

Management Plan for the Eastern Mole (*Scalopus aquaticus*) in Canada

Eastern Mole



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¹ <http://www.registrelep-sararegistry.gc.ca>

Preface

The federal, provincial, and territorial government signatories under the [Accord for the Protection of Species at Risk \(1996\)](#)² agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of management plans for listed species of special concern and are required to report on progress five years after the publication of the final document on the SAR Public Registry.

The Minister of the Environment and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Eastern Mole and has prepared this management plan as per section 65 of SARA. To the extent possible, it has been prepared in cooperation with the Government of Ontario, and any others as per section 66(1) of SARA.

Success in the conservation of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this plan and will not be achieved by Environment Canada, the Parks Canada Agency or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this plan for the benefit of the Eastern Mole and Canadian society as a whole.

Implementation of this management plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

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Acknowledgement and thanks are given to all other parties that provided advice and input used to help inform the development of this management plan including various Aboriginal organizations and individual citizens and stakeholders who provided input and/or participated in consultation meetings.

² <http://registrelep-sararegistry.gc.ca/default.asp?lang=en&n=6B319869-1#2>

Executive Summary

The Eastern Mole is listed as a species of Special Concern under the *Species at Risk Act* and is the focus of this management plan. The Eastern Mole is the size of a large mouse with a robust body; short, scantily-haired tail; large, broad front feet; and a long pointed, hairless snout. The colour of the dense fur varies throughout the mole's range from a greyish brown (almost black) in the northern parts of its range, including Ontario, to a light golden colour in the southern parts of its range. The Eastern Mole occurs throughout most of the eastern and central U.S., where its population is considered Secure in 24 of the 36 states across its range. In Canada, the known extent of occurrence is a 546 km² area in southern Ontario, specifically three municipalities in Essex County, Ontario (Towns of Essex and Kingsville, and the Municipality of Leamington) and the western portion of Romney Township in the Municipality of Chatham-Kent.

The Canadian³ Eastern Mole population in 1997 was estimated to be between 2,120 and 12,760 individuals, with all individuals found in Ontario (COSEWIC 2010). The Canadian Eastern Mole population is believed to be stable, although in a survey in 2008 they were not recorded in 6 of the 23 sites where signs of moles were observed in 1997. Approximately one third of suitable habitat (combination of suitable soils and sufficient forest cover) for the Eastern Mole in Canada is thought to be located in Point Pelee National Park, Ontario (COSEWIC 2010).

Habitat loss and fragmentation have substantially reduced the habitat historically available to the Eastern Mole. Current threats are thought to include urban, industrial, and intense agricultural development; road mortality; discriminate killing; and flooding. However, very little is known regarding the population size, threats or biology of the Eastern Mole in Canada.

The objective of this management plan is to maintain and, where feasible increase, the distribution and abundance of Eastern Mole in Canada, and improve knowledge on demographics, habitat use and threats to the species in Canada. Broad strategies to achieve these management objectives are outlined in section 6.2 of this document.

Conservation of the Eastern Mole is also likely to benefit the environment, including a number of species at risk, through the protection of Carolinian woodlands in southern Ontario (Appendix A).

³ The only population of the Eastern Mole in Canada is located in southern Ontario.

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1. COSEWIC* Species Assessment Information

Date of Assessment: November 2010

Common Name: Eastern Mole

Scientific Name: *Scalopus aquaticus*

COSEWIC Status: Special Concern

Reason for Designation: This small mammal has a Canadian range restricted to about 1000 hectares near Point Pelee National Park in southern Ontario. It has a restricted and fragmented distribution, but lack of adequate monitoring effort and quantification of threats underline the uncertainty of its conservation status. Although there is some evidence of decline, one third of the species' habitat is relatively secure in the park. Threats have not been evaluated elsewhere.

Canadian Occurrence: Ontario

COSEWIC Status History: Designated Special Concern in April 1980. Status re-examined and confirmed in April 1998, November 2000, and November 2010.

*COSEWIC – Committee on the Status of Endangered Wildlife in Canada

2. Species Status Information

The Eastern Mole has the broadest range of all mole species in North America, and occurs in northern Mexico, throughout most of the eastern and central United States and into extreme southern Canada (Figure 1). Globally, the Eastern Mole is ranked as Least Concern⁴ by the International Union for Conservation of Nature (IUCN) and as Secure⁵ (G5) by NatureServe (NatureServe 2013a). In Canada (Ontario), NatureServe ranks the Eastern Mole as Imperiled⁶ (N2, S2). The percentage of the North American population of the Eastern Mole that occurs in Canada is not known, but based on the species' limited range in Canada it is believed to be less than 1% of the total North American population. In the United States the Eastern Mole is nationally ranked as Secure (N5), while the subnational conservation status is Secure (S5) in 24 states,

⁴ A species is Least Concern when it has been evaluated against the criteria outlined by the IUCN for classifying species at high risk of global extinction, and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant species are included in this category (IUCN 2014).

⁵ Secure (G5/N5/S5): At very low risk of extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.

⁶ Imperiled (G2/N2/S2): At high risk of extirpation in the jurisdiction due to a very restricted range, few populations or occurrences, very steep decline, severe threats, or other factors.

Imperiled (S2) at the edge of its range in the northwest (Colorado, Wyoming) and Vulnerable⁷ (S3) at the edge of its range in West Virginia (Appendix B).

Located near the northern limit of the North American range, the Eastern Mole population in Southern Ontario has a limited distribution (Figure 2) compared to the predominantly Secure populations in the United States. In Canada, the Eastern Mole population was estimated to be between 2,120 and 12,760 individuals in 1997 (COSEWIC 2010). In 2008, the Eastern Mole was not recorded in 6 of the 23 sites across Essex County and the Municipality of Chatham-Kent in Ontario where mole activity was recorded in 1997, a 26% decrease in occurrence. However, due to inconsistencies in search effort and natural population fluctuations for this species, it is difficult to interpret this decrease in occurrence. Approximately one third of suitable habitat (combination of suitable soils and sufficient vegetative cover) for the Eastern Mole in Canada is thought to be found in Point Pelee National Park (PPNP). The species is listed as Special Concern⁸ in Ontario under the Ontario *Endangered Species Act*, 2007 (ESA), and is also listed as Special Concern⁹ in Canada on Schedule 1 of the federal SARA.

3. Species Information

3.1 Species Description

The Eastern Mole is the only mole species in the genus *Scalopus* in the world. Eastern Moles are the size of a large mouse, with a robust body; short, scantily-haired tail; large, broad front feet; and a long, pointed, hairless snout. The mean body length for a female is approximately 154 mm, while males are typically longer with a mean body length of approximately 166 mm (Feldhamer et al. 2013). The colour of the dense fur varies throughout the mole's range from a greyish brown (almost black) in Ontario and the northern parts of its range, to a light golden colour in the southern parts of its range. The northernmost subspecies, *Scalopus a. machrinus*, is found in the northern United States and is the only subspecies found in Canada. The Eastern Mole can be distinguished from other Ontario moles such as the Star-nosed Mole (*Condylura cristata*) by the lack of fleshy appendages on its nose, and from the Hairy-tailed Mole (*Parascalops breweri*) by the absence of hair on the tail.

Eastern Moles have a maximum lifespan of approximately 6 years (Davis and Choate 1993, Hartman and Yates 2003). The approximate age of an individual can be determined based on two traits: size and pelage staining (brown fur spots caused by anal gland secretions). The size of an individual (body mass, total length, and width across the upper canines) is indicative of both sex and age, with males being larger

⁷ Vulnerable (G3/N3/S3): At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.

⁸ A species that lives in the wild in Ontario, is not endangered or threatened, but may become threatened or endangered because of a combination of biological characteristics and identified threats.

⁹ A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.

than females and adults larger than juveniles (Feldhammer et al. 2013). In addition, pelage staining increases with age (Kamm et al. 2008).

The Eastern Mole is difficult to study due to its fossorial¹⁰ lifestyle. One source for occurrence data is the analysis of bones in the scat and pellets of predators. Skull measurements (including the wear of teeth and jaw bones) can be used to identify Eastern Moles and their approximate age (Davis and Choate 1993, Fauteaux et al. 2014, Feldhamer 2013, Hartman and Yates 2003). The Eastern Mole has large broad front feet that create unique claw impressions in the walls of the tunnels it constructs. Casts of underground tunnels can be examined to determine the presence of Eastern Moles (Gobet 2005).

3.2 Population and Distribution

The Eastern Mole has the broadest range of all mole species in North America, and ranges from northern Mexico, through central and eastern United States, to its northernmost extent in southern Canada (Figure 1). In the United States it ranges eastward from Texas, Kansas and the southeastern corner of Wyoming, and in the north its range is bounded by South Dakota, southern Minnesota, Michigan and Massachusetts. In Canada, the species' known extent of occurrence is restricted to a 546 km² area in southern Ontario, specifically three municipalities in Essex County, Ontario (Towns of Essex and Kingsville and the Municipality of Leamington; Figure 2) and the western portion of Romney Township in the Municipality of Chatham-Kent. The Canadian Eastern Mole population in 1997 was estimated to be between 2,120 and 12,760 individuals and is believed to be stable (COSEWIC 2010). Currently, the distribution is based on the known extent of occurrence (546 km²; COSEWIC 2010).

¹⁰ digging or adapted for digging; burrowing.

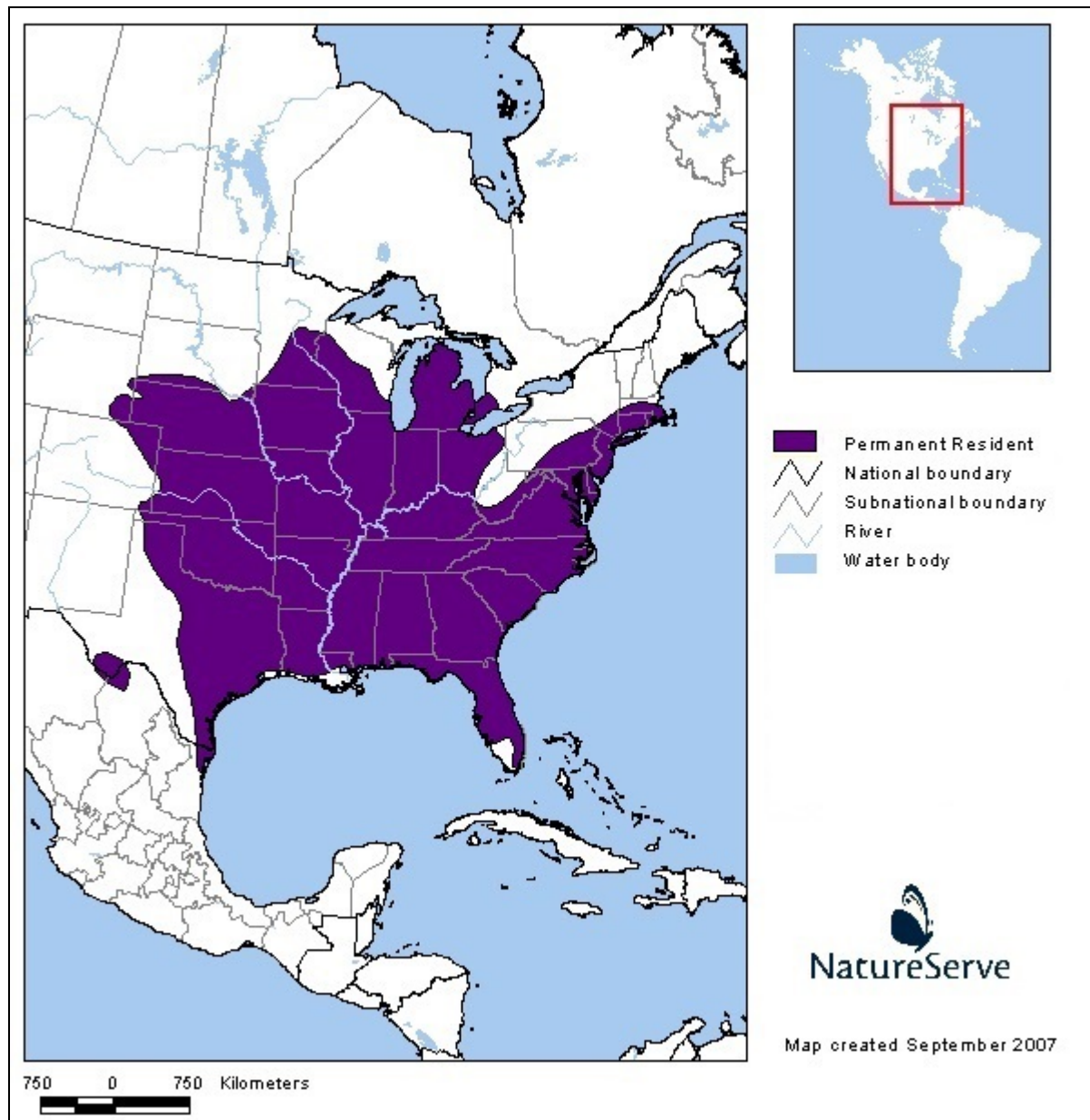


Figure 1. Global distribution of the Eastern Mole (modified from NatureServe 2013a).

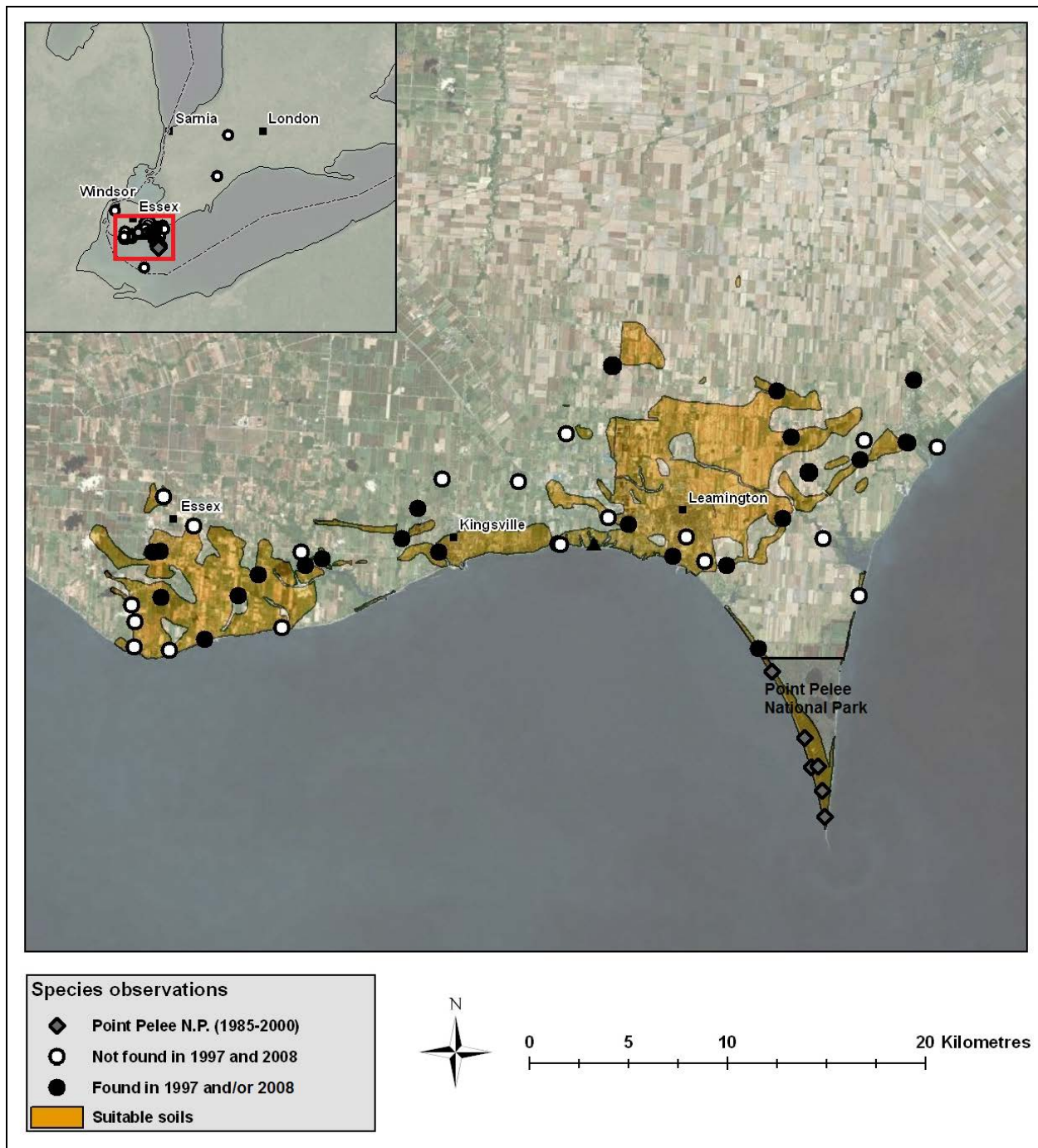


Figure 2. Occurrences of the Eastern Mole in southern Ontario (modified from COSEWIC 2010). The three easternmost species observations (2 black dots; 1 white dot) are within the Municipality of Chatham-Kent. Suitable habitat for the Eastern Mole occurs where there are both suitable soils and sufficient vegetative cover (not shown in Figure 2).

3.3 Needs of the Eastern Mole

3.3.1 Habitat and biological needs

Throughout its range the Eastern Mole occupies a variety of habitats from open woodlands to open fields where the soil is sufficiently soft to allow tunnel construction (COSEWIC 2010). In Ontario, Eastern Moles are most frequently found in loam or sandy loam soils in forested areas, and along wooded or brushy hedgerows, water courses or open drains, where the soil is stone-free, coarse-textured, and generally fast-draining. In open habitat, mole tunnels generally radiate out from the edges of hedgerows or forest up to 3 m into cultivated lands (Waldron et al. 2000). Ritchie and Nocera (2010) described ideal habitat as heterogeneous habitat where both forest cover and open areas were available. Historically, suitable soil types in Ontario were extensively modified by intensive agriculture and residential development, with only a small percentage containing sufficient vegetative cover to provide suitable habitat. Eastern Moles are eight times more likely to occur at sites with loam or sandy loam soils compared to other soil types (Ritchie and Nocera 2010). COSEWIC (2010) identifies the soil types in Essex County and the Municipality of Chatham-Kent in which moles have been found as Berrien sand; Berrien sandy loam; the sandy knolls of Brookston clay sand spot phase and Caistor sand spot phase; Eastport sand; Fox sandy loam; Harrow sand; Harrow sandy loam; Plainfield sand; and Tuscola fine sandy loam.

Eastern Moles are solitary and territorial for most of the year. They excavate two types of tunnels, near surface tunnels which are used for foraging, and deep permanent gallery tunnels. Deep gallery tunnels produce the characteristic molehills, or “pushups” caused by the piling of removed soil during gallery construction (Harvey 1976). Eastern Moles rarely swim, but are capable of swimming across small water features using the front legs to steer and the webbed hind feet to propel themselves (Hanawalt 1922).

Based on studies in the United States, moles feed on a wide variety of invertebrates, including earthworms, larval and adult beetles, ants and vegetable matter (including mycorrhizal fungi; Whitaker and Schmeltz 1973). Captive Eastern Moles have been observed eating frogs, small snakes, and live mice (Hanawalt 1922). Moles rarely drink water directly but may consume plant roots and tubers during dry months in the summer as a source of water (Hanawalt 1922).

Due to their largely subterranean existence, Eastern Moles are usually not susceptible to predation, unless predators enter (e.g., snakes, weasels) or dig up tunnels (canids), or flooding causes moles to come to the surface (where they are vulnerable to raptors, cats and other predators; COSEWIC 2010). Eastern Moles are susceptible to several external parasites such as mites, fleas, and ticks, and internal parasites including several species of intestinal worms (Ford and Duszynski 1988, Hanawalt 1922, Hartman and Yates 2003, Mahunka 1973, Whitaker and Schmeltz 1973). The relationships between the Eastern Moles and its various parasites are not understood (Whitaker and Schmeltz 1973).

The Eastern Mole breeds once a year, with the timing of breeding varying by several months according to geographic location. For example, in Wisconsin the peak breeding season is during the last week in March and first week in April (Conaway 1959), whereas it may be as early as January in southern parts of its range. Following a gestation period of between 28 and 42 days, most young moles are born in late April (Conaway 1959) or early May (Banfield 1974) in the northern part of their range. Litter size ranges between 2-5 young (Hartman and Yates 2003). Once independence is reached (at approximately 6 months of age), young moles disperse from the nest. Eastern Moles may be philopatric¹¹, possibly breed in their first year, and may live to a maximum age of approximately 6 years (Davis and Choate 1993, Hartman and Yates 2003).

3.3.2 Biological Limiting factors

The Ontario population of the Eastern Mole is near the northern limit of the species' continental range, and is likely isolated from populations in the United States due to the Great Lakes and breaks in connectivity of suitable habitat. In Ontario, the Eastern Mole occurs where there is a limited extent of suitable habitat (based on soil type and vegetative cover; Waldron et al. 2000). Suitable habitat patches are frequently small and isolated by intervening unsuitable habitat, and the dispersal capabilities of the Eastern Mole remain unknown (Ritchie and Nocera 2010).

¹¹ An organism with a tendency to stay in, or return to its home area.

4. Threats

4.1 Threat Assessment

Table 1. Threat Assessment Table

Threat	Level of Concern ^a	Extent	Occurrence	Frequency	Severity ^b	Causal Certainty ^c
Habitat Loss or Degradation						
Urban, industrial and intense agricultural development	High	Widespread	Historic/ Current	Recurrent	High	Medium
Road Mortality	Low	Unknown	Current	Continuous	Low	Low
Disturbance or Harm						
Discriminate killing	Low	Unknown	Current	Recurrent	Low	Low
Climate and Natural Disasters						
Flooding	Low	Localized	Current/ Anticipated	Seasonal (spring to fall)	Low	Medium

^a *Level of Concern: signifies that managing the threat is of (high, medium or low) concern for the conservation of the species, consistent with the management objectives. This criterion considers the assessment of all the information in the table.*

^b *Severity: reflects the population-level effect (High: large population-level effect, Moderate, Low, Unknown).*

^c *Causal certainty: reflects the degree of evidence that is known for the threat (High: available evidence strongly links the threat to stresses on population viability, Medium: there is a correlation between the threat and population viability e.g. expert opinion; Low: the threat is assumed or plausible).*

4.2 Description of Threats

Urban, industrial and intense agricultural development

Habitat loss and fragmentation have substantially reduced the habitat available to the Eastern Mole. However, little is known about current threats to the Eastern Mole population. Habitat loss through land conversion may no longer be a significant threat to the Eastern Mole population in the remaining areas where it occurs in Ontario. Forest cover has remained relatively constant in Essex County since 1997, and may even be slowly increasing with reforestation (COSEWIC 2010). However, remaining habitat patches are small and frequently isolated by unsuitable habitat (e.g. roads and open fields) that may constitute a barrier to dispersal, effectively isolating local populations and possibly leading to local extinctions in small populations. Based on the limited distribution of this species, further habitat loss and fragmentation may reduce the dispersal capacity and the likelihood of colonization of unoccupied suitable habitat (COSEWIC 2010).

Eastern Moles will use human-made habitats (e.g. private lawns) as long as sufficient vegetative cover is available. In these habitats they may suffer higher levels of predation

from feral and domestic cats. Although no studies have been conducted on predation of Eastern Moles by feral or domestic cats in Canada, it is very likely that cats do prey on this species. Feral and domestic cats are thought to be the single greatest source of human-caused mortality of small mammals (including native shrew species which are closely related to Moles) in the United States (Loss et al. 2013). The level of predation by domestic pets, and the impact of increased predation levels on population viability are not known.

Road mortality

Roads and trails may also result in direct mortality and declines in population density of Eastern Moles. Despite the largely fossorial lifestyle of the species, a number of Eastern Moles are reported killed on roads by collisions with vehicles in North America each year (Ford and Fahrig 2007, Waldron et al. 2000).

Discriminant killing

Eastern Moles inhabiting developed areas (for example private lawns, golf courses, and baseball diamonds) may be caught and killed in mole traps, although the number of moles killed and the effect on population viability is unknown (COSEWIC 2000).

Flooding

Eastern Moles are affected by fluctuations in the water table and may be displaced by flooded tunnels (Waldron et al. 2000). Displaced moles are at greater risk of predation. In addition, erosion of the western shoreline of Point Pelee National Park (PPNP) may decrease the Eastern Mole population in the park (Waldron et al. 2000). Erosion of the western shoreline of PPNP is a significant threat to coastal ecosystems (Parks Canada Agency, 2010). No studies on effects of erosion on the Eastern Mole have been conducted in the park so the impact of shoreline erosion on the species is not known.

5. Management Objective

The objective of this management plan is to maintain and, where feasible increase, the distribution and abundance of Eastern Mole in Canada, and improve knowledge on demographics, habitat use and threats to the species in Canada.

In Canada, the estimated extent of occurrence for the Eastern Mole is a 546 km² area in southern Ontario (COSEWIC 2010). Although dated, the best abundance information is from 1997 when the Canadian Eastern Mole population was estimated to be between 2,120 and 12,760 individuals (COSEWIC 2010). Historical data on the distribution and abundance of Eastern Mole in Canada is not available, but given the reduction of suitable habitat available to the species as a result of development and agricultural activities, it is likely that the former range was somewhat larger. Accordingly, if there are opportunities to increase the distribution and abundance of Eastern Mole through natural expansion of the species into unoccupied suitable habitats in southern Ontario, these should be pursued. By gaining further knowledge of the Eastern Mole's demographics, habitat use, and threats to the species, conservation efforts can be better targeted to support the conservation of this species.

6. Broad Strategies and Conservation Measures

6.1 Actions Already Completed or Currently Underway

The Eastern Mole was monitored annually in Point Pelee National Park between 1985 and 2000, and again in 2007 and 2008, along 6 transects, each transect was 3 m wide and 500 m long (Michano 1991). Four transects were located in habitats having high habitat value¹² (mature forest), and two were located in habitats with medium value (younger forest successional stages; Sahanatien and Leggo 1989).

Waldron et al. (2000) surveyed 43 sites in Essex County, 3 in Chatham-Kent, 1 in Middlesex County and 1 in Elgin County for Eastern Moles in 1997. These sites represented the locations of all historical records as well as large forest patches occurring on sandy-loam soil types across the known Canadian range of the species. Each site was searched opportunistically during summer and fall for fresh mole signs.

The Ministry of Natural Resources and Forestry studied the distribution, habitat use and dispersal behaviour of Eastern Moles in Ontario in 2008 and 2009. In 2008, Ritchie and Nocera (2010) resurveyed 46 of Waldron's 48 sites, described the distribution of Eastern Moles in relation to loam soils and forest cover and evaluated several techniques to live-trap moles within PPNP. In 2009, soil samples were collected from mole tunnel systems and from paired random locations within PPNP to refine understanding of soil conditions used by moles in surface tunnels. Temperature data were gathered from a subset of the tunnels. Live-trapping efforts resulted in low capture success rates. Hair samples were collected for genetic analysis, and a small portion of one rear claw was clipped from each mole live-trapped or collected as road-kill in 2008 or 2009 for biogeochemical analysis (COSEWIC 2010).

Jalava et al. (2009) summarized actions that have been completed or are ongoing to recover the Carolinian woodland ecosystem, and consequently Eastern Mole habitat. These actions include improved policy and legislation to protect Carolinian woodlands, stewardship activities, restoration of natural heritage systems, tree planting, communication/education/outreach activities and research/inventory/monitoring activities.

As noted in Jalava et al. (2009), land tenure has a direct influence on the kinds of conservation strategies and recovery actions that can realistically be implemented on a landscape. Thirty-three percent of suitable habitat occurs within Point Pelee National Park, while the remaining suitable habitat is located outside of PPNP. Some land outside the National Park is managed by Conservation Authorities, but the majority is privately-owned land (COSEWIC 2010).

Eastern Moles (and their habitat) occurring in Point Pelee National Park are protected by the *Canada National Parks Act*. Populations and habitat occurring on lands managed

¹² Value is relative to the preferred habitat of the Eastern Mole.

by Conservation Authorities are regulated under the *Conservation Authorities Act, 1990*. Private lands may receive a degree of protection from development by being designated in municipal plans as environmentally sensitive areas (ESAs), or being identified as significant habitat under the Ontario Provincial Policy Statement.

The Eastern Mole has been recorded from the Towns of Essex and Kingsville and the Municipalities of Leamington and Chatham-Kent in southwestern Ontario. Eastern Moles were recorded at 25 of the 48 sites in 1997 and at 19 of these sites in 2008 (Waldron et al. 2000, Ritchie and Nocera 2010), a 26% decrease in occurrence. In 2009, moles were found at an additional location in Leamington (G. Waldron, pers. comm.).

6.2 Broad Strategies

To date, no reliable live-trapping protocol has been implemented in Ontario to monitor mole populations and the relationship between mole sightings or activity indices and mole density is unknown. An effective monitoring protocol needs to be developed and annual surveys undertaken.

To complement annual surveys of population abundance, the amount of forested habitat on suitable soils present within the Canadian range of the Eastern Mole needs to be periodically assessed in order to determine trends in habitat availability. Threats to the Eastern Mole population, once fully identified, also need to be periodically monitored. These programs need to be part of a formal inventory and monitoring strategy for the Eastern Mole.

The fossorial lifestyle of the Eastern Mole makes it a difficult species to monitor or manage directly. Research is required to develop an effective live-trapping monitoring program so that important knowledge gaps may be addressed. Consequently, the Eastern Mole population may currently be best maintained through conservation of its habitat. The Carolinian Woodlands Recovery Plan (Jalava et al. 2009) outlines a comprehensive strategy to recover forests and woodlands across the range of the Eastern Mole in Canada.

The broad strategies of this management plan are as follows:

1. Conduct outreach and communicate with stakeholders, Aboriginals, municipalities and landowners to encourage habitat stewardship and reduce threats (e.g., discriminate killing) to the species and its habitat.
2. Develop a monitoring protocol and implement regular monitoring for the Eastern Mole.
3. Encourage research to address biological knowledge gaps relating to this species through inventory, monitoring and other research.

6.3 Conservation Measures

Table 2. Conservation Measures and Implementation Schedule

Conservation Measure	Priority ¹³	Threats or Concerns Addressed	Timeline
1. Conduct outreach and communication with stakeholders, Aboriginals, municipalities, and landowners			
1.1 Encourage Best Management Practices for woodlots that provide suitable habitat for Eastern Moles in their Ontario range. Determine extent of landowner nuisance-trapping for moles and target these landowner groups in measure 1.2.	High	Habitat loss or degradation; discriminate killing	Ongoing
1.2 Promote awareness of the Eastern Mole, Carolinian woodlands, and the identification of new populations.	Medium	Habitat loss or degradation; discriminate killing	Ongoing
1.3 Encourage landowners and land trusts to explore stewardship options and conservation incentives to help conserve Carolinian woodlands.	Medium	Habitat loss or degradation	Ongoing
2. Develop and implement regular monitoring			
2.1 Monitor populations (using monitoring protocol identified in 3.1).	High	All threats; knowledge gaps	2015-2020
2.2 Monitor identified threats.	Medium	All threats	2015-2020
3. Encourage research to address knowledge gaps			
3.1 Encourage research to develop a live-trapping monitoring protocol to collect data to support demographic, genetic, and biological research.	High	All threats; knowledge gaps	2015-2017
3.2 Conduct research on the species and its habitat to improve knowledge of Eastern Mole ecology (including food resources and microhabitat) and threats to the species (including flooding, forest fragmentation, and discriminate killing).	Low	All threats; knowledge gaps	Ongoing

¹³ "Priority" reflects the degree to which the measure contributes directly to the conservation of the species or is an essential precursor to a measure that contributes to the conservation of the species. High priority measures are considered those most likely to have an immediate and/or direct influence on attaining the management objective for the species. Medium priority measures may have a less immediate or less direct influence on reaching the management objective, but are still important for the management of the population. Low priority conservation measures will likely have an indirect or gradual influence on reaching the management objective, but are considered important contributions to the knowledge base and/or public involvement and acceptance of the species.

7. Measuring Progress

Every five years, success of the implementation of this management plan will be measured against the following performance indicators:

- The distribution and abundance of the Eastern Mole in Canada has been maintained, or where feasible, increased.
- Development of a monitoring program for the Eastern Mole in Canada has increased knowledge on the Canadian population's demographics, habitat use, and threats to the species where possible.

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Appendix A: Effects on the Environment and Other Species

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](#)¹⁴. 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 and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or achievement of any of the [Federal Sustainable Development Strategy's](#)¹⁵ (FSDS) goals and targets.

Conservation planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that implementation of management plans may 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 plan itself, but are also summarized below.

This management plan will benefit the environment by promoting the conservation of Eastern Mole habitat. Jalava et al. (2009) list 53 species at risk restricted to woodland habitats or occupying a mosaic of woodland and open habitats in the Carolinian life zone. Activities that conserve the habitat of the Eastern Mole will likely also benefit a number of other species that make use of similar habitats; in particular, other species that inhabit open areas or forests with loam or sandy loam soils across Essex County (Table 3). Woodland-associated species at risk and taxa are expected to directly benefit from actions taken to secure and manage habitat for the Eastern Mole. No forest- or woodland-native species are anticipated to be adversely affected by this management plan.

Table 3. Some of the species at risk that may benefit from conservation of the Eastern Mole and its habitat.

Common Name	Scientific Name	SARA Status
Spoon-leaved moss	<i>Bryoandersonia illecebra</i>	Endangered
Eastern Flowering Dogwood	<i>Cornus florida</i>	Endangered
Purple Twayblade	<i>Liparis liliifolia</i>	Endangered
Five-lined Skink, Carolinian population	<i>Eumeces fasciatus</i>	Endangered
Milksnake	<i>Lampropeltis triangulum</i>	Special Concern
Acadian Flycatcher	<i>Empidonax virescens</i>	Endangered
Cerulean Warbler	<i>Dendroica cerulea</i>	Special Concern

¹⁴ <http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1>

¹⁵ www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1

Appendix B: Subnational Conservation Ranks for the Eastern Mole

Table 4. Subnational Conservation Status Ranks (S-Ranks) for the Eastern Mole (*Scalopus aquaticus*) in Canada (Ontario) and the United States of America (NatureServe 2013a).

Subnational Rank	State/Province
SNR	Florida, Minnesota, Missouri, Ohio, Rhode Island, South Carolina
S2	Colorado, Ontario, Wyoming
S3	West Virginia
S4	Indiana, South Dakota
S4S5	Louisiana
S5	Alabama, Arkansas, Connecticut, Delaware, District of Columbia, Georgia, Illinois, Iowa, Kansas, Kentucky, Maryland, Massachusetts, Michigan, Mississippi, Nebraska, New Jersey, New York, North Carolina, Oklahoma, Pennsylvania, Tennessee, Texas, Virginia, Wisconsin

Rank Definitions (NatureServe 2013b)

SNR: Unranked - National or subnational conservation status not yet assessed.

S2: Imperiled - At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.

S3: Vulnerable - At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.

S4: Apparently Secure - At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.

S5: Secure - At very low risk of extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.