regulated in Ontario (OMNR 2006).

The earliest reports of timber rattlesnakes in Canada occurred in 1669 in what is now known as Waterdown in Halton County (Logier 1939 in Smith 2001). Historically, the species was reported in Essex, Halton, Kent, Elgin, Bruce, Peel, Niagara, Welland, Hamilton-Wentworth, and Manitoulin District (Fitzwilliam Island) (Logier and Toner 1961). Records from some areas including Manitoulin and Pelee Island are unverified, although confirmed records on islands adjacent to the latter suggest some credence to its occurrence.

[2] G4: NatureServe Global Conservation Status Rank, Apparently Secure - Uncommon but not rare; some cause for long-term concern due to declines or other factors (NatureServe, 2007)

S-Rank	State/Province
S1 – Critically Imperiled	Connecticut, Massachusetts, Nebraska, New Hampshire, Vermont
S2 – Imperiled	Indiana, Minnesota, Ohio
S2S3 – Imperiled to Vulnerable	Wisconsin
S3 – Vulnerable	Florida, Illinois, Iowa, Kansas, Maryland, New York, North Carolina, Oklahoma, West Virginia
S3S4 – Vulnerable to apparently secure	Louisiana, Pennsylvania
S4 – Apparently Secure	Arkansas, Georgia, Kentucky, Missouri, Tennessee, Texas, Virginia
S4S5 – Apparently Secure to Secure	
S5 - Secure	Alabama, Mississippi
SH – Historic	District of Columbia,
SX - Extirpated	Maine, Rhode Island, Ontario
SNR – Not yet ranked	New Jersey, South Carolina

Figure 1: Subnational ranks for the timber rattlesnake (NatureServe 2006)

Although historic reports have suggested that the species was quite common in Ontario, the only historic record that can be supported with any degree of certainty is that from the Niagara area. The last known collection was in the Niagara Gorge – specifically, the Niagara Glen - in 1941 (Cook 1999). There were a few reported sightings, in the 1950s and 1960s, mostly in the Niagara Gorge area; however, there is general consensus that the species has been extirpated from the province (Rowell, in prep). Beyond the Niagara area, the extent of the distribution of the timber rattlesnake in Ontario is very unclear. Although there have been reports of sightings in extreme southern Quebec (Phillipsburg and Covey Hill areas), none of these have been substantiated (Martin 1982; Figure 2).

Populations within the United States have been studied to determine the minimum viable population size. Some authorities believe that in order to maintain a "stable" population, a minimum of 40 individuals is required with an even aged distribution within the population (Ewing 2003).

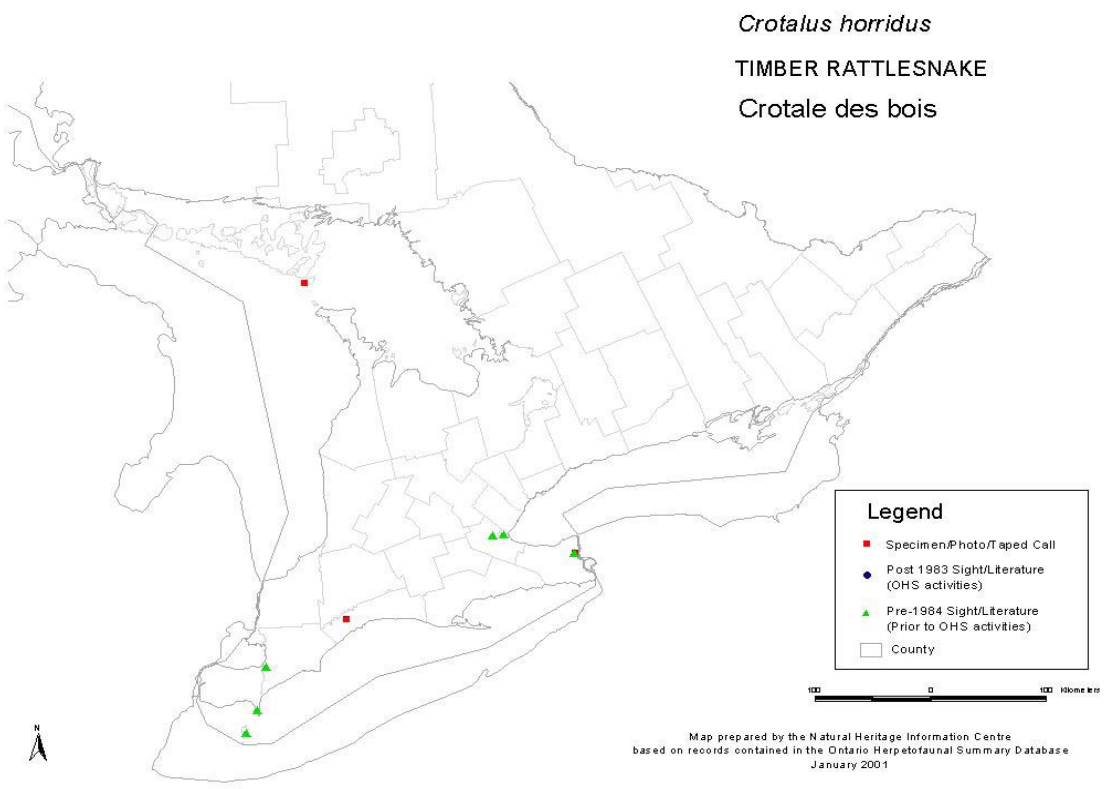

Figure 2. Timber rattlesnake historical occurrence map in Canada (NHIC, 2001)

1.4 Needs of the Timber Rattlesnake

1.4.1 Habitat and biological needs

The timber rattlesnake is secretive and shy by nature and prefers areas not frequented by humans (Brown 1981). This snake typically inhabits forested areas with rock outcrops, dry ridges and second growth deciduous or coniferous forests with southern exposures (Brown 1993; Smith 2001). The most common overstory trees include red oak, eastern hemlock, sugar maple, white ash, white pine, American beech, birch, American basswood, and eastern red cedar (Brown 1993).

Ditmars (1939 as reported in Rowell, In Prep) refers to timber rattlesnakes in New Jersey as inhabiting 'flat forested country back of the central coast, [and] quite damp in spots'. This suggests that, if this snake was ever widely distributed throughout Ontario, it likely occupied similar habitat in addition to forested areas with rocky outcrops.

Specific summer habitat requirements differ according to sex (Brown 1993; Smith 2001; Ewing 2003). Males and non-gravid females tend to use habitat with greater than 50% forest canopy cover, dense surface vegetation, and few fallen logs (Ernst 1992). Gravid females tend to use less densely forested areas with 25% canopy cover, numerous fallen logs, equal portions of vegetation and leaf litter as well as warmer microclimate (Brown et al. 1982, Ernst 1992).

Studies in the US have indicated that an area of approximately 51km² of suitable habitat is necessary to sustain a population of timber rattlesnakes (Brown 1993).[3]

Hibernacula for this species are typically located in a rocky area with underground crevices (Brown 1993). A hibernaculum will characteristically be one of three types: fissure in a ledge or crevice interface between ledge and ground; talus below a cliff, or open scree slope; or fallen rock partly covered by soil (Brown 1993). In Ontario, hibernacula were most often located along the Niagara Escarpment (Logier and Toner 1961). Timber rattlesnakes have high fidelity to their hibernacula, returning year after year (Odum 1979).

Snakes near the northern extent of the range usually hibernate for 7.4 months. Typically they emerge in early to mid-May and enter hibernation generally in mid September to early October but may stay out as late as November (Brown 1993). Emergence and entrance into hibernation are likely affected but not completely determined by temperature (Smith 2001). They are also known to hibernate communally, putting them at risk of being captured or killed by poachers, or susceptible to catastrophic loss due to land development (Odum 1979). There is very little information specific to dens historically found in Ontario, although two potential den sites – one in Spencer Gorge below Dundas Peak and the other in Medad Valley – are noted by Lamond (1994).

Timber rattlesnakes also use specific habitat transition zones to migrate from their hibernacula to their summer habitat that tends to be located within 200m of the hibernaculum. The transition zone is often broken by the rough topography and rocky terrain with a more open woodland containing exposed clearings and shelter rocks (Brown 1993). This habitat is used for basking by migrating snakes in the spring and fall as well as by gravid females for gestation and birth (Brown 1993). These snakes are known to have strong site fidelity for specific basking rocks within this habitat (Brown 1993).

During the summer, the snakes may be active during the day or night; however, nocturnal activity is especially common during hot summer nights (Smith 2001; Ewing 2003). Snakes travel throughout their summer range in search of food and mates. Timber rattlesnakes are also known to be proficient climbers and swimmers, although they are primarily terrestrial. Mean maximum migratory distance from the hibernaculum during the summer was 4.07 km (2.5 miles) for males and 2.05 km (1.3 miles) for females tracked in New York (Brown 1993), although the majority travel a maximum of 1.6 km (1.0 miles) from their den sites during the summer.

Mean sizes of activity areas for timber rattlesnakes in New Jersey and Pennsylvania ranged from 4 ha for gravid females to a maximum of 207 ha for males (Brown 1993).

Gravid females do not typically leave the transitional habitats (Reinert and Zappalorti 1988b). Males tend to move greater distances in search of mates, while females are more passive in the search for mates (Reinert and Zappalorti 1988b). As well, the higher energy costs associated

[3] "Occasional individual rattlesnakes are known to move as far as 4.5 miles (7.2km) from their den. The maximum migratory distance averages 2.5 (4.07km) miles for males. With the den as a central focal point, a radial distance of 2.5miles in all directions from a den yields a total area of 19.6 square miles (51km²) of habitat area for a healthy population." (Brown 1993)

with reproducing may leave non-gravid females with lower energy reserves than males, reducing the distance they can travel (Reinert and Zappalorti 1988b).

Timber rattlesnakes males reach maturity at an average age of 5.3 years while the mean age of first reproduction for females is 7.8 years (Smith 2001). In the northern regions of their range, females reproduce on average every three years (Brown 1981). Therefore, a female might have only three to five reproductions in a lifetime (Brown 1981).

Mating takes place in late summer (Martin 1993). In northern New York state, the mating season is estimated to occur between mid-July and late September (Aldridge and Brown 1995). There appears to be sperm storage in the oviduct of the female over the winter (Aldridge and Brown 1995). Males may use scent trails to locate receptive females during the breeding season (Reinert and Zappalorti 1988b).

Gestation periods are likely between four and six weeks, however, periods of up to three months have also been reported (Martin 1993). Females give birth to about 5-13 young, with reports ranging from 3 – 19 and an average of about 8, typically between late August and mid-September (Martin 1982). Neonates are about 200-280mm snout to vent length (Galligan and Dunson 1979). There is also some evidence to indicate that neonates follow scent trails of their mothers and other rattlesnakes in order to find a hibernaculum for the winter (Reinert and Zappalorti 1988a).

The average lifespan of the timber rattlesnake is 25 years (Brown 1993; Ewing 2003). However, mortality tends to be high in the first few years. One study estimated mortality at 45% in the first year and 25% annually thereafter (Smith 2001). A timber rattlesnake lived for approximately 36.5 years in captivity and reached a total length of 1770mm (Cavanaugh 1994).

The timber rattlesnake is predominately an ambush predator (Ernst 1992). It coils adjacent to fallen logs with its head positioned perpendicular to the long axis of the log and waits for its prey (Smith 2001). It feeds primarily on small rodents, such as white footed mouse, red-backed voles, eastern chipmunks, and cottontail rabbits. It may also consume carrion, other reptiles, amphibians, birds and bird eggs (Uhler et al. 1939, Myers 1956, Anderson 1965), although reptiles and amphibians appear to make up only a small proportion of their diet (Clark 2002).

The timber rattlesnake injects venom into its prey in order to kill it. The snake's venom is harmful to humans, especially small children who are more sensitive to the venom due to their small size (Guidry 1953), and it has a reported striking distance of 46 cm (Ditmars 1907). However, reports of humans being accidentally bitten are rare, and timber rattlesnakes are generally viewed as being quite placid in nature, preferring to escape unnoticed (Ditmars 1907, Anderson 1965). In fact, Minton and Minton (1969) describe the timber rattlesnake as being 'one of the more mild tempered rattlers'.

1.4.2 Ecological role

Timber rattlesnakes are small mammal predators and therefore help control the rodent population. This can help to reduce damage to crops.

1.4.3 Limiting factors

There are a number of biological traits which limit timber rattlesnake population growth and its ability to recover from large-scale losses. This species has a low reproductive rate and females are not typically capable of reproducing until nine years of age (Brown 1993). This along with the small litter size, low adult survivorship, and the triennial reproduction period prevent a high recruitment rate (Brown 1993). The snake also has a highly variable reproductive success that hinders its ability to replace snakes which are removed from the population (Brown 1993). High juvenile mortality rates, often as a result of predation by species such as crows, ravens, hawks, and carnivorous mammals, also inhibit a larger population size (Brown 1993).

Research has shown that individuals within the same hibernaculum are more closely related to each other than they are to individuals from other hibernacula. The potential for a high frequency of mating among individuals sharing the same hibernation site can lead to inbreeding and reduced genetic variation (Bushar, et al. 1998).

1.5 Threats

1.5.1 Threat classification

Table 1. Threat Classification Table

1	**Indiscriminate Killing**	**Threat Attributes**		
Threat Category	Disturbance or Persecution	**Extent**		
			Local	***Range-wide***
General Threat	Indiscriminate killing	**Occurrence**	Historic (anecdotal evidence)	
		Frequency	Likely seasonal (historic)	
Specific Threat	Killing individuals	**Causal Certainty**	Very Likely	
		Severity	High	
Stress	Overharvesting; burning of habitat and dens; Small population size; Low recruitment	**Level of Concern**	High	

2	**Pet Trade**	**Threat Attributes**		
Threat Category	Consumptive Use	**Extent**		
			Local	***Range-wide***
General Threat	Pet Trade	**Occurrence**	Historic (unknown)	
		Frequency	Likely seasonal (unknown)	
Specific Threat	Collection of Animals	**Causal Certainty**	(unknown)	
		Severity	(unknown)	
Stress	Overharvesting; low recruitment; small population size; vigour	**Level of Concern**	Moderate (low)	

3	Hunting	Threat Attributes		
Threat Category	Consumptive Use	**Extent**		
			Local	***Range-wide***
General Threat	Hunting	**Occurrence**	Opportunistic (unknown)	
		Frequency	Likely seasonal (unknown)	
Specific Threat	Cultural Use	**Causal Certainty**	Moderate (unknown)	
		Severity	High (unknown)	
Stress		**Level of Concern**	High (unknown)	

4	Habitat Loss and Degradation	Threat Attributes		
Threat Category	Habitat Loss and Degradation	**Extent**		
			Local	***Range-wide***
General Threat	Residential, and Agricultural Development on tableland, and Industrial development in gorge	**Occurrence**	Historic	
		Frequency	Extreme (Niagara Glen) Extreme (other areas)	
Specific Threat	Habitat destruction, fragmentation, isolation	**Causal Certainty**	Extreme (Niagara Glen) Extreme (other areas)	
		Severity	Extreme (Niagara Glen) Extreme (other areas)	
Stress	Reduction in Genetic Diversity through impacts on population size	**Level of Concern**	Extreme (Niagara Glen); Extreme (other areas)	

5	Habitat Loss and Degradation	Threat Attributes		
Threat Category	Habitat Loss and Degradation	**Extent**		
			Local	***Range-wide***
General Threat	Sand and Gravel (e.g. aggregate) Extraction	**Occurrence**	Historic	
		Frequency	Severe	
Specific Threat	Disturbance and removal of substrate (ie. blasting)	**Causal Certainty**	Observed -evidence	
		Severity	High	
Stress		**Level of Concern**	Low	

6 Road Mortality		**Threat Attributes**		
Threat Category	Habitat Loss and Degradation	**Extent**		
			Local	***Range-wide***
General Threat	Road Construction and Vehicle Traffic	**Occurrence**	Historic	
		Frequency	Unknown	Low
Specific Threat	Road Mortality	**Causal Certainty**	Unknown	Low
		Severity	Unknown	Low
Stress	Local, related to large populations expanding into table lands for feeding. Low prey abundance	**Level of Concern**	Moderate (low)	
7 Disturbance or Persecution		**Threat Attributes**		
Threat Category	Disturbance or Persecution	**Extent**		
			Local	***Range-wide***
General Threat	Recreational activities (e.g. hiking trails)	**Occurrence**	Current	
		Frequency	Moderate	
Specific Threat	Behavioural disruption through the alteration of habitat	**Causal Certainty**	High	
		Severity	Low	
Stress	Direct mortality	**Level of Concern**	Moderate	
8 Natural Succession		**Threat Attributes**		
Threat Category	Natural Processes or Activities	**Extent**		
			Local	***Range-wide***
General Threat	Natural Succession	**Occurrence**	On-going	
		Frequency	low	
Specific Threat	Decreased habitat suitability	**Causal Certainty**	Observed evidence	
		Severity	Low	
Stress	Limits basking and feeding areas. Changes to movement patterns	**Level of Concern**	Low	

Note: The reference to unknown in the Threat Attributes category indicates where the threat level is not known for Canada due to the absence of the species here. The level is based on information from the United States or that obtained from similar species in Ontario.

1.5.2 Description of threats

The precise threats leading to the decline and ultimate extirpation of the timber rattlesnake from Ontario are not understood with any degree of certainty; however, it is likely that habitat loss and human persecution played a significant role. The threats are presented in order of decreasing significance:

1.5.2.1 Disturbance or Persecution and Consumptive Use

In Ontario, these snakes have been historically subjected to direct persecution and it is anticipated that this would be true today, similar to the persecution directed at the Massasauga Rattlesnake. It is not uncommon for snakes, particularly venomous ones, to be killed for being in the vicinity of human activity. Rowell (in prep) documents various sources to suggest that the consumption of timber rattlesnake and its use in folk remedies may have also played a role in its decline.

Recreational activities, such as the use of hiking trails, in areas that were historically used by timber rattlesnake might pose a direct threat to the species if they were reintroduced through disturbance to the individuals and to their habitat. Timber rattlesnakes are believed by some researchers to be susceptible to disturbance by human beings and result in behavioural changes including abandonment of basking areas (Brown, 1993). Other researchers have concluded that non-threatening activities by human beings, including pedestrian and vehicular traffic in close proximity, do not typically result in long term changes in the snake's behaviour (Reinert and Zappalorti, 1988a).

The timber rattlesnake's colouration and ability to adapt well to captivity make them an attractive species for people involved in the pet trade (Brown, 1993). Collection of individuals for the pet trade is known to occur in the United States (Ewing, 2003), and may threaten a population reintroduced into Canada. Currently, there are no "harvestable" snakes in many existing populations of timber rattlesnake because of the demographic constraints and age structure of the populations (Brown et al. 1982). In fact, the removal of even one individual, especially an adult female, can easily reduce the population's ability to be self sustaining (Brown et al. 1982). Such removals would be anticipated to have significant impacts on any natural or reintroduced populations.

In the United States, timber rattlesnakes have been the subject of bounty hunting since 1719 (Smith 2001). Until recently, a number of county and state governments, including Minnesota, New York, Pennsylvania, Vermont, and Wisconsin, paid such bounties, which ultimately contributed to dramatic declines in some populations (Brown 1993).

In addition to bounty hunting, timber rattlesnakes have been harvested for commercial purposes. Snakes are harvested for their rattles and oil (Galligan and Dunson 1979). They are also captured for roadside reptile "farms" and tourist exhibits. Fortunately, the popularity of these is declining (Brown 1993).

Organized snake round ups still occur in parts of the northeastern United Sates. These round ups are organized hunts for snakes, to remove snakes from the area or to continue the tradition of hunting snakes, and are often treated as community events and are often used as fundraisers for the community. These hunts are legal in the United States. These events are contributing to the population decline (Reinert 1990; Brown 1993). Although some snakes are released, they may not be released in the same areas where they were captured or might have sustained internal injuries from being captured and ultimately die as a consequence (Reinert 1990). In the late 1960s and early 1970s, it was a common occurrence in north-central Pennsylvania for local

communities to host fall fairs at which timber rattlesnake belts and mounted heads, made from snakes captured the previous week, were sold and displayed (W.F. Weller, pers. comm.).

Overall, hunters have noted large declines in local populations and much of this decline can be attributed to hunting practices (Galligan and Dunson 1979). For example, it has been observed that a large population within one hibernaculum can be completely eliminated within five to seven years (Galligan and Dunson 1979).

1.5.2.2 Habitat Loss and Degradation

Habitat loss through urban development, logging, and aggregate extraction reduces the amount of available habitat for the species, leading to population declines (Wright and Wright 1957, Weller 1982). The timber rattlesnake's historic Canadian range was within some of the most developed areas in Ontario, which suggests that suitable habitat has since been largely destroyed.

There has been considerable industrial, agricultural, and residential development in the Niagara area where the timber rattlesnake historically occurred. A limestone extraction operation located near the Whirlpool began in the early 1800s and continued for many years. As well, in the late 1800s, the Tablerock area was developed for tourism, the Maid-of-the-Mist operation began, as well as development and the operation of the railway system, located (in some areas) near the Niagara river shoreline, was initiated. The Ontario Power Generating Station just below Niagara Falls was put into service in 1905. Finally, the construction of Sir Adam Beck generating stations (#1 and #2), both owned by Ontario Power Generation Inc., were put into service in 1922 and the early 1950s respectively. (Weller, pers. comm.). This development and increased activity degraded habitat in the Niagara region and likely contributed to the extirpation of the species.

Road kill is an additional aspect of human-induced mortality (Martin et al. 1992). Roads are a significant cause of mortality to many species of snakes. A very extensive road network and increasing traffic are leading to increasing incidences of road mortality. This would likely be a threat to timber rattlesnakes if they were reintroduced to Ontario. Roads may also act as a barrier to dispersal as many snakes are killed crossing roads.

Habitat degradation by humans may also affect population numbers. Alterations such as continuous repositioning of basking and shelter rocks or repeated visits by humans to basking sites may eventually lead to the snake's abandonment of the site entirely (Brown 1993).

The alterations made to the habitat of the timber rattlesnake in Ontario cannot be mitigated and the habitat cannot be rehabilitated.

1.5.2.3 Natural Processes or Activities

The natural progression of forest succession may be incompatible with the long-term survival of timber rattlesnakes, if the canopy cover results in too much shade (Brown 1993). Eventually such growth may render a hibernaculum unsuitable for use and cause the extirpation of the species from the area. However, the impacts of increased shading are not entirely understood, with some suggestions that selective tree removal may actually harm the snakes more (Smith 2001).

1.6 Actions Already Completed or Underway

Actions that have been completed or are underway include:

- Museum and library searches for specimens and information.
- Meetings with rattlesnake experts in Canada and the United States.
- Zoo checks for a source of genetic material.

1.7 Knowledge Gaps

Information gaps for timber rattlesnake include:

- Impact of reintroduction on other species
- Critical habitat requirements
- Habitat restoration techniques – creation of hibernacula, artificial birthing sites, etc.
- Causes of the species extirpation from Canada
- Former range, population size and habitat needs in Canada
- Prey availability studies at former and potentially suitable sites.
- Habitat quality at former and potentially suitable sites
- Verification of historical reports

2. RECOVERY FEASIBILITY

The recovery of timber rattlesnake is deemed not to be technically and biologically feasible for the following reasons:

1. Are individuals capable of reproduction currently available to improve the population growth rate or population abundance?
   Unknown. There are no known extant populations of the timber rattlesnake in Canada. The species is, however, relatively widespread in the United States. The U.S. populations could be used to assist with the reintroduction of the species to Canada, if it is determined that the populations can withstand removal of individuals for this purpose.

2. Is sufficient suitable habitat available to support the species or could it be made available through habitat management or restoration?
   No. There is not sufficient habitat for the species remaining in the verified historical locations in Canada.

3. Can significant threats to the species or its habitat be avoided or mitigated through recovery actions?
   Unknown. It is unknown if the threats to the species can be avoided or mitigated through recovery actions. The threats which led to the extirpation of the species are not fully understood. Extensive review of the literature and private records will be required to determine the full extent of the threats and whether they can be mitigated.

4. Do the necessary recovery techniques exist and are they demonstrated to be effective?
   Unknown. The necessary techniques for reintroducing this species are currently being studied in the United States. It is unclear whether these techniques would be effective for recovering the timber rattlesnake and therefore more study is required. It is expected that reintroduced populations would likely experience high juvenile mortality.

Recovery is not recommended unless:

1) the species is found in Canada;
2) sufficient suitable habitat is discovered within the historical range to support a viable population of timber rattlesnakes.

3. CRITICAL HABITAT

3.1 Identification of the Species' Critical Habitat

Critical habitat is not identified in this recovery strategy because recovery is currently considered not feasible due to the lack of suitable habitat to support a population of timber rattlesnakes and there are currently no plans to reintroduce this extirpated species. If this decision should change, critical habitat identification will be reconsidered at that time.

4. CONSERVATION APPROACH

The recovery of this species is considered "not feasible" at this time. No specific recovery efforts will be made, however if individuals are rediscovered then this decision will be reexamined.

Monitoring and follow-up work (e.g. confirmation) on timber rattlesnake observations reported by individuals during surveys done for other species in southern Ontario, will be undertaken wherever possible.

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W.F. Weller, pers. comm.

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