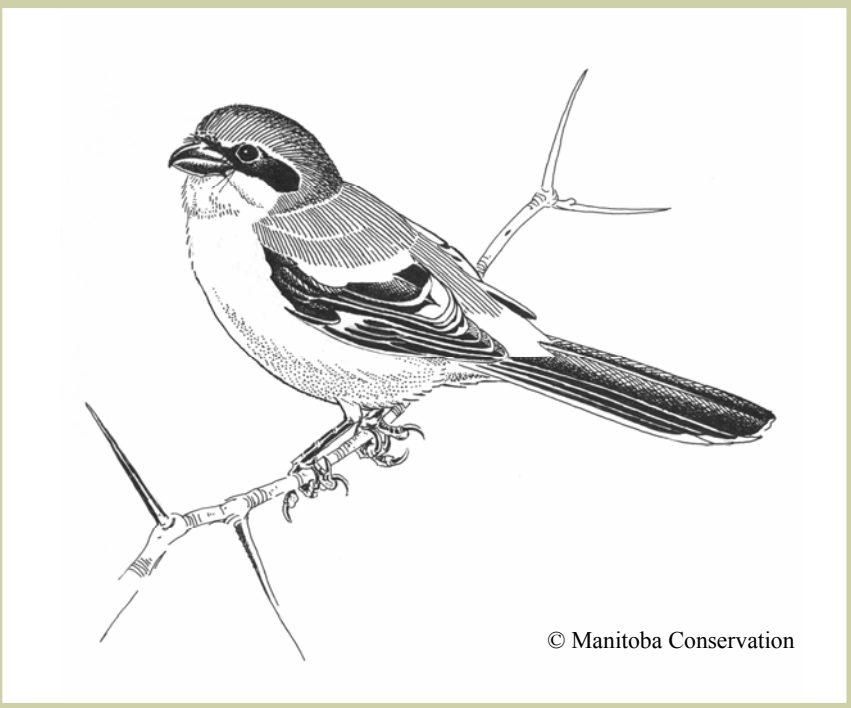
PROPOSED

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Loggerhead Shrike, *migrans* subspecies (*Lanius ludovicianus migrans*), in Canada

Loggerhead Shrike, *migrans* subspecies



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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 (http://www.sararegistry.gc.ca/the_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. 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

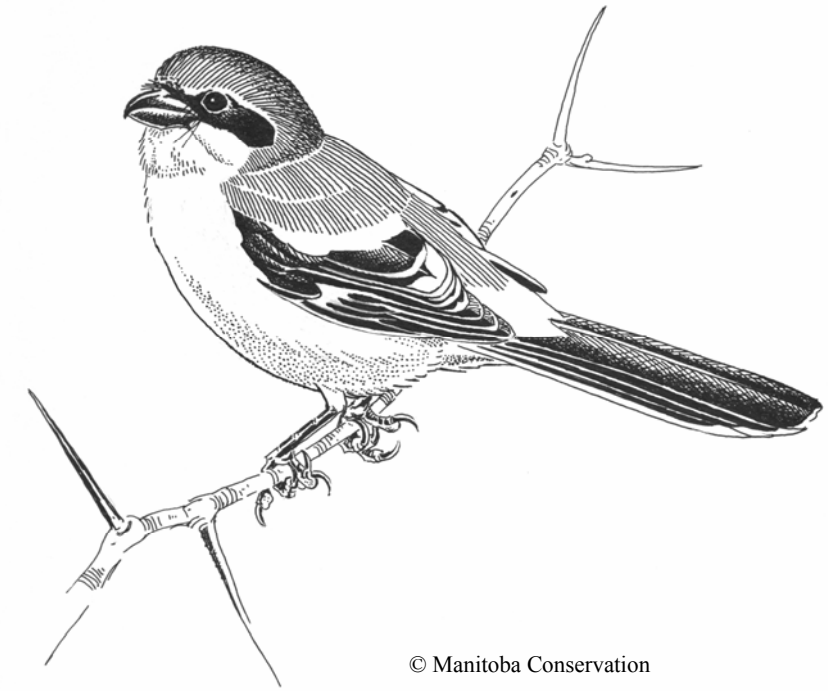
This series presents the recovery strategies prepared or adopted by the federal government under SARA. New documents will be added regularly as species get listed and as strategies are updated.

To learn more

To learn more about the *Species at Risk Act* and recovery initiatives, please consult the SARA Public Registry (http://www.sararegistry.gc.ca/) and the Web site of the Recovery Secretariat (http://www.speciesatrisk.gc.ca/recovery/default_e.cfm).

Recovery Strategy for the Loggerhead Shrike, *migrans* subspecies (*Lanius ludovicianus migrans*) in Canada [Proposed]

November 2006



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Additional copies:

Additional copies can be downloaded from the SARA Public Registry (http://www.sararegistry.gc.ca/).

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Également disponible en français sous le titre
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DECLARATION

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

The goals, objectives and recovery approaches identified in the strategy are based on the best existing knowledge and are subject to modifications resulting from new findings and revised objectives.

This recovery strategy will be the basis for one or more action plans that will provide details on specific recovery measures to be taken to support conservation and recovery of the species. The Minister of the Environment will report on progress within five years.

Success in the recovery 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 strategy and will not be achieved by Environment Canada or any other jurisdiction alone. In the spirit of the *Accord for the Protection of Species at Risk*, the Minister of the Environment invites all responsible jurisdictions and Canadians to join Environment Canada in supporting and implementing this strategy for the benefit of the Eastern Loggerhead Shrike and Canadian society as a whole.

RESPONSIBLE JURISDICTIONS

Canadian Wildlife Service – Prairie and Northern Region, Ontario Region, and Quebec Region
Parks Canada Agency
Province of Manitoba
Province of Ontario
Province of Quebec

AUTHORS

This recovery strategy was prepared by Dr. David Anthony Kirk, Aquila Applied Ecologists (Nature Canada), 85–900 Albert Street, Ottawa, Ontario K1P 6A4; and Dr. Jennie Pearce, Pearce & Associates Ecological Research, 1405 Third Line East, Sault Ste. Marie, Ontario P6A 6J8.

ACKNOWLEDGMENTS

The original national recovery strategy (Johns *et al*. 1994) and two documents prepared by Dr. Murray Smith (The Biodiversity Management Group) and Pierre Laporte, Environment Canada – Quebec Region were used to prepare this current recovery strategy. Many individuals contributed to the development of the document prepared by Dr. Murray Smith: Dr. David Bird (Avian Science and Conservation Centre, McGill University), Robin Bloom (Contract Biologist with Environment Canada), Amy Chabot (Contract Biologist with Environment Canada), Don Cuddy (Ontario Ministry of Natural Resources), Richard Danziger (City of Kawartha Lakes), Ken De Smet (Manitoba Conservation), Andrew Didiuk (Environment Canada – Prairie and Northern Region), Chris Grooms (Contract Biologist with Environment Canada), Pierre Laporte (Environment Canada – Quebec Region), Michel Lepage (ministère des Richesses naturelles et de la Faune du Québec), Dr. Steve Lougheed (Queen's University), Tom Mason (Toronto Zoo), Jon McCracken (Bird Studies Canada), Todd Norris (Ontario Ministry of Natural Resources), Isabelle Ringuet (Environment Canada – Quebec Region), Dr. Laird Shutt (Environment Canada – National Wildlife Research Centre), Peggy Strankman (Canadian Cattlemen's Association), Shaun Thompson (Ontario Ministry of Natural Resources), Robert Wenting (Environment Canada – Ontario Region), and Elaine Williams (Wildlife Preservation Canada). As well, numerous local landowners and action groups have played a significant role in the development and delivery of the shrike program. Thanks are extended to Manitoba Conservation for providing the cover illustration and to Christine Vance (Canadian Wildlife Service – Ontario Region) for preparing the maps. Thanks also go to the official sponsors of the Ontario Breeding Bird Atlas (Bird Studies Canada, Canadian Wildlife Service, Federation of Ontario Naturalists, Ontario Field Ornithologists, and Ontario Ministry of Natural Resources) for supplying atlas data and to the thousands of volunteer participants who gathered the data for the project. Thanks go as well to staff of the Habitat Conservation Section, Canadian Wildlife Service, for their advice and to staff of the Recovery Section, Canadian Wildlife Service, for their advice and efforts in preparing this document for posting.

STRATEGIC ENVIRONMENTAL ASSESSMENT

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 on non-target species or habitats. The results of the SEA are incorporated directly in the strategy itself, but are also summarized below.

This recovery strategy will clearly benefit the environment by promoting the recovery of the Eastern Loggerhead Shrike. The potential for the strategy to inadvertently lead to adverse effects on other species was considered. The SEA concluded that this strategy will clearly benefit the environment and will not entail any significant adverse effects. The reader should refer to the following sections of the document in particular: Ecological role, Recovery goal, Recovery objectives, Approaches recommended to meet recovery objectives, and Effects on other species.

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*" **[SARA Subsection 2(1)]**.

It typically occurs around the time of listing. Residence descriptions, or the rationale for why the residence concept does not apply to a given species, are posted on the SARA public registry: http://www.sararegistry.gc.ca/plans/residence_e.cfm

PREFACE

The Loggerhead Shrike, *migrans* subspecies, also known as the Eastern Loggerhead Shrike, was officially listed as Endangered under the *Species at Risk Act* (SARA) in June 2003. It is also a migratory bird protected under the *Migratory Birds Convention Act, 1994* and is under the management jurisdiction of the federal government. SARA (Section 37) requires the competent minister to prepare recovery strategies for listed extirpated, endangered, or threatened species. The Canadian Wildlife Service (Ontario Region), Environment Canada, led the development of this recovery strategy, in cooperation with the Parks Canada Agency and the provinces of Manitoba and Ontario. All responsible jurisdictions reviewed and approved the strategy. This proposed strategy meets SARA requirements in terms of content and process (Sections 39−41). This recovery strategy is based on two draft recovery strategies, one prepared by Dr. Murray Smith and the other by Pierre Laporte as well as the original national recovery strategy.

EXECUTIVE SUMMARY

The Loggerhead Shrike, *migrans* subspecies (*Lanius ludovicianus migrans*), also known as the Eastern Loggerhead Shrike, is designated as endangered because it occurs in very small and isolated populations and is declining in numbers in Canada. Threats to its populations on both the breeding and wintering ranges include a decrease in habitat availability, quality, and spatial distribution, mortality caused by collisions with cars, and possibly environmental contaminants.

The long-term recovery goal for the Eastern Loggerhead Shrike is to achieve a viable, self-sustained, and broadly distributed population within the current population range in Ontario and Manitoba and to reestablish the species in parts of the historical range, including in Quebec, Ontario, and Manitoba, where appropriate habitat still exists. Population estimates and monitoring of productivity and survival will facilitate population viability analyses and achieving desired population size. Protocols and methodologies for a data management system have been established. A substantial amount of work has also gone into the development of a critical habitat model for the Eastern Loggerhead Shrike.

The reasons for the decline of the Eastern Loggerhead Shrike in North America remain unclear, but the collective presumption is that the decline is habitat-based. Therefore, research activities will continue to focus on habitat related issues throughout the continental range of this endangered subspecies, whenever possible, including (1) habitat degradation and fragmentation, (2) pesticide use and prey availability, (3) diseases and parasitic infestations, (4) collisions with vehicles, (5) predation, and (6) weather and climate change. Habitat mapping in Ontario and Quebec suggests that, over the last 10 years, some suitable habitat has not been used, implying that habitat quantity is not a limiting factor; however, habitat loss in some areas may have caused local extirpation. While some work has been done in Ontario on habitat fragmentation, more quantitative information is needed on the minimum size of grassland patches and their dispersion and connectivity within the landscape throughout the range of the subspecies.

Investigating habitat requirements in wintering areas and the potential impacts of contaminants on the Eastern Loggerhead Shrike will require cooperative arrangements with U.S. and Mexican agencies.

It is believed that recovery of the subspecies is feasible. A captive population of Eastern Loggerhead Shrike and an experimental propagation and release program have been established in Ontario and Quebec. Moreover, DNA work on captive and wild birds was initiated and is ongoing.

Critical habitat will be identified in separate action plans for Manitoba, Ontario, and Quebec, with appropriate public consultation. It is expected that critical habitat will be identified by 2008 in each of the three provinces.. Options for effective protection of identified critical habitat will be explored in 2007–2009. Information, education, and conservation and stewardship agreements will be the focus for the protection of Eastern Loggerhead Shrike critical habitat in Canada.

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SPECIES INFORMATION

Date of Assessment: November 2000

Common Name (population): Loggerhead Shrike *migrans* subspecies

Scientific Name: *Lanius ludovicianus migrans*

Assessment Summary

COSEWIC Status: Endangered

Reason for Designation: This species occurs in very small and declining numbers in Canada. It is facing a number of threats on both its breeding and wintering ranges, including: decrease in habitat availability, quality, and spatial distribution; mortality caused by collisions with cars; and possible effects of environmental contaminants.

Canadian Occurrence: MB, ON, QC

COSEWIC Status History: The species was considered a single unit and designated Threatened in April 1986. Split according to subspecies in April 1991. The *migrans* subspecies was designated Endangered in April 1991. Status re-examined and confirmed in November 2000. Last assessment based on an update status report.

1. BACKGROUND

1.1 Description

Eastern Loggerhead Shrikes are medium-sized black, white, and grey birds with hawk-like bills and habits. Their upper parts are dark grey, with mostly black wings and tail, and their underparts are whitish. The species has a characteristic black facial mask, which extends through the eyes across the lower forehead. Light greyish-brown bars occur on the breast and sides of juvenile Eastern Loggerhead Shrikes, and they have a less prominent black facial mask.

Eastern Loggerhead Shrikes are slightly smaller than Northern Shrikes (*Lanius excubitor*), with which they are sometimes confused. However, Northern Shrikes occur within the range of Eastern Loggerhead Shrikes only during migration and in the winter in the United States. Eastern Loggerhead Shrikes are very similar in appearance to Prairie Loggerhead Shrikes (*Lanius lanius excubitorides*), which occur from southwestern Manitoba to Alberta.

Although Eastern Loggerhead Shrikes winter in the southern United States, areas of particular importance to migrants are unknown at this time.

The Loggerhead Shrike is one of only two species of shrike that have colonized North America. Like corvids, they are unique among North American passerines, in that they are predators of other vertebrates (small mammals, birds, frogs). A typical characteristic is their habit of impaling

prey on thorny branches or barbed wire to secure it while they tear the flesh apart with their hooked beaks.

1.2 Populations and distribution

The range of the Eastern Loggerhead Shrike is believed to have expanded in eastern North America after forest clearance and creation of pastures by European settlers (Yosef 1996). It is thought that the range once extended east from Manitoba to New Brunswick and south to northeastern Texas, western North Carolina, and Maryland (Environment Canada 2006). However, since the 1960s, there has been a steady decline in shrike numbers in the northeastern United States and Canada. The last breeding record for New England was reported in 1978 and for the Maritime provinces in 1972 (Laughlin and Kibbe 1985; Erskine 1992; Yosef 1996).

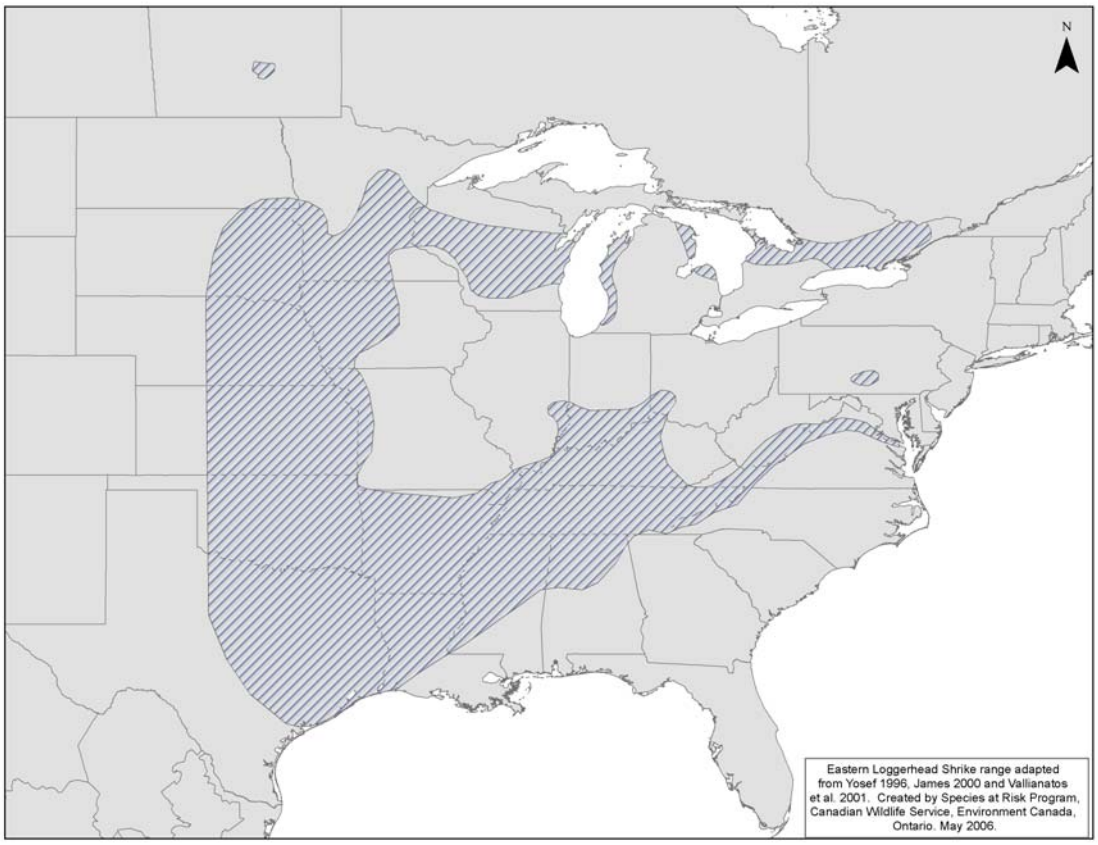

Figure 1: Breeding Range of Eastern Loggerhead Shrike in North America

The Eastern Loggerhead Shrike occurs in eastern Canada and central and eastern United States (Figure 1), and its global rank is G4T3Q (apparently secure - uncommon but not rare). Throughout the range, its conservation designations vary:

- In Canada:
  -It is listed as S1 (critically imperilled) in Manitoba and Quebec.
  - It is listed as S2B (imperilled) in Ontario (6–20 occurrences).
  - It is listed as SNR (not breeding) in New Brunswick, Nova Scotia, and Prince Edward Island.
- In the United States:
  - It is listed as S1 (critically imperilled) in Michigan, New Jersey (S1B, S1N), New York (S1B), Pennsylvania (S1B), Virginia (S1B, S2N), and West Virginia (S1B, S2N).
  - It is listed as S2 (imperilled) in Oklahoma and Texas (S2B).
  - It is listed as S3(vulnerable to extirpation) in Tennessee, Arkansas (S3B, S3N), and Iowa (S3B, S3N).
  - It is listed as SNR (not breeding) in Georgia, Illinois, Minnesota, Missouri, Nebraska, Ohio, Rhode Island, and South Carolina.
  - Historically, the subspecies bred (SHB) in Maine, New Hampshire, and Vermont; it has been extirpated (SX) from Massachusetts, Connecticut, and the District of Columbia (NatureServe 2006).

The southern distribution of the subspecies has remained unchanged, but the bird is rarely observed in most of the central and northern regions of its former range. In Canada, the Eastern Loggerhead Shrike now occurs mainly in Ontario and southeastern Manitoba and is essentially isolated during the breeding season from the larger populations occurring in the south-central United States (Figure 2). Excluding birds in captivity, the wild population in Canada is believed to number fewer than 100 individuals. Eastern Loggerhead Shrikes in Ontario are found in the Carden Plain (14 pairs in 2004 and 2005) and Napanee area (12 pairs in 2004, 11 pairs in 2005). Although some pairs occur in other areas (e.g., Smiths Falls, Manitoulin Island, Grey and Bruce Counties), no other significant numbers have been found since 2000.

During the first Ontario Breeding Bird Atlas (1981–1985), Eastern Loggerhead Shrikes were recorded in 145 of the 1824 squares surveyed (8%) (Cadman *et al*. 1987). Of these records, 60 were possible (41%), 28 were probable (19%), and 57 were confirmed (39%). In the second atlas (2000–2005), the subspecies was recorded in only 29 squares (Birds Ontario 2006). Fourteen of these squares had records from both the first and second atlases, whereas 15 squares had records only from the second atlas.

In 2005, five breeding pairs were found in Manitoba; however, one female was killed by a car before laying eggs (C. Lindgren, pers. comm.). There were no breeding pairs in Quebec, although a single individual was located in 2003 (L. Robillard, pers. comm.). The subspecies was last recorded as nesting in the Maritimes in 1972, and the last recorded nest in Quebec was found in 1995. During the Atlas of Breeding Birds of Southern Quebec (1984–1989), nesting Eastern Loggerhead Shrikes were recorded in 7 of the 2464 squares surveyed (Gauthier and Aubry 1995).

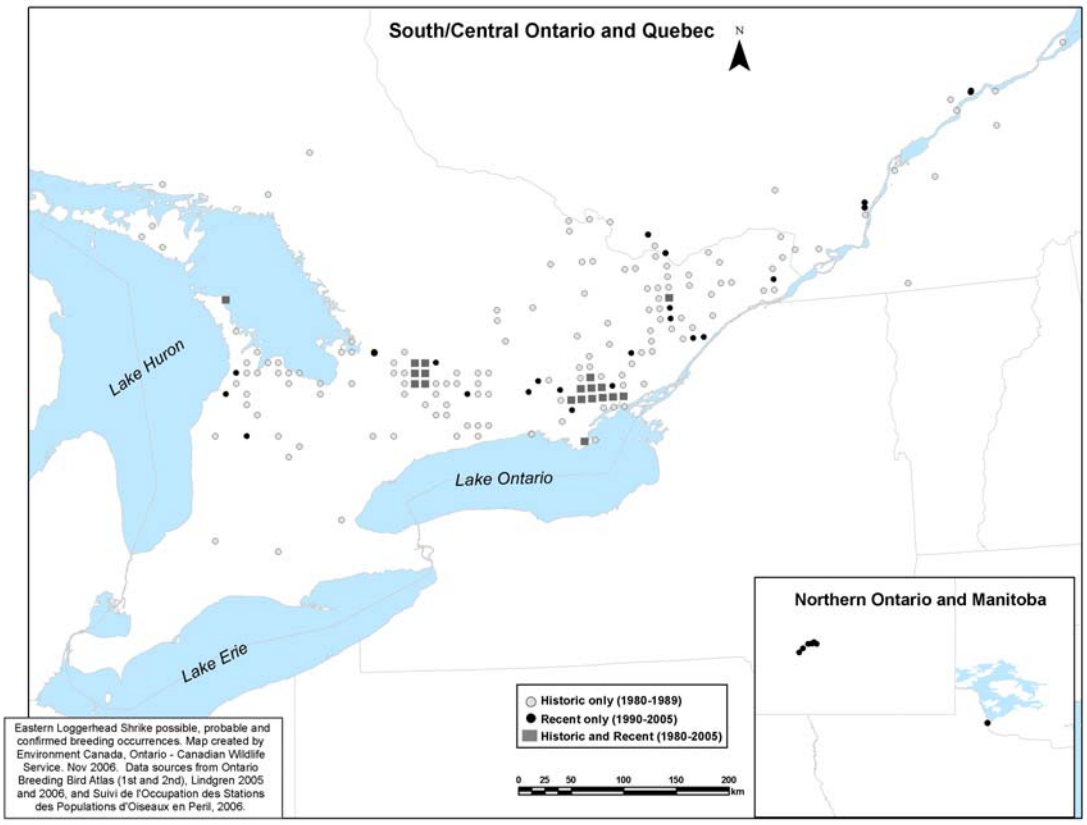

Figure 2: Breeding Range of Eastern Loggerhead Shrike in Canada

Note: The grid-like appearance of occurrences is a result of adapting many of the data from the Ontario Breeding Bird Atlas. OBBA = Ontario Breeding Bird Atlas; EMRAG = Eastern Manitoba Loggerhead Shrike Recovery Action Group; SOS POP = Suivi de l'Occupation des Stations des Populations d'Oiseaux en Péril.

The long-term trend information for the Eastern Loggerhead Shrike comes from the Breeding Bird Survey (Canadian Wildlife Service 2006). Since the beginning of the survey in Canada (1968) to 2004, the overall trend was negative but not statistically significant (−23.1 based on 21 routes) for Bird Conservation Region 13 (the Lower Great Lakes and St. Lawrence Plains, south of the St. Lawrence Seaway in Ontario and Quebec up to around Quebec City). The reason that this trend estimate is probably not significant is that there were relatively few routes and the number of individual shrikes counted on routes was very low.

1.3 Needs of the Eastern Loggerhead Shrike

1.3.1 Habitat and biological needs

Loggerhead Shrikes are associated with open grassland habitats with scattered trees and shrubs in both breeding and wintering seasons (Pruitt 2000). The Eastern Loggerhead Shrike forages in or along the edges of pastures, hayfields, parking lots, idle areas, ditches, yards, or other areas where food items occur. Large invertebrates are a major component of the diet, and shrikes are the only small/medium-sized North American songbird to feed on small mice, voles, smaller birds, snakes, and other small vertebrates. Breeding territories usually contain 1) a tree or shrub harbouring the nest; 2) elevated perches (both natural, such as tree branches, and artificial, such as power lines or fence posts) for hunting, mating systems, and territory advertisement; 3) foraging areas (generally, open shortgrass areas with scattered shrubs or perches and some bare ground); and 4) impaling sites (dense, multi-stemmed and/or thorny shrubs or barbed wire fences) (Chabot 2002a,b, pers. comm.; Bloom 2003a,b; Bloom and Darwin 2003).

Suitable habitat is created and maintained by a balance between successional processes that create habitat structure (i.e., perch and nest trees) and disturbances, such as periodic grassland fires, cattle grazing, or even mowing, that prevent encroachment of woody vegetation (Bloom 2003a,b).

Some differences exist in the types of habitat used for nesting in the three provinces. In Manitoba (near Winnipeg), most pairs reside in suburban acreages where a mixture of mowed yards or parks, small pastures, idle grassy areas, and roadside ditches all occur within close proximity. More than half of the known nests in that province occur in ornamental spruce trees (K. De Smet, pers. comm.).

It has been suggested that shrikes tend to nest in eastern red cedar (*Juniperus virginiana*) on the Napanee Plain in Ontario, but a recent study indicates that tree species were used in proportion to their availability (Chabot *et al*. 2001). On the Carden Plain area in Ontario, shrikes generally nest in hawthorn (sp.).

In Quebec, where the breeding population is extirpated, historic data show that hawthorn was largely preferred as nesting habitat (Robert and Laporte 1991).

Little is known of habitat conditions along migration routes and in the wintering areas. However, current genetic and stable isotope research on the subspecies throughout its continental range is expected to provide a much clearer understanding of the dynamics among the remaining widely separated populations, their mating systems, and distribution patterns during annual breeding and non-breeding intervals (A. Chabot, pers comm.; Hobson and Wassenaar 2001).

1.3.2 Ecological role

The Eastern Loggerhead Shrike is a predator of insects and small vertebrates in grassland ecosystems and is thus an integral part of ecosystem function. It is not known what role the Canadian population plays in contributing to the viability of the continental population. Recruitment rates between the Canadian and American populations are not known.

1.3.3 Limiting factors

It is likely that a combination of limiting factors, acting cumulatively, could be affecting populations. Eastern Loggerhead Shrikes begin breeding in their first spring, and productivity and survival up to the time of independence and recruitment into the breeding population both appear to be within the normal range of variation for the subspecies. Therefore, these demographic factors do not appear to be limiting the population. Mortality rates of adults in both the breeding and wintering areas may be an important limiting factor but are currently unknown.

1.4 Threats

While it is clear that Eastern Loggerhead Shrike has declined in many parts of its range, little is known about the precise cause of this decline. Pruitt (2000) lists a variety of possible causes for the decline in Loggerhead Shrikes, several of which are relevant to the eastern subspecies including: habitat loss and deterioration (on the breeding and wintering areas), increased pesticide use, decreased prey availability, diseases and parasites, collisions with vehicles, wet spring weather, and climate and warming trends that could affect vegetation and predation.

1.4.1 Habitat loss and degradation

Widespread European colonization of eastern North America in the 1800s and 1900s was associated with forest clearance and the establishment of short grassland, creating habitat for the Loggerhead Shrike. It is probable that the Eastern Loggerhead Shrike occurred in prairie and alvar grasslands in southern and central Ontario and in prairie grassland in Manitoba that were more extensive prior to European settlement.]

Throughout its range, habitat for the Eastern Loggerhead Shrike has been lost or has deteriorated in quality. During the last century, land use changes have converted former native grasslands and human-made pastures, particularly on more productive soils, to cropland (Johns *et al*. 1994; Pruitt 2000). Grasslands have been ploughed up, and small farm fields previously separated by windbreaks and hedgerows have been amalgamated to form large fields (Laporte and Robert 1995). No noticeable reversal of this downward trend in habitat has occurred. Housing developments, aggregate extraction and hydro/gas corridors also have the potential to destroy grassland habitat. Another factor is vegetation succession, as without management or grazing, pastures may be invaded by shrubs and trees and this is known to be happening in parts of rural southern Ontario.

Recent declines in Eastern Loggerhead Shrike populations in Canada appear to be greater than would be expected based on the extent and rate of habitat loss. However, habitat quality may also have deteriorated and is likely to continue to do so in areas where the pasture cattle industry is in decline. Habitat mapping in Ontario and Quebec (Jobin 2003) suggests that over the last 10 years, some suitable habitat has not been used, implying that habitat quantity is not a limiting factor. However, habitat loss in some areas (e.g., Smiths Falls Plain, Ontario, and Le Gardeur, Quebec) does appear to account for the local extirpation of the subspecies there. More local-scale analysis of remaining habitat in terms of prey availability and predation risk could identify key factors in these declines. Continental declines in grassland bird species as a group have largely

been attributed to fragmentation effects, including small patch size and isolation and subsequently increased predation rates in small grassland fragments (Herkert *et al*. 2003). Likewise, habitat for the Eastern Loggerhead Shrike has also become drastically fragmented, with decreased grassland patch size, increased isolation of patches, and thus decreased connectedness.

For example, much of the current shrike habitat in Ontario occurs in flat or gently rolling limestone plains, which are isolated patches within a heavily cultivated landscape (COSEWIC 2000). While some work has been done in Ontario on habitat fragmentation (Chabot 1994; Cuddy and Leviton 1996), more quantitative information is needed on the minimum size of grassland patches and their dispersion and connectivity within the landscape throughout the range of the subspecies (R. Bloom, pers. comm.). What is currently known suggests that shrikes are quite versatile and the size of grassland patches used varies substantially, depending on landscape configuration. For example, the subspecies breeds in highly fragmented suburban habitat near Winnipeg, but also uses large expanses of rural grassland.

1.4.2 Pesticides and prey availability

The role played by pesticides and other contaminants in population declines of the Eastern Loggerhead Shrike is unclear (Yosef 1996). It has been suggested that the advent of organochlorine pesticides coincided with shrike declines. However, a recent comparison of pesticide residues in Loggerhead Shrike eggs collected in 1971–1972 and 1995–1996 suggests that although levels were 79% less in 1995–1996, shrikes have nevertheless continued to decline (Herkert 2004). In contrast, most populations of raptor species impacted by organochlorine pesticides have rebounded (see Kirk and Hyslop 1998 for summary).

Since the banning of organochlorine pesticides, increased use has been made of acetylcholinesterase-inhibiting compounds, such as carbamates and organophosphates; these may have lethal and sublethal effects (Mineau *et al*. 1999). Sublethal effects include impaired motor coordination and judgment (Mineau *et al*. 1999), and these can increase susceptibility to predation, especially in migrating birds. An analysis of Breeding Bird Survey data in the Prairie provinces found a significant negative relationship between trends of five bird species in relation to the spatial intensity of granular insecticide use (Mineau *et al*. 2005). Loggerhead Shrikes have been killed by certain formulations of carbofuran; this substance is now banned in Canada (Mineau *et al*. 2005). Unfortunately, spatially explicit information on pesticide use, as collected in other jurisdictions (e.g., California), is not available in Canada (Mineau *et al*. 2005), which limits any assessment of the impact of pesticides on the Eastern Loggerhead Shrike.

The most likely candidate wintering areas for Eastern Loggerhead Shrikes in the southeastern United States are locations where prey species (e.g., fire ants *Solenopsis invicta*; mole crickets *Neocurtilla hexadactyla* or *Scapteriscus* spp.; and invertebrate orchard pests) may be exposed to substantial levels of pesticides as part of control programs (P. Mineau, pers. comm.). Among these are diazinon and its derivative diazoxon, both of which are highly toxic to birds (U.S. EPA 2000).

Given the propensity of shrikes to forage along roads, there has been concern over the use of the compound Dombind as a dust suppressant. Dombind may have an adverse effect on shrikes

because it apparently increases the density of invertebrates along roads and may therefore attract shrikes, especially when applied along roads within their territories. Furthermore, Dombind contains chemicals such as dioxins, furans, and other contaminants that could have a negative effect on shrikes (Bird Studies Canada 2006).

Both insecticides and herbicides may have indirect effects on prey availability and habitat structure. Declines of some farmland bird species in Europe have been attributed to pesticide effects on prey availability (e.g., Gray Partridge *Perdix perdix*; Potts 1997). Some herbicides have toxic effects on invertebrates, but it is their indirect effects that are believed to be most important (Freemark and Boutin 1995). In Europe, more diverse assemblages of native plant species are found in hedgerows adjacent to fields managed with few or no chemical inputs than in those adjacent to fields that are sprayed with agrochemicals (Kleijn and Snoeijing 1997). By reducing vertical structural complexity of vegetation, herbicides have a detrimental effect on abundance and species diversity of invertebrates (e.g., Baines *et al*. 1998; Moreby and Southway 1999). These findings suggest that herbicides could potentially have an indirect effect on Eastern Loggerhead Shrikes by affecting prey availability. Similarly, fertilizers may have an indirect effect on food availability (Yosef and Deyrup 1998).

1.4.3 Disease and parasitic infestations

In 2001, several captive Eastern Loggerhead Shrikes died at the Toronto Zoo from an apparent infestation by an esophageal nematode (*Capillaria* sp.) that has also been found in wild birds. In 2002, five captive birds at the Toronto Zoo died and were confirmed to have had West Nile virus. Another bird also at the zoo died, having West Nile virus. It is not clear whether the birds deaths were due to the virus or whether they are mere more susceptible to it due to stress. The impact of these diseases on wild populations is unknown. While susceptibility to West Nile virus has also been reported by the U.S. Centers for Disease Control and Prevention and may prove to be an important limiting factor, it does not account for past declines. In some years, severe nest mite infestations in some wild populations may have caused substantial abandonment of nests and chicks (R. Wenting, pers. comm.).

1.4.4 Collisions with vehicles

Shrikes have a propensity to forage along roadsides, because roads have an abundance of essential habitat features, and both lookout perches and nest trees are often better represented along roadsides than elsewhere. Shrikes may be attracted to invertebrates found on the warm pavement of roads. Because of the way they swoop down upon prey, they are susceptible to fatal collisions with vehicles (T. Norris, pers. obs.). Shrikes were often found near roads on the breeding grounds in Ontario, suggesting that this could also be a significant factor contributing to mortality on the wintering grounds (COSEWIC 2000). In Virginia, 29% of all winter mortality has been attributed to automobile collisions (Blumton 1989). In eastern Manitoba, numerous young and occasionally adult Eastern Loggerhead Shrikes have been killed by vehicles (K. De Smet, pers. comm.).

1.4.5 Weather and climate change

For many years, extreme local weather conditions have resulted in nest failure (e.g., nest abandonment or loss of young birds during cold wet breeding seasons, especially with heavy rains; Pruitt 2000; K. De Smet, A. Chabot, and C. Grooms, pers. comm.). It is predicted that climate change will have a significant effect on ecosystems within the range of the Eastern Loggerhead Shrike as well as other species (U.S. EPA 1997; Twilley *et al*. 2001; Union of Concerned Scientists 2006). Determining which climate variables are associated with the distribution of grassland species and how the species respond to the climate changes will permit predictions to be made as to how global climatic change will influence species' distributions (J. Price, pers. comm.).

1.4.6 Predation

Susceptibility of shrikes to predation from a variety of species, including cats, raccoons, crows, magpies, and several raptors (Blumton 1989; Wiggins 2004), has been observed, but its significance has not been evaluated due to a lack of quantitative analysis. In Ontario, there is evidence of predation of shrike nest contents by corvids (R. Wenting, pers. comm.). Nest predators are generally more common near edges in some landscapes (Dijak and Thompson 2000; Winter *et al*. 2000), and several studies have demonstrated that nest predation rates are reduced in large prairie fragments (Herkert *et al*. 2003). Pruitt (2000) suggested that shrikes in linear habitats are more susceptible to predation than those nesting in non-linear habitats, as a variety of predators use linear corridors as conduits (Lane 1989; DeGeus 1990).

1.5 Actions already completed or under way

Environment Canada has partnered with a number of government and non-government organizations to support recovery efforts. This has included population monitoring, habitat mapping, stewardship for habitat protection, management of the captive population and experimental releases, and communication. The main organizations involved include (in Ontario) Wildlife Preservation Canada, the Canadian Cattlemen's Association, and the Toronto Zoo; (in Manitoba) Manitoba Conservation and Manitoba Cattle Producers Association; and (in Quebec) the Nature Conservancy, McGill University, and the Club des ornithologues de l'Outaouais.

Habitat assessment work is nearing completion in Ontario and Quebec and has been initiated in Manitoba. Habitat information is being used, in conjunction with occurrence information, to investigate habitat suitability and habitat availability and to identify potential critical habitat. Criteria for identifying habitat for the subspecies include "emerging" (habitat that could be occupied in the near future), "optimal," and "restorable." Some of this information (i.e., nest locations and breeding habitat) has been incorporated into municipal planning processes. Working relationships have been established with farm organizations, local citizens, and affected landowners. As well, education packages, videos, news releases, and public service announcements have been developed and distributed.

A breeding program using Ontario birds was developed with several breeding facilities: the Toronto Zoo, McGill University, Sainte-Anne-de-Bellevue, and Ingersol. In 2000 two adult females were released into the wild in Ontario. Since 2001, young birds have been released through the field propagation and release program — 110 birds between 2001 and 2005, and 111

in 2006. No birds were released in 2003 because of breeding failure attributed to West Nile virus vaccinations. A breeding program was also established in Quebec. Seven young were released in 2004, and five young and two adults in 2005 (P. Laporte, pers. comm.). In 2006, 18 young were released (Gérard Desjardins, comm. pers.). Confirmation that captive-bred birds can survive, migrate successfully and fledge young came in both 2005 and 2006, when two different captive raised females released the previous year were discovered nesting on the Carden Plain in Ontario.

Throughout the continental range of the Eastern Loggerhead Shrike, DNA testing of wild and captive birds has been undertaken to identify the genetic makeup of the birds. An intensive program to band wild birds was started, and analysis of the wild population, based on identified bands on birds returning in subsequent years, was initiated. A Canadian/U.S. consulting group was established, and a strategy for cooperative recovery efforts was initiated.

1.6 Knowledge gaps

In order to halt the continuing decline of the Eastern Loggerhead Shrike, additional information is required regarding habitat use and potential limiting factors:

1. Quantity and quality of prey for Eastern Loggerhead Shrikes must be evaluated to assist in design of habitat stewardship approaches.

2. The potential impacts of West Nile virus and other diseases on Eastern Loggerhead Shrike populations must be investigated throughout the North American range.

3. Productivity and return rates should be monitored following years of warm, dry midsummer climatic conditions so they can be compared with productivity and return rates following years with occasional wet, cool midsummer weather conditions. This will provide an assessment of the relative importance of weather conditions to population change and insights into how habitat may be enhanced to limit this impact.

4. The importance of predation upon Eastern Loggerhead Shrikes requires investigation, to allow effective design of habitat stewardship.

5. DNA sampling of captive and wild populations must be continued to complete the genetic profile for the subspecies throughout its continental range, to determine genetic management units, to identify the wintering range, and to assist with appropriate reintroductions.

6. A cooperative program with U.S. partners to identify potential limiting factors on the migration and wintering areas, such as intraspecific and interspecific competition, is required.

7. Information is needed on methods to increase productivity in captive birds for release purposes, and research should be carried out on all aspects of associated husbandry and interactions with wild populations.

The results of this research will immediately be used to advance on going and planned recovery actions.

2. RECOVERY

2.1 Rationale for recovery feasibility

The recovery of the Eastern Loggerhead Shrike population is believed to be feasible. The reproductive potential of the remaining populations suggests that increases to population growth and abundance are possible. Genetic research currently under way suggests that recruitment of individuals from widely separated populations does occur.

There is an expectation that the threats to the subspecies or its habitat can be avoided or mitigated through recovery actions. Knowledge gaps have been identified and research is needed to identify solutions. Results from research will be used adaptively to improve stewardship activities and other recovery actions.

There appears to be sufficient suitable habitat available to support the species in Canada, and more could be made available through grassland habitat management or restoration. Maintenance of what is currently understood to be suitable habitat is essential to provide breeding habitat while potential limiting factors on the migration and wintering areas are addressed. Techniques for protection and management of grassland habitat are available and effective. Protecting and managing critical habitat (once identified) where the species currently occurs, and for increased populations arising from recovery actions, will be necessary. It will also be important to ensure that there is a positive and constructive environment for community participation in habitat stewardship.

A captive breeding and release program has been developed and may be a necessary recovery action to augment existing populations in Ontario and Manitoba and to establish a viable population in Quebec.

Restoring the Canadian populations to their former numbers or range in Canada is unlikely. Recovery goals can be achieved only with the full cooperation and participation of regions of the United States where the subspecies is found. A significant challenge will be securing sufficient community support for a single-species recovery effort.

2.2 Recovery goals

The long-term recovery goal for the Eastern Loggerhead Shrike is to achieve a viable,[1] self-sustained, and broadly distributed population within 20 years in the current population range in Ontario and Manitoba and to re-establish the species in parts of the historical range, including in Quebec, Ontario, and Manitoba, where suitable habitat still exists.

The short-term goal is to halt the decline of the extant populations of the subspecies in Manitoba and Ontario within five years.

[1] A viable population has a less than 5% probability of becoming extinct within the next 100 years.

2.3 Recovery objectives

The following objectives will be implemented within five years:

1. Conduct monitoring to estimate population size, productivity, and survival and to perform population viability analysis.

2. Identify and protect, maintain, and enhance critical habitat.

3. Maintain the captive population, and deliver release programs as necessary

4. Address knowledge gaps through research where results are immediately used for the design of appropriate stewardship and recovery actions.

5. Locate wintering areas and, if possible, migration routes, and investigate potential limiting factors in collaboration with appropriate U.S. jurisdictions.

6. Establish at least one recovery action group in each province.

2.3.1 Rationale for goals and objectives

The relative importance of various demographic factors affecting the population across its range remains unknown. Therefore, this recovery strategy focuses on identifying and protecting sufficient habitat; delivering a captive propagation and release program to augment existing populations, to reestablish populations, to maintain genetic diversity, and to help resolve knowledge gaps; and determining the significance of the probable causes of decline. A broadly distributed population is essential for long-term viability, providing resistance to such things as stochastic events and loss of genetic diversity. The causes of the population's decline will be determined where possible through current and future research, as outlined in Section 1.6 (Knowledge gaps) and Table 1.

2.4 Approaches recommended to meet recovery objectives

Broad approaches and strategies recommended to meet the recovery objectives for the Eastern Loggerhead Shrike in Canada are briefly outlined in Table 1, together with general steps and outcomes.

Table 1. Recovery planning table for Eastern Loggerhead Shrike in Canada

Priority	Obj.	Broad approach/ strategy	Threat	General steps	Outcomes
High	1	Population and productivity monitoring	N/A	Monitor population size, distribution, and productivity throughout the Canadian range on a yearly basis. Use monitoring data to develop statistical models for estimation of population size, productivity, and survival and for population viability analysis.	Statistical models for estimation of population size, productivity, and survival and for population viability analysis developed.
High	5	Applied research	Habitat loss and degradation	Use methods such as banding, stable isotopes, and genetics to locate birds on their wintering areas and, if possible, migration routes.	Location of wintering areas and, if possible, migration routes.
Medium	5	Applied research	Habitat loss and degradation	Assess potential habitat loss and intraspecific and interspecific competition in wintering areas.	Potential habitat loss and intraspecific and interspecific competition in wintering areas assessed.
Medium	4, 5	Applied research	Pesticides and prey availability, disease and parasitic infestations, collisions with vehicles, weather and climate change, predation	Assess prey availability and effects of pesticide use on prey. Assess significance of mortality along roads. Assess effects of local and continental weather on shrike survival and productivity. Assess impact of diseases such as West Nile virus on captive and wild birds. Assess importance of predation as a limiting factor.	Knowledge of the importance of predation as a limiting factor and of the impacts of prey availability, use of pesticides, road mortality, local and continental weather, and diseases such as West Nile virus on the population.
High	2	Habitat protection	Habitat loss and degradation	Identify “critical habitat” at multiple scales. Secure required critical habitat.	Identification and protection of critical habitat.
Medium	2	Habitat protection	Habitat loss and	Refine habitat management techniques and deliver to	Enhanced habitat stewardship.

Priority	Obj.	Broad approach/ strategy	Threat	General steps	Outcomes
			degradation	maintain and restore habitat (e.g., rehabilitation of quarries to create and enhance shrike habitat).	
High	3	Captive breeding	N/A	Consult with affected stakeholders on potential release sites prior to releases to provide opportunity for identification and mitigation of potential socioeconomic impacts and other concerns. Evaluate potential and need for use of release programs to augment wild populations and, if necessary, determine genetic profiles for individuals in captive and wild populations. Determine locations for release activities for captive birds. Improve management of the captive population to maximize breeding success and releases.	Establishment and augmentation of wild populations and maintenance of genetic diversity.
High	6	Communication and stewardship	All	Develop training materials to raise recovery participants' awareness. Promote cooperative agreements and other voluntary measures to protect critical habitat. Ensure that land use agreements and stewardship are implemented for critical habitat and residence protection. Engage relevant U.S. authorities regarding threats associated with migration and overwintering.	At least one recovery action group developed in each province.

2.4.1 Narrative to support recovery planning table

The approach for recovery focuses on protection and enhancement of suitable breeding habitat with concurrent studies addressing potential threats on the breeding grounds. Population monitoring will provide important information for habitat protection and studies of potential threats. There will also be concurrent studies to identify the wintering areas and determine if low survival in these areas is a primary cause of population declines. Captive breeding and release programs, possible tools to augment wild populations, may be necessary and will require an examination of the benefits and costs of this approach for recovery. Recovery in Canada will require the viability of early successional grasslands, which will depend upon effective partnerships with habitat stewards. Recovery may also benefit from participation in multispecies or landscape approaches for species at risk recovery.

2.5 Critical habitat

2.5.1 Identification of the species' critical habitat (proposed)

The *Species at Risk Act* requires the identification of the habitat that is necessary for the survival or recovery of the subspecies in Canada. Critical habitat for the Eastern Loggerhead Shrike will be identified in action plans to be prepared for Manitoba, Ontario, and Quebec.

A habitat model has been developed and will be applied range-wide to predict patterns of patch occupancy given known dispersal behaviour, influences of site fidelity, and the expectation that distribution is a highly stochastic process (Bloom 2003a). Shrikes will occasionally use previously unoccupied areas, as a small proportion of individuals are known to disperse from established populations.

The identification of critical habitat will target areas with both a high concentration of suitable habitat and a high level of predicted occupancy for a recovered population. In order to be viable, tracts of critical habitat need to be subject to processes that ensure the long-term maintenance of the structure of these habitats (e.g., grazing).

Owing to variability in habitat characteristics across the range of this subspecies, recovery will have to be based on the specific characteristics of the ecological regions that these geographically isolated populations occupy. Efforts will be directed towards the protection of the most valuable habitats, with anticipation of expansion of the population through recovery action, including reintroduction.

Effective stewardship of identified critical habitat will focus on community-based participation in integrated ecosystem management and population recovery.

The modelling and mapping of potential critical habitat in Ontario have been undertaken. However, ground-truthing of assembled data is not complete, and additional cooperation with potential stakeholders is required. Similar work has been completed in Quebec; however, some updating and field testing are required. In Manitoba, data collection has been completed, but modelling, field testing, and further cooperation are required.

2.5.2 Schedule of studies

Recommended activities to identify critical habitat, which will be identified using approaches developed for Ontario and will be designated within action plans to be prepared for Quebec, Ontario, and Manitoba, are outlined in Table 2.

Table 2. Schedule of studies

Description of research activity	Outcome rationale	Timeline
Manitoba – Conduct habitat modelling and mapping	Identify potential habitat to guide identification of critical habitat and assess population size and distribution	2006–2007
Manitoba – Targeted surveys using results of habitat modelling	Determine population distribution and abundance and validate habitat modelling	2007–2008
Manitoba – Analyses of habitat and population data	Use population and habitat information to develop recovery population goals, identify critical habitat required for recovery population goals	2007–2008
Ontario – Complete field studies for identification of critical habitat	Verify critical habitat through field testing, identify critical habitat required for recovery population goals	2006–2008
Quebec – Update habitat mapping and complete field testing for identification of critical habitat	Complete mapping of critical habitat, verify critical habitat through field testing, identify critical habitat required for recovery population goals	2006–2008

2.6 Performance measures

The goals and objectives and the strategies to attain them provide a number of benchmarks, which will be used to measure the success and progress of the recovery efforts over the next five years (Table 3). These will be augmented in the regional action plans.

Table 3. Performance measures

Recovery objective	Performance measures	Broad approach
Conduct monitoring to estimate population size, productivity, and survival and to perform population viability analysis.	Population and distribution goals established for each province. Population viability analysis guides development of goals.	Population and productivity monitoring
Identify and protect, maintain, and enhance critical habitat.	Critical habitat identified and effectively protected to meet recovery population goals.	Habitat protection
Maintain the captive population, and deliver release programs as necessary.	Number of birds released, and success of recruitment to breeding population.	Captive breeding

Recovery objective	Performance measures	Broad approach
Address knowledge gaps through research where results are immediately used for the design of appropriate stewardship and recovery actions.	Number of studies initiated to address the seven knowledge gaps.	Applied research
Locate wintering areas and, if possible, migration routes, and investigate potential limiting factors in collaboration with appropriate U.S. jurisdictions.	Identification of wintering areas, initiation of studies to determine limiting factors on wintering areas, development of conservation partnerships.	Applied research, communication, and stewardship
Establish at least one recovery action group in each province.	At least one recovery action group established in each province.	Communication and stewardship

2.7 Effects on other species

In the last decade, greater and more geographically extensive declines have occurred in the grassland bird guild than for any other group of North American species (Dunn *et al*. 2000; Sauer *et al*. 2005). Relatively little is known about the specific causes of the declines for most species. For some, however, a clear link has been demonstrated between declining hay and pasture area and population trends (e.g., Bobolink *Dolichonyx oryzivorus*; Bollinger 1992) and between native grassland patch size and population trends (e.g., Sprague's Pipit *Anthus spragueii*; Davis 2004).

As the factors contributing to the decline of shrike populations become better understood and programs are implemented to mitigate these threats, the results can be shared with those who work on other grassland species, particularly insectivorous species. The new knowledge can be shared and incorporated into the management strategies for all affected species, leading to the development of integrated management plans for certain open space ecosystems (see Davis *et al*. 2004).

2.8 Statement of when one or more action plans will be completed

The preparation of individual recovery action plans will be led by the Canadian Wildlife Service in Ontario and Quebec. Manitoba Conservation will lead development in Manitoba with support from the Canadian Wildlife Service. Identification of critical habitat is needed to achieve the establishment of a viable breeding population of the subspecies and is an important component of these actions plans; progress in identifying critical habitat varies among the three provinces. In order to ensure consistency among the three action plans for identification and protection of critical habitat, to account for the varying stages of completion of identification of candidates for critical habitat, and owing to the importance of effective consultation, the three action plans will be completed by June 2009. For some recovery activities, the national recovery team will provide a consistent approach to be incorporated in the three provincial action plans (e.g., applied research).

It is anticipated that recovery action groups will initiate other recovery activities recommended by their provincial action plan while in a draft stage as the critical habitat component is being completed.

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4. CONTACTS

4.1 Responsible jurisdictions

Canadian Wildlife Service – Prairie and Northern Region, Ontario Region, and Quebec Region
Parks Canada Agency
Province of Manitoba
Province of Ontario
Province of Quebec

4.2 Recovery team members

Ken Tuininga (Chair)
Senior Species at Risk Biologist
Canadian Wildlife Service – Ontario Region
4905 Dufferin Street
Toronto, Ontario M3H 5T4
Telephone: (416) 739-5895
Email: Ken.Tuininga@ec.gc.ca

Ken De Smet, Manitoba Conservation, Winnipeg, Manitoba
Andrew Didiuk, Canadian Wildlife Service – Prairie and Northern Region
Todd Norris, Ontario Ministry of Natural Resources, Kingston, Ontario
Luc Robillard, Canadian Wildlife Service – Quebec Region

4.3 Personal communications

R. Bloom, Canadian Wildlife Service – Prairie and Northern Region, Environment Canada.

A. Chabot, private consultant, Ph.D. candidate, University of Guelph

K. De Smet, Species at Risk Biologist, Manitoba Conservation

C. Grooms, Contract Biologist with Environment Canada

P. Laporte, Senior Biologiste, Service canadien de la faune – Région du Québec, Environnement Canada

C. Lindgren, Ducks Unlimited, Oak Hammock, Manitoba

P. Mineau, Head, Pesticides Section, National Wildlife Research Centre, Canadian Wildlife Service, Environment Canada

T. Norris, Ontario Ministry of Natural Resources

J. Price, Director of Climate Change Impact Studies, American Bird Conservancy

L. Robillard, Service canadien de la faune – Région du Québec, Environnement Canada

R. Wenting, Environment Canada, Ontario Region