
Species at Risk and Park Development: The Eastern Foxsnake (*Elaphe gloydi*) and the Killbear Provincial Park Visitor Centre

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Abstract

*Ecological monitoring is an important component of the protection and management of protected areas. Globally, monitoring is conducted in support of ecosystem status assessments and the evaluation of management effectiveness. At Killbear Provincial Park, on the eastern shore of Georgian Bay, inventory, monitoring, and research of species at risk have been underway for many years by university researchers and the Ministry of Natural Resources. This paper provides an overview of this activity and focuses on the inventory and monitoring of the Eastern foxsnake (*Elaphe gloydi*) that was initiated in 2000 for the proposed new visitor centre. It describes the visitor centre planning process with respect to Environmental Assessment Act obligations, the design, implementation, and results of inventory and monitoring for Eastern foxsnake, and how the results were used to mitigate potential negative effects of the visitor centre on Eastern foxsnake and other species-at-risk reptiles in the park. Recommendations on inventory and monitoring are offered, especially in the context of park development. Finally this paper has general value because (1) it provides a bridge between development, monitoring, and research; (2) it provides a reasonably comprehensive*

overview of park development and monitoring activities of SAR over time; (3) it provides timely and practical recommendations; and, (4) it provides a summary of practical aspects of operations/development and monitoring and research.

Keywords: monitoring, management effectiveness, species at risk, Eastern Foxsnake

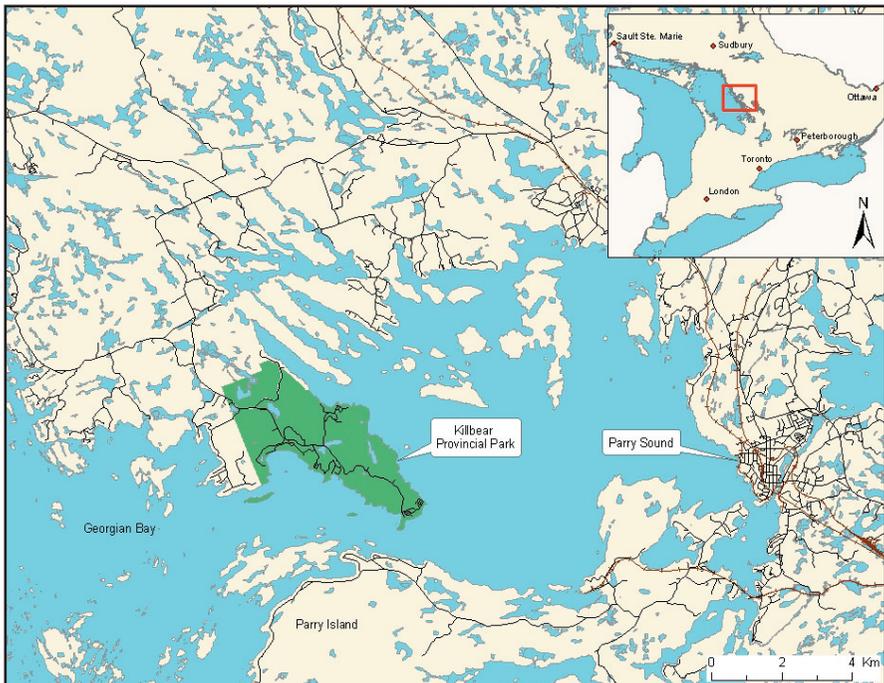
Background and Context

Location and Visitor Use

Killbear Provincial Park (Figure 1) is a natural environment class park located on the eastern shore of Ontario's Great Lakes Heritage Coast at the southern edge of the Canadian Shield, an area of transition between the coniferous forests of the north and deciduous forests of the south. Comprising 1133 hectares of land and 623 hectares of water, the park is known to have eight species of reptiles that are listed as threatened or of special concern in Ontario (Table 1) (MNR, 2005a).

Killbear Provincial Park is situated on a peninsula about 20 km west of the Town of Parry Sound (population approximately 6500) and about 2 ½ hours north of the Greater Toronto Area which has a population of more than three

Figure 1. Location of Killbear Provincial Park.



million people. Annually, about 250,000 to 300,000 people visit the park, generating about \$6.5 million to the provincial economy and 152 person years of employment (Ontario Parks, 2000). The park's 882 campsites operate at 88% occupancy during the summer months of July and August. Campers stay an average of 7.2 nights per visit—the highest in the provincial park system. During the summer months, the main recreational pursuits are swimming, canoeing/kayaking, windsurfing, sailing, boating, hiking and biking.

Development and Operations

The local area was logged in the early 1900s. Between 1920 and 1958 there was no disturbance to the area, including no roads. The park was opened in 1960 and, at that time, park staff and visitors regularly killed any rattlesnakes they found. During the mid 1970s, staff began relocating rattlesnakes a few kilometres away from campgrounds as a means to protect them while responding to perceived concerns about visitor safety. In hindsight, the perceived concerns were unfounded and the relocation was likely counter pro-

Table 1. Species-at-risk reptiles in Killbear Provincial Park.

<i>Species at Risk</i>	<i>Status</i>	<i>Relative Abundance</i> ¹
Eastern Massasauga Rattlesnake (<i>Sistrurus catenatus catenatus</i>)	Threatened	daily sightings during summer
Eastern Foxsnake (<i>Elaphe gloydi</i>)	Threatened	daily sightings during summer
Eastern Hog-nosed Snake (<i>Heterodon platirhinos</i>)	Threatened	seen very infrequently ²
Eastern Milksnake (<i>Lampropeltis triangulum triangulum</i>)	Special Concern	seen very infrequently ²
Northern Map Turtle (<i>Graptemys geographica</i>)	Special Concern	seen very infrequently ²
Blanding's Turtle (<i>Emydoidea blandingii</i>)	Threatened	2-3 sightings per year ³
Stinkpot (<i>Sternotherus odoratus</i>)	Threatened	seen very infrequently ²
Spotted Turtle (<i>Clemmys guttata</i>)	Endangered	historical accounts; not seen for over 30 years
Five-lined Skink (<i>Eumeces fasciatus</i>)	Special Concern	seen very infrequently ²

¹ Based on park records and experience.

² Seen once or twice over the past 6 years.

³ This is the only other SAR found on the visitor centre site.

ductive since the snakes were moved out of their home range and would not have been able to find their hibernation site and therefore would be unlikely to survive the winter. Some education efforts began in the park during this period; however, it was not until the 1990s that a more intensive educational program was initiated. Education efforts were co-ordinated with research in a campaign to change park visitor and local landowner attitudes toward rattlesnakes. Also, rattlesnakes on campsites or roads were relocated only a few hundred metres from their capture site. Visitors and landowners have generally responded very well to this initiative. For example, “*Please Brake for Snakes*” t-shirts sell very well and the proceeds, amounting to about \$5000 per year, are used to support park research. Today, educational programs are very popular with about 5000 people per year attending a program on species-at-risk reptiles (via school group events, community talks, and in-park programs). The new visitor centre features species at risk in the static and life exhibits.

While the land base is relatively small for a busy park, it has a remarkable diversity of flora and fauna, primarily because the campgrounds are concentrated in a limited area and most recreational activity takes place on the sandy beaches. This leaves 800 hectares in natural environment or nature reserve zone status. Nevertheless, visitation does have an impact on reptiles, as described later.

Park Management Plan

A new park management plan for Killbear Park was prepared between 1998 and 2000. The plan presents the park’s zones (nature reserves, natural environment, historical, access and development) where certain activities are permitted or restricted. It identifies park-level policy and priority actions for resource protection, operations and development.

The park is classified as a natural environment park, and its goal is “*to protect the park’s significant natural and cultural resources for a wide variety of high quality recreational and educational experiences*” (Ontario Parks, 2000, 3). The plan states that park management will take a greater ecosystem view, recognizing that management activities undertaken within the park may have environmental effects outside the park boundary, and vice versa. Specific direction concerning reptiles is provided in section 8, which states:

Operations and development activities undertaken within the park will be carefully considered to ensure that they do not jeopardize species at risk or their habitat. Whenever possible, park

staff will develop or participate in user education and information programs regarding these and other significant wildlife species. Ontario Parks recognizes that the seasonal movements of many species of wildlife result in their movement between Killbear Provincial Park and surrounding areas. To fulfil park objectives, park staff will contribute to initiatives that foster wildlife stewardship in the greater park ecosystem.

A resource stewardship plan for the park's species at risk reptiles will be prepared. The plan will be composed of two parts: a framework conservation strategy, and; specific guidelines for individual species (the guidelines will be developed over time as specific research and information becomes available to support detailed guidelines for species). The stewardship plan will include:

- guidelines for the protection of species and their habitat;*
- direction for further research and monitoring of Killbear's species at risk populations; and*
- natural heritage education initiatives within the park and the community to promote protection of species at risk (Ontario Parks, 2000, 12-13).*

This direction provides the basis for monitoring and research of species-at-risk reptiles in the park. The management plan also provided direction for the development of a new visitor centre, which would be supported by detailed inventories.

Visitor Centre Project

Late in 2000, the government announced funding for the development of the new visitor centre. In accordance with Ontario Parks policy and the *Environmental Assessment Act*, a consultant was contracted to prepare an Environmental Study Report to assess the overall positive and negative effects of the development. The study identified mitigation measures to offset or minimize potential negative effects. The need for monitoring and research was considered in light of the park's species at risk and directions in the park management plan.

While good population information was available for Eastern Massasauga rattlesnake (*Sistrunus catenatus catenatus*) as a result of research (Parent, 1997) and ongoing studies (Parent, 2000), information was lacking for Eastern Foxsnakes (*Elaphe gloydi*). Park staff examined options for monitoring

and research as a means to confirm, with a reasonable degree of certainty, that the development would not have undue negative effects on Eastern foxsnakes. For example, a main concern was to ensure that the visitor centre would not inadvertently destroy a communal hibernation site. Four options were examined:

1. use available information from previous years;
2. undertake inventory of the visitor centre site;
3. undertake population research throughout the park, employing mark-release-recapture studies and radio telemetry tracking; and,
4. undertake population research in the greater ecosystem (beyond the park), employing mark-release-recapture studies and radio telemetry tracking.

Option 3 was selected on the basis that the results of the study would achieve the following:

- enhance existing mark-release-recapture efforts in the park;
- permit estimation of Eastern foxsnake population size, sex ratios, and age structure and provide information about growth rates and survivorship;
- to the extent that transmitter-equipped individuals remained in the park, the telemetry data would permit determination of Eastern foxsnake activity periods, home range sizes, patterns of movement, and also allow the identification of critical habitat features, including hibernation and oviposition sites;
- demonstrate that the development of the new visitor centre was carefully considered to ensure that it did not jeopardize Eastern foxsnakes or their habitat;
- support the preparation of an Eastern Foxsnake stewardship plan, including the development of guidelines for the protection of the species and its habitat; and,
- assist staff to develop or participate in user education and information programs on Eastern foxsnakes.

However, since transmitter-equipped snakes would not be tracked outside of Killbear Provincial Park, the third option would not fully support stewardship activities in the greater park ecosystem. This key limitation was overcome in 2003 through the persistent efforts of the principal researcher (Lawson) to establish a funding partnership between World Wildlife Fund, the University of Guelph (R. Brook's lab), the Friends of Killbear Park, MNR's Parry Sound office and Ontario Parks. This funding partnership enabled a more complete study with broader geographic tracking (option 4).

The goal of the visitor centre monitoring project was “to ensure that the development of a new visitor centre in Killbear Provincial Park does not jeopardise Eastern foxsnakes or their habitat” (Chora *et al.*, 2001). Monitoring was to consider the pre-construction, construction, and post-construction phases. The objectives were the following:

1. to identify the location of communal hibernation sites used by the park’s Eastern foxsnakes;
2. to obtain behavioural, ecological, and population genetic data on the park’s Eastern foxsnakes to:
 - a) assess the impacts of the visitor centre construction and evaluate the effectiveness of mitigation measures;
 - b) develop guidelines for the protection of Eastern Foxsnakes and their habitat in the park; and,
 - c) provide information about Eastern foxsnakes to incorporate in the park’s Natural Heritage Education programs (Chora *et al.*, 2001).

Summary of Research and Monitoring Activities and Key Results

Eastern Massasauga Rattlesnake, 1992-2001

Between 1992 and 2000, Ontario Parks, MNR’s Parry Sound district office, and university research contributed research and monitoring information to the knowledge base on Eastern Massasauga rattlesnake. This research has included:

1992-94: Chris Parent, park naturalist, started a modest mark-release-recapture program, which was expanded and carried out with dedicated staffing in 1994.

1995-2001: An intensive study over this period included graduate research and the highway 69 expansion study (Parent, 1997; Parent, 2000); 37 individual rattlesnakes were tracked, with hundreds of captures and recaptures.

2002-2005: Monitoring of rattlesnakes on roads and in campgrounds by park staff.

The results of these investigations have indicated that the park has two populations of Eastern Massasauga rattlesnake that are bisected by the main park road. The park population is estimated to be 200 mature rattlesnakes. Researchers gathered information about habitat requirements, movement patterns, ranges, growth rates, age to maturity, and brood size. They also

discovered critical areas such as hibernation sites and gestation sites. Parent (1997) found that rattlesnakes that come into contact with humans (i.e., live near campgrounds or park trails) move less and hide more than snakes that live in undisturbed areas of park.

Eastern Foxsnake, 1992-2004

Research on Eastern foxsnake was carried out primarily by Lawson with a specific focus on inventory and monitoring to support the visitor centre project (Chora *et al.*, 2001; Lawson, 2002-4).

1992-2001: Incidental observations of Eastern roxsnake were made during studies on Eastern Massasauga rattlesnake.

2000: Continued opportunistic mark-release-recapture study, and tracked Eastern roxsnakes on the mainland. Three snakes were tracked from between late July and August until hibernation. Based on information from 1996 and 2000, the park knew of one confirmed hibernation site and three potential hibernation sites.

2001: Two researchers were hired to search the preferred visitor centre site. Three foxsnakes were found on the proposed site. One was implanted with a radio-transmitter and the two others were juveniles found in late September. When tracking began in earnest in 2001 (Chora *et al.*, 2001), it was quickly discovered that the foxsnakes spent considerable time on islands in Georgian Bay. With the MNR district office assistance in off-shore tracking, island hibernation sites were confirmed. While Chora and Lawson were able to find out how much time the transmitter-equipped foxsnakes spent on the visitor centre site and in the park, there were many times when the snakes' location was not known because they had swum away from Killbear and were beyond the imposed limits of the study. This gap in the information limited the confidence and certainty of the interpretation of the results.

2002: Prior to construction beginning in 2002 the location of one hibernation site was known and the location of four more sites were suspected, one on the mainland and four on islands. One of the island sites was a communal site with at least four foxsnakes hibernating together. The research and monitoring results indicated that Foxsnakes spent most of their time within 30 m of the water's edge. Subsequently, the visitor centre was set back from the shoreline to minimize potential disruption of snake movement and impacts on important habitat. The visitor centre site was also searched extensively in this year, but only one Eastern foxsnake was found on the site. It was

implanted with a radio-transmitter but was killed in the campground within a few days of release, likely by a dog.

2003: The new partnership, with adequate resources, enabled staff to follow the snakes through their entire field season and to establish enclosures at hibernacula, which improved population information. Thirty-six Eastern foxsnakes were captured at one island, nine were captured at another island, and eight at another. An additional 113 opportunistic captures were made during the 2003 season. This enhanced study provided improved information on the population of Eastern foxsnakes and provided a much greater understanding of Eastern foxsnake ecology in the Killbear area. While tracking the snakes throughout the islands, Lawson was able to document their ranges and the distance travelled by different snakes (average 20 km per season). Lawson (2005) was also able to document, and in some cases film, some rather interesting behaviour, including mating, male-to-male combat, and communal oviposition (egg laying). The visitor centre site was searched extensively but no Eastern foxsnakes or other species at risk were found on the site.

2004: Lawson found one of the hibernacula pillaged, likely by a fisher. While 36 snakes were captured at this location in 2003, only two snakes were caught emerging in 2004. Extensive radio telemetry (up to 16 individuals at a time) and mark-recapture (71 individuals captured 136 times) continued in and out of the park. The visitor centre was searched extensively but no Foxsnakes were found, however, a Blanding's turtle (*Emydoidea blandingii*) was found on the site.

The Eastern foxsnake monitoring study for the visitor centre project, especially the enhanced study in 2003-04 (Chora *et al.*, 2001; Lawson, 2002-04), and the related academic research (Lawson, 2005), have resulted in a wealth of new knowledge about the Eastern foxsnake. For example, the location of 9 hibernacula, several oviposition sites, and several shedding sites are now known. The research has demonstrated that Eastern foxsnakes show quite strong affinity for the shoreline, which will help in the definition of critical habitat for the Eastern foxsnake in the Georgian Bay area (MacKinnon, in prep). Eastern foxsnakes move very long distances (up to 4.5 km/day, and up to 35.5 km within a season). Previously undocumented mating behaviour and interactions among individuals have been observed. Mortality on the mainland appears to be quite high from roads and humans. Eastern foxsnakes tend to show fidelity to hibernacula, shedding sites, possibly oviposition sites, and sometimes to travel routes.

Future Needs and Recommendations

The research and monitoring work associated with the visitor centre development has been successful from a number of perspectives, including identifying needs and recommendations for future consideration.

Ecosystem Protection

Protecting hibernation sites on the islands and communal egg laying locations is very important. Ontario Ministry of Natural Resources (including Ontario Parks) and other partners should work together to develop outreach initiatives aimed at encouraging landowners to protect their lands and the natural habitat. Protection mechanisms and incentives should be examined and made available to landowners, such as sale or donation of land for permanent protection as a park or conservation reserve or trust land, conservation easements, and the Conservation Land Tax Incentive Program. The results of the research and monitoring provide evidence and supporting rationale for consideration when setting acquisition priorities.

Research and Monitoring

The project underlined a key stewardship principle held by MNR: “*A sound understanding of natural and ecological systems and how our actions affect them is key to achieving sustainability*” (MNR, 2005b, 7). This case demonstrated that multiple years of research and monitoring are needed to achieve the necessary degree of certainty about potential effects. Insufficient information can lead to incorrect conclusions and potentially serious implications. For example, the first Eastern foxsnake that was tracked within Killbear Provincial Park in 1995-96 was anomalous; it was the only one of 31 foxsnakes tracked between 1996 and 2004 that was never observed to leave the mainland. Accordingly, protected area managers, ecologists and planners should examine future plans for development to identify potential risks and needs for research and monitoring well in advance of planning. This is particularly important where species at risk may be present.

Foxsnake research and monitoring needs to continue and, importantly, must be conducted in the context of the greater ecosystem, as directed in the park management plan. The discovery that foxsnakes used off-shore islands in addition to the park mainland indicates the geographic extent of its critical habitat.

With permission of the landowners, known hibernacula should be monitored each spring (and possibly fall) to collect mark-release-recapture data. Timing is very important for this aspect of monitoring. Foxsnakes begin

to emerge in late April and emergence can continue into early June. Peak emergence is around the first week of May (weather depending). Researchers should begin in mid to late April. Known shedding sites and oviposition sites should also be monitored at the appropriate time of year (July 12-20 for oviposition). All foxsnakes captured in the park should be, at a minimum, scanned for PIT tags, sex and age/size class should be determined and their location should be recorded using GPS.

Without the information from the enhanced 'partner study' with the University of Guelph, a skewed view of the local Eastern Foxsnake population could have resulted, and the degree of certainty associated with predictions about potential effects of the visitor centre project would have been low. Effort should continue to be invested in developing effective partnerships for research and monitoring, as occurred in this project.

Moreover, it is clear that activities in Killbear Park could have a significant negative impact on the surrounding Eastern foxsnake population.

Of 23 transmitter-equipped foxsnakes monitored in 2003 and 2004, nine were killed (and an additional three died over winter). Six of the nine deaths were likely caused by humans, two were likely caused by predators, and one died of unknown causes. All but two of these deaths occurred on the mainland (four in Killbear, three just outside of the park) and six of the seven mainland deaths were caused by humans and traffic. However, only 411 of 3176 telemetry locations (13%) collected during this time were on the mainland. This suggests the possibility that Killbear and the area immediately outside of the park may be acting as a sink for the local Foxsnake population (Lawson 2004).

It also indicates that park management has a direct role to play in mitigating negative impacts on the population, as discussed below.

Park Management

A Rattlesnake Stewardship Plan was initiated in 2005 and recommends continuing active rattlesnake monitoring with a focus on surveys of hibernation and gestation sites. Many of the park's rattlesnakes are able to hibernate, feed, mate and gestate without having to cross a road in the park. However, some snakes do try, and the road-kill monitoring data shows obvious travel corridors. More 'Please Brake for Snakes' signs should be installed, speed limits should be lowered and/or enforced, and properly designed snake crossings at these corridors should be installed to help alleviate road mortality.

Eastern foxsnakes, on the other hand, move much more than rattlesnakes – on average 20 km per season versus only 3 km per season for rattlesnakes. Foxsnakes are often killed on small local cottage roads or campground roads in the park. Strategies to minimize this negative impact need to be examined. For example, options to address traffic volumes, patterns of flow, closure of roads that run parallel to shorelines, and conversion of some shoreline campsites to walk-in sites should be examined.

As required in the park management plan, other implementation plans of this type are needed and should include guidance for park development, operations, and enforcement to help minimize negative effects on species at risk reptiles and to enhance their protection.

Education

The park's natural heritage education program plays a vital role in improving awareness and understanding about species at risk in the greater ecosystem. All park staff should be encouraged to play a valued role in their work. Ontario Parks should develop a strategy to implement the park management plan direction, as stated: "*Ontario Parks will promote the use of the knowledge and management strategies developed through applied research in Killbear Provincial Park, to assist reptile conservation initiatives in other jurisdictions.*" (Ontario Parks, 2000, 12-13)

Through these efforts, Killbear Provincial Park with the help of many partners can continue to be a leader in reptile conservation. Ontario Parks will be acting to achieve its aim to protect ecological integrity and ensuring the ecological sustainability of its natural assets.

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