

DEFENSIVE BEHAVIOUR OF THE EASTERN MASSASAUGA RATTLESNAKE

Kerstin Hedgecock

SUMMARY

Defensive behaviour of the eastern massasauga at Bruce Peninsula National Park was tested over a five month period in 1991 and compared to similar data collected in 1990.

Massasaugas were found not to respond to disturbance (mostly at two metres or less) 63% of the time.

Factors such as body temperature, cover and individual disposition play a role in responsiveness. The snakes were found only to strike when stepped on and then only 7% of the time.

Guidelines for Park visitors encountering massasaugas are suggested. The tracking of interperitoneal implants should continue to allow proper assessment of this surgical technique.

INTRODUCTION

The eastern massasauga rattlesnake (*Sistrurus catenatus*) is one of three venomous snakes endemic to Canada and the only one found in Ontario. It reaches an average length of 50 to 70 cm and can be distinguished from harmless snakes by its distinct head, vertical pupil, rattle at the end of its tail and heat sensitive pits between the eyes and nostrils (Froom, 1981).

The range of this nonaggressive snake once extended across southwestern Ontario, though it was probably not continuous. Its range and numbers have declined due to habitat loss and human persecution and is now restricted to the Georgian Bay area and small populations in the Ojibway Prairie near Windsor and Wainfleet Marsh near Welland (Weller, 1986). Bruce Peninsula National Park is one of the last areas where this species can be found in healthy numbers. Preferred habitat within the Park was found to be marshes and coniferous forest (Weatherhead, 1991).

In 1991, the eastern massasauga rattlesnake was assigned threatened status by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and is protected by law in Ontario under the Game and Fish Act (Bowman, 1991).

The Canadian Parks Service and the Metro Toronto Zoo have been working to preserve this snake through ongoing public education and research such as radiotelemetry and mark-recapture studies. The radiotelemetry study of the eastern massasauga at Bruce Peninsula National Park was initiated in 1989 to determine its habitat requirements in order to make recommendations for a management plan for the conservation of this species, visitor safety, and future research needs (Weatherhead, 1991). Testing of defensive behaviour began in the 1990 field season and continued in 1991. Tolerance of human disturbance was investigated through a series of disturbance trials. The objective of this report is to analyse the disturbance data obtained in the 1991 study, make comparisons with the 1990 data and make recommendations for visitor safety.

METHODS AND MATERIALS

Radiotracking of the snakes took place in St. Edmunds and Lindsay townships, Bruce County, Ontario, at various locations throughout Bruce Peninsula National Park, the Federation of Ontario Naturalists (FON) Nature Reserve at Dorcas Bay and private property.

In the Summer of 1990, 12 snakes were implanted subcutaneously with radio transmitters. Five of these were tracked for a second season in 1991. The others had died or had been removed from the study because of skin abrasion at the transmitter site. In 1991, two additional snakes were implanted interperitoneally to eliminate abrasion problems and were tracked from August into hibernation in October.

The transmitters used were those produced by Holohil Systems Ltd. A built-in thermistor enabled calculation of the snake's body temperature from the pulse rate and a 20 centimetre wire whip antenna was attached to allow the signal to be picked up by the receiver. The receiver was a PLL synthesized tracking receiver, model TRX-1000S, manufactured by Wildlife Materials Inc.

The surgical procedure was based on methods by Weatherhead and Anderka (1984) for subcutaneous implantation and Reinert and Cundall (1982) for interperitoneal implantation. All surgery was conducted at the Ontario Veterinary College, University of Guelph.

The snakes were tracked daily if possible, otherwise as often as time permitted. One or two disturbance trials were carried out randomly every three or four visits. Trials were divided into eight categories (Table 1). Responses to trials were recorded as positive or negative in five categories (Table 2).

Trial categories 1-4 were used for the random trials. Categories 5-8 were not deliberate trials, but listed as responses noted as the field worker approached the snakes during routine tracking. Only positive responses were used for analysis as negative responses were not always noted. For the 1990 season trial categories 1-3 and response categories 1-3 were used. Other pertinent data recorded included percent cover of the snake and pulse rate from which body temperature was determined.

RESULTS

During the 1991 season, the snakes were located 422 times. Field work was carried out from 01 May into October when the last of the 1990 snakes were removed from the study (others were removed at different times throughout the season due to abrasion problems) and the 1991 snakes had gone underground (Table 3). Data for disturbance trials were collected between 01 May and 05 October from nine snakes. The number of observations for trials 1-4 were 100 (73 for analyses involving body temperature) and 69 for trials 5-8.

The tracking of Crane Lake was intermittent since this snake spent a fair amount of time on private property. Data collected from McLander1 (27 observations) could not be used for analyses involving body temperatures (Figures 1 and 3) as there were discrepancies in the calibration curve used to calculate them. Data involving body temperature and cover (Figures 1-3) were presented in a similar manner as the 1990 data (Weatherhead, 1991) for easy comparison.

Figure 1 indicates that positive responses increase with higher body temperatures (up to 35 C where it drops again). A comparison of positive responses and per cent cover indicates that snakes were more likely to react when exposed than when hidden (Figure 2). When both body temperature and cover are considered (Figure 3) snakes were more likely to react when exposed regardless of body temperature. The snakes were least likely to react when well hidden and cool and reacted most when cool and exposed.

Reactions to different disturbance trials (1-4) are shown in Table 4. "No response" was the most common reaction for each trial except for #4 where it was the second most common after "rattle". In 63% of the trials the snakes did not respond. For trials 1 and 2 "rattle and flee" was the most common positive response; for trial 3, it was "rattle". These responses were observed in less than 25% of the trials. The "flee" response was for trial #4 and then in only 7% of these trials.

Responses for trials 5-8 were divided up according to distance at which the response took place (Table 5). In the >2 m category most responses were at 2 m. Very few were at greater distances, the greatest being 4 m. No strikes were observed and again the "flee" response was rare (3% of trials). There were twice as many responses at >2 m and at this distance snakes were more likely to just rattle (as opposed to rattle and flee) than at one metre.

Table 1.
Categories of Disturbance Trials

1. walk past at 0.5 metres
2. stop for 30 seconds at 0.5 metres
3. step over
4. step on
5. walk past at 1 metre
6. walk past at ≥ 2 metres
7. stop for 30 seconds at 1 metre
8. stop for 30 seconds at ≥ 2 metres

Table 2.
Categories of Responses

1. no response	negative
2. rattle	
3. rattle and flee	positive
4. flee	
5. strike	

Table 3.
Tracking Periods of Snakes

Snake	Tracking Period	# days in field
Dorcas S.	02 May – 30 August	121
JR2	02 May – 09 August	100
McLander2	01 May – 06 September	129
Crane Lake	02 May – 09 August	100
CF2	11 August –	still in field
Cty Forest	02 May – 23 October	175
Emmett	11 August –	still in field
McLander1	01 May	1
Dorcas H.	02 May	1

Individual snakes showed variation in sensitivity to disturbance trials as shown in Table 6. Dorcas S. and JR2 were most likely to react whereas Cty Forest and Emmett were least likely. Out of seven snakes, Dorcas S. accounted for half of the responses for trials 5-8. Dorcas S. and JR2 together accounted for 75%. McLander1 and Dorcas S. were removed from the study the first day so were not used in this analysis.

DISCUSSION

Because of the secretive habits of snakes it has been difficult to obtain information about their ecology. Radiotelemetry has become a useful method of providing more accurate data (Weatherhead and Charland, 1985; Reinert and Zappalorti, 1988). Defensive behaviour is an area in which more information is needed.

Klauber (1982) stated that how a rattlesnake will react to disturbance depends on many factors, such as the species of snake, temperature, availability of cover, the suddenness of the disturbance, distance to the snake and individual temperament. They detect an approach by smell and ground tremors.

The rattle is used as a warning to larger animals which may step on and injure the snake, but it will by no means always rattle a warning before reacting (Klauber, 1982; Fenton and Licht, 1990). Usually a rattlesnake will first rely on its cryptic colouration and remain still to escape detection. If that fails, it may rattle and then flee or strike depending on the circumstances (Klauber, 1982).

As in 1990 the snakes did not respond to disturbance in over 60% of the trials, instead relying on crypsis to avoid detection. I personally have stepped right next to snakes not noticing them because they remained motionless. The tongue is used for

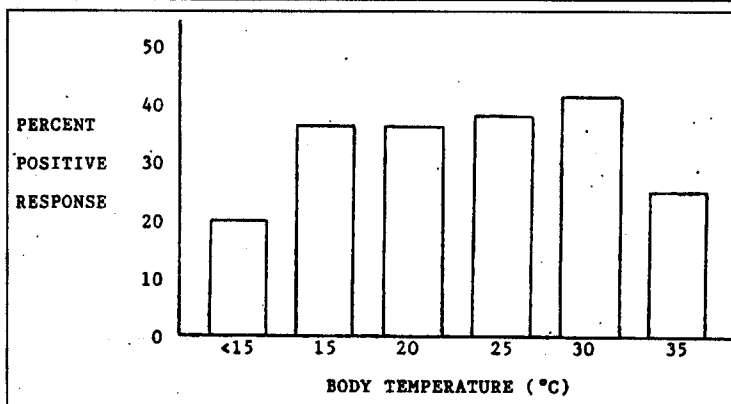


Figure 1. Relationship between positive response and body temperature.

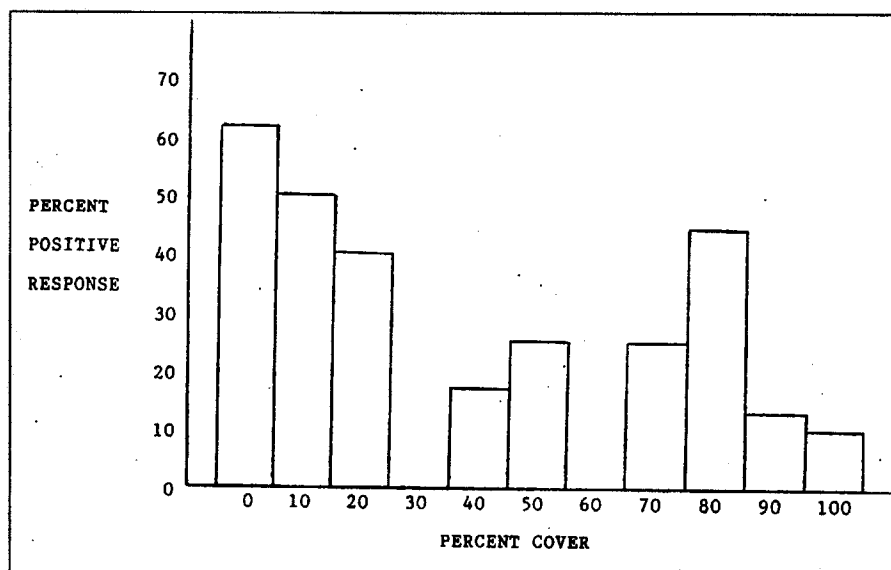


Figure 2. Relationship between positive response and cover.

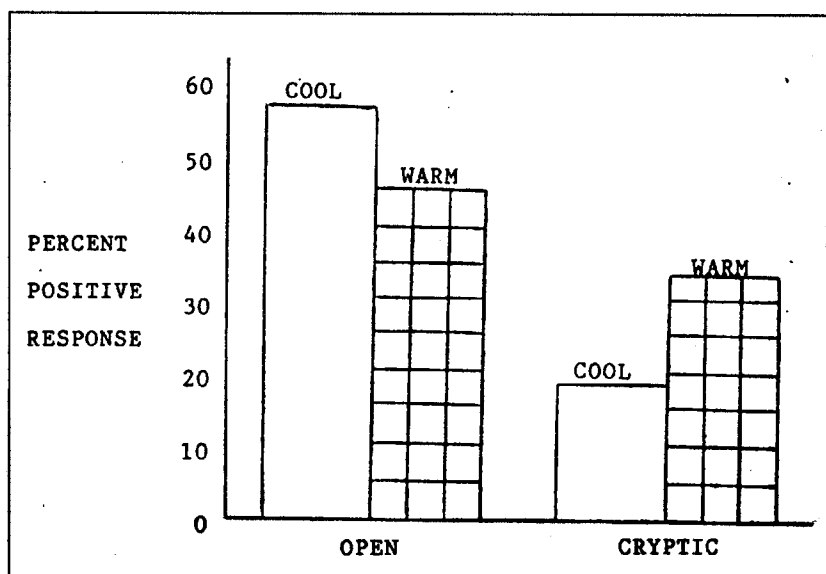


Figure 3. Relationship between positive response and temperature and cover.

detecting odours, and tongue flicking was often observed even if the snake did not react, it being well aware of the field worker's presence.

There was some variation in response to different trials. Positive responses when walking past or stopping near the snake usually resulted in rattling and fleeing as in 1990, but when stepping over or stepping on just rattling was more common, possibly because of a reduced chance of escape. Only few instances of fleeing without rattling were observed. Half of these cases may have been because the rattle was wet preventing a sound to be heard. Rattlesnakes may also flee without rattling if disturbed quite suddenly.

Snakes generally seek shelter during the partial blindness a week before it sheds (Klauber, 1982). Snakes in this condition did respond to some trials by rattling, but did not move.

Strikes were only observed when snakes were stepped on and then only in two instances. Both were by the same snake at cool temperatures and little cover. Although this category recorded the most positive responses, no response was recorded in a third of the trials. Snakes struck most often when pinned to the floor and provoked with a hook while preparing to pick them up for processing.

A response appears to be quite likely if the snake is interrupted while feeding. Cty Forest, when disturbed while feeding on sparrow nestlings, rattled and fled at four metres. This snake, one of the more passive ones, normally would not react until approached at a closer distance. However, he did return to continue to feed while the field worker was within two metres on the nestlings.

There were definite individual differences in responsiveness of the snakes. These ranged from Dorcas S., the most sensitive, who rattled as much as four metres away, to Emmett who exhibited no positive responses at all. Although individualism has been noted in snakes (Klauber, 1982; Shine, 1987; Hedgecock, 1990), it is possible that the health of the snakes may have been partially responsible for these differences. Those snakes most sensitive to disturbance also showed signs of infection and weight loss. Both snakes implanted interperitoneally (CF2 and Emmett) appeared to be in good health and were among the less sensitive snakes. However, more data is needed to determine whether this method has less of a negative effect on the snakes' health than the subcutaneous method. It is also difficult to assess how transmitters may affect snake behaviour.

Since snakes are ectothermic their behaviour is affected by temperature and at lower temperatures will be less responsive. This trend was shown by 1990 and 1991 data, although it was less pronounced in 1991. The drop in positive responses at 35 C could be due to individualism of the snakes. At this temperature data was collected from only two snakes (4 or 5 at other temperatures) and 88% of these were from Cty Forest, one of the more passive snakes. Well hidden snakes were less likely to respond. While the 1990 data indicated that temperature appeared to be a more important factor than cover, the 1991 data indicated the opposite. Apparently both play an important role in determining the responsiveness of snakes.

Visitor numbers at Bruce Peninsula National Park have been slowly increasing in the last few years and this trend is expected to continue (M. Wiercinski, pers. comm. 1991). Probably more visitor/snake encounters can be

Table 4.
Response to Disturbance Trials 1-4.

	percent response			
response	trial 1	trial 2	trial 3	trial 4
no response	56	86	64	32
rattle	17	2	18	39
rattle and flee	22	9	9	18
flee	5	2	9	4
strike	0	0	0	7

Table 5.
Response to Disturbance Trials 5-8

response	1 metre	≥ 2 metres	total
rattle	12	32	44
rattle and flee	10	13	23
flee	1	1	2
strike	0	0	0
9	23	46	69

Table 6.
Responses of Individual Snakes

	trials 1-4	trials 5-8
snake	% positive response	% chance of positive response
Dorcas S.	75	49
JR2	62	43
McLander2	44	5
Crane Lake	38	14
CF2	38	12
Cty Forest	26	4
Emmett	0	0

expected as well. Most of the snakes encountered are found by the sound of their rattle, which also allows the person approaching to avoid the snake. Although one should not downplay the dangers, a situation involving a bite is unlikely. A strike by a rattlesnake does not necessarily mean it will bite. There have been few bites in Ontario and all victims in the last 20 years recovered (Johnson, 1989).

CONCLUSION

There were some differences between the 1990 and 1991 data, but results indicate that massasaugas rely on crypsis to avoid detection and usually allow a person to get within two metres before reacting, if at all. Cover and temperature affect responsiveness as well as differences in individual temperament. Strikes were a rare occurrence and only observed when the snakes were stepped on. Snakes were most likely to strike when provoked. The subcutaneous method of transmitter implantation affects the health of the snakes and possibly their behaviour.

RECOMMENDATIONS

- 1) Amphitheatre programs on the massasauga should continue with emphasis on its threatened status and promotion of its coexistence with Park visitors,
- 2) For visitors that encounter massasaugas, guidelines should be set up in the form of posters and brochures. Procedures for snake encounters and bites should be included. Prompt reporting of encounters to Park staff should be encouraged, but attempts to corner or capture them should be discouraged as this is when they are most likely to strike.
- 3) Park staff should be trained to pick up any massasaugas reported and have access to enough proper equipment (i.e. snake hooks and bags). This would facilitate and increase data collection for the mark-recapture study.
- 4) Since only one of the twelve 1990 snakes implanted subcutaneously could be tracked to the end of the second season, the two snakes implanted interperitoneally should be tracked for another season to ascertain whether this is an acceptable method for massasauga radiotelemetry.

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