

HABITAT USE AND ABUNDANCE OF THE COMMON GARTER SNAKE, *THAMNOPHIS*
SIRTALIS, AT THE NORTHERN LIMIT OF ITS RANGE IN MANITOBA

BY

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A Thesis submitted to the Faculty of Graduate Studies of
The University of Manitoba
in partial fulfilment of the requirements of the degree of

MASTER OF SCIENCE

Department of Environment and Geography
University of Manitoba
Winnipeg

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ABSTRACT

The common garter snake (*Thamnophis sirtalis*) is a wide-ranging species that reaches the northern limit of its range in central Manitoba. Although *Thamnophis sirtalis* (and especially the subspecies *parietalis*) has been the subject of intense biological research, there are large gaps of knowledge regarding the ecology of this species in extreme northern latitudes. A recently discovered northern hibernaculum in the boreal forest region near Jenpeg, Manitoba, provided an ideal opportunity for comparing the ecology and biology of this species with geographically distant populations. The climate at Jenpeg is sub-arctic continental and consists of cold winters, and cool short summers. The area lies on the Canadian Shield, and is characterized by surface outcrops of granitic bedrock. Garter snakes were found colonizing artificial habitat features for winter habitat including dikes and rock quarries. Research on the ecology of this species was conducted from May 2005 to May 2007. Snakes emerged in late April and early May. Activity at the den lasted approximately two weeks before snakes dispersed for the summer. Mark-recapture results from 2005 indicate that this population is small (~ 79 individuals ± 10.6) and exhibits a wide variation in adult sizes (350-1340 mm total length). Radio telemetry and funnel trapping have shown that summer habitat use is concentrated around wetlands, with wood frogs (*Lithobates sylvatica*) constituting the most common food source (56%). Many snakes dispersed over distances exceeding two kilometres, despite the apparent abundance of prey species near the den site. Analysis of colour patterns revealed substantial variation in the skin folds between the lateral scales. The majority of snakes expressed no red colouration on the lateral scales (45%), while some individuals expressed rare examples of bright red colouration (erythristism) (6%) and dark colouration (melanism) (1%). Traditional local knowledge gathered from aboriginal hunters, fishers and trappers outlined the long-term presence of garter snakes in the region, and

provided local distribution data for the species. Aboriginal peoples stated that the overall population density of snakes in the region was low, and provided additional support for the findings of large variation in body sizes and colour. It is hypothesized that relative reproductive isolation and a prolonged overwintering period are factors contributing to the uniqueness of this northern population. Information from this study will benefit our understanding of garter snake biology and provide valuable information to assist the conservation efforts of wildlife and landscape managers in the region.

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CHAPTER 1

INTRODUCTION

1.1 COMMON GARTER SNAKE ECOLOGY

1.1.1 DESCRIPTION

Common garter snakes (*Thamnophis sirtalis*) are a long and slender snake species (Figure 1.1). They express a wide array of dorsal colour patterns in various parts of their range, which has allowed for the recognition of eleven geographically defined subspecies (Rossman et al. 1996). Dorsal rows reach a maximum of 19 rows, with a lateral stripe usually found on the second and third scale row. Adult females attain sexual maturity at 504 mm snout-vent length, while males have attained sexual maturity at 387 mm (Fitch 1965). Females can grow larger than males and can attain a maximum total length of 1372 mm (Froom 1972). Mating typically occurs in spring, immediately after emergence from a communal hibernaculum. Fall mating has also been recorded. Young are born live (ovoviviparous), in a litter generally ranging in size from 10-15. Neonate snout vent lengths (SVL) range from 154.4 mm in Manitoba to 201.3 mm in British Columbia (Rossman et al. 1996). Female reproduction varies annually from 23.5% to 88.0% (Whittier and Crews 1990), with evidence that females in northern latitudes do not reproduce annually (Larsen et al. 1993). Survival rates are highly variable for this species, with survival largely dependent on predation pressure, food availability, and overwintering conditions (Rossman et al. 1996).

Common garter snakes are able to withstand very cold temperatures. Body temperatures as low as 0.5°C have been recorded in Wood Buffalo National Park, Alberta (Larsen and Gregory 1988). This tolerance of cold temperatures may help explain the ability of this species to survive northern latitudes (Preston 1982).

In the northern part of their range, the common garter snake commonly overwinters in communal dens. The population sizes of these hibernacula vary, but in the Interlake of Manitoba can often reach population sizes of thousands of individuals. These sites have been well documented by many researchers (Gregory 1974, 1977; Gregory and Stewart 1975) and provide valuable locations for zoological research.

1.1.2 TAXONOMY

Thirty species of garter snakes have been identified in the literature with the common garter snake (*Thamnophis sirtalis*), being the best studied (Rossman et al. 1996). The common garter snake has the most variable dorsal colour pattern of all species within its genus and, as a result, has a long and varied taxonomic history, with the recognition of numerous subspecies (Rossman et al. 1996). A large number of researchers have evaluated geographically consistent morphological forms (Cope 1900, Ruthven 1908, Fitch 1941) and eleven subspecies continue to be generally recognized based on colour (Rossman et al. 1996). Manitoba falls within the range of the red-sided garter snake (*Thamnophis sirtalis parietalis*), which is generally identified by red colouration on the dorsolateral area. Eastern garter snakes (*Thamnophis sirtalis sirtalis*) are known to interbreed with red-sided garter snakes in south-eastern Manitoba (Preston 1982), and may interbreed across northern Manitoba and north-western Ontario. However, based on recent genetic studies, the validity of *Thamnophis sirtalis* subspecies has been questioned, and its continued use is now uncertain. (Rye 2000, Janzen et al. 2002).

1.1.3 DISTRIBUTION

1.1.3.1 NORTH AMERICA

Garter snakes (*Thamnophis sp.*) are the most widespread and abundant snakes in North America (Rossman et al. 1996). Their extensive range stretches from northern Canada to the southern tip of Mexico. The common garter snake occurs across much of the United States and southern Canada (Figure 1.2). It is noticeably absent from a large portion on the American southwest, and the Canadian prairies. Common garter snakes are known to exist in high alpine environments in areas such as Banff National Park, AB. A northern disjunct population occurs in the region around Wood Buffalo National Park in northern Alberta and the Northwest Territories. The factors limiting the distribution of this species in Canada, has only received attention from one other study (Larsen 1986). The distribution and population dynamics of the common garter snake in northern Ontario and Quebec has not been studied. The relative abundance of this species makes it an ideal model for understanding how reptiles survive in northern latitudes. Endangered reptile species such as the Northern Prairie Skink (*Eumeces septentrionalis*) or Eastern Massasauga Rattlesnake (*Sistrurus catenatus*) are difficult to study at the northern edge of their range, so basic biogeographical information from other northern reptile species can help aid in the understanding of their basic biology.

1.1.3.2 MANITOBA

In Manitoba, the common garter snake is found across the southern portion of the province. It is common to abundant everywhere except in the south-western Manitoba, where it becomes rare, and the Western Plains Garter Snake (*Thamnophis radix haydeni*) is more prevalent. To the North, the distribution of the common garter snake is poorly known, but it is found discontinuously from Flin Flon in the west, to Gods Lake in the east (Preston 1982).

Unconfirmed reports also exist of garter snake sightings in the lower stretches of the Churchill River near the community of Churchill (Shelford and Twomey 1941, P. Harms pers. comm.). Common garter snakes could have started invading Manitoba as far back as 10,000 years ago. The retreat of the last Pleistocene glacier allowed squamate reptiles to colonize northern environments as quickly as the glacier receded. As recently as 9,900 years ago Michigan had its complete reptile fauna (Holman 2000). During the climatic optimum that occurred 8,000 years ago, common garter snakes may have reached their northern limit in Manitoba. Distribution of common garter snakes in Manitoba since then may be a response to available habitat and conditions.

1.2 RESEARCH BACKGROUND AND OBJECTIVES

1.2.1 ORGANIZATION OF THE THESIS

This thesis is organized in a series of six journal-article style chapters. It is tied together with three common chapters, including an introduction, study area description, and conclusion with management recommendations. A literature review of each topic is imbedded in the introduction of each chapter.

1.2.2 CONTEXT

Extreme latitudes and climates create survival challenges for all life forms. Some of the most vulnerable organisms are ectotherms, which must rely on external energy sources for body heat. Life history traits of many species are known to vary over their geographic ranges, and studies from extreme locations provide valuable insight into survival and reproductive strategies.

Although *Thamnophis sirtalis* (and especially the subspecies *parietalis*) has been the subject of intense biological research, there are large gaps of knowledge regarding the ecology of this species at the northern limit of its range. Many studies have been published from southern Manitoba, including the large hibernacula sites near Narcisse and Inwood, but there is no information from near the known northern limit of distribution for the species. Some researchers have suggested that concentrated research of these atypically large aggregations might be biasing our understanding of *Thamnophis* biology (Shine et al. 2001). Therefore, it is important to expand our research efforts into other regions where wildlife conservation is a concern and basic ecological questions remain unanswered.

This study examines the ecology of a population of garter snakes near Jenpeg, Manitoba (54°30 N, 98°03 W). Information from this study will benefit the conservation efforts of

landscape and wildlife managers, including Manitoba Conservation and Manitoba Hydro. Five major questions are directed to understanding the issues surrounding these newly documented snake dens. These questions function as research objectives for this study.

1.2.3 OBJECTIVES

The goal of this study is to determine the habitat use and abundance of common garter snakes near the known limit of their range in Manitoba. Specifically, the objectives were to:

1. Collect basic life-history information on growth, foraging ecology, and colouration of common garter snakes in northern Manitoba;
2. Determine the population size of a northern denning site over multiple seasons;
3. Determine habitat use, dispersal directions, migration distances, and identify important landscape features;
4. Consult with local peoples, including First Nations, on their traditional and local knowledge of common garter snakes in the region;
5. Develop management recommendations for common garter snakes in northern Manitoba.

1.2.4 CONTRIBUTION TO SCIENCE

This study will address three important questions contributing to the understanding of common garter snakes ecology:

1.2.4.1 HABITAT USAGE

What types of habitat are used by common garter snakes in Manitoba? Current information indicates that wetlands with high abundance of prey items represent ideal habitat for common garter snakes in Manitoba. This study will verify these findings and identify specific habitat features used in extreme latitudes. It will also attempt to learn about movement patterns and the proximity between summer and winter habitat.

1.2.4.2 LIFE-HISTORY CHARACTERISTICS

This study will provide baseline information on life-history characteristics and habitat use over two active seasons. These findings will allow for comparisons with geographically distant populations and provide information on limiting factors in northern latitudes.

1.2.4.3 MANAGEMENT

This research will help determine how garter snakes survive in extreme latitudes in Manitoba, and provide information for wildlife management planning. Landscape managers such as Manitoba Hydro and Manitoba Conservation will be better prepared to preserve and conserve other hibernacula that may be discovered in northern Manitoba. Garter snakes may also serve as important representative species for interpretation in northern Provincial and National parks.

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