An Assessment of Commercial and Recreational Management Options for the Red-Sided Garter Snake in Manitoba

By

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A Practicum Submitted in Partial Fulfillment
of the Requirements for the Degree
Master of Natural Resources Management

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ABSTRACT

The Red-sided garter snake (*Thamnophis sirtalis parietalis*) exhibited observed declines in isolated populations of the Interlake region of Manitoba prior to 1989. Concerns over the utilization and management of the Red-sided garter snakes prompted a Moratorium on the commercial harvest of Red-sided garter snakes. Research was initiated to determine alternative management techniques to optimize the social and financial requirements of user groups, while maintaining healthy sustainable snake populations. User groups, interest groups and individuals were asked to comment on future proposed management scenarios.

Personal interviews and formal questionnaires were carried out to determine attitudes of interested parties on the future management direction of red-sided garter snakes in Manitoba. An assessment of financial requirements was also carried out to estimate the possible revenues and expenditures of management alternatives. Information was collected on the potential biological impact of management alternatives on the natural populations and denning areas. Results were compiled for the management alternatives on the harvest and were ranked according to the social, financial and biological strengths and weaknesses.

It was determined that at the present time the Moratorium on the harvest of Red-sided garter snakes should be continued and that further research on the biological impact of commercial harvesting is warranted in the event of attitudes towards a harvest change. The majority of individuals and interests groups surveyed supported the development of recreational uses over commercial harvesting. Recommendations were to continue to develop and improve local ventures oriented towards the recreational viewing of the Red-sided garter snake in Manitoba, and continue the moratorium on commercial harvesting until further research on sustainable harvesting techniques can be obtained.

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DEFINITIONS

The following is a list of terms, and definitions, that are used throughout the body of this paper. The definitions apply in all cases except where otherwise stated.

Interlake Area:

The Interlake area is defined as the area located between Lake Winnipeg on the east and Lakes Manitoba, Winnipegosis and Cedar on the west. The Interlake extends south to the Assiniboine River directly south of Lake Manitoba's eastern shoreline and along the northern boundary of metropolitan Winnipeg. The northern boundary follows the 36th township line at approximately 52^0 10' N Latitude. This area contains the highest concentration of red-sided garter snakes and their habitat in Manitoba. The Interlake area is also the area where the majority of collecting for commercial purposes has occurred in the past.

Snake Den:

Snake dens are defined as the spaces or areas in which snakes overwinter. Dens are often referred to as hibernacula. Manitoba's snake hibernacula vary in size, parent material, use and in numbers using them. Dens occur in gravel piles, bed-rock cracks, garbage dumps, stone fences, decayed tree roots, mines, wells, river banks, mammal holes, human graves, old basements, and artesian wells, as well as the more favourable and traditional limestone sinks and crevices.

Commercial Use:

Commercial use is defined as any activity involving the red-sided garter snake that results in direct or indirect financial gain to individuals or groups. An example is the collection and sale of red-sided garter snakes to various customers in the United States and Europe.

Collecting/Picking/Harvesting:

Collecting, picking or harvesting of snakes is defined as the act of actively capturing snakes at or near snake dens during the fall. This may involve the use of mechanical devices such as crowbars or simply an individual using his/her hands to scoop the snakes up.

Harvest Season:

Harvest season is defined as the period of time within which snakes are legally allowed by the Province of Manitoba to be harvested. The most recent harvest season consisted of two weeks in the fall of 1988. Where referring to a possible future harvest season any specific differences in the prior definition will be stated.

Snake Pickers:

Snake pickers are defined as individuals or groups of individuals who have legally obtained an individual or family license from the Province of Manitoba allowing them to harvest red-sided garter snakes during the harvest season. In the past most snake pickers were residents of the Interlake area, the majority being First Nations peoples.

Biological Supply House:

A biological supply house is defined as a facility that holds, breeds, processes and sells various biological specimens of live and preserved nature, including red-sided garter snakes.

Snake Buyers:

Snake buyers are defined as individuals who purchase snakes from pickers in order to sell the snakes to various customers in the United States and the World. A snake buyer may be a local resident of an area where snakes are picked or from somewhere else. Snake buyers must obtain export licenses if they are planning on selling the snake outside Manitoba, Canada.

Snake Dealers:

Snake dealers are defined as individuals who purchase snakes from snake buyers or snake pickers directly. All dealers are foreign and reside in the United States. These dealers are the major sellers of red-sided garter snakes on the world market and they have extensive clientele lists. Dealers usually do not deal in the sale of snakes alone and often sell a number of other animals on the world market.

Pet Trade:

The pet trade is defined as that part of the commercial sale of snakes that purchases, distributes, and sells red-sided garter snakes from Manitoba as pets. The pet trade usually consists of snake dealers developing market through pet stores for the sale of snakes. The pet trade for red-sided garter snakes has developed in Canada, the Untied States, Japan, and much of Europe.

Recreational Use:

Recreational use is defined as those activities involving recreation and the red-sided garter snakes. Such uses may or may not result in the generation of revenue. However, such revenue is considered to be non-priced under present conditions in Manitoba. Revenues occur through indirect activities that are associated with recreation and snakes. An example of a recreational use is viewing the snakes and their dens at Narcisse, Manitoba. Such uses can be considered consumptive or non-consumptive depending on the activity and the management measures undertaken.

Appropriate Management Strategy:

Appropriate management strategies are defined as those strategies that allow optimal sustainable uses of snakes for Manitobans. These uses must be biologically sound, socially acceptable, and where appropriate, economically viable.

Snake:

The red-sided garter snake (Thamnophis sirtalis parietalis) is described as 1016 mm (40 inches) snout to vent in length, occasionally larger. At mid-body there are 19 dorsal scale rows and the dorsal scales are keeled; the anal plate is single. The dorsum is black with a yellow mid-dorsal stripe and a yellow lateral stripe on the second and third scale rows. Along the side there are usually a series of red blotches. The top of the head is black and the side yellow (Fig.1). Unless otherwise stated the word "snake" will be used to represent red-sided garter snake.

The Department of Natural Resources:

Unless otherwise stated "DNR"will be used throughout the text to represent the Department of Natural Resources .The Department Natural Resources is defined as the provincial government body that is responsible for the conservation and management of wildlife, which includes snakes, in Manitoba. The management of snakes is carried out by the wildlife branch within the Department of Natural Resources.

CHAPTER 1

Background Information and Issues:

1.1 Unique Biological Qualities

The red-side garter snake (*Thamnophis sirtalis parietalis*) is found farther north than any other reptile in the Western Hemisphere (Fig. 1). It ranges into Western Canada, where the winter temperature can be as low as -40 degrees Celsius and the snow cover continuous from late September through May (Crews and Garstka, 1982), (Fig. 2). In terms of numbers and distribution, it is the most successful reptile existing under the extreme climatic conditions (bordering on subarctic) of central Canada. At these latitudes, extreme seasonal changes in the environment undoubtedly represent a major evolutionary force moulding the characteristics of the population (Aleksiuk and Gregory, 1974). Such evolutionary adaptations include bearing their young live (most reptiles lay eggs), physiological changes in blood (their blood becomes as thick as mayonnaise), and using communal denning areas to overwinter (Crews and Garstka, 1982; Gregory, 1974; Koonz, 1991; Macmillan, 1987; Scott, 1976). Den sites are limited to where snakes are able to find access below the frost line yet still above the water table. Such den sites may include tree roots, shale cliffs, rock piles, sewers, building foundations, animal burrows, rock outcrops, and sinkholes.

One of the more unique and spectacular adaptations of these snakes occurs at large denning areas in limestone sinkholes. Large sinkhole networks in the Interlake region of Manitoba allow for as many as 10,000 snakes to accumulate and den in one particular place. This unique adaptation has resulted in a world wide appreciation and interest in the animals. The red-sided garter snakes of Manitoba's Interlake are considered to be the worlds' largest concentration of reptiles (Macmillan, 1987). These snakes have attracted attention in Manitoba for many years. It was fashionable in the 1880s to picnic at a large snake den near Stony Mountain. Other Manitoba communities (Inwood, Skownan, and Crane River) happened to be built near or over major snake denning areas. Such a

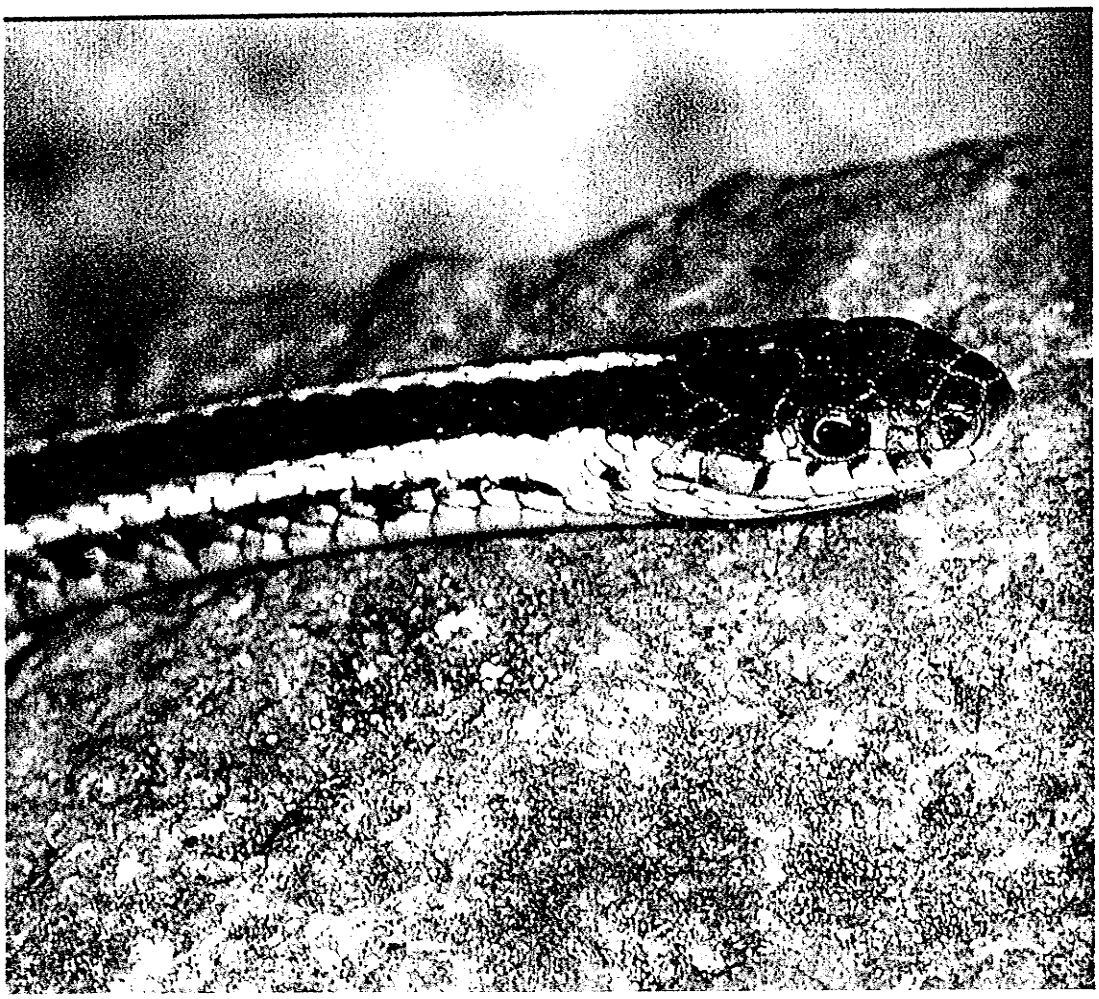

Figure 1: The red-sided garter snake (*Thamnophis sirtalis parietalis*).Source: (Preston, 1982).

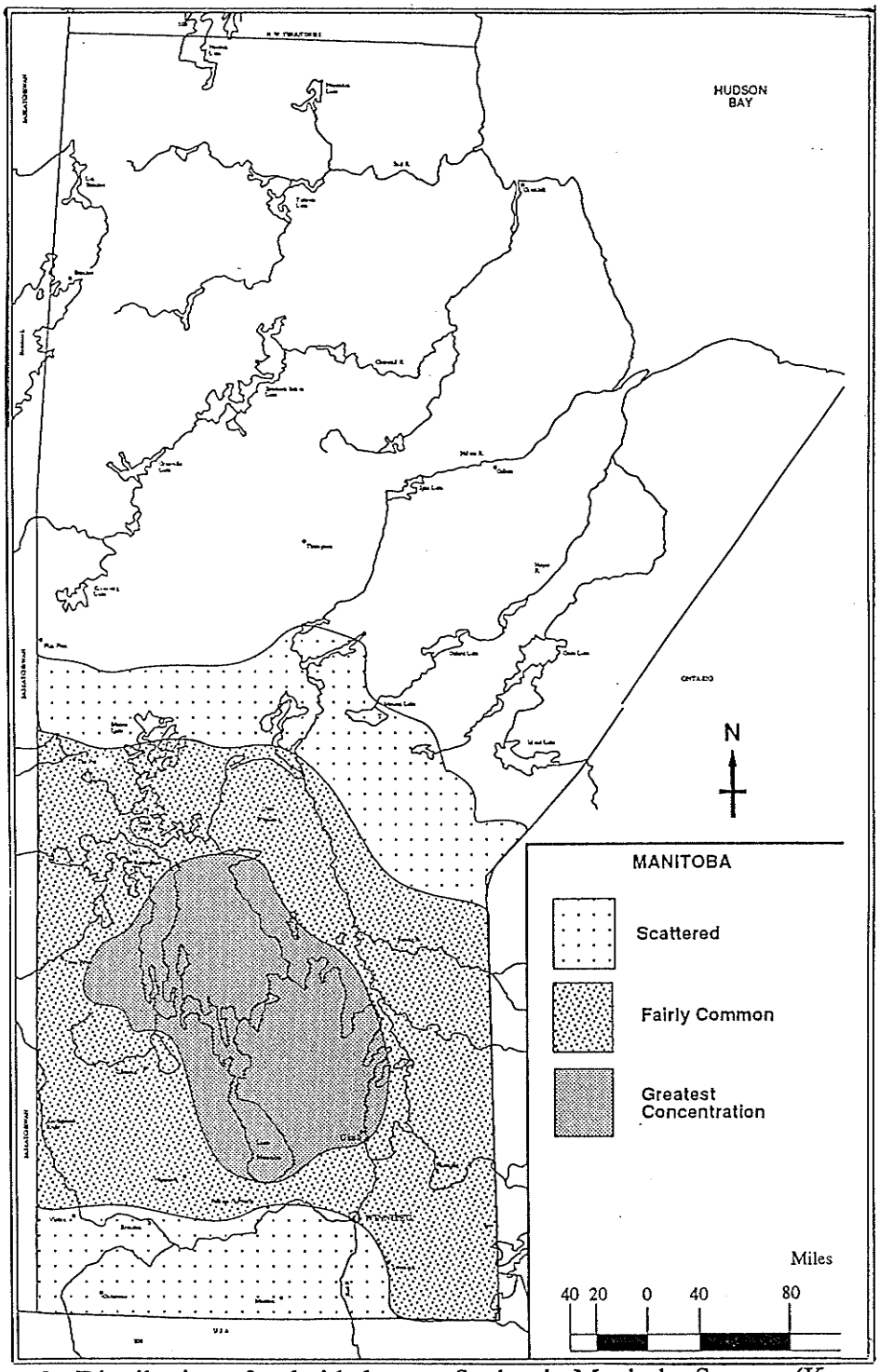

Figure 2: Distribution of red-sided garter Snakes in Manitoba Source: (Koonz, 1991)

phenomena has also resulted in the development of commercial and recreational ventures in the Interlake region of Manitoba.

The management of recreational and commercial ventures using snakes in a long-term sustainable manner, is the goal of Manitoba's Department of Natural Resources (DNR). In 1989 the DNR initiated a moratorium on the commercial collection of snakes and initiated research on ways to improve the management techniques. Perceived declines in local snake populations and concern with the potential negative impacts from harvesting, resulted in the 1989 moratorium and initiation of research on improved management techniques. No documented or reliable data existed or presently exists to substantiate concerns over population declines relating to recreational and commercial ventures. Regardless, the DNR initiated research on the possibility that ventures may have negative impacts on snake populations. The possibility of negative impacts resulting from such ventures could not be overlooked by the DNR based on the already sensitive life history parameters of the snakes. Severe environmental conditions could result in the elimination of a denning population, without any human intervention. Such environmental conditions include sever winter temperatures, spring flooding, drought, or unseasonably low spring temperatures. The addition of human uses only serves to increase the potential for a denning population to be negatively impacted and may result in a higher degree of den extirpation. The purpose of this study was to assess improvements to management techniques for recreational and commercial uses of Manitoba snakes and to make recommendations to the DNR on appropriate uses and management techniques.

1.2 Uses and Management:

There have been two uses for red-sided garter snakes in Manitoba; 1) Recreation and educational viewing at Narcisse, Manitoba; and 2) Commercial harvesting of snakes for sale in the pet industry, scientific institutions, and educational institutions. A description of the system of management for these two main uses follows. Such a

description is needed in order to help illustrate the relationship between the use for the snakes and the concern over the potential negative biological impacts of snake populations.

1.2.1 Recreational Viewing at Narcisse, Manitoba:

The DNR operates an educational and recreational viewing facility at Narcisse, Manitoba, 100 km north of Winnipeg (Fig. 3). Three limestone dens, exhibiting large representative populations of denning snakes were established in 1980. The Narcisse area consists of trails and interpretive signs that educate tourists about snakes and their biological qualities. The Narcisse dens are viewed by families, individuals, and school tour groups. Interpretive guides are present during peek spring visitation times to provide directions and answer questions. An estimated 10 000 people come to view the snake each year. The Narcisse dens generate various indirect economic benefits to local residents in the form of snack food sales , gasoline sales, and souvenir items. No fee is directly levied to view the Narcisse snake dens.

Management for the recreational and educational site at Narcisse has involved the legal protection of snakes and their den sites from commercial snake pickers since 1984. Site management to protect the dens from subsequent disturbances has also been initiated by local DNR staff. For example, the DNR has built viewing platforms and fences around the dens to minimize viewer impacts on the snakes and den area vegetation. The platforms have also reduced the degree of soil erosion caused by viewer activity around the dens. These platforms limit human access to areas close to the dens yet still provide a high degree of viewing quality. Management has also included the deployment of snake fences during the spring and fall migration in an attempt to reduce snake mortality due to road kill from cars travelling along Highway #17 adjacent to the Dens. Snakes are diverted to a culvert under the road during their migration to and from summer feeding habitat reducing the number of snakes that cross over the road. There is some concern that the snakes may be using the road as a basking area during their migration, especially in the fall. Roads act as

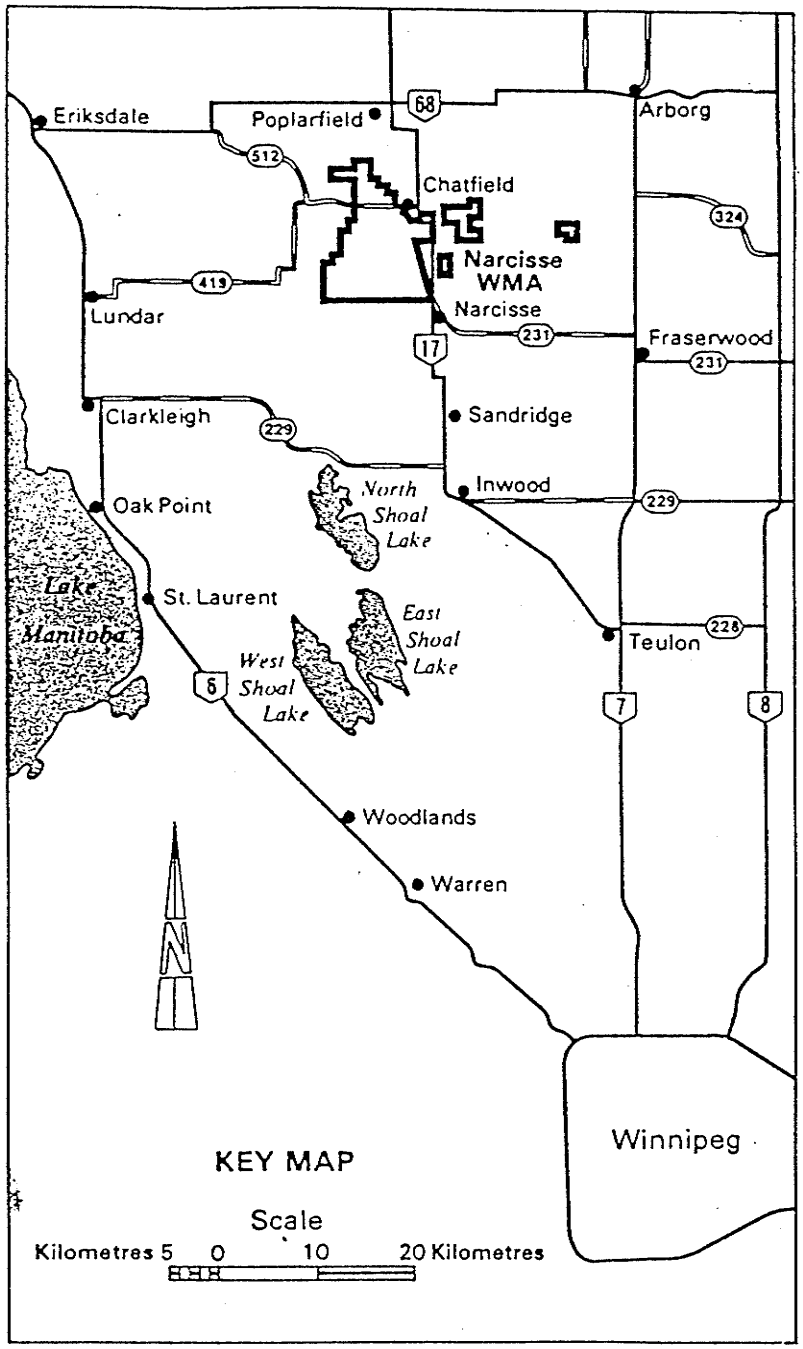

Figure 3: The Narcisse Recreational Viewing Site, Narcisse, Manitoba.

extremely efficient thermal sinks. If this is so, then simply diverting the snakes under the road may not efficiently keep the snakes from using the road and being subject to road kill.

1.2.2 Commercial Harvesting:

There was a commercial harvesting industry involving the collection, export and sale of red-sided garter snakes from Manitoba to worldwide customers. The harvesting of Manitoba snakes for commercial purposes had taken place as early as the 1950's. Prior to 1971, snakes were unprotected in Manitoba, with commercial harvests unregulated and snakes harvested at undetermined numbers. In 1972, legislation was introduced which established a one month season on the collection of snakes. It required snake pickers to obtain a license allowing them to legally harvest snakes in Manitoba. The legislation also allowed for monitoring the annual legal harvest of snakes (Koonz, 1983). In 1975, due to a perceived reduction in snake numbers, the season was reduced to one week but, under pressure from snake pickers and buyers, the season was extended to two weeks in 1982, where it remained until the 1989 moratorium. An average of 47,000 snakes were legally harvested annually from 1972 to 1988.

The harvest industry structure was such that snakes were usually collected by local residents and sold to a small group of buyers. The buyers would then sell the snakes to biological supply house operators in the United States who sold the snakes to various customers throughout the United States and the world. Customers included research scientists, pet stores, and educational institutions (Fig.4). The two week fall snake harvest led to management problems associated with negative biological impacts related to inefficient snake harvesting techniques. Licenses were issued on an individual or family basis and entitled the holder to pick snakes in Manitoba. However, there were no restrictions on the methods of collection or numbers of snakes collected except for the seasonal time restriction. The result was that there was no consideration given to the unique life history strategies of the snakes or for the annual variability of denning

populations caused by seasonal environmental conditions by the DNR or the snake user groups.

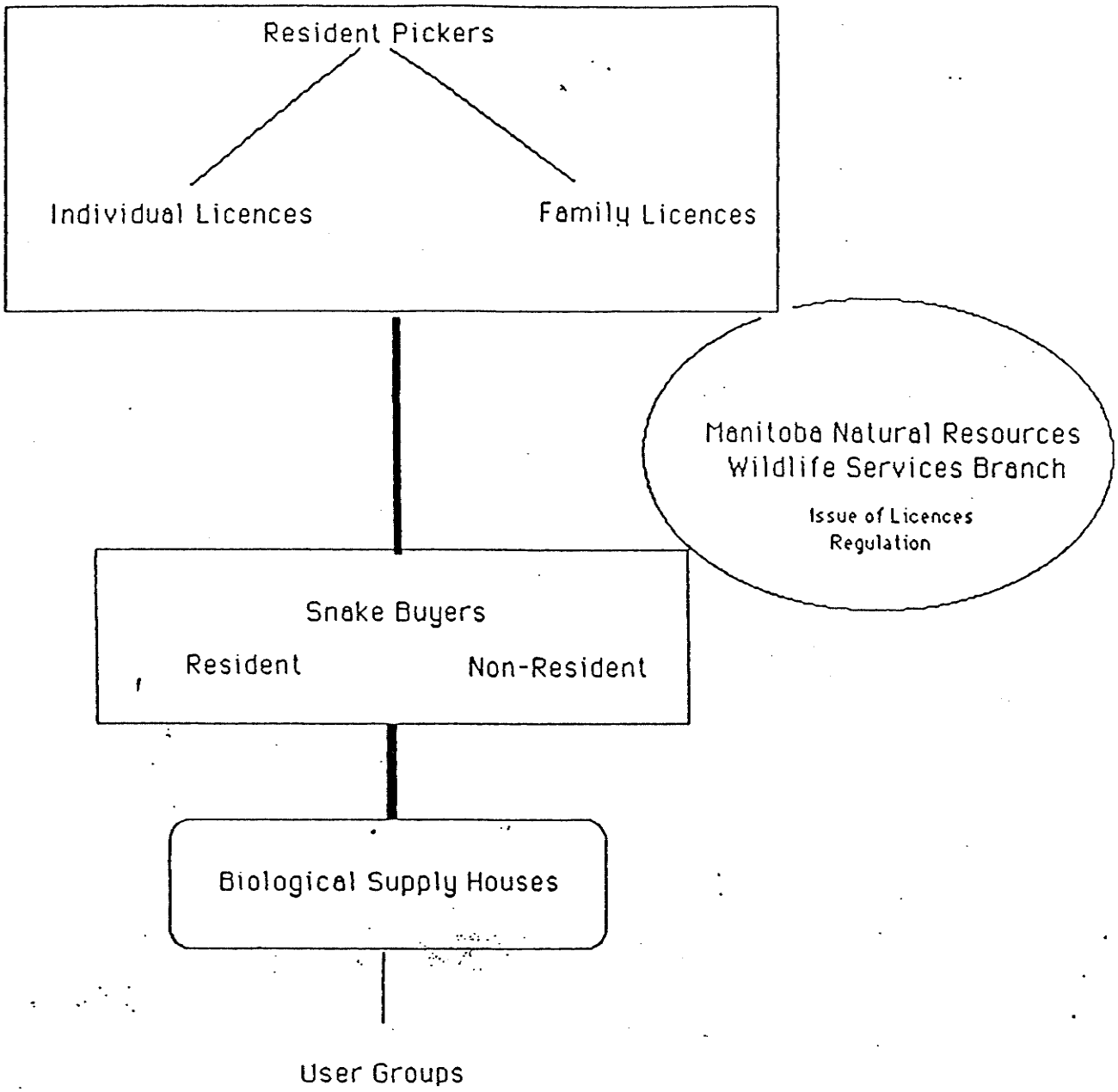

Figure 4: The historical market structure and management involvement for the commercial harvest of red-sided garter snakes in Manitoba.

The lack of consideration for the unique ecology of the snakes regarding past harvesting techniques was compounded further by the structure of the industry. The world market for snakes was relatively stable with respect to demand for snakes. As a result, dealers were highly competitive with respect to supplying the market. Dealers attempted to obtain as many snakes as possible as quickly as possible in hopes of gaining the greatest access to the market demand and a greater share of total market revenues. The competition between dealers to get as many snakes as possible, as soon as possible, lead to competition between pickers to supply snakes to dealers on or before day one of the season. Because pickers sold their animals to buyers on day one of the season (or before the season officially opened) there was no guarantee, for those picking snakes legally during official times, of being able to sell their snakes. There was no guarantee because illegal suppliers may have met the needs of buyers and foreign dealers on the first day of the season or earlier. It was therefore uncertain whether buyers would be purchasing snakes on day 2,3, 4, or 14 of the season. Pickers were forced to collect their snakes as soon as possible, and by any means available, in order to have the chance to sell them to buyers. This situation resulted in pre-season picking, den disturbance and the taking of snakes from protected areas. It also contributed to negative biological impacts and den extirpations through the use of indiscriminate practices such as mechanical devices, (the use of crow bars and tar paper), to mine snakes directly from the dens. Such mining techniques were considered by the pickers to be a more efficient form of harvesting. It allowed pickers to harvest snakes quickly and in greater numbers than, previously less damaging harvesting techniques. These indiscriminate techniques, when combined with all terrain vehicles, allowed pickers to cover a much larger harvesting area resulting in the picking of dens that were previously considered inaccessible to pickers.

Another structural fault in the commercial harvest industry was the lack of any real long-term interest in the conservation and management of the resource by pickers because of the relatively small proportion of the total revenues obtained. The income gained by

pickers was low, an average of $0.50 Canadian, per snake sold. This translated into an annual gross income of $15,000 to $50,000 divided between approximately 150 pickers annually between 1971 to 1989. This revenue represents a small proportion of the revenues generated from the harvest of the snakes. The majority of income was made by dealers in the United States who had built up an extensive clientele list over time. Out of province revenues were estimated at approximately $600,000 U.S. (an annual harvest of 47,000 snakes at a retail price of $14.00/snake for live snakes and $5.29 for dead ones; based on Carolina Biological Supply Company Catalogue price, 1989). In general, the majority of pickers did not view the snakes as a valuable commodity to be conserved and maintained as a business or a livelihood, but more or less as a family recreational activity (Koonz, 1989). The 1989 moratorium has cut off this revenue source for pickers and United states biological supply companies. At present there is no direct economic benefit generated from the harvest of snakes in Manitoba.

1.3 Life History Parameters; Related Issues and Concerns:

The negative impacts of snakes caused by recreational and commercial uses compound an already precarious life strategy that exists under natural environmental conditions. Denning populations are large, but may be susceptible to large annual fluctuations. Population declines may occur because of reproductive failure in response to poor weather conditions, rather than because of variable survivorship of adults. The poor weather conditions combined with the relatively low but fluctuating annual survivorship rate of between 0.470 and 0.702 can result in severe reductions in populations. When the potential negative impacts are added from recreational viewing and past indiscriminate harvesting techniques the result can be the total elimination of a denning population (Macmillan, 1987). Such uncertainty with respect to the annual population at a den creates difficulties in trying to manage snakes on a provincial basis. The lack of scientific data on population parameters, abundance and distribution also serves to increase the difficulty in developing management techniques for sustainable uses of the snakes. The difficulties

associated with the management of commercial and recreational ventures related to the life history of red-sided garter snakes constitutes the major reason for assessing improvements to management of recreational and commercial uses for red-sided garter snakes. No attempt has been made to assess or compare the uses and improvements in management techniques for red-sided garter snakes in Manitoba.

1.4 Objective:

The objective of this research is to develop, assess, and compare commercial harvesting and recreational viewing and to suggest improvements in management techniques. This objective should lead to the development of a management strategy that would minimize negative biological impacts on snake populations in Manitoba. These assessments will help to provide the DNR staff with an adequate management strategy for recreational viewing and a potential commercial harvest. Determining improvements in management techniques for potential commercial snake harvesting and recreational viewing involves the following:

1.4.1 Recreational Viewing:

1) to assess the economic and social importance of recreational snake viewing at Narcisse to Manitoba;

2) to examine the possible biological implications and impacts from recreational viewing;

3) to assess the management techniques presently used at Narcisse; and

4) to suggest improvements to present management techniques that minimize the biological impacts of recreational viewing at Narcisse.

1.4.2 Commercial Harvesting:

1) to assess the importance of the commercial harvest in terms of social attitudes, potential for negative biological impact, and financial contribution.

2) to assess and compare suggested improvements for the management of a commercial harvest. Assessment will be based on available financial data, potential for negative biological impact, and impact on social attitudes;

3) to determine the potential for a renewed commercial harvest of snakes in Manitoba;

4) to suggest improvements to present management techniques.

1.4.3 Recreational Viewing and Commercial Harvesting:

1) to make recommendations regarding future uses of snakes that should be pursued in Manitoba.

2) to make recommendations on management techniques that should be used to ensure that minimal biological impact occurs from the recommended uses of snakes.

CHAPTER 2
Methods

The following methods were used to determine, assess and compare improvements to management techniques for both recreational viewing and commercial harvesting:

2.1 Identification of Individuals and Groups:

The identification of user groups and other interested parties for both commercial and recreational management strategies was carried out using the following methods:

1). An examination of DNR records to determine various individuals who had been involved with or expressed interest in the commercial or recreational use of snakes in Manitoba. Records included export permits, snake collecting licenses, correspondence from various individuals, and attendance lists from any past forums held on snake management;

2). An extensive literature search was undertaken to obtain information on individuals who may have had a vested interest in snakes in Manitoba;

3). Consultation with committee and DNR members to identify interested individuals or groups.

2.2 Improved Commercial and Recreational Management Techniques:

The following methods were used to develop sound commercial and recreational management strategies for the red-sided garter snake in Manitoba:

1). An extensive literature search of wildlife management studies, common property resource management case studies, and sustainable wildlife use studies were undertaken to determine possible management scenarios for the red-sided garter snake.

2). Consultation with wildlife management experts was carried out and their opinions and suggestions were incorporated into the development of management scenarios.

2.3 Recreational Viewing:

The following methods were used to assess the economic and social importance of recreational viewing at Narcisse, Manitoba:

2.3.1 Survey of Recreational Viewers:

A survey of individuals viewing the snake dens at Narcisse Manitoba: Direct interviewing was carried out on a random basis for a total of 112 individuals. Interviewing took place over two days during the spring emergence of 1990. Respondents were chosen systematically as they passed by a selected area at the entrance and exit to the viewing facility located adjacent to the parking area. Determination of survey respondents was based on soliciting every fifth person to pass by the interviewer as they returned from viewing the snakes and the dens. Information on attitudes toward commercial and recreational uses of the snakes was solicited as well as other basic information regarding age of respondent, place of residence, and sex (Appendix 1). A five point likert scale was used to determine attitudes of respondents to various management questions (Mason et al, 1983). Closed ended questions were also used to determine general information on the respondents. Financial expenditure by respondents to view the snakes and a value for willingness to pay to view the snakes was also requested as part of the survey. This information was used to calculate the economic importance of the snake viewing facility.

2.3.2 Survey of Long Time Local Residents:

Long time residents of the Inwood, Narcisse and Sandridge areas of the Interlake were personally interviewed to determine their attitudes toward the management alternatives and economic importance of recreational ventures with snakes in the area. A representative sample of local residents with interest in the snakes was developed. Local business people, private landowners with dens on their land, political representatives and locally concerned individuals were interviewed. Information regarding attitudes toward past and improved management strategies for the recreational uses of the snakes was requested. A five point likert scale was used for the attitudinal questions. Open ended and closed ended questions were employed for various other questions (Appendix 2).

2.3.3 Financial Assessment of Recreational Viewing:

A financial assessment of the importance of recreational viewing to Manitoba was carried out using data obtained from DNR records. Operating costs for the Narcisse site were calculated from DNR records. Data from the 1990 survey of recreational viewers was used to calculate the economic importance of the Narcisse site. Estimated willingness to pay (WTP) values were generated from the survey respondents and a total WTP by viewers was calculated. Calculations were also made to estimate the approximate revenue generated by viewers to the Interlake region for 1990. This information was used to assess the economic importance of the Narcisse site and to compare this information with other potential uses for snakes.

2.4 Commercial Harvesting:

The following methods were used to assess improvements to the management of commercial harvesting:

2.4.1 Market Assessment:

General Information on the world market for red-sided garter snakes was obtained through consultation with various individuals, snake dealers, supply house operators , pet store operators, and biological supply house catalogues. Company representatives were asked to comment on supply and demand for snakes as they related to changes in market prices. Information was obtained on wholesale and retail prices for red-sided garter snakes from Manitoba.

A) Telephone Survey of Snake Dealers:

A search was conducted to determine those biological supply house dealers who bought and sold Manitoba snakes prior to the 1989 moratorium. Biological Supply house catalogues were searched for red-sided garter snake advertisements. Those supply house catalogues that advertised red-sided garter snakes for sale were contacted. After contacting supply houses it was determined if the snakes were bought in Manitoba and if so, contact

with the person involved in the sale and distribution of snakes at the supply house was attempted. General questions regarding the dealer's attitude toward the effect of the 1989 moratorium on the harvest of red-sided garter snakes , and the world market, were applied. General information on world supply and demand was also requested, including pricing and end market locations.

B) A Survey to Snake Dealers:

Formal questionnaires were sent to each dealer that was contacted by telephone. The purpose of the questionnaire was to determine; A) the opinions and suggestions of the dealers regarding the future management of snakes in Manitoba and the feasibility of re-establishing the commercial harvest of snakes; B) the estimated world demand for red-sided garter snakes; and C) the approximate breakdown in snake numbers for respective uses (ie Scientific Research, Pets, Education). All questions were open ended so as not to limit or restrict the responses of dealers (Appendix 3).

2.4.2 Financial Assessment of Improved Harvest Techniques

A) An examination DNR's records and data regarding the financial revenues and expenditures for managing the commercial harvest of red-sided garter snakes in Manitoba was carried out.

B) An estimation of possible financial revenues and expenditures of various suggested alternative management strategies for red-sided garter snakes in Manitoba.

C) Consultation with various DNR staff was undertaken to determine possible financial revenues and costs for the suggested management strategies.

2.4.3 Social assessment of the Importance of a Commercial Harvest:

A) Personal interviews with identified user groups and individuals with interests in the management of the commercial harvest of snakes in Manitoba: Information regarding attitudes toward past and future management strategies was requested. Information on attitudes toward supply and demand for a commercial harvest industry was also solicited. A

five point likert scale was used for the attitudinal questions. Open ended and closed ended questions were employed for various other questions (Appendix 2).

B) Long time residents in the Inwood, Narcisse and Sandridge areas of the Interlake were personally interviewed to determine their attitudes toward the management alternatives and the economic importance of commercial harvesting of snakes in the area. A representative sample of local residents with interest in the snakes was developed. Local business people, private landowners with dens on their land, political representatives of the area and locally concerned individuals were also interviewed. Information regarding attitudes toward past and improved management strategies for the commercial harvesting of the snakes was requested. A five point likert scale was used for the attitudinal questions. Open ended and closed ended questions were employed for other questions (Appendix 2).

C) Interest groups and individuals were contacted by telephone to set up a meeting time and place for a personal interview with representatives. If a time and place could not be arranged an interview was attempted over the phone. Prior to these interviews the parties in question were each sent a copy of the Wildlife Branch's recently completed red-sided garter snake management plan so that interviewees were aware of the present management situation. Information regarding attitudes toward past and improved management strategies for the commercial harvesting of the snakes was requested.

D) Information on attitudes from recreational viewers regarding commercial snake harvesting was solicited during the 1990 recreational viewing survey.(Appendix 1). A five point likert scale was used to determine attitudes of respondents to various management questions. Closed ended questions were also used to determine general information.

2.4.4 Comparison of Management Techniques

Using survey information, social attitudes, biological impacts and financial consideration, harvest techniques were compared and ranked to determine appropriate improvements in management for the commercial harvest of snakes. Ranking was determined by assigning a weighted value to each of the various categories based on the

researcher's assessment of data. Biological impacts were assigned more weight because maintenance of the resource was considered to be of greatest concern. Social attitudes were weighted second because the views and needs of local residents regarding the use of the resource should be highly valued. The financial considerations were given less weight because social and biological considerations outweigh a particular management strategy decision.

2.5 Recommendations to the DNR:

1) A formal written report was submitted to DNR staff involved in the management of snakes in Manitoba.

CHAPTER 3
Literature Review

3.1 Introduction:

With the exception of Macmillan (1987), and Gregory (1979), discussions of the issues involved with the conservation and management of the red-sided garter snake in Manitoba are virtually absent from the current scientific literature. Furthermore, only a few studies have focussed on the conservation and management of snake populations of the world in general (Darymple and Reichenbach, 1984; Dodd, 1987; Galligan an Dunson, 1979, Seigel 1986; IUCN Bulletin, 1894). Nevertheless, it is of great importance that the characteristics and related concepts pertaining to the conservation, management and uses for the red-sided garter snake in Manitoba be discussed.

3.2 Biological Consideration for Snakes:

According to Dodd (1987), because there are relatively few studies concerning successful approaches to snake conservation, aside from statutory protection for the collection or trade in snakes, individuals concerned with biological considerations must turn to the experiences of other taxonomic groups and disciplines. A major constraint on the success of conservation programs, and one that is difficult to work with because of the lack of scientific study of many snake species, is that all conservation approaches are limited by the biological characteristics of the species themselves. For programs to be successful, it is necessary that as much as possible be known about the biology of the species in question. Continuous scientific study must be undertaken to ensure that conservation methods are selected within the constraints imposed by the species. In order to formulate any kind of management program for these various species, we need to have more information on distribution and abundance, habitat use, mortality rates, reproductive potential, ect (Dodd, 1987). Unfortunately for most Canadian snake populations, we lack such data (Gregory, 1977).

In the case of snakes in Manitoba, relatively little is known about the biological considerations of the species. Fortunately more is known about the red-sided garter snake

than for most other snake species. According to Koonz (1983), Manitoba red-sided garter snake dens have been the subject of scientific study since 1973. However, even though there exists an extensive array of scientific studies on the snake none have dealt with the basic ecological requirements and the impacts of harvesting on denning populations. According to Macmillan (1987), "No rigorous survey of remaining large denning populations, enabling evaluation of the status of the resource, has been conducted. Normally, awareness of the status of the resource is a pre-requisite for successful management". Macmillan (1987), states that "ignorance of the status of dens in Manitoba and of the biological needs of the species is a major hindrance to effective management of denning populations".

Koonz (1983) recognizes the lack of information on snake and states that a poor understanding of snake numbers, survival rates, environmental factors, productivity, general biology, and lack of knowledge regarding dens are major factors limiting the effective management of the snakes. According to Koonz (1983), it is important that these characteristics be addressed in any improved management strategies for the red-sided garter snake. The life history parameters for the red-sided garter snake and the relationship of negative impacts caused by the uses of snakes are addressed below.

3.2.1 Population parameters for the red-sided Garter Snake:

Throughout the range of the species, populations of *T. sirtalis parietalis* appear to be subject to considerable fluctuation. It has usually been felt that such fluctuations occur in response to variations in weather, either directly or indirectly. In the Interlake region of Manitoba, where the climate is extreme and highly variable, population fluctuations of *T. sirtalis parietalis* are particularly great and yearly population declines of as much as 50% have been observed to occur. Despite this, the species remains abundant in the Interlake, even during population lows. Its abundance may be partly explicable in terms of physiological adaptations to its environment, but the ability to regain high numbers following a large-scale population decline involves adaptations in the area of life history

strategies. Because of differences in environmental severity and stability, and the resultant population effects, populations of *T. sirtalis parietalis* in the Interlake and in more southerly regions should exhibit important differences in life history (Gregory, 1974). The variation in life history among denning populations is significant when considering concerns over the use of snakes and improved management techniques. When considering the re-establishment of a harvest season for Manitoba snakes, a critical factor in the decision to allow a harvest must be the biological parameters for the snakes and the negative impacts that a harvest may create. Past harvesting techniques were indiscriminate and did not take into account the variability in population effects at den sites from the environmental conditions for that particular year. In years where the environmental conditions were optimum, indiscriminate harvesting may not have had any severe negative impacts on the denning population. However in years when severe environmental conditions existed, harvesting may have further impacted on an already hard hit denning population. This same principal applies to the dens at Narcisse, stress from humans viewing the snakes may have little impact in years when environmental conditions were good, but may have significantly added to the population stress in years when environmental conditions were poor. Concerns over such impacts were the main rational behind the DNR's initiation of research on management improvements and for the 1989 moratorium.

In an animal population which is subject to frequent fluctuation, the ability to rebuild numbers following a decline depends on the attainment of a high intrinsic rate of population increase r_{max} (Gregory, 1974). Although red-sided garter snakes can produce as many as 40 young in one birth the actual or intrinsic rate of population increase is low. Survival of young born in the first year can be as low as 20%, and survival rates for snakes after their first year can be on average 58% (Gregory, 1974; Koonz, 1991) (Fig.5). On top of the relatively low survival rates, sexually mature female red-sided garter snakes in the Interlake region may not breed annually due to the high energy costs of reproduction.

These costs involve the opportunity costs of inability to feed while gravid and the increased risk of mortality while basking. Such costs become more acute as the growing season becomes shorter and the percentage of the season consumed by reproductive activities increases. Macmillan (1987), states that in the Interlake region, the energy costs associated with reproduction may be too high to permit annual reproduction. Gregory (1977), suggests biennial reproduction might be expected, with frequency of reproduction depending on the date of parturition and the subsequent availability of food. Aldridge (1979), believes a true biennial cycle probably does not exist, but that the availability of energy, either as stored fat from a favorable growing season the year before or resulting from spring foraging success, determines the proportion of females reproducing in a given year. Weather ultimately determines the availability of energy since it influences both the date of parturition and subsequent foraging success. If young are born late due to a cold summer-prolonged gestation, reproducing females may have little or no time to feed before they begin the migration from their summer feeding area (Macmillan, 1987). In such cases it has been suggested that the females will not bear young the following season. This has important implications with respect to the severity of impacts caused by using snakes. It increases the difficulty in determining improved management techniques. Under the past harvesting management structure,it would be difficult to determine the impact of harvest or an annual harvesting rate for snakes due to the uncertainty of reproduction from year to year. Such uncertainty could result in miscalculating the impact of a harvest on populations and could therefore severely damage denning populations. Improvements in the management of the snakes must consider such uncertainties so that potential impacts on snake populations can be minimized.

Figure.5.: Logarithmic survivorship curve for red-sided garter snakes (*Thamnophis sirtalis parietalis*) in the Interlake region of Manitoba, Gregory (1974).

Additional concerns are 1) that first year snakes rarely go to the fall denning areas and 2) adults may not return to the same denning area every year. Some snakes may remain in summer foraging areas over winter, especially females who have given birth (Koonz, 1991). Such variance in life history strategies would also have to be considered by DNR staff in any commercial harvest.

3.3 Threats to Snake Populations:

There are many threats to snake populations cited in the current literature (Dodd, 1987; Langton, 1989; Macmillan, 1987, Koonz, 1983). Many of these threats apply directly to the red-sided garter snake in Manitoba. It is therefore important to discuss these threats and their relationship to snake management in Manitoba.

3.3.1 Collection of Snakes:

According to Dodd (1987), both common and uncommon snakes are traded extensively. Most of these animals are sold either in pet shops or by dealers in exotic animals, and for the most part such trading is illegal. Although some snakes are products of captive breeding programs begun specifically to supply the trade, most are resident species collected from the wild with little concern for natural population effects. Whether or not the annual take represents a sustainable yield depends entirely on the size and ecological characteristics of the population. This is usually unknown, particularly by the harvester, and the exploitation continues until either the population becomes extinct or the law of diminishing returns makes it no longer profitable to collect the animals (Eltringham, 1984).

The negative biological impacts of commercial harvesting is one of the main concerns regarding the cause of the observed decrease in local snake populations of Manitoba. According to Macmillan (1987), intensive harvesting over a period of years leads to severe reductions in numbers. He argued that if we want to ensure the future of the red-sided garter snake, the annual commercial harvest must be terminated immediately (Macmillan, 1987).

The red-sided garter snake exhibits communal denning and dens in the Interlake of Manitoba may contain several thousand individuals during peak years. As a result, professional collectors have been attracted to this area and have made severe inroads on certain denning populations. In addition, these snakes face destruction of their denning areas as farmers often fill in the limestone sinks which the snakes use as dens. Loss of their summer habitat is also likely as several of the marshes which they use in summer have been drained for agricultural uses while other marshes appear to be in late successional stages, gradually filling in. The fragmentation of natural migration routes from denning areas to marshes by roads is also suspected of affecting the general health of Manitoba

snake populations. Roads limit access to dens or marshes when they bisect travel routes. Many snakes can be killed while trying to cross these unnatural barriers. Finally, snakes are markedly affected by weather, which is unpredictable in this region. Populations may fluctuate in numbers markedly because cool weather conditions adversely affect reproduction or the spring melt in high snowfall years flood out den sites. Considering these factors, mass collecting could be an excessive burden on snake populations unless it is controlled more rigorously than in the past (Gregory, 1977). Mass collecting of snakes has taken several forms:

1). Collecting for the pet trade. This is probably not serious at present, but may become more so as tropical species become less available. Casual collecting by children and others is probably not too important, but the prospect of large scale collecting for the pet trade is alarming. Prior to the 1989 moratorium on the collection of Manitoba's snakes this was considered to be a more serious contribution to the loss of Manitoba snakes then Gregory states for snakes in general.

2). Collecting for commercial purposes other than for the sale as pets. This is not a widespread practice, but may be important where snake populations are large. Sales are usually made to biological supply houses, which in turn sell them for use in university anatomy classes, ect. This type of activity may also lead to collecting for the pet trade. Annual estimates of this type of collection for Manitoba snakes before the 1989 moratorium tend to support Gregory. Approximately 10% of harvested snakes were diverted to this use.

3). Collections for research by biologists. This type of collecting probably does not represent a serious source of loss for most snake populations, especially since most populations are exploited by a very small number of researchers. Biologists, as experts on various groups, should be prepared to set examples for others to follow(Gregory, 1977).

All of these forms of snake collection were practiced by commercial snake pickers in Manitoba prior to the 1989 moratorium.

An example of the commercial collection of snakes other than the red-sided garter snake in Manitoba is given by Galligan and Dunson (1979). This example helps to illustrate similarities in biological impacts that can occur from harvesting snake populations. In the United States there are a small number of individuals who still may be considered commercial snake collectors. In Pennsylvania, Galligan and Dunson (1979), recorded interviews with 11 rattlesnake hunters, all of whom reported a substantial decline in the snake population and in the viability of dens within the last ten years. Macmillan (1987), stated that many disturbing parallels in the course of events regarding the status of the timber rattle snake (*Crotalus h. horridus*) studied by Galligan and Dunson (1979), could be found with regard to the red-sided garter snake in Manitoba. Higher prices, increased accessibility, and publicity have combined to interest people more in hunting the Timber Rattle snake. As a result, many dens have been exterminated and the search for unexploited dens has intensified. Dens can tolerate only five to seven years of hunting. Some of the snakes collected for fairs are released at a later date, but the snakes are maltreated and it is doubtful whether they can survive after release. Similar actions were taken by snake pickers in Manitoba toward red-sided garter snake commercial harvest.

Directly related to the collection of snakes is the keeping of snakes by people. According to Langton (1989), there are probably around 40,000 reptile and amphibian keepers in Europe, while in the USA there are in excess of one million keepers at any one time. These numbers are changeable because the majority of reptiles and amphibians imported are unsuitable for trade and are dead within a few months of collection from the wild. Langton (1989), describes three forms of keeping that exists. First there are a handful of keepers who contribute to the published information on species. Second the casual keeper, who usually keeps one or two animals, simply for the fascination or desire

to know more about these often secretive animals. The casual keeper constitutes the majority of people who are collecting snakes. The third category of keepers includes those who collect animals like stamps, who aim to keep the rarest of a particular type. Even the breeding of albino snakes constitute a thriving interest, like aberrant issues of stamps (Langton, 1989).

3.3.2 Habitat Destruction:

Another major threat to snake populations is habitat destruction. According to Dodd (1987), the greatest threat to snakes as a group is habitat destruction. Habitat destruction results in the physical elimination of both animals and their ecosystems and the fragmentation of remaining populations which are then subject to reduced population size and the resulting potential loss of genetic diversity. Habitat loss is difficult to quantify because no baseline data exists to document either the extent of loss of habitat in many areas or the resulting effects on snake populations. As is true for nearly all factors affecting a species status, loss of habitat may only be one of a series of factors simultaneously threatening a population and can set in motion other detrimental effects. These detrimental effects may include the disruption of social behavior or genetic problems. In snakes, these factors are still largely unstudied, and most conservation surveys try to answer more basic questions concerning where a species is located, how many individuals there are, and the nature of the obvious threats (Dodd,1987).

In North America, habitat loss stems from residential or agricultural development, logging and forestry practices, and impoundment of streams and rivers. However, specific data are rarely supplied. One exception is that for *Thamnophis couchi gigas* in the San Jauquin Valley of California; this species has lost at least 33% of its available habitat, primarily in the northern part of its range, to land clearing for agriculture (Dodd, 1987). A loss of natural habitat is rarely correlated with a decline in the number of snakes but undoubtedly is responsible for major population changes. Other forms of habitat destruction may impact snakes, but again few data are available. These include introducing

domestic animals that cause disturbance of ground cover, spreading oil on dunes for stabilization, and building dams that eliminate retreats and appropriate habitats. Mowing grass to enhance the habitats of other forms of wildlife can result in loss of an appropriate habitat and direct killing of snakes (Dodd, 1987).

In the case of the red-sided garter snake, the most significant form of habitat destruction is from the use of mechanical devices at hibernacula to collect snakes. Such devices directly damage the hibernacula rendering them uninhabitable (Macmillan, 1987). Another form of habitat destruction is the destruction caused by direct human disturbance through tourism (Whittier *et al*, 1984). Snake habitat is sensitive to disturbance and the stress that results from tourists or commercial pickers wandering near or on top of the snake dens can often have significant impacts. Macmillan (1987), found that the commercial harvest of snakes exerted a negative effect on the population through the degradation of the den structure. According to Macmillan, harvested dens typically showed signs of trampling, digging, and general disruption. In an interview with Koonz (pers comm. 1986) Macmillan learned that some commercial harvesters block entrances to dens with debris, thus forcing snakes to remain above ground and available for capture. It was concluded that such disruption may reduce the available hibernation space and contribute to a reduction in denning populations. Macmillan further substantiated his comments by stating that exterminated dens show little sign of repopulation decades after disturbance, and transplantation as a means of re-establishing populations may not be feasible (Macmillan, 1987).

Whittier *et al* (1984), stated that commercial harvesting of snakes had negative impacts on habitat. "One issue related particularly to the management of the red-sided garter snake resource deals with observations of den excavation by snake harvesters" (Whittier *et al* ,1984). Because so little is known about the requirements of the snakes in selecting and using a den site, the effects of excavating sites on populations is presently unknown. However, as excavation of dens could be regarded as habitat destruction, this

activity should be curtailed by an aggressive enforcement policy linked with an active educational campaign (Whittier *et al* ,1984). The authors also state that habitat destruction of snake dens associated with agricultural, gravel extraction, and urban development have also significantly contributed to reducing the numbers and quality of snake dens in the province. Many dens on private property have been filled, and reports of efforts to extirpate local populations of denning snakes are common.

Whittier *et al* (1984), also discussed the impact of tourism on the red-sided garter snake. " Another concern we have developed about the snake populations is the use of the Narcisse Wildlife Management Area for tourism...Although signs at the dens request visitors not to enter the dens, many do, and paths beaten down the sides of the dens are evidence...Again our knowledge of the subterranean environment is a concern as we do not know the impact of filling of the den with soil. It is likely, however, that it is having a significant effect...Tourist activity also hinders the mating behaviour of the animals with the result that females are not mated and, hence, do not produce young" (Whittier *et al* ,1984).

3.3.3 Malicious Killing

Another threat to snake populations is prejudice. Snakes have always aroused intense feelings in people,whether they inhabit cities and have never seen a snake or live in rural areas where snakes abound (Dodd, 1987). Reptiles, particularly snakes, are most frequently named as the least liked animal by the general public. Such prejudice is almost always based on ignorance and superstition. Snakes are more often judged on their reputation than on their true role in our natural environment (Langton, 1989). "The average person has completely erroneous notions about what snakes are, and many myths about them are perpetuated. In many areas snakes are commonly killed on sight, especially if they are venomous " (Gregory, 1978). Conserving snakes presents very special problems in overcoming human prejudice; in many countries snakes are destroyed whenever possible

(I.U.C.N. Bulletin, 1984). According to Dodd (1987), the effects of wanton killing on wild populations of snakes has not been studied.

There is some documentation of the killing of red-sided garter snakes for reasons of prejudice (Koonz, 1983). According to Koonz, local people seem to dislike snakes or snake dens. " Stone piles, dead animals, oil, bulldozers and debris have rendered many den sites useless. In general there seems to be little concern for snakes on the part of the public. Most people believe that the only good snake are dead ones. Some local people, especially those in the Boggy Creek and San Clara area of Manitoba, greatly fear snakes" (Koonz, 1983).

3.4 Management of snakes:

The goal of resource managers is to maintain a sustained annual harvest without harming the integrity of the species involved. This is difficult for a species, such as the red-sided garter snake, which is only available for a short time each spring and fall, especially since the snake pickers are more aware of den locations and numbers than wildlife staff (Koonz, 1983). However, it is important to discuss snake management goals to determine the current practices employed by resource managers to ensure the conservation of snakes.

3.4.1 Snake Management Techniques for the red-sided Garter Snake:

According to Macmillan (1987), there must be a change in current management practices for snakes if some large denning aggregations are to remain. However, the nature of the denning populations themselves make it impossible to propose general commercial harvest guidelines appropriate for all denning populations. The results of his study suggested that population parameters may be den-specific. Gregory (1979), also discussed den specific factors that determine the annual population of local snake denning areas. Numbers, sex ratios, and the population composition of dens in one area are probably different from those for dens in another area. The population at a single den can also

fluctuate significantly from one year to the next. Therefore, the impact of management guidelines on different dens will not be the same. The wandering tendencies of the snakes in the fall migration tend to complicate the issue further, as pickers at one den could effectively harvest two or more dens at the same time since it is not exactly known if the snakes will return to one den or the other. Additionally, much of the information necessary to evaluate population parameters must be collected annually in fall without interference from commercial harvesters.

Effective den population management in the face of continued commercial exploitation necessitates a den-specific management scheme. Macmillan (1987), argued that the cost of such a scheme, if theoretically possible, would likely exceed revenues generated by the harvest. It was concluded that the red-sided garter snake harvest in the Interlake Region of Manitoba should not be viewed as being economically exploitable (Macmillan 1987).

Few proven management options have been tried in an effort to conserve snakes. Most management has taken the form of statutory or otherwise restrictive prohibitions: regulations aimed at controlling trade or collecting of a particular species. At times, these methods can be extremely effective in curtailing detrimental activities affecting particular species (Dodd, 1987). In the case of snakes in Manitoba there is statutory legislation under the Wildlife Act which restricts the commercial harvest of the snakes. Alternative forms of management have not been explored in the past as is the case for most snakes according to Dodd , (1987).

3.4.2 Legislative Protection:

Many countries have taken steps to ban the collecting, keeping and sale of native wild herpetofauna. Some advocate that captive bred animals should replace all wild-caught specimens or that native herpetofauna should not be kept at all; similar policies have been effective in parts of the U.S.A. (Langton, 1989).

Manitoba currently restricts the collecting of plains and red-sided garter snakes (Wildlife Act, Regulation 134/71). There are, however no quotas on numbers or limits to the size of the snakes taken. Instead the length of the collecting season is controlled. As mentioned, prior to 1973 collecting was restricted to the month of September. The demand for snakes then dramatically increased and the season was shortened to the first week of September in 1975 . Unfortunately, this may have shifted some of the collecting pressure onto Saskatchewan populations. Although the price paid per snake is low ($0.50), the natural resources in the Interlake are few and the snake harvest represents an important source of income. For some, money from the sale of frogs and snakes may represent a substantial source of added income.

Co-operative legislation among provinces, quotas and size limits, and good policing would seem to be appropriate. None are easy to bring about, but we certainly have sufficient information at present to suggest size limits which would protect much of the reproductively significant segment of these populations (Gregory, 1977).

Central to the premise of management through statutory regulation is the ability to enforce the regulations. According to the current literature, the enforcement of regulations that deal with the management of snakes has proven difficult. "Enforcing trade controls is a difficult process for customs officers, police departments and scientific authorities. This is largely because of the administrative difficulties that result from permit systems and the specialist nature for identifying controlled species as they enter the numerous borders by land, air, and sea "(Langton, 1989). Much attention has recently focussed upon the enforcement of trade controls and the smuggling of herpetofauna within Europe. India has found it difficult to enforce its 1976 ban on the snake skin trade and smuggling is believed to be widespread. A 1983 assessment of old skins left over from the trade showed 11.3 million, which were to be bought by a state-owned company on a 'once only' basis to clear old stocks (I.U.C.N. Bulletin, 1984).

Regulations, restricting the collection of snakes in Manitoba have also been difficult to enforce. The following description regarding the enforcement of regulations exemplifies the difficulty involved. " The wildlife regulations concerning the red-sided garter snakes are difficult to enforce. In 1989 a number of people were picking in the Narcisse Wildlife Management Area (WMA), a location closed to picking of snakes. Wildlife staff and conservation officers were present during most of the season and acted as a deterrent to picking, but large numbers of snakes were still being removed. Last year we observed pickers in the Narcisse WMA several weeks after the picking season had closed" (Koonz, 1990). These observations indicate that an illegal trade in red-sided garter snakes is occurring in the Province. Thus, while there are official reports of numbers of snakes removed during the picking season, these reports are low estimates. It is not known to what extent snakes are removed illegally from Manitoba. A recent apprehension and conviction of three individuals trying to smuggle 3,000 snakes into the United States in the spring of 1991 confirmed that illegal picking and smuggling exists. The attraction of obtaining $10.00 per snake for a total of $30,000 and the ease involved in harvesting such a number of snakes is tempting to many individuals. Such illegal collection and trade practices hamper efforts to effectively manage snakes in Manitoba.

3.4.3 Habitat Protection:

Another management technique employed to conserve snakes is habitat protection which also proves to be a difficult process (Dodd, 1987; Macmillan, 1987). Habitat protection aimed at particular species must also recognize that entire ecosystems cannot be managed for individual species; reserves must provide for interactions, even if established primarily for a particular species. It will also be necessary to ensure that reserves are large enough to achieve the purpose for which they are established. Research on snakes will therefore be required to determine the effective population size capable of sustaining the species through time (Dodd, 1987). According to Dodd it would be necessary to know

seasonal variations in habitat use, population structure, recruitment and survivorship, movement patterns, and effective population size, in order to establish a reserve.

There are few clear management options presently available for snake conservation. Research may provide clues to the methods needed to reduce certain conflicts, such as restrictions on vehicles, mowing, or prescribed burning during periods of snake migration (Dodd, 1987). According to Dodd, Johnson (1978), has provided general suggestions for habitat management to enhance snake populations. However, management options will be limited by the biological constraints imposed by the species, so research into basic life history is the first step in effective management (Dodd, 1987).

Snake habitat protection has involved the closure of dens in the Narcisse WMA to commercial harvesting. The 1989 Moratorium on the harvest of snakes throughout Manitoba has also indirectly protected snake habitat.

3.4.4 Captive Propagation:

One of the more recent techniques for managing snake populations has been the process of captive propagation, but this technique is not without problems. Breeding snakes in captivity with subsequent release of progeny into the wild is theoretically possible, but the mass-breeding of snakes in captivity is difficult as is raising young to a size where they are likely to survive after release. In addition, the effects of releases from artificial breeding programs on the local gene pool should be considered (Gregory, 1977).

According to Dodd (1987), as in other forms of management, before establishing captive propagation programs, goals should be clearly established. Too many propagation programs are operated under the guise of 'conservation'. When this really means to supply individuals with a sufficient number of pets, it is not conservation but recreational use of wildlife (Dodd, 1987). In the case snakes in Manitoba, such considerations must be taken into account regarding captive propagation as a means of supplying the demand for snakes in the pet trade and in indirectly conserving natural populations of snakes.

Dodd (1987), states that several conditions should be met before espousing captive propagations as a conservation tool.

The conditions are:

1. The species should clearly need captive propagation to ensure or enhance survival.

2. Proper facilities should be available for long-term programs.

3. Accurate scientific data must be kept and made available to other researchers, preferably through a refereed journal publication. In addition, a species survival plan, such as that developed by the American Association of Zoological Parks and Aquariums (AAZPA), should be maintained by individuals in breeding collections.

4. Goals should be clearly established and should focus on preservation of the species in the wild while maintaining a genetically viable population in captivity. When animals are introduced into the wild, a suitable protected habitat should be available and released animals should be monitored to determine the success or failure of the program.

According to Curry (1988), red-sided garter snakes are the simplest and most popular snakes to keep in captivity. In general, their large appetite, tolerance of varying temperatures and resistance to disease make them particularly suitable. The author maintains that snakes can be kept outdoors and inside relatively easily. Curry (1988), also states that the most commonly imported garter snake is the red-sided garter snake and they are particularly recommended as pets. He also identifies Manitoba as the main source of these snakes to keepers in Britain and Europe. A more complete description of the care and maintenance, as well as breeding methods for the red-sided garter snake can be found in Curry (1988). The captive propagation with subsequent sale to pet stores may be an option available regarding the management of the commercial harvest of Manitoba snakes.

3.4.5 Tourism:

One of the more popular forms of managing wildlife in efforts to conserve populations is through the creation of tourist parks. It must be made clear from the beginning that the economic value of wildlife through tourism is distinct from any other value. Societies often support activities that are uneconomic, such as the preservation of ancient buildings, and it does not follow that if wildlife viewing proves to be a loss-making enterprise, national parks should therefore be closed down (Eltringham, 1984).

Tourism has expanded world-wide over the past few decades and many countries contain sustainable wildlife populations (Eltringham, 1984). There is no doubt that tourism is profitable and that many countries, including rich nations like the U.S.A. and Britain, benefit greatly from the tourist trade, but we need to examine the premise that a tourist trade based entirely on wildlife can be lucrative. Many argue that recreation and tourism activities may be one of the most appropriate ways to conserve wildlife populations in Canada and the World. It is argued that by assigning economic values, in the form of tourism/recreation expenditures (direct and indirect), that an economic argument can be made for the protection of wildlife species and their habitat. Such considerations directly apply to future uses and management options for snakes in Manitoba.

3.5 Recreation and Conservation of Wildlife:

Our sound understanding of demand for wildlife-related recreational activities can be improved by taking into account important differences between groups or segments of wildlife users. Wildlife participants include **consumptive participants**, such as hunters, and **non-consumptive** participants. The latter category includes those who take primary non-consumptive trips, especially to photograph or study wildlife, those who enjoy incidental wildlife encounters during trips or outings taken for another purpose, those who take part in residential wildlife activities such as feeding and observing wildlife around their home and those who take part in indirect wildlife activities such as reading and

watching films on wildlife or purchasing related arts and crafts (Filion, Parker, and DuWors,1988).

3.5.1 The Narcisse Snake Dens:

Presently, there exists a rudimentary, yet popular, internationally known tourist industry for the red-sided garter snake in Manitoba, and it is an area that warrants further research. There have been some observed negative impacts on snake populations and their habitat resulting from the viewing operation at Narcisse. Vegetation around the dens, which may serve an important ecological purpose, allows the snakes to avoid predators. It also helps in regulating micro-climate around the den acting as part of a thermal sink during spring emergence. Recent increases in viewer numbers have resulted in some observed den degradation, due to trampling of vegetation around the dens by visitors. Other impacts on the snakes by visitors include stress on the animals as a result of viewers handling snakes in and around the den. The handling of snakes can be stressful and could reduce reproductive success among females. The increase in road kills due to the added traffic travelling to the viewing area is also of concern to resource managers. Snakes have been observed crossing roads but more importantly it has been observed that they are using roads as basking areas. It is now thought that deaths by road kill may be a significant factor in the mortality of snakes at Narcisse. Another significant concern resulting from people viewing the Narcisse dens is the erosion of soil around den sites. Trampling in some areas of the den sites has resulted in complete elimination of vegetation rendering the top soil accessible to various erosion forces. Some of the soil that erodes around the dens is subject to filling in the crevices and holes that the snakes use to find access below the frost line. Over the long term unmanaged erosion of soil may result in the complete blockage of access to these dens.

3.6 Economic Values of Wildlife:

Economists are examining the complexities of wildlife policy issues and valuation problems in an economic framework. Cocheba (1987), states that there is universal agreement that knowledge of wildlife biology and ecology is necessary for making good wildlife management decisions. Information about the benefits and costs associated with alternative courses of action is essential for making defensible wildlife management decisions and apply directly to snake management in Manitoba.

In the past, difficulty has arisen in attempting to assign economic values to wildlife related management decisions because of the nature of the resource. The production and consumption of wildlife take place outside organized markets (Davis and Lim, 1987). Most applications of economics to the problems of wildlife valuation have not made use of market values directly observed. However, economists have, over the last twenty years, begun to develop a conceptual framework for the valuation of wildlife. A synthesis of some of the more popular valuation tools used by economists in the wildlife management arena is described below.

There are a number of authors who deal with the total valuation framework (Bishop, 1987; Cocheba , 1987; Randall, 1987;Steinhoff et al, 1987;). Such a framework is an attempt to cover, within a unified theoretical structure, the full range of possible values that any particular wildlife asset might generate (Bishop, 1987). If such values are known, an economic value can be placed on the wildlife resource in question and consequently a compensation test can be carried out assisting management or policy makers in a decision.

The total values that a wildlife asset might generate can be divided into use values and non-use values. Use values are generated when management decisions affect the enjoyment people get from current use of the wildlife asset. The most familiar use values-

consumptive use values- are generated by hunting, fishing and trapping. Another use value is nonconsumptive use, which can be direct or indirect (Bishop, 1987). Cocheba (1987), argues that the terminology of consumptive and nonconsumptive uses is not appropriate in an economic framework and should be avoided. He classes uses other than hunting, fishing and trapping as non-hunting activities. These uses of wildlife include outings, the primary purpose of which is to study, to observe, and or to photograph wildlife. These activities are classified as wildlife-based activities. Another use for wildlife can be classified as wildlife-related activities, such as camping , canoeing, picnicking, and driving for pleasure. In such cases wildlife is not the central focus of the activity.

Non-use values are generated when management decisions affect possibilities for future use or impinge on people's altruistic concerns (Bishop, 1987). Randall (1978), describes non-use values as future use values and defines them as the value expected to be generated in the future by use of a wildlife resource. He argues that the distinction between use (current) and non-use (future) values is not conceptually important but has implications for measurement. Future use must be projected, which can be subject to change in unexpected ways. The uncertainty of future use leads to two kinds of option values (Randall, 1987). Ordinary (option) values and Quasi option values. However, Randall's definition of option value is not easily understood. Cocheba (1987), gives a much better definition of option values. According to Cocheba (1987), option value is not a use value but an additional source of benefits related to future time periods. More specifically, when future availability of wildlife is in doubt and/or future demand for use of a wildlife species is uncertain, option value is likely to be positive. Option value can be viewed as a risk-aversion premium individuals are willing to pay for retaining an option for future use of a species. In other words, option values can be thought of as the willingness to pay a kind of insurance premium to retain the opportunity of future use.

Quasi-option values are described as the values of wildlife as genetic material for future research or as a future source for useful chemical compounds. More clearly, this is the value of preserving options, given the expectation for growth in knowledge (Cocheba,1987). Randall (1987), illustrates what is meant by Quasi-option value as the following: "if development is irreversible (for example, preservation in period 1 allows the choice of preservation or development in period 2, but development in period 1 precludes development in period 2) and one expects new information about the value of preservation to emerge after period 1 but before the second-period decision must be made, a quasi-option is positive. It is essentially the value of the emerging information conditioned on having made the first-period choice (preservation, in this case) that maximizes the second-period array of alternatives" (Randall, 1987).

Another value that needs to be addressed in a total economic framework for wildlife valuation is what has been termed the existence value. An existence value is derived from the knowledge that the environmental resource continues to exist. Individuals with an understanding and appreciation for natural systems and the important role that diversity plays in those systems may derive utility from the mere knowledge that those systems exist intact. "The disappearance of a natural environment or the extinction of an individual species may, therefore, cause disutility for an individual who has never been observed 'using' those natural resources. This utility from existence, or disutility from extinction or disappearance, provides the source of existence value" (Randall, 1987).

The idea of bequest value is somewhat related to existence value. Bequest value can be defined as the willingness to pay for ensuring that future generations will have the opportunity to benefit from the existence of a species. As this definition implies, bequest value can be considered an intergenerational option value (Bishop, 1987). The difference between bequest and existence values ar that bequest values involve the value of providing

for future generations, whereas existence values arise merely from the individual knowing that the animals exist (Steinhoff et al, 1987).

3.7 Summary of the Literature

There is a need to study the biological requirements of snakes. Reproduction, habitat requirements, feeding requirements, and environmental requirements must be considered when determining appropriate management strategies regarding red-sided garter snake conservation in Manitoba. Many of the threats to snakes are human induced and therefore any management strategy must address the relationship of humans. Furthermore, snake managers must provide techniques that are compatible with both the use of the snakes by humans and the individual needs of the snakes themselves. In the case of the red-sided garter snake such issues must be addressed in order to ensure a successful management plan.

CHAPTER 4:

Recreational Viewing and Tourism:

The results of surveys and financial estimations for recreational viewing will be described in this chapter. The importance of recreational viewing in terms of social attitudes, financial contribution and minimal biological impact will be discussed. Improvements to present management techniques and the rational to continue to support such uses of snakes will be discussed.

4.1 Survey of Recreational Viewers:

The purpose of this survey was to obtain; A) basic information on why people came to view the snakes at Narcisse; B) information regarding basic expenditures by people viewing snakes and; C) attitudes toward red-sided garter snake management in Manitoba. Direct interviewing was carried out on a random basis with people as they passed by the interviewer. Survey results were obtained from 112 individuals visiting the Narcisse Snake Dens over a two day period in May, 1990. More general information obtained in the survey can be found in Appendix 4.

Figure 6 represents responses to the question of whether respondents had spent any money as a result of coming to view the snakes at Narcisse. Fifty-nine of 112 individuals indicated they had spent money to come and view snakes, while 48 indicated that they had not spent any money. Five did not answer the question. The 59 who said they had spent money as a result of viewing the snakes were asked to describe how money was spent. Forty-eight of the 59 stated that they spent money on transportation, 10 indicated snack food as an expenditure, 1 did not answer (Fig. 7).

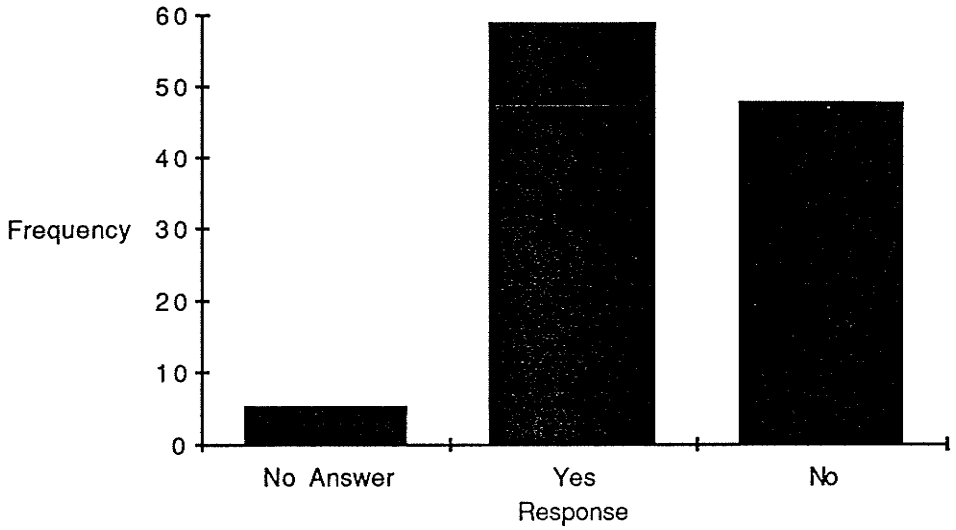

Figure 6: Response of surveyed individuals regarding money spent on viewing the Snakes (n=112).

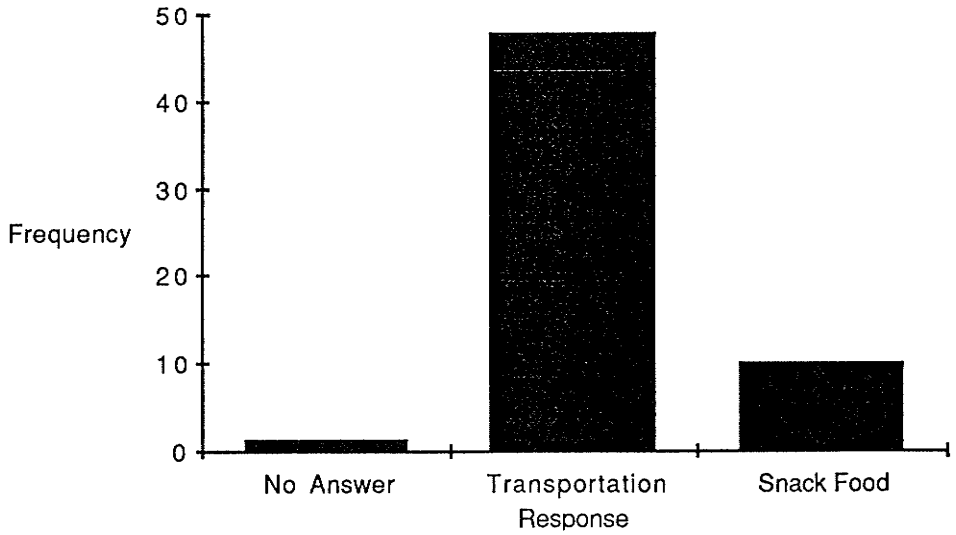

Figure 7: Response of those individuals indicating an expenditure and what they spent money on to view the Snakes(n=112).

Figure 8 portrays the amounts of money spent by surveyed individuals to view the snakes at Narcisse. Forty-five of the 59 individuals indicated that they had spent between $0-$20, 11 had spent $20-$50, 1 stated that they had spent over $100, and 2 individuals surveyed did not answer the question. All of the 112 were asked how much they would consider spending to view the snakes after being to Narcisse (Fig. 8). Eighty-two said that they would be willing to spend $0-$20, 13 stated that they would be willing to spend $20-$50, and 2 would be willing to spend $50-$100. Fifteen out of the 112 individuals surveyed did not answer the question.(Fig 9)

Individual attitudes toward snake management issues were solicited using a 5-point likert scale. Results are represented in figures 10 to 13. Respondents were asked to indicate how strongly they felt about a statement,(5) meant that they agreed strongly with the statement,(3)meant they were neutral and 1 meant that they strongly disagreed with the statement). There was also a no opinion option given for each of the statements.

In figure 10 individuals surveyed were asked to indicate how they felt about the statement that 'it is important to protect the red-sided garter snake and their denning areas in Manitoba'. Ninety-one out of the 112 individuals surveyed strongly agreed with this statement.

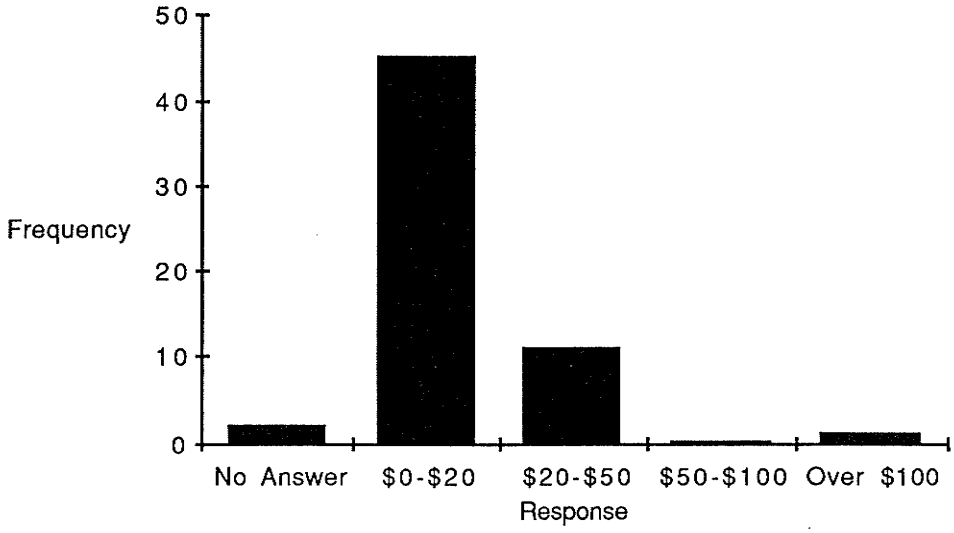

Figure 8: The value stated by respondents on the expenditure made to View Snakes (n=112).

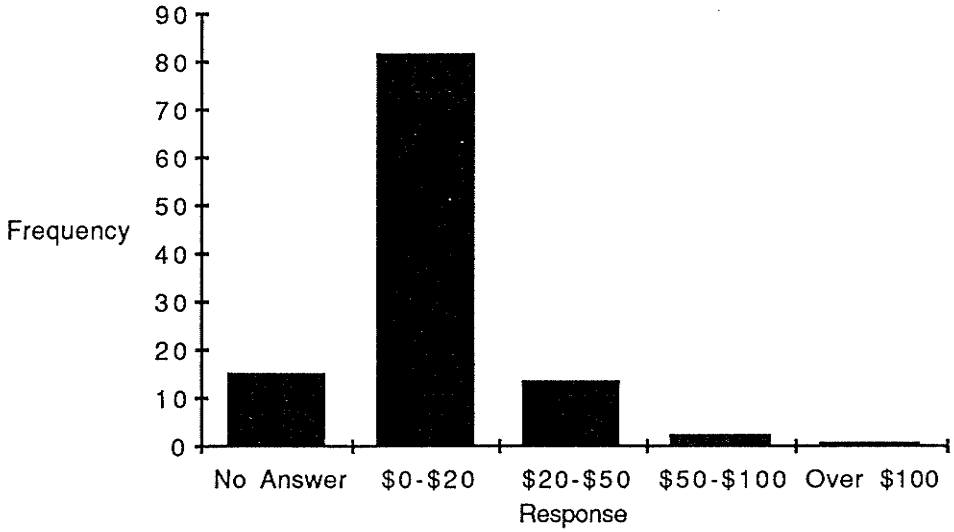

Figure 9: The value of expenditure that all respondents would be willing to pay to view the snakes at Narcisse (n=112).

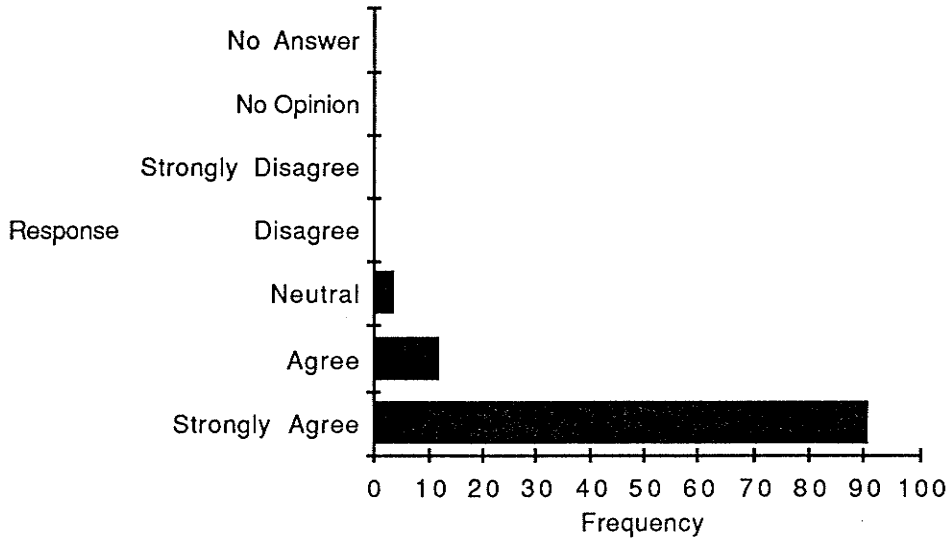

Figure 10: Response of individuals surveyed regarding the question "it is important to protect the red-sided garter snake and its denning areas in Manitoba "(n=112).

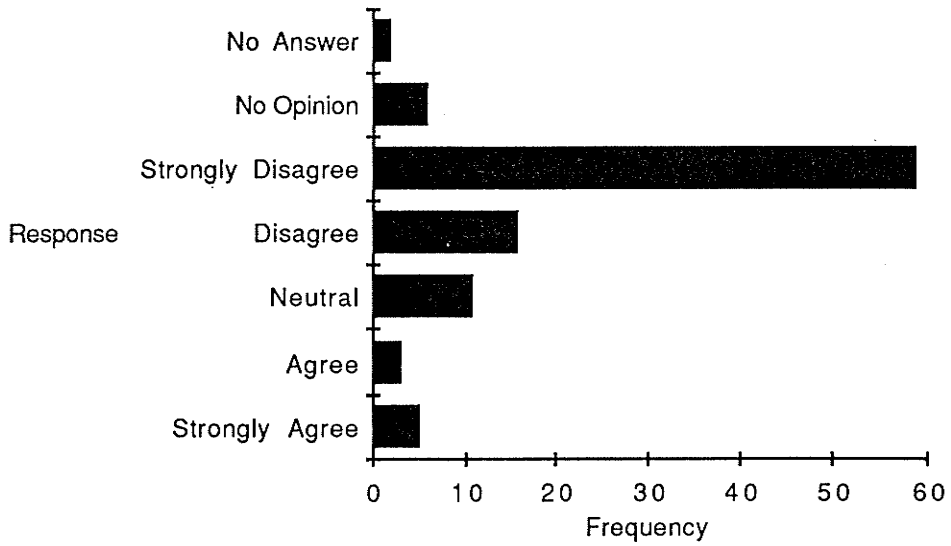

Figure 11: Response of individuals surveyed regarding the statement that " people should be able to derive income from the collection of the snakes in Manitoba (n=112).

Twelve individuals moderately agreed and 4 were neutral with the statement. No surveyed individuals disagreed or strongly disagreed with the statement (Fig 10).

Figure 11 illustrates the feelings surveyed individuals expressed about the statement that 'people should be able to derive income from the collection and sale of snakes to the pet trade'. Five of 112 strongly agreed with the statement, 3 moderately agreed,11 individuals were neutral, and 16 moderately disagreed. Sixty-nine out of 112 respondents strongly disagreed with the statement, while 6 had no opinion.

Individuals were asked to indicate how they felt about the statement that' it is important to educate people about the red-sided garter snake in Manitoba '(Fig 12). Fifty-eight individuals strongly agreed, 33 moderately agreed, 12 were neutral, and 3 individuals moderately disagreed with the statement. Four respondents had no opinion

Figure 13 represents the responses of the 112 people surveyed to the statement that: 'it is important to do scientific research on the red-sided garter snake in Manitoba'. Thirty-four strongly agreed, 33 of 112 moderately agreed, 31 individuals were neutral, while 2 moderately disagreed and 4 strongly disagreed. Six individuals had no opinion(Fig. 13).

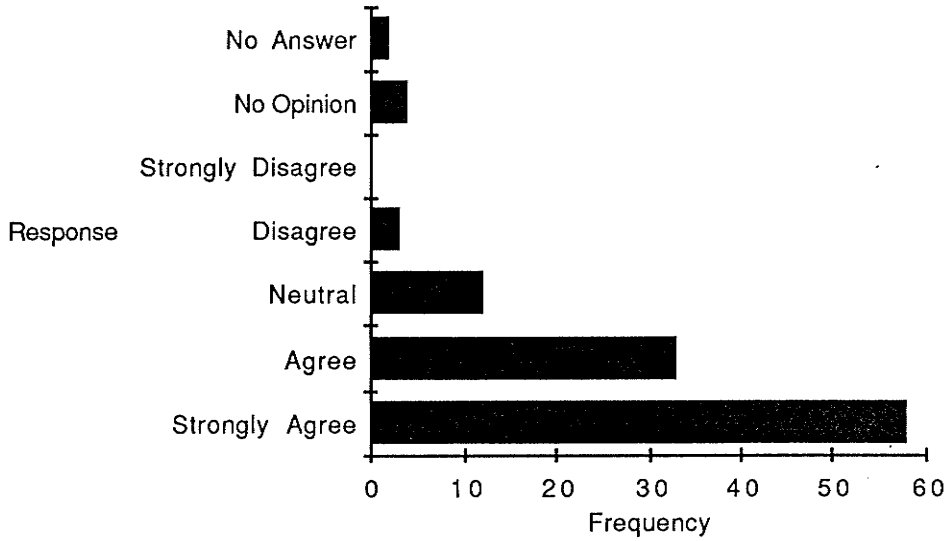

Figure 12: Response of individuals surveyed regarding how they felt about the statement that " it is important to educate people about the red-sided garter snake in Manitoba " (n=112).

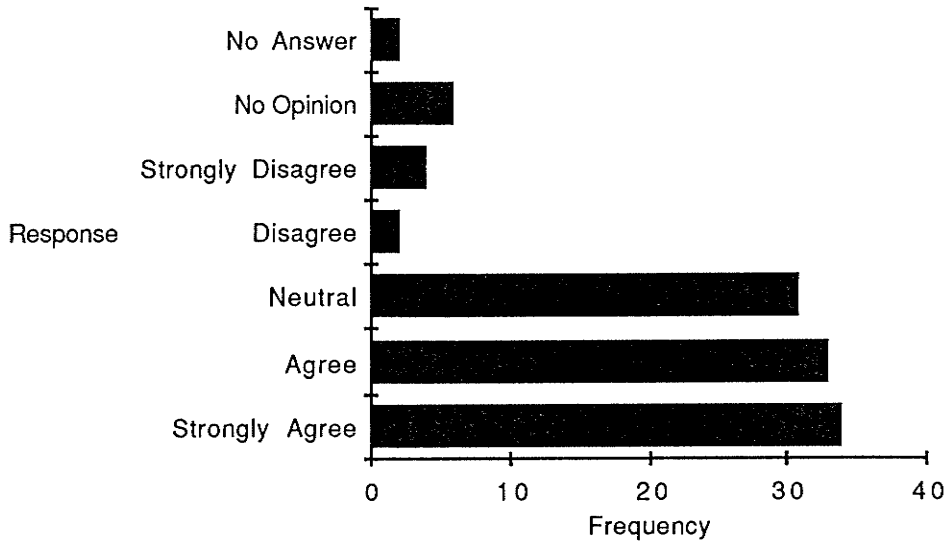

Figure 13: Response of individuals surveyed regarding the statement that " it is important to do scientific research on the red-sided garter snake" (n=112).

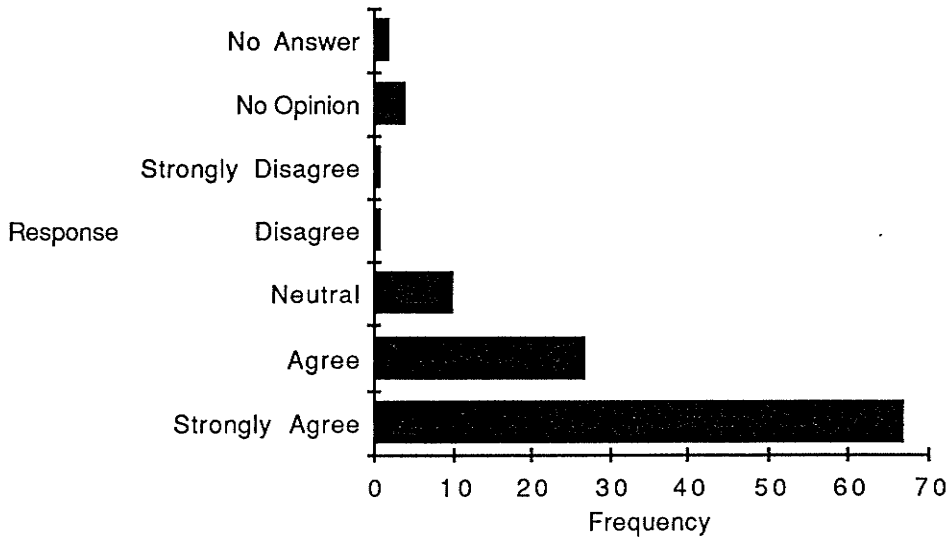

Figure 14: Response of individuals surveyed regarding the statement that " tourism should continue at the Narcisse Dens" (n=112).

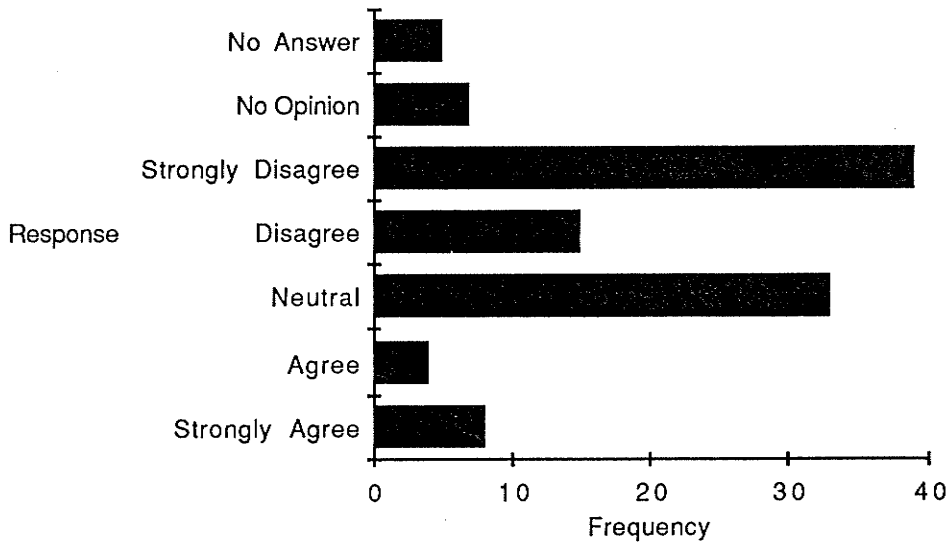

Figure 15: Response of individuals surveyed regarding the statement that "admission to see the snakes should be charged" (n=112).

The statement that 'tourism at Narcisse should be allowed to continue ' was asked of survey respondents (Fig 13). Sixty-seven of 112 individuals strongly agreed with the statement, 27 moderately agreed, and 10 were neutral. One respondent moderately disagreed and 1 strongly disagreed. Four individuals had no opinion

People were also asked how they felt about the statement that: admission should be charged to see the snakes. Eight of 112 individuals strongly agreed, 4 moderately agreed, and 33 individuals were neutral. Fifteen individuals moderately disagreed with the statement and 39 strongly disagreed. Seven individuals had no opinion and 6 did not answer the question (Fig. 14).

4.2 Survey of Long Time Local Residents:

Long time residents of the Inwood, Narcisse and Sandridge areas of the Interlake were personally interviewed. The purpose of the survey was to determine attitudes toward the economic importance of recreational viewing in the area. A representative sample of local residents with interest in the snakes was developed. Local business people, private landowners with dens on their land, political representatives of the area and locally concerned individuals were interviewed. Following is a summary their attitudes toward the recreational snake viewing industry:

Some of the general comments toward the importance of the Narcisse pits as a drawing card for economic activity were A) most local residents do not care for the snakes in any capacity.Snakes are considered to be more of an annoyance than as an economic opportunity. B) public visitation to Narcisse injects a great deal of economic activity into the local economy. A new restaurant in Inwood opened last year with the major purpose of capturing economic opportunities from tourists going to view the snakes. Three local business operators stated that the snake dens had a strong impact on their business revenues and two others stated that the snake dens had a moderate impact. Another store owner stated that the snakes could impact on his business significantly but did not because the store was closed on Sundays, a busy day for snake viewing. C) regional disparities

of a rural farming area accentuates the importance of the snake pits to the economies of local communities. Several entrepreneurial residents can generate significant proportions of annual revenues over short periods of time. D) harvesting of snakes for sale as pets should not be allowed unless local populations increase and snakes can be harvested sustainably. E) recreational snake viewing and the tourism aspect of the snakes is a much better way of using the snake resource. One respondent indicated that if a harvest could be carried out in a sustainable fashion then it should be allowed because it would enhance the awareness of snakes outside the area, and could therefore potentially result in greater public visitation to the Narcisse pits.

An interesting comment had to do with possible improvement to managing the snakes pits at Narcisse. This individual indicated that a possible way to minimize deaths at the pits would be to fertilize the grass areas around the den sites as to create a vegetational buffer for the snakes. This buffer would help in giving snakes protection from predators as well as from overzealous recreational viewers.

4.3 Financial Analysis of Recreational Viewing:

Data obtained from DNR records were used to calculate the provincial costs to operate and maintain the Narcisse site (Table 1). Data from the 1990 tourism survey was used to calculate the economic benefits generated by the Narcisse snake pits (Table 2). The approximate revenue generated by the snake viewing facility to Manitoba was calculated using willingness to pay information obtained from questionnaire responses (Appendix,1).

Table 1: Costs associated with maintaining and operating the Narcisse snake viewing facility for the 1991 season.

Spring 1991 Expenditures:	
Seasonal Staff	$5,063.78
Vehicle Mileage	$ 886.23
Expenses	$ 210.98
Maintenance & Construction Materials	$ 124.98
Cleaning Supplies	$ 5.13
Photo Station Film	$ 29.08
Traffic Counter Batteries	$ 13.88
Subtotal	$6334.06
Fall 1991 Expenditures	
Seasonal Staff	$ 875.84
Vehicle Mileage	$ 448.50
Expenses	$ 171.81
Subtotal	$1496.16
TOTAL	$7830.22

NOTE: (Data obtained Department of Natural Resources, 1495 St. James , Winnipeg).

The costs for the Province of Manitoba to operate the snake viewing facility at Narcisse Manitoba for the 1991 season was estimated at $ 6,334.06 during spring viewing season and $1,496.16 during the fall viewing season, totalling$7,830.22. The bulk of the expenditure was used to provide seasonal staff interpreters ($5,939.62). The 1991 spring season marked the first time that direct economic revenue was obtained from the viewing of snakes at Narcisse Manitoba. An experimental Mobile food concession was allowed to operate in the southeast corner of the snake den parking lot for 6 days. No direct information on the revenue generated from the operation of the food concession has been obtained to this point. It was estimated that the operator generated a gross revenue of $10,000 to $ 20,000 for six days of operation (Roberts, Pers Comm.1992).

The indirect economic benefits generated from the Narcisse pits are illustrated in table 2. In 1990,it was estimated that people would be willing to pay a total of approximately $211,000 to come and view the snakes. Most respondents stated that these willingness to pay expenditures would be for transportation and snack food costs. Survey respondents were also polled on whether they actually did spend money to come and view the snakes at Narcisse. Estimated revenue generated was determined from survey respondents and extrapolated for the total tourist population of 1990. Approximately $140,000 was spent in 1990 to come and view the snakes at the Narcisse pits based on survey data. This figure represents the estimated wtp value of recreational viewers during mid-trip. Values were not determined with respect to wtp to return from viewing the snakes. Therefore, maximum wtp was used to determine the financial importance of the snake dens to recreational viewers. The estimated mean and minimum wtp values based on mid-trip responses of surveyed individuals was $120,755 and $30,090 respectively.

Table 2: Estimated willingness to pay (WTP) values and estimated revenue generated by survey respondents at Narcisse dens 1990.

Year	Tour Visits	Total Visits	General Public	ESTIMATED WTP VALUES *	ESTIMATED REVENUES ^
1987	1090	5590	4500	$124,277.68	$82,352.68
1988	1912	7712	5800	$171,454.29	$113,614.29
1989	889	7289	6400	$162,050.09	$107,382.59
1990	**2214**	**9494**	**7280**	**$211,071.96**	**$139,866.96**
1991	1978	12500	10522	$277,901.79	$184,151.79
Average	1616.6	8517	6900.4	$189,351.16	$125,473.66
Total	8083	42585	34502	$946,755.80	$627,368.30

* WTP VALUES WERE CALCULATED USING SURVEY DATA FROM 1990
^ ESTIMATED REVENUES CALCULATED FROM 1990 SURVEY DATA (VALUES IN 1990 DOLLARS).
NOTE: FOR "WTP" CALCULATIONS MAXIMUM VALUES WERE CALCULATED

4.4 Discussion:

Results illustrate that snakes in Manitoba should not be harvested under the pre-moratorium management system and that the DNR should concentrate their efforts and resources on the management of recreational viewing. The tourism and recreational viewing that occurs was determined to be a more socially acceptable use than was the commercial harvest. The potential for negative biological impacts was determined to be less likely and easier to mitigate for recreational viewing when compared with potential commercial harvesting impacts. A substantial amount of annual revenue is generated from viewing snakes in the Interlake region. This revenue is generated and remains in Manitoba, whereas past commercial harvest revenue was lost to foreign interests. Recreational viewing contributes more direct economic benefit to Manitobans, and therefore is more economically important and socially desirable than was the commercial harvest. A number of issues related to the Narcisse site and other recreational viewing management options were raised during this study. More discussion is required to illustrate why recreational viewing is an acceptable use for snakes. The rationale behind the continuation and improvement of recreational viewing will be discussed.

4.4.1 Social Considerations:

The snake dens were regarded as a valuable resource because they; A) are a natural phenomena unique to Manitoba; B) contribute to local economies'; and C) have great educational and scientific value. The majority survey respondents were aware of the value associated with the snake pits. Recreational viewers, scientific researchers, local residents, and DNR staff all indicated that it was very important to protect the snakes at Narcisse (Fig.9). Although reasons for protecting the dens were not recorded the responses dealt with the unique biological characteristics of the snakes being something that should be preserved for others to see.

Over 80% of the people surveyed either strongly or moderately agreed that it was important to educate people about snakes and the denning populations in Manitoba. The importance of educating the general public about snakes can not be over emphasized. Malicious killing was indicated as one of the reasons for declines in snake populations world wide, although no such data exists for the red-sided garter snake in Manitoba. However, instances of whole dens being wiped out have been reported. By allowing people a hands-on experience and educating them about the snakes unique characteristics and contributions, awareness for the red-sided garter snake is developed. Many of the people surveyed felt strongly about access to the Narcisse den sites being continued and developed further in the future. The DNR should continue to develop and promote the educational aspect of red-sided garter snake and the relationship that snakes play in the conservation of natural ecosystems.

Recreational viewing was regarded as a more socially acceptable use for the snakes by survey respondents then was commercial harvesting. For example, local residents commented that they would much rather see recreational viewing of the snakes then commercial harvesting as the main use in the area. Recreational viewing affects far more people not only from a biological or economical standpoint but also from a social standpoint with regard to recreational activity and enjoyment for many families, as well as an educational tool. The ideal location of the Narcisse snake pits makes them available to a substantial proportion of the Province's population. The viewing of snakes at Narcisse also occurs at a time of year when few other outdoor recreational activities are available or desirable. Survey respondents perceive recreational viewing as a benign use that would not significantly interfere with the continued protection of snake populations. On the other hand, harvesting is perceived to be destructive to snake populations. The positive response by individuals with respect to protecting snakes is fundamental to the final recommendations of this study. The responses of individuals was an important

consideration when determining appropriate uses and management techniques for red-sided garter snakes.

4.4.2 Biological Considerations:

If the biological impacts of recreational viewing are not managed, there is the possibility of denning populations being lowered and of the viewing quality of the Narcisse dens being lowered. Negative impacts of recreational viewing would include a loss of 1) a unique wildlife phenomena, and 2) large amounts of money and effort that has already been invested in Narcisse in terms of infrastructure. The maintenance and long-term operation of the Narcisse snake populations should be considered as an important factor in the improved and continued management of recreational viewing at the Narcisse site. If snake populations decline, then viewing quality may decline to a point where by it is no longer an attractive option for many recreationists to come and visit. Declining snake populations at Narcisse would also have a substantial impact on local businesses and the regional economy. It is vital that the welfare of the snakes over-rule any recreational or economic activities at the Narcisse dens

Another concern is that improved management techniques may lower the viewing quality. An estimated average of 8,517 people have visited Narcisse since 1987 on an annual basis, or a total of 42,585 people (Tab 2). The current trend suggests that viewing is increasing. As viewing increases the concern over negative impacts on the denning populations increases. Conflict arises from the fact that unmanaged viewing or viewing under the present management system may result in the same outcome in viewing quality as a more controlled viewing site would. Viewing quality may be lowered under a more managed scenario. Historically, there has been very little recreational viewer management at Narcisse. Viewers were free to come and go as they pleased, and even when accompanied by an Interpreter no restrictions were made on the number of people viewing a particular den. Visitor number restrictions would be one management technique that

could be employed to protect and maintain large numbers of snakes at Narcisse. However this would restrict the freedom of viewers and may increase the time required to view the snakes reducing viewing quality. More research on this issue is needed to determine an adequate mixture of viewing quality and snake protection.

Passive viewing management techniques should be employed that do not perceptually lower the quality of viewing. Grassing a swath around the dens except for the platform area would allow the snakes a transition zone from viewers and would also have the added benefit of protection from predators. This management technique would be relatively inexpensive and cost effective. Grassed areas would have to be fenced except at the platform positions so as to maintain the quality of protection that would otherwise be lost from viewers trampling on the grass. Viewers would still have a high degree of viewing quality provided from the platform viewing area.

Another management concern associated with recreational viewing and tourism at Narcisse is an increase in road kill related to increased viewing. Road kill has been considered to be a major cause of mortality for the snakes at Narcisse. Migration routes to summer feeding areas run across Highway #17, the road which tourists travel on to come to the Narcisse pits. The conflict is that tourists contribute to a significant percentage of the Narcisse snake mortality. As viewing increases there is the possibility that road kill may also increase and the viewing quality decrease. An important observation here is that most people who come to view the snakes come in the spring (Table 2). The effect on the snake population may be even greater since mating occurs during the spring. Road kill could be effectively destroying snakes that have mated thus compounding the negative impacts on natural populations. The impact that road kill is having on the Narcisse snakes must be addressed immediately and mitigative measures taken. Some suggestions include gravel basking areas being placed adjacent to highway #17, and at the end of the snake tunnels, that divert the snakes into culverts under the road. This would help to deter snakes from using the road and reduce the potential road kill during migration.

The potential biological impacts from tourism and recreational viewing activities are relatively more easier to mitigate compared to the impacts of past commercial harvesting techniques. Nonetheless, further research on the impacts viewing has on snakes is needed to ensure the long-term sustainability of the Narcisse pits More information on the impacts of viewing should be initiated in order to ensure the long-term survival of the snakes at Narcisse.

4.4.3 Financial Considerations:

Information was obtained on why people come to view snakes at Narcisse, basic expenditures by people viewing snakes, the financial importance to local business was obtained, and attitudes toward future recreational management and commercial harvesting Information illustrates the importance of Narcisse in terms of economic opportunities for local residents. Willingness to pay (wtp) and estimated expenditures of viewers were solicited. Indirect purchases related to viewing the snakes has contributed to roughly $125,000 annually since 1987 (Tab 2). WTP values indicate that approximately 85% by people surveyed would pay $20 or more to view snakes (Fig 9).

Local residents perceived the Narcisse dens as important to the local economy and important to local businesses. A number of individuals have taken advantage of the economic opportunities that exist from viewing. A new restaurant opened in 1991 specifically to capture economic opportunities from an increasing number of travellers going to view snakes. Such economic activities can provide revenues to local economies without the destroying the snakes or their denning areas.

The potential economic loss to local area residents from not being able to derive economic benefits from the commercial harvest of snakes was a concern expressed by interview respondents. However, it can be argued that harvesting snakes could have negative impacts on viewing quality associated with recreation and tourism through potential reduction of denning populations. It is argued that harvesting snakes using past

techniques reduces natural populations which would in turn reduce the potential economic opportunities derived from recreation and tourism activities. There was no way to determine whether or not harvesting had significant impacts on viewer quality

Information obtained illustrated that Narcisse is an important educational facility for Manitoba's Schools. Approximately 20% of total den viewing consists of school groups. These tours constitute another important source of revenues. Most revenue is earned by tour groups from Winnipeg based companies. The cost for a Winnipeg based tour would average $25 per person (Based on the Museum of Man and Nature's annual rate, Winnipeg, 1991). Tours constitute an area where economic opportunity exists, not only for Narcisse, but for other possible recreational viewing sites.

One concern with respect to tour groups and the improved management of recreational viewing at Narcisse deals with the lack of structure and over-crowding associated with snake viewing . The number of school groups that have come during the spring to view the snake dens at Narcisse has increased each year since 1987. It was also determined that many of the tour groups visiting the Narcisse dens in 1991 did not register with regional staff. This resulted in over-crowding of the viewing facility on certain days. Such over-crowding has negative impacts on the den sites and the snakes. Although education is important and accounts for a significant proportion of visitors annually, tour groups should be required to contact DNR staff to arrange a date to view the snakes and the dens.

4.5 Conclusions:

There exists a large potential to develop recreation and tourism ventures based on the snakes as a unique biological phenomenon. In the long term, such ventures make more sense with respect to the present day sustainable development policies. As such, the DNR should encourage individuals and groups to develop projects related to uses of red-sided garter snakes which are non-consumptive and biologically sustainable. This is not to say

that a commercial harvest of snakes should not be re-established but that perhaps the benefits both economically and socially could be realized at a far greater potential through recreational and tourism ventures. This study documents the social and economic importance of recreational and tourism ventures to small regional communities with limited resources for economic development. The continued support and promotion of the Narcisse dens and other areas with potential for similarly based ventures should be a dominant theme in future management for the snakes for the DNR.

Although there were no direct economic gains from the Narcisse site, revenue was generated indirectly. More focus is needed in developing ventures that generate direct local economic benefits from red-sided garter snakes, as well as better figures on WTP values for recreational viewing. The DNR should encourage local entrepreneurs who want to enter in to recreational ventures dealing with red-sided garter snakes. It is also suggested that strict rules regarding such ventures be developed by the DNR. Such rules should help to minimize any negative impacts on denning areas or the snakes caused by new ventures. Any new venture should be on an experimental trial basis initially, until impacts can be identified and mitigative measures developed. It is recommended that such ventures be encouraged in areas where an interest is indicated. However, it is also suggested that some denning populations should be protected from exploitation due to the relative stress that contact with humans may have on the snakes.

The most appropriate management strategy for the DNR to pursue with respect to uses of Manitoba snakes should not include a commercial harvest. Instead, the DNR should promote the improvement and development of tourism and recreation viewing. The DNR should also initiate and encourage further research on the ecology and life history parameters of red-sided garter snakes. Research and monitoring of tourism and harvesting impacts on snake ecology and life history should also be initiated as soon as possible.

The following actions are suggested areas that the DNR should address to develop an appropriate management strategy for the snakes:

1. The continued support and promotion of the Narcisse dens should be a dominant future theme in snake management. The promotion and development of new recreational ventures based on the viewing of snakes in Manitoba should also be carried out (Appendix 5).

2. The DNR should continue to develop and improve the Narcisse snake den viewing area to better accommodate the large number of annual viewers in a manner that minimizes the negative biological impacts on the snakes and their denning areas.

3. The DNR should continue to develop and promote the educational aspects of red-sided garter snakes and the relationship of snakes in conservation.

4. Research on the viewing capacity that the Narcisse site can support with minimal negative impacts on the red-sided garter snakes should be carried out. Such research should address the possibility of supervised tours as well as alternating viewing at dens on a rotational basis so that one den is always free of viewers on a particular day.

5. Mitigative measures should be employed to minimize the impacts caused viewing activity. Such measures might include thermal basking gravel beds adjacent to Highway #17 to deflect snakes from becoming subject to road kill, and creating a large fenced grass buffer zone around the Narcisse den sites to reduce soil erosion and human disturbance.

6. The initiation of research to determine alternative sites for additional viewing should also be determined.

CHAPTER 5

Commercial Harvesting

Chapter 5 will illustrate results of the comparison criteria and survey information for alternative commercial harvest management strategies. The choice of not to harvest snakes under present conditions will be discussed and the rational behind this choice explained. Information regarding possible management strategies that could be employed in the event of a renewed harvest will also be discussed. The main issue of not being able to monitor the negative biological impacts from harvesting will be highlighted and explored in some detail. Suggestions on further research will be recommended.

5.1 Market Assessment:

General Information on the world market for red-sided garter snakes was obtained through consultation with knowledgeable individuals, snake dealers, biological supply house representatives , pet store operators, and biological supply house annual catalogues. Individuals were asked to comment on supply and demand for snakes in relation to changes in market prices. Information was obtained on wholesale and retail prices for red-sided garter snakes from Manitoba from annual catalogues and local pet store representatives. It was determined that the wholesale price for snakes was approximately 50% that of the retail price observed in North American pet stores or approximately $10.00 to $15.00. Retail prices were estimated at approximately $20.00 to $30.00 in North America. The retail prices in Europe were considered to be higher and one price for Manitoba snakes in Japan was quoted at $200.00, although this was not confirmed.

5.1.2 Dealer Telephone Interviews and Mail-out Questionnaire:

A search of biological supplies catalogues determined four biological supply houses bought and sold Manitoba snakes before the 1989 Moratorium. The purpose of this survey was to obtain general information on the market for snakes from Manitoba. The following informal telephone interview and a formal mail-out questionnaire (Appendix 3) results

were obtained from four North American biological supply house dealers who buy and sell Manitoba snakes:

All four dealers were contacted by telephone and asked to comment on the closure of the harvest season. They were also asked to comment on the impact that the season closure in Manitoba in 1989 has had on the garter snake market in North America and the world. Finally the dealers were asked to provide suggestions regarding management scenarios for snake harvesting in Manitoba. Following is a summary of each of the four dealers comments during the informal telephone interviews:

DEALER #1:

Dealer #1 stated that, prior to the 1989 moratorium, he dealt mainly with the educational market for red-sided garter snakes in the form of preserved specimens. Preserved specimens were sent to schools for use in biology classes as dissection assignments. He stated that he would very much like to obtain snakes from Manitoba again and he had sent a letter to the Manitoba Wildlife Branch with the purpose of obtaining a special permit to collect a specified number of snakes. He would pay the pickers to collect a large number of snakes that would sustain his customer demand for one or two years. Dealer # 1 said that contrary to most people's opinion there is relatively little mortality in holding the snakes for long durations of time, perhaps 1 in 100. The dealer was willing to pay the pickers a salary for collecting snakes instead of the traditional market system before the 1989 moratorium.

Dealer #1 could sell approximately 1,000 to 2,000 Manitoba red-sided garter snakes each year. He said that the snakes that he buys are strictly for educational uses and that the educational uses for red-sided garter snakes in his opinion accounts for approximately 10% of the total market. Dealer #1 also stated that he sells only 100 -200 live snakes per year to certain scientific researchers. He stated that the market for snakes for research purposes is relatively small compared to educational uses or the pet trade. Since 1989 he had obtained snakes from local sources in the United States and that the local dens and snakes were not

nearly as good in quality (Size, Physical Condition and Number available) compared to snakes from Manitoba.

DEALER #2:

Dealer #2 was very enthusiastic and interested in the future of the snake market. She said that her business deals with five scientific researchers at the most, and does not deal in the sale of snakes for educational uses or for pets. Dealer #2 stated that her supply house has supplied live snakes to these scientific researchers for about 10 years. The total demand for snakes is approximately 1,000 per year but she has not been able to meet this demand since the 1989 Moratorium. She stated that the cost of the snakes has soared perhaps doubled or even tripled because they have to be individually collected in the United States. They deal strictly as suppliers to researchers but do sell snakes to pet dealers as an outlet for the surplus snakes.

Dealer #2's understanding was that the snake issue was a very political one and perhaps volatile. She used to be in the snake pet trade about 15 years ago but not any more. Her customers have been left "high and dry" with regard to obtaining red-sided garter snakes from Manitoba and that they are quite disappointed.

DEALER #3:

Dealer #3 deals mainly in selling red-sided garter snakes to pet stores but he does deal with scientific researchers as well. He stated that he was disappointed with the harvest moratorium and mentioned that the moratorium had affected about 30 researchers.

Dealer # 3 said that the pet trade must be allowed to continue if the harvest of snakes in Manitoba is to be allowed because collectors don't get much money for the snakes. He was of the opinion that there was no ecological/biological concern about the snakes, but, that the concern was social in respect to Native pickers and the generation of income. He stated that this study should address what levels of harvest could be sustained with snake populations being unharmed, the study should address the economics of the

native bands and the constitutional question of allowing people to pick snakes on their own land, which would arise in the United States. He stated that the study should ask the question of whether the pet trade deserves to be supported. He thinks yes if an industry is going to be sustained.

DEALER #4:

Dealer #4 was not very co-operative in answering questions about supply and demand of snakes from Manitoba. The dealer stated that he did not want to take the risk of sharing information regarding the markets for snakes that he had established over a long period of time. The dealer was concerned that such information would fall into the hands of competitors and that as a result he would lose his competitive advantage. Dealer #4 stated that his major market for snakes from Manitoba was in the Pet trade and that he had an extensive network of stores that sold snakes in the United States and one store in Europe.

The dealer's opinions on the possibility of a new harvest season for Manitoba snakes was very strong. He stated that the closure of the season in 1989 had resulted in a significant loss of income for his business and that snakes from Manitoba constituted the major source of snakes for him. Dealer #4 thought that the harvest of Manitoba snakes should be allowed to continue in the future and that a specific management scheme should be instituted to ensure a sustainable harvest.

Dealer #4 was of the opinion that the world market for red-sided garter snakes could sustain a demand of approximately 25,000-30,000 annually. He had been in contact with a local Native Band regarding the possibility of obtaining 10,000 snakes from them. He suggested that he could negotiate a contract with the band members to supply snakes to him and that he would in return pay them a wage rate for the collection of the snakes. He suggested that under such a contract the moratorium should remain closed and that his company would be the only one that would be allowed to take snakes from Manitoba.

Dealer #4 four also stated that he would be receptive to dealing with the DNR with regard to the implementation of size restrictions on the snakes to be collected as a management technique to maintain healthy populations in Manitoba. The dealer also expressed some interest in the possibility of Quota's as a management technique for maintaining healthy populations of snakes in Manitoba. He stated that he had thought of a way to obtain snakes from Manitoba during the Moratorium, but did not elaborate.

5.1.3 Formal Mail-out Questionnaire Results:

Two of four surveys were returned. One dealer stated that he would not fill out the survey due to concern over losing his market to other competitors if information in the survey was available to the public. There has been no communication on the survey from the fourth dealer. Information obtained from the two returned surveys is described below:

The first dealer received his supply of snakes from Manitoba from 1965 through 1988. He had received snakes from two local residents of the Interlake Region of Manitoba. The dealer stated that he had received an average of 3,000 snakes annually for the years of 1971 through 1988. He sold all of these snakes during these years and the majority were sold to High School Classrooms throughout the United States for dissection. Approximately 2% to 3% were sold live to researchers mostly in the United States. He indicated that the major demand at present for preserved snakes for dissection was for high school classrooms. The dealer concluded by stating that he would estimate that only 10% of the snakes collected in Manitoba were marketed to educational and research markets and that the majority of snakes were sold to the pet trade.

The second dealer stated that he dealt mainly with European customers. He stated that he had received Manitoba snakes but he did not receive his snakes directly from Manitoba. Snakes were bought from another person who would purchase snakes directly from Manitoba. The dealer had only purchased 400 to 800 snakes per year from 1986 until the moratorium. He sold snakes in Great Britain, Germany, Switzerland and the U.S.

According to the dealer, University research accounted for approximately 100 snakes per year. The dealer also stated that he did not lose snakes after receiving them from Manitoba. Perhaps ten snakes died in holding, which may have lasted until after the New Year.

He also noted that two of his University customers had recommended that the collection of snakes be allowed for purposes of research only. He stated that such proposals are selfish-and extremely dumb. He argued the following counter to such proposals:

1) Canada, or Manitoba, can not control, either in law or in fact, how its animals will be used once they enter the United States; and

2) Most important for the researcher is the fact that his use of Canadian Garters, the numbers used, is far too small to allow a collection industry to survive. He estimated that U.S. researchers, and there are relatively few of them, will use about 600 to 1000 garters per year **from all sources**. He stated these sources were almost exclusively Manitoban. The money gained from the sale of snakes to researchers only would not be enough to support a business solely based on snakes. Researchers do not understand that a lively and generalized animal trade permits them to enter that trade for their relatively modest needs. He stated that if trade was halted, research activities would halt as well.

5.1.4 Summary of Dealer Survey Results:

The following is a list of the most relevant points obtained through interviews with snake dealers:

6) The annual world demand for red-sided garter snakes is estimated by dealers to be between approximately 20,000 and 30,000 snakes. These snakes are distributed throughout the United States and Europe. Approximately 90 % of the snakes are sold to the pet trade and 10 % for educational and scientific research;

2) All dealers stated that the quality of snakes and the ease of collection of snakes in Manitoba make them superior to snakes obtained from other areas;

3) A market for the sale of snakes could not be supported unless snakes were sold as pets. The demand for snakes as educational tools and in scientific research is not large enough to support a viable trade in snakes under current market prices;

4) Snake management techniques should be developed and implemented if a harvest of snakes is to be allowed in the future;

5) Research on sustainable levels of harvest should be conducted in the event that the harvest moratorium is lifted;

6) Dealers are highly competitive and all are concerned with one dealer obtaining a competitive advantage. As a result, dealers are cautious about divulging information dealing with market factors.

5.2 Potential Commercial Harvest Management Strategies:

Consultations with DNR staff, snake researchers, snake dealers, interested local area residents, and an examination of respective provincial documents and records was carried out. The purpose of such consultations was to determine potential commercial harvesting projects related to snakes in Manitoba. The following is a list of possible management options for the commercial harvest of Manitoba snakes:

1) Continue Harvest Under Past Conditions:

The harvesting of snakes in Manitoba would be allowed to continue under past management techniques. Anyone who purchases a picking license from the DNR can collect snakes for the purpose of sale to snake buyers. The season lasts for two weeks during the fall (September 1-15). Snake buyers would again buy snakes from pickers and

sell the snakes to American dealers who required export permits to take the snakes out of Canada. The harvest of snakes would take place under past management strategies with no significant changes.

2) No Harvest of Snakes:

The moratorium would continue and pickers would not be allowed to harvest snakes in Manitoba.

3) Renew Harvest Under Improved Harvest Methods:

A number of harvest methods were considered as possible improvements to past harvesting methods. These methods would result in a more sustainable snake harvest by discriminating for a more specific class or number of snakes. These methods were determined not to be mutually exclusive and could be used in combination if such a decision was made.

Method A: Restrict Numbers Harvested per Den Site:

There would be a restriction on the maximum number of snakes collected per den site. Snake collectors would be able to collect as many snakes as they wanted as long as they only collected a certain number from a den site. This number could be a percentage of total snakes visible at the site or could be a set number determined to be sustainable regardless of den condition or size.

Method B: Size Restrictions on Snakes Collected

The DNR could issue licenses for snake harvesting with the requirement that any snakes collected would have to be a certain length. The size stipulated would be within a range with a maximum and minimum length. Any snakes over the maximum or under the minimum length requirements would not be acceptable for picking. Size limitation would provide the most viable animals to pickers while protecting the large females from being

taken. A length of 45 cm to 70 cm has been suggested as an appropriate size restriction on the size of snakes harvested (Koonz, 1990).

Method C: Quota Numbers Per Snake Collector

A collector or Native band council would acquire the annual harvest rights for a predetermined number of snakes. World demand is currently estimated to be near 30,000 snakes. Quota's could be issued to pickers by the DNR. It is possible to add requirements such as size restrictions and maximum number picked per den as pre-conditions to obtaining and retaining a harvest quota. If the picker wants to leave the collecting industry the DNR should have the right to buy back the quota. If the DNR defers the right to either by back the quota or cancel the quota, then the picker can sell it to any one person interested in obtaining harvesting rights.

Method D; Trap Line Idea: Area Quotas

Snake pickers would be issued an annual license which would allow them to collect snakes in a certain area. The DNR could assign each collector a certain area from which they would be entitled to collect snakes. This right to collect snakes would be for the holder of the license only. Another suggestion using area Quotas is that the DNR could change these areas each year to allow snake populations to recover from harvest pressures. Collectors would be assigned areas based on past harvesting pressures and the expected world demand. Again, size and number restrictions could be a pre-condition of being allowed to collect snakes in designated areas.

4) Captive Breeding Supplemented by Small Wild Harvest

The development of a biological breeding facility for red-sided garter snakes. Such a facility would be run by local residents in an area where the harvest of snakes was previously a source of income. The facility could also be expanded to include other

amphibians and reptile Species. Such an operation could be publicly or privately owned. A co-management venture between any interested Native band and the DNR could also be a possibility. Such an operation could supply the world demand for red-sided garter snakes and would relieve the pressures associated from the collection of snakes in the wild. A small annual or semi-annual harvest of snakes could be included in this operation to maintain healthy stock.

5) Locally Operated Marketing Board

A marketing board could be developed to work with buyers and dealers in Manitoba and the United States that would pre-determine the world demand for snakes before a season. The marketing board could then issue snake pickers contracts to pick pre-determined numbers of snakes at a price set in relation to the world demand. One or more of the suggested improved harvesting methods could be applied as a precondition to obtaining a contract to collect snakes. This marketing board could be privately or publicly operated. The result of such a management structure would be that competition for snakes to supply the world demand would be regulated. This regulation would contribute to eliminating competition between pickers and indiscriminate harvesting practices.

6) Locally Operated Producer Co-operative:

People involved in the picking of snakes could form a snake co-operative through which the snakes could be marketed. The co-operative could work in cooperation with the DNR to determine appropriate harvesting methods and numbers of snakes to be harvested. Each of the snake pickers would be allowed to pick a determined number of snakes. Snakes would be temporarily held in an appropriate area until they could be distributed to potential buyers. The pickers would appropriately divide profits after operating costs were deducted. One or more of the suggested improved harvesting methods could be applied as a precondition to collect snakes. A producer co-op would result in similar management

improvements as a marketing board would except that the pickers themselves would responsible for the administration and marketing aspects of the snakes.

5.3 Financial Assessment of Harvest Alternatives

5.3.1 Continue Harvest Under Past Management:

Data were obtained from DNR records on the approximate expenditures to the province in 1985, to monitor and enforce the harvesting of snakes in Manitoba. These data were then compared with past economic revenues generated by the harvest of snakes to Manitobans under past market conditions.

A review of expenditures and revenues generated by the snake harvesting industry was carried out for the 1985 season by DNR staff.

Table 3: Estimated expenditures and revenues associated with the management option of harvesting snakes under past management conditions.

PAST STRATEGY		
USER GROUPS	Revenue	Expenditure
Pickers	$45,000	
Individual Revenue	$340	
licenses		$1,120
Harvest Equipment		N/A
Buyers/Dealers		
Resident Buyers (2)	$45,000	$80
Non-Resident Buyers/Dealers	$500,000	$640
Provincial Gov't		
Licenses	$1,840	
Enforcement		$22,500
Fines	N/A	
Net Revenue to Gov't	(-- $20,660)	
Total		
Gross	$592,180	$24,340
Net Revenue	$567,840	
Net Revenue In Manitoba**	$67,840	

** Estimated That $500,000 was made by American Snake dealers not Manitobans.

1985 Revenues:

The revenue earned for local snake pickers ranged from $40,000 to $45,000 for the 1985 season at a purchase price by snake buyers of $0.50 per snake. This translates into an estimated $340.00 per snake picker for the two week season.

Four resident and two non-resident snake buyers were issued reptile dealer's licenses in 1985. It was estimated that buyers earned between $20,000 to $45,000 in total. This would translate into an average of $3,300 to $7,500 in gross revenues earned per snake buyer.

Revenue to the Province from license sales was estimated at a total of $600 in 1985. The Revenues for Biological Supply houses or snake dealers in the United States were not estimated for 1985 but it was stated that the revenues would greatly exceed those received by local snake pickers.

1985 Expenditures:

Expenditures for snake pickers, Biological supply house dealers and buyers was not estimated for the 1985 season. The cost of enforcing the regulations restricting snake picking were estimated to be $22,500, most of which was represented as staff time.

Estimated 1985 Net Outcome:

Although expenditures for snake buyers, pickers and dealers were not determined, it could be argued that these costs represent operating costs which can be considered sunk costs (an attempt to factor such costs into future harvested strategies will be carried out if appropriate). These costs need not be included if considered sunk. The result for Manitobans then is a net outcome of an revenue of between $39,100 and $68,100.

5.3.2 Alternative Harvest Strategies:

The following results were obtained from projected revenues and expenditures on possible harvesting strategies. It should be noted that the results of these comparisons are

only projections and more then one possible financial outcome may exist for each of the suggested management alternatives for commercial harvesting. However, the data used for the projections were obtained from DNR records and staff, as well as consultations with snake pickers, dealers, buyers, and other experts in the field of reptile sales and wholesale reptile breeding operations. The results should be considered as guides upon which to compare financial possibilities of suggested strategies and are used in conjunction with other criteria to determine an acceptable option.

Projected Gross Revenues:

Discussions with various individuals resulted in the determination that the annual demand for snakes world wide would be approximately 20,000 to 30,000. The wholesale price for snakes was determined to be approximately $11.00 to$15.00. Calculations were made to determine the gross revenue that could be generated from the harvest of snakes under various wholesale prices at different harvest quotas. Wholesale price per snake ranged from $5.00 to $15.00 and harvest numbers ranged from 10,000 to 47,000 snakes. The gross revenue that could be generated from the harvest of snakes was determined to range between $50,000 to $705,000. The gross revenue generated at 20,000 snakes ranged between $100,000 to $300,000. The gross revenue at 30,000 snakes would be between $150,000 to $450,000 depending on the wholesale price obtained for the snakes.

Projected Expenditures:

No Harvest Option:

Estimated expenditures and revenues were determined for the continuation of a moratorium on the harvest of snakes. The annual added cost of enforcement since the closure of the harvest season was determined to be $3,000 annually. A continued moratorium would result in an annual expenditure to the Province of approximately $31,500 (costs of enforcement obtained fro Gord Johnston, 1992, DNR, 1495 St. James Street, Winnipeg, Manitoba) and an estimated revenue of zero dollars, or a total estimated

loss of approximately $450,000 in potential revenues from the sale of snakes. No estimate on the revenues generated by fines levied on persons caught breaking the law were obtained.

5.4 Improved Harvesting Techniques:

The added cost of implementing improved management techniques to the Manitoba government would be relatively small or zero. These techniques would be implemented in an attempt to develop a more sustainable harvest by local pickers minimizing negative biological impacts on the snakes. Such techniques would allow the commercial harvest of snakes to continue and an estimated revenue of $450,000 (based on estimated world demand of 30,000 snakes) or more to be generated. The revenue received for each respective interest party and the allocation to pickers would have to be determined at a later date in the event that such an option was implemented. It should be noted that under such a management scenario the DNR should attempt to increase the total share of revenues earned to Manitobans. Such attempts should include the increase in price for what pickers receive per snake. Expenditures for the Provincial government would likely remain the same at $31,500 and revenues generated by the province could be determined if and when the Moratorium is lifted.

Captive Breeding Operation:

Capital and operational costs were simulated for the creation of a hypothetical captive breeding operation for snakes in the Interlake region. Estimates for capital expenditures were based on the mean price of three quoted prices from randomly chosen suppliers or sellers of the required capital (Table 4). For example, the price per square foot of commercial property in the Interlake region was determined by obtaining prices quoted for various sized commercial buildings that were for sale in the Interlake. Estimates for operational expenditures were determined through consultations with various experts in the breeding and maintenance of snakes in captivity.

Table 4 : Estimated expenditures and revenues associated with the management option of a captive breeding management option.

CAPTIVE BREEDING OPERATION		
CAPITAL COSTS	Expenditure	
	HIGH VALUE	LOW VALUE
BUILDING^	$96,000	$58,000
120 SQFT REFRIGERATED AREA#	$16,000	$11,500
SNAKE CAGES*	$63,000	$6,300
SNAKE RACKS**	$76,800	$7,680
MISCELLANEOUS EQPT.	$2,000	$2,000
TRUCK(RENTAL)		
OPERATING COSTS		
FOOD (2-4 Months)	$20,000	$10,000
STAFF		
TECHNICIAN	$28,000	$22,000
MKTNG & SALES MANAGER	$24,000	$19,000
GENERAL LABOURER (PART TIME)	$8,000	$8,000
TOTAL	$333,800	$144,480

^ SQFT VALUES ESTIMATED FROM MEAN VALUE OF 3 DIFFERENT COMMERCIAL PROPERTIES
#VALUES ESTIMATED FROM MEAN VALUE OF THREE DIFFERENT QUOTED PRICES
* &** EQUIPMENT OBTAINED IN CAROLINA SUPPLY CATALOGUE (NOT VITAL TO OPERATION)

Information was obtained from DNR and Manitoba Parks records on a biological supply house venture that was attempted during the early 1970's. The venture was developed as a supply house for the sale of frogs and snakes. The venture did not succeed. A comparison has been made between the costs estimated for the 1970 supply house and those estimated for a captive breeding operation for 1992. It was determined that operating and capital costs in 1970 were approximately $148,000 (1991 dollars).

These cost estimates represent only one of many possible operational ventures that could be developed to breed snakes in captivity. It was determined however that a cost range of between $144,000 and $333,800 could be used as guides to develop and operate a captive breeding operation for red-sided garter snakes in the Interlake region. The revenues generated by such an operation would be the same as any other management option.

Producer Run Co-operative:

The management of a harvest season by a producer operated co-operative in the Interlake area of Manitoba could be an option. The specific costs associated with such a venture would have to be determined in the event that interest to harvest snakes under such a system was shown by a local group or groups of people. The administrative costs associated with a producer co-op were estimated to be $40,000, and revenues would be an estimated $450,000 annually. Such an option would effectively put control into the snake pickers therefore increasing their share of revenues and also increasing their interest in the long-term maintenance of snake populations in order to ensure a healthy source of supply.

Marketing Board:

A marketing board alternative is also a possible management option for the harvest of snakes. The costs would be similar to those associated with a producer co-op. Revenues may differ for the pickers however since the marketing board would control the supply and price of the snakes. Interview respondents indicated that such a scenario may not be the most appropriate due to the conflicting Free Trade agreement with the U.S. that considers supply management a subsidized and restricted structure.

5.5 Social assessment of the Importance of a Commercial Harvest:

In an attempt to gauge the acceptability of each of the suggested management options a number of target groups were interviewed. They were asked to comment on the acceptability of the various harvesting options from a professional and social point of view. The reasoning behind such an analysis was to derive the most acceptable management alternative. Although an alternative may produce better economic results,it may not be attractive to interested parties due to social constraints or any technical or biological constraints, such considerations have also been illustrated with regard to recreational viewing. The results are described below.

5.5.1. Survey of Long Time Local Residents:

Long time residents of the Inwood, Narcisse and Sandridge areas of the Interlake were personally interviewed to determine attitudes toward the management alternatives and economic importance of the commercial harvesting. A representative sample of local residents with interest in the snakes was determined. Local business people, private landowners with dens on their land, political representatives of the area and locally concerned individuals were interviewed. A total of 11 people were contacted and interviewed by telephone, 4 were personally interviewed (n=11). Following is a summary of their attitudes toward the uses and management alternatives for Manitoba snakes in the Interlake area:

The attitude expressed by respondents was that the harvesting of snakes for sale as pets should not be allowed unless local populations increase and snakes can be harvested sustainably. The recreational viewing and tourism aspect of the snakes as a much better way of using the snake resource. One respondent indicated that if a harvest could be carried out in a sustainable fashion then it should be allowed because it would enhance the awareness of the snakes outside of the area, and could therefore potentially result in greater public visitation to the Narcisse pits.

A more significant discovery was that very few if any local residents of Inwood picked snakes and that revenues from picking usually went to outside parties. Many individuals also expressed concern over trespassing by pickers on private land containing denning sites. Although the sample size of respondents is small it is important to note that the individuals surveyed were determined to have a long time interest in the snakes and in the local community. Many people in the area were not interested enough in snake management to be aware of the present issues involved. A more informed opinion was needed in this case. The attitudes of individuals that may not have had a full grasp or significant long-term interest in the status of snakes were obtained from the Narcisse survey. It should be noted that approximately 25 percent of individuals surveyed at

Narcisse were from the Interlake region (Appendix 4;). Results of specific responses by those individuals surveyed are shown below:

Table 5: Responses of local residents interviewed regarding major management concerns for the snakes **(NOTE: Respondents could chose one or more concerns).**

Major management concerns for the red-sided garter snake in Manitoba	Response
Habitat destruction	1
Land development	
Recent Drought Conditions	2
Environmental Contaminants-Pesticides	
The harvesting of snakes	3
Lack of scientific and ecological information on snakes	
Enforcement of regulations to protect the snakes	1
Other Problems	

Table 6 : Responses of local residents regarding their opinions about the price pickers received for snakes in the past.

Opinions on Price Pickers Received for Snakes Under Past Harvest Structure	Response
Extremely High	
High	1
About Right	
Low	3
Extremely Low	

Table 7: Responses of locally interviewed residents regarding their opinions on the harvest of snakes for the pet trade.

Opinions on Whether Snakes Should be Harvested in the Future	Response
Yes	1
No	3

Table 8: Responses of local residents regarding their opinions on the management of snakes.

Attitudes towards Management	Strongly Agree	_	_	_	Strongly Disagree
Past harvesting techniques are not sustainable	2	2			
Past harvesting techniques do not provide adequate protection of snake populations	2	2			
Information on sustainable harvesting techniques should be provided to Pickers	2	1			
Protection against abuse of harvesting regulations is not effective and should be improved	1	1	1		
Tourism and viewing is important to snake management in Manitoba:	2	2			
Community Involvement and Input is essential to sound management of snakes	2	1			1
Sustainable harvest populations must be known before harvest season is allowed to operate:	3	1			
Successful management of snake populations requires educating Snake collectors and buyers on the biological requirements of the snakes	3	1			

Table 9: Responses of local residents regarding their opinions on suggested management alternatives for harvesting snakes.

Attitudes towards Suggested Management Alternatives	Strongly Agree	_	_	_	Strongly Disagree
Continue Harvest Under Past Conditions:			1	1	2
Improved Management Techniques:	3	1			
No Harvest	3	1			
Captive Breeding	1	1		1	
Locally Operated Marketing Board		1	2		
Locally Operated Producer Co-operative:	1	1	1	1	

5.5.2 Local First Nations Band Council Responses:

Discussions with regional DNR staff was carried out to determine First Nations bands that would be interested in the potential economic opportunities and management of snakes in Manitoba. A strategy was developed as a means of contacting local First Nations bands of the Interlake to determine their interest in Manitoba snakes. A total of seven First Nations band councils of the Interlake region were determined to to have a possible interest in snake management. These bands are A) Fariford, B) Little Saskatchewan, C) Dauphin River, D) Crane River, E) Dog Creek, F) Peguis, and G) Fisher River. There was no response indicated by those band councils contacted with regard to interest in the management and potential commercial opportunities of snakes in Manitoba. Contact was attempted a total of four times. The researcher sent correspondence explaining the study and the reasons for participation of First Nations bands. The correspondence was followed up by attempted telephone contact two weeks later. Next, the DNR staff sent a letter and a supporting snake management plan explaining the request to meet to discuss management options for snakes. Three weeks later DNR staff attempted contact by telephone to discuss

whether bands were interested in providing input. Native facilitators were also hired to contact bands to request input into snake management. No response was obtained from any of the bands contacted.

Although it is risky to project future management alternatives for the snakes based on this "no response" the researcher has no other choice at this particular time. Any future interest exhibited by local bands will need to be factored into the management alternatives for the red-sided garter snake. Any recommendations that are made with respect to future uses and improved management should also consider the potential for First Nations involvement, since the majority of historical snake harvesters were First Nations peoples. The recommendations of this research will be such that it will not eliminate any specific group, including First Nations groups, that may have a potential future interest in uses of snakes in Manitoba.

5.5.3. Scientific and Research Interests:

Comments on future management options were solicited from researchers who use or study snakes from Manitoba. Researchers were also asked to comment on various management scenarios with respect to harvesting snakes for the pet trade.

Researchers indicated that snakes offered a number of unique and important research avenues that could not be easily replaced by using another snake species. However, they also indicated that the harvest of snakes for the pet trade over prolonged periods of time could have serious impacts on natural populations under the past harvest structure. The consumption of snakes by researchers is relatively small as compared to snakes collected for sale for the pet trade (an estimated 3,000 snakes annually are used in education and research). Most researchers interviewed would much rather see economic ventures centred around recreational uses so long as negative impacts from such activities could be minimized. The researchers stated that the large denning aggregations of

Manitoba red-sided garter snake is a unique phenomena and generally lobbied for the protection of such dens from harvesting or recreational viewing ventures that had negative impacts on natural populations.

Concern over sustainable harvests of snakes was voiced by researchers because of the difficulty in determining what constituted a sustainable harvest. The unpredictability and vulnerability of a local denning population's ability to maintain viable numbers was considered to be the greatest barrier to sustainable harvesting of snakes for the pet trade. There is a significant lack of solid life history information on the snakes and, until this information is investigated, a sustainable harvest of natural populations would be very difficult to predict.

5.6 Comparison of Management Techniques

Using survey information, social attitudes, biological impacts and financial projections, harvest techniques were compared and ranked to determine appropriate improvements in management techniques for the commercial harvest of snakes. Table 10 is a compilation of data comparing the social, financial, and biological issues for the harvesting of snakes. It allows the researcher to compare suggested alternatives based on a solid base of information. Due to the unique nature of the data collected such a comparison is qualitative and therefore subject to the basis of the researcher and the sources of data used. However, under the circumstances such data should be considered reliable until more quantitative data can be obtained on the biological impacts and financial characteristics of potential uses

Table 10: A relative comparison of social, biological, and financial issues for suggested Harvesting management alternatives (A ranking of "1" represents that scenario that was considered to be the most appropriate for a category , while "6" represents the least appropriate. Ranking was determined based on the responses of individuals surveyed and data obtained).

Management Alternatives	Social Ranking @	Financial Ranking #	Biological Ranking *	Weighted Ranking	Final Ranking ^
No Harvest	**1**	**5**	**1**	**160**	1
Improved Management Techniques:	2	1	2	185	2
Captive Breeding	3	4	3	315	3
Locally Operated Producer Co-operative:	4	2	4	370	4
Locally Operated Marketing Board	5	3	4	420	5
Continue Harvest Under Past Conditions:	6	6	6	600	6

Ranking determined by comparing scenario costs with possible revenues. Each scenario has the same possible revenue. Costs differ between scenarios, therefore costs were the determining factor in ranking scenarios.
* Ranking was determined by hypothesizing potential negative impacts on the biology and ecology of natural populations of snakes from a perspective scenario.
@ Social ranking was determined by summarizing input from various surveys and interviews with respect to attitudes and suggestions towards the various alternative harvesting scenarios.
^ Total ranking was determined by averaging social, financial and biological rankings and rounding off to the nearest whole number. Biological ranking was weighted more than social ranking which was in turn weighted more than financial (Assigned Weighted Values out of 100 pts : Biological Ranking = 50 pts, Social Ranking = 35 pts, Financial ranking = 15 pts)

5.7 The Question of Sustainability:

The main reason for the moratorium on the harvest of snakes in 1989 was due to perceived declines in local snake populations and concern over further declines that may be caused by past commercial harvesting techniques. No specific population data is available on past harvest impacts. However, an indication of over-harvest that is quite often used when there is a lack of real biological information on natural populations was applied to Manitoba snakes. Over harvest can occur if the trend in effort used to collect or harvest the resource (catch per unit effort) increases over time. Effort increases because harvesters have to go further or work harder to harvest at past levels. A historical examination of effort per unit snake harvested was determined using data obtained from the DNR for the

years of 1972 to 1986 (Fig. 14). Effort per unit snake was produced by DNR staff by dividing the total number of legal snakes harvested by the total number of licenses sold to snake pickers.(Hummelt, 1986). This information suggests that the relative effort expended by pickers to collect snakes has increased substantially and that major increases occurred from 1980 to 1983. A number of assumptions can be made from this observed increase in effort per unit snake harvested; A) Pickers had to put more effort into harvesting the same number of snakes that previously required less effort. B) Effort increased because pickers were having to go further and further away from past harvesting sites to obtain the same numbers of snakes; C) If pickers had to go further away to collect snakes then historical harvest sites were no longer capable of providing ample snakes for pickers. D) Pickers were harvesting snakes at historical den sites at unsustainable harvest levels, and if snakes were harvested at sustainable levels effort should have remained relatively stable.

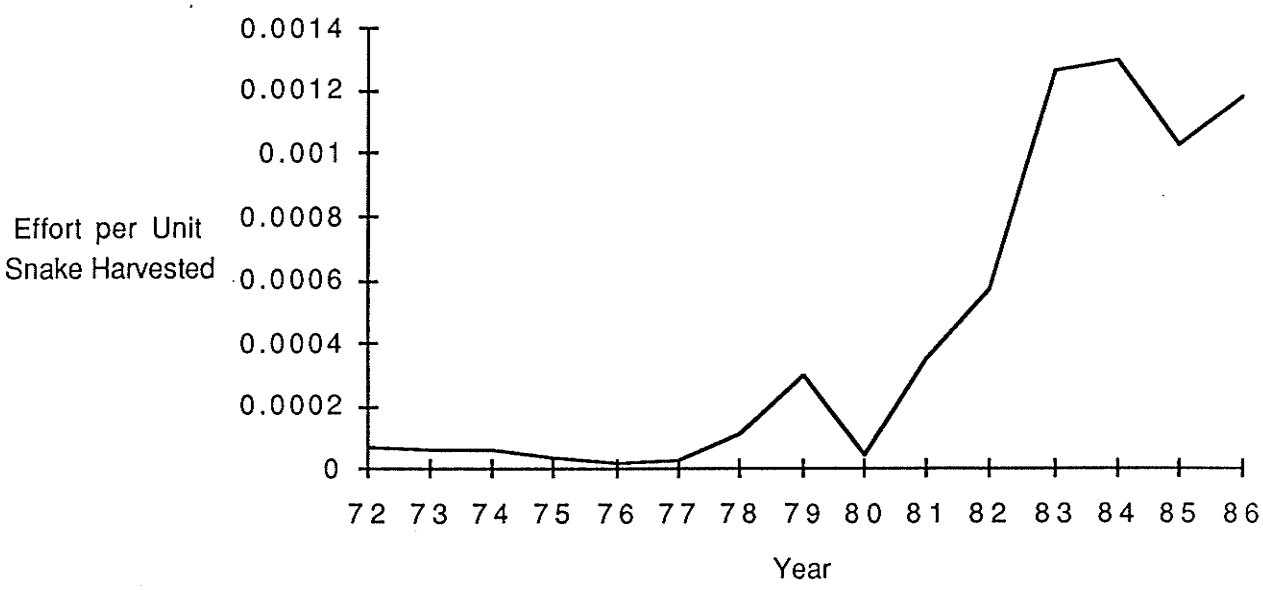

Figure 16: The relative effort expended per unit snake (Total number of annual licenses divided by the number of snakes legally harvested) harvested from 1972 to 1986.

5.8. A No-Harvest Strategy

Not harvesting snakes was determined to be the most appropriate management option for the DNR to follow based on data presently available. In order to understand why the no harvest option was determined to be the most appropriate management strategy requires a discussion of the related issues.

5.8.1 Biological Considerations:

The potential biological impacts of indiscriminate harvesting techniques was the fundamental factor for choosing the option not to harvest snakes . This is an important point when considered in conjunction with the attitudes expressed by survey respondents regarding commercial harvesting options. The long term conservation of snakes and their denning areas was considered to be the most important issue in the development of snake management strategies. The option not to harvest would reduce an essentially large human induced negative impact on natural snake populations in Manitoba. Present literature substantiates the concern expressed by user groups and this research. Dodd states that the lack of information concerning the life history for most species is considered to be the greatest impediment to effectively conserving snake populations (Dodd, 1987).

Information obtained through an examination of available literature on the impacts of snake harvesting, indicated that there was a potential for severe damage to local denning populations (Darymple and Reichenbach, 1984, Dodd, 1987; Gregory, 1971; Gregory, 1973; Koonz, 1991; Macmillan, 1987; Whitier et al, 1984). Information about population dynamics, detailed life history parameters, and the present status of the abundance and distribution of snakes throughout Manitoba is largely unknown. The lack of any significant biological data on the red-sided garter snake is a fundamental consideration when assessing the potential impacts of a commercial snake harvest. According to Macmillan (1987), "No rigorous survey of remaining large denning populations, enabling evaluation of the status of the resource, has been conducted. Normally, awareness of the

status of the resource is a pre-requisite for successful management". Macmillan (1987), states that ignorance of the status of dens in Manitoba and of the biological needs for the species are major hindrances to effective management of denning populations. The fact that no quantifiable scientific documentation on the biological impact of harvesting exists is extremely important.

Substantial increases in the historical effort per unit snake harvested expended by pickers has direct bearing on the biological considerations of commercial snake harvesting(Fig. 15). This increase suggests that snake numbers were declining in traditional harvesting areas of the Interlake. Long time residents of Inwood considered that since the moratorium on snake harvesting local populations have increased in numbers . There is no proof to show that the increase in snake populations was directly related to the moratorium, the increase could be a result of other factors such improved environmental conditions or life strategies. Regardless, the impacts of harvesting are a significant concern. Research should be initiated that would determine the impacts of commercial harvesting in greater detail then Macmillan (1987). The issue of harvest techniques impacting on populations has to be addressed and the consideration of re-establishing a harvest based on old techniques should be fundamentally ruled out.

This study substantiates the concern voiced by Macmillan (1987). The majority of individuals surveyed stated that proper knowledge of harvesting impacts needs to be obtained so that sustainable harvest levels can be determined. The decision of whether a renewable resource should be exploited relies on its ability to maintain a constant source of supply in the long term. This exploitation can only be successful if knowledge about the impacts on the resource are known. The option not to harvest snakes scored the highest ranking for biological concerns of a snake harvest. The strategy allows natural populations to recover from past harvesting and also allows for scientific studies to be carried out on the status of the resource and the potential impacts of a harvest.

Results of the survey at the Narcisse pits indicated that individuals 96% of those interviewed thought snakes should be protected in Manitoba. The other 4% responded as neutral (Fig 10). At the same time 67% stated that they strongly disagreed or moderately disagreed with the statement that people should be allowed to derive income from the collection and sale of snakes in the pet trade. Only 7% of the individuals surveyed strongly or moderately agreed that people should derive income from harvesting snakes (Fig 11). Based on the response obtained from this survey and from the response of local residents (Table 9) and scientists, there was a strong opinion by Manitobans that harvesting snakes for the commercial pet trade should not be allowed.

The impacts on the biology of the snakes and the conservation attitude expressed by surveyed individuals were strong determinants in the developing of an appropriate management strategy. User groups and conversationalists were in agreement on the issue of appropriate management options for the snakes. There was an agreement that the lack of documented proof on the potential impacts from commercial harvesting had a strong influence on the attitudes toward a potential harvest. The long-term survival of natural snake populations and their denning habitat outweighed any use that would have negative impacts. Dealer response to the issue of harvesting snakes was mixed (Chapter 4, market survey results). Not all dealers sold Manitoba snakes as pets, but instead sold them to educational institutions and scientists. The number of snakes or demand for these uses was determined to be approximately 10% of the world demand. Theses dealers indicated that it was important to establish sustainable harvesting levels in the event the moratorium is lifted. This illustrates that some of the dealers think that responsible management of snakes should be a requirement for renewed harvests. Such attitudes are important because they illustrate, that dealers who have in the past contributed to the inappropriate harvesting system would be open to participating in improving the management of snakes and harvesting techniques. Such participation would help to eliminate major inefficiencies of

past harvest practices but would also limit access by dealers to a larger market share at the lowest possible cost.

Some surveyed individuals stated that a snake harvest could occur under optimal management conditions, where a sustainable number of snakes could be taken from the wild without having negative impacts. This result becomes an important issue in the event that a sustainable harvest of snakes can be established because it indicates that most individuals are concerned with the biological impacts past harvest practices have had on snake populations. If harvesting would not threaten the long-term survival of the snakes and denning areas then it seems that it would be socially acceptable to some individuals surveyed. There is a point of contention around this issue and a potential for conflict between interest groups based on social and ethical point of views toward harvesting snakes. There was disagreement on the issue of a renewed harvest of snakes. Many surveyed individuals expressed the view that the harvest of snakes should never be re-established. The red-sided garter snake is the only wild animal in Manitoba that the Provincial government allowed to be collected and sold as pets. This seems to contradict the mission statement or policy of the government toward the conservation and management of the provinces wildlife. This point becomes even more controversial when the economic or financial aspect of harvesting snakes is considered. Most people believe that snakes were allowed to be harvested to provide income for Interlake residents. However, under the past harvest system, very little income was gained by harvesting snakes and some suggest that since the increase in effort per unit snake most pickers were probably not making any financial gains from the harvest of snake. The real issue with many respondents was that the province was supporting the financial gain of foreign dealers through the exploitation of Manitoba's resources. This is an important point that should be strongly considered under any new management option and helps to substantiate this studies' conclusion that the snake harvest should not be re-established.

A major concern in the harvest of snakes is the attitude of pickers. The failure of pickers and First Nations band councils to respond to requests for input into future management options is a major missing link. Results indicate that former pickers were not significantly interested in the re-establishment of a harvest. This is illustrated by local First Nations band councils and representatives failure to respond to repeated requests for input by the researcher, and DNR staff. Information gained about pickers suggests that, under the historical harvest industry structure, they were not in the industry for substantial economic gain but were picking snakes because of the recreational enjoyment that it brought. The income earned was a secondary reason for snake picking. This may explain why pickers did not react strongly to the closure of the harvest of snakes (DNR records indicate that there were no formal complaints by Manitoba residents to the Moratorium), and indirectly indicates that such a closure may be socially acceptable to pickers. However, until such results can be substantiated the question of a no harvest option will be in doubt with respect to First Nations involvement.

5.8.2 Financial Considerations:

The option not to harvest was ranked fifth under the financial criteria used in the comparison matrix. It was determined that there was a potential to generate revenues in the sale of snakes as pets of approximately $450,000 to $700,000 depending on demand. The option not to harvest snakes would mean that these potential revenues to Manitobans would not be realized. Further discussion on this point is needed to explain why the no harvest option was considered appropriate. Under the past industry structure the revenues generated by the pet trade were found to be on average approximately $700,000 annually. However,the information obtained indicates that much of this revenue was not being passed on to Manitobans and in fact was being obtained by foreign pet trade dealers in the United States. A 1985 study indicated that a maximum of $90 000 in annual revenues was staying in Manitoba and that on average only $340 per picker/ per year was being earned

for picking snakes (Table 3). Therefore, more than 85% of the realized revenues were lost to Manitobans. The reason why the no harvest option was considered appropriate was that loss in revenues to Manitobans under this option would be relatively low based on the past market structure.

The no harvest option also raises issues respecting enforcement. There is potential for an illegal harvest and trade to be initiated by opportunist pickers, and that it may already exist. Three thousand snakes were confiscated from three individuals trying to enter the United States in the Fall of 1991. They expected to make $10/per snake or a total of $30,000 from selling their illegal harvest. The fact that they were caught indicates that enforcement measures have some affect on an illegal trade. There are indications that some of the foreign dealers may attempt to solicit the collection and sale of red-sided garter snakes illegally. This was evident from the dealer interviews yet no proof exists at present to substantiate this claim

Illegal trade of snakes has been documented on a global level. Some states (California, Arizona, and Utah), have banned the commercial collection of native snake species, but in most states,(Florida with a wealth of unique species), commercial collection is not regulated or monitored (Dodd, 1987). According to Dodd (1987), The U.S. Fish and Wildlife Service revealed a massive illegal trade in both domestic and foreign protected species. Over 10,000 illegal reptiles were obtained during a sting operation in mid 1981, that included Federally protected species. Over 1,100 animals were seized, 40 search warrants were issued, and warrants were served for the arrest of 27 persons. Both amateur and professional biologists were among those trafficking in rare snakes, and certain zoos were investigated for suspected illegal activities. The Fish and Wildlife Service estimated that up to 100,000 reptiles were shipped illegally through the U.S. mail each year (Dodd, 1987). Since there exists a strong demand for Manitoba snakes the probability of illegal trade must be considered as real and any management strategy should make provisions to minimize or eliminate the possibility of such illegal acts taking place.

The increase in the cost for enforcement since the 1989 Moratorium of $3,000 annually (Gord Johnson, 1992). The issue of the initiation of an illegal trade operation to supply American dealers with Manitoba snakes is a concern, recent border prosecutions indicate that there is a demand for snakes. There is a small time frame when snakes would be available to be collected and traded illegally. Customs officials could be educated and alerted as to times when the possibility of illegal contraband might be shipped. Local residents should be made aware of the Turn in Poachers Program (TIPS). TIPS could be used as an avenue to help enforce a no harvest scenario and to minimize illegal trade opportunities.

Approximately 10 % of the snakes harvested in Manitoba went to scientific researchers and educational institutions. The issue arises as to whether the harvest of snakes for such uses should be allowed. The demand difference of snakes for use in the scientific and research field means that only approximately 3,000 snakes or fewer would be needed to meet the global demand. The problem here would again be the method of harvest. Even 3,000 snakes harvested under improper techniques could potentially have an important negative impact on specific local populations. Controversy could also rise from such differential preference between user groups and end uses since restricted user groups would argue that they were being discriminated against. There would also be difficulty in controlling the end use of snakes after they had been exported according to an interviewed dealer. The situation could arise where by a person could state that they are harvesting and exporting snakes for scientific purposes but once out of Canada the exporter could sell the snakes for what ever purpose or end use that they wanted. Legally, such actions would be permitted through the permits issued to allow snakes to be harvested. However, the difficulty of enforcing, regulating and monitoring the end use of snakes in the United States or other countries would enable such illegal activities to occur.

On the other hand, the importance and contribution to science, of some of the research using snakes may warrant a special permit for the collection of snake for scientific

purposes. The government may also want to consider a special fee for such permits. One snake dealer in the U.S. stated that due to the current price associated with red-sided garter snakes, an industry based only on the sale of snakes for scientific purposes would not be able to support a commercial operation based on historical demand in that end use. A special fee would perhaps make it viable for a more sophisticated harvest operation to be set up to harvest snakes for scientific research only. Such a fee raises the issue of discriminatory pricing for snakes based on end use as a means of management. The possibility of abuse of such regulations would likely limit any such harvesting system.

5.8.3 Summary:

The no harvest option was ranked most appropriate because of the present lack of biological information on the impacts of harvest and potential harvesting techniques that would allow for sustainable harvests to occur. The lack of sound knowledge on the status of snake populations in Manitoba also strengthens the no harvest argument. The people interviewed agreed that protection of the natural resource outweighs any commercial gain through harvesting snakes. There was some conflict over whether the re-establishment of a commercial snake harvest. Some individuals agreed that snakes should be harvested if techniques could be developed that would not threaten the long-term survival of snake populations and denning areas. It was also important that as much of the gross revenues gained from the sale of Manitoba snakes be realized in Manitoba. If these two major conditions could be addressed than there was some agreement on Manitoba snakes being harvested. Others who were interviewed, argued that under no circumstances should snakes be harvested commercially for the pet trade. This brings us to the question whether a harvest could be re-established would the suggested improved management options available be appropriate. Such a discussion is important since the use of the snakes represents a sustainable economic opportunity to local regional economies.

5.9 In the Event of a Snake Harvest:

There is a potential market for the sale of snakes as pets. Demand for Manitoba's snakes is world wide, and they have been sold in the United States, Europe and Japan, with an estimated 20,000 to 30,000 animals sold annually. Although foreign dealers were quite secretive and defensive of their established markets for snakes, the difficulty of developing established markets and customers may not be that difficult based on the results obtained. First, customers want snakes regardless of who sells them. Dealers compete heavily to obtain as much of the market share as possible. The fact that dealer competition for as large a market share as possible indicates that the market is not likely secretive or controlled by a small number of foreign dealers. The fact that a major department store chain provided the St.Laurent operation with a list of customers, also indicates that it would be relatively easy to develop a customer base for Manitoba snakes. There is also the possibility that previous foreign dealers who have clientele lists would buy snakes from a more controlled or regulated Manitoba operated harvest industry. Under such a scenario, Manitoba pickers would become the middle men or wholesale distributors of snakes and would be able to control the supply as well as price on the global market. The uncertainty of customer base can therefore be ruled out as an impediment to a Manitoba regulated harvest and supply. A more important issue to be addressed is the development and implementation of the most appropriate improved harvest techniques and management options to ensure the sustainable use of the snakes.

The most appropriate management action was a combination of improved harvest techniques with a local producer run co-op or marketing board. Another option that may be considered but would most likely be less attractive is a captive breeding operation with a limited or no wild harvest (Table 4).

The reason for choosing to improve harvesting techniques is that such an option would be socially acceptable and financially inexpensive compared to other options. The improved harvesting techniques option ranked most appropriate in the financial category

(Table 10). Estimated expenditures were determined to be similar to expenditures required to operate and maintain the no harvest option. There would be no added costs associated with improving management techniques to the major user groups. The structure of the harvest industry would remain relatively the same except that pickers would be required to discriminate in their picking practices for the snakes.

However, the strategy does not allow for control of the market to be by Manitobans. The greatest amount of revenues (over 85%) would still be earned by foreign interests. The improved management techniques option would allow for more control on the biological impacts of a harvest but would not increase provincial control of the market for the sale of snakes. If control of the market can be maintained by Manitoban interests and regulated by Manitobans then a more sustainable operation could be developed. Control is not necessary, but if not control then regulation of the market by the provincial government is needed. The elimination of historical inefficiencies must be a priority for any new management option in the event of a harvest being re-established.

Inefficiencies in the harvest industry include over picking as a result of extreme competition first between buyer, in an attempt to dominate control over the world market, and second by pickers to expeditiously sell their harvest to buyers before the world demand is met and buyers stop buying. The elimination of these historical inefficiencies are an important factor in developing sustainable harvesting techniques. If competition can be eliminated between pickers then there would not be the need to harvest snakes using indiscriminate techniques. If supply can be regulated and a known number of snakes required to be harvested that can be communicated to pickers then the likelihood of an over-harvest would be substantially reduced.

5.9.1 Biological Considerations:

From a biological standpoint, the most appropriate strategy to invoke if the commercial pet trade was allowed to be re-established would be a large scale captive

breeding program. The potential impacts on natural denning populations would be minimal with respect to den destruction and den extirpation caused under historical harvesting techniques. However, there would be a number of difficulties that would limit the success of a captive breeding facility. Discussions with various individuals involved in the breeding of snakes revealed that the technical difficulties in breeding snakes on a large scale to supply the pet trade would be quite difficult and often uncertain. Difficulties considered include 1) genetic variation in captive snakes and the subsequent escape of genetic morphs into the natural environment causes some ecological concern; 2) no attempts to breed red-sided garter snakes on a large scale have been made in the past; and 3) the elimination and continued effort to maintain a disease and pest free facility would have a strong bearing on the captive breeding facility's success. Pests and diseases, if present, could spread throughout the captive population and contaminate the snake stock. The susceptibility to disease and parasites was argued to be to great to consider breeding snakes in captivity. The contamination of stock would effectively wipe out the supply from Manitoba

The degree of technical certainty with respect to hibernation (in refrigerated units) may also make this strategy difficult. The narrow environmental requirements needed to induce physiological changes in snakes for mating would be difficult to control in a closed environment. Snakes require two to four months in hibernation in order to invoke physiological reactions needed for reproduction to occur. In a closed environment the simulation of such a hibernation period would require expensive and very sophisticated refrigeration units. The refrigeration units available would be adequate but would most likely not be reliable enough to ensure that producers could maintain a steady annual supply of snakes. Present refrigeration units are just not sophisticated enough to ensure the narrow and constant range of temperature and humidity that is needed for the breeding of snakes.

Another concern in the success of a captive breeding operation for snakes was that of food for the snakes and the costs involved. Food would account for a large part of the

operating costs. The financial and technical requirements needed to adequately ensure a constant supply of snakes result in the rejection of a captive breeding option to supply the snake market.

The maintenance and operation of a captive breeding operation would be comparatively more expensive than other available management options. For these reasons the strategy was ranked third biologically behind 1) improved management techniques and 2) a producer run co-op. This is not to say that a captive breeding operation could not be attempted, but strict controls would be needed and an experimental stage would be expected as a cautionary measure. These actions would help to increase the costs of such an operation and therefore reduce net revenues from the sale of snakes.

Combining the best of A) the improved harvesting techniques management option and B) the producer co-op management option; was considered. A combination or mixture of these proposed management options would result in the most appropriate combination of options to pursue.

5.9.2 Financial Considerations:

From a financial point of view, any strategy that generates maximum revenues to Manitobans should be considered to be more appropriate. The net revenues that might be obtained from a producer co-op, marketing board, or captive breeding strategy in Manitoba, would be less overall than would the improved harvesting techniques strategy. However, the revenues that would stay in Manitoba would be far greater under the former three strategies than under the latter. For example, expenditures for a producer run co-op would be estimated at a range similar to an improved management techniques strategy. Under such a strategy the total revenues that would stay in Manitobans would substantially jump from $90,000 to approximately $450,000 to $700,000. Although the improved techniques strategy provided the greatest net revenues it does not provide it to Manitobans. The producer co-op is therefore a more appropriate management structure to undertake.

The fact that a strategy can have very little benefit to Manitobans but a great deal of benefit to foreign interests raises the issue of social responsibility. The Manitoba government, should attempt to maximize resource benefits of to Manitobans. The social ranking category of strategies will help highlight this rational.

5.9.3 Social Considerations:

Public attitudes toward the harvest of snakes have direct bearing on the management strategy that will be determined most appropriate. There was little interest in the harvest of Manitoba snakes by historical user and interest groups. The attitude from society was not to harvest snakes for the pet trade at least until the protection of the resource can be ensured. Social attitudes toward the suggested options that could be employed in the event of a harvest being re-established, were mixed.

An important issue emerging from the this research was that past harvesting techniques were not considered to be socially acceptable by interview respondents. The ethical issues of conservation and stewardship were fundamental concerns of snake harvesting. There is a view that pickers did not practice harvesting techniques that were conservation oriented and, in fact, some pickers blatantly disregarded conservation practices for efficiency. Many interview respondent's attitudes about keeping the season closed were strongly related to the pickers lack of regard for snake conservation. This disregard could have resulted from the historical structure of the harvest industry and the attitude "as much as possible as quickly as possible", brought on by foreign interests for profit and not resource sustainability. Conservation techniques should be a requirement in a new industry structure including pickers, buyers and foreign dealers, in the event of a harvest season. Many of the suggested options would address the issue of conservation either directly through picking restrictions or indirectly through establishing a long-term self interest of the users. Conservation ethics are vital to any harvest re-establishment regardless of the option chosen.

5.9.4 Summary of Harvest Management Options:

Improved harvesting techniques would be hard to instill in pickers if they have no long-term interest in the resource. Enforcement would be costly and inefficient under such a management structure. By involving local pickers in the marketing and management of the resource the long term maintenance and management of the resource becomes not only their responsibility but in their best interest. The enforcement of harvesting and harvesting techniques is much more successful when it is regulated by the people who rely on the sustained use of the resource. Such a management structure eventually instills a strong conservation ethic into the users of the resource.

5.10 Conclusions:

When considering the re-establishment of a harvest season for Manitoba snakes a critical factor in the decision must be the biological parameters and the negative impacts that a harvest may have. Studies such as those by Gregory (1973), and Macmillan (1987) indicate that the life of snakes under natural conditions is precarious at best. Mortality rates are relatively high resulting in large natural fluctuations in denning populations from one year to the next. Macmillan (1987), stated that the added stress of past harvesting could result in the extirpation of a denning population. The unreliability of being able to predict a natural sustainable number of snakes at a den on a regular annual basis is one of the major difficulties in managing any future commercial harvest of snakes. In the event that a harvest was to be re-established, it should be carried out in a scientifically prudent manner to ensure that the harvest does not significantly contribute to the extirpation of a snake denning area . Extensive monitoring of the biological impacts of any future commercial harvest should be a requirement to ensure that if significant negative impacts occur the commercial harvesting at dens under such pressure could be postponed until populations bounce back.

There may be some initial financial costs associated with determining proper harvesting techniques, however, compared to the value gained from revenues generated from a re-established sustainable harvest the costs associated with determining such vital information would be justified from a financial view. Such information is also vital from a biological management aspect and even more important in developing sustained harvest techniques that would be successful. It is therefore essential that the DNR consider a harvest feasibility pilot study of commercial harvesting prior to lifting the harvest moratorium. The biological restrictions on harvesting techniques that should be addressed in such a pilot study should be extensive including but not limited to size restrictions, sex restrictions as well as the impacts associated with restrictions on collecting if denning populations are observed to be in poor health.

The scenario chosen to be the most appropriate for a harvest of snakes was a combination of a Producer operated co-operative with improved harvesting techniques, which could be run by a local area interest group or a local First Nations band and its band council. Financial expenditures for this scenario were determined to be relatively low, involving a small storage area to be available for approximately one month after season closure. This would allow enough time to distribute all the snakes to the consumers. This scenario is less costly for the provincial government because it places the responsibility of the resource in the hands of the resource users, a vital management component that did not exist under past commercial harvests. In order to maintain a long term sustainable source of supply, snake pickers would have to develop a more responsible stewardship ethic toward the resource if a commercial harvest was to be re-established.

The producer co-operative management option discussed above would eliminate market inefficiencies that existed under the old commercial harvesting industry. There would be no waste of snakes or competition to sell snakes to foreign buyers. The producer co-operative could develop and maintain its own market for snakes and therefore would not have to rely on foreign interests that controlled the past market structure. The co-operative

could then establish a harvest quota that would take into account the status of snake populations in Manitoba.

Important to any sound management strategy involving a re-established harvest season is the development of an accurate snake monitoring system. This information is vital to determining the sustainable harvest numbers for snake picking. The establishment of an effective monitoring system would be complex, compounded by the lack of scientific information on the snakes. Natural catastrophe's and occurrences that result in a wide fluctuation in a specific dens' population from year to year would confuse monitoring results. Commercial harvesting of red-sided garter snakes at denning sites may have to be managed on an site specific basis, depending on the numbers present during not only the harvest season but also during the following spring emergence. Relative abundance estimates, of a den and its location and last harvested year could be required information by the producer co-operative in order to issue a license to commercially harvest red-sided garter snakes. A picker could then be issued an area where a number of dens exist that could easily meet the pickers quota. The picker could then be advised on what dens to harvest from and what dens to leave fallow. This is by no means an accurate method of harvest due to the large degree of uncertainty in the snakes biological and behavioral patterns. But it is more responsible than an indiscriminate collection of snakes from dens. Another requirement of pickers that the co-operative and the DNR could invoke is that only a certain maximum size could be collect, leaving the larger snakes. Such a strategy may allow for a higher potential reproductive rate among commercially harvested snake dens to be established since the larger older females would be present and not removed from the reproductive population. According to Gregory (1973) larger females reproduce more individuals than smaller snakes.

It is suggested that not all dens be open to harvest in any one season, if snake dens are being harvested correctly there should be no need to harvest all dens. Allowing some dens to continue free of harvest would also strengthen the harvest industry. Not all snakes

return to the same den each year, some immigration and emigration does occur. By limiting harvest in areas where dens are present harvesters could create islands of populations that may serve as resources to the areas that are harvested. Perhaps satellite areas around harvest den sites could enable such a scenario.

Such an extensive or complicated monitoring system may raise concerns with respect to costs associated with the development and operation involved. However costs could be minimal for the DNR if the monitoring is required to be carried out by the individuals who are harvesting the snakes. This makes sense for a number of reasons of which the most significant is the fact that the resource user would have a strong stake in a continued sustainable supply of snakes. The producer co-op would have to limit licenses to commercially harvest snakes so that an individual could receive economic returns that would make it worth their while to maintain an interest in harvesting snakes as well as an interest in the long term status of the resource. Costs involved with such a system would mostly be associated with education and training of commercial harvesters with respect to proper monitoring and harvesting techniques. Random spot checks could be carried out on pickers by DNR staff in cooperation with members of the producer co-op to ensure that proper and consistent monitoring techniques were occurring. The added financial resources needed to carry out such procedures would be minimal and could be carried out by existing staff in the areas where picking occurs. Such a management system does rely heavily on the responsible and professional conduct of the resource users, however, if individuals can be educated to understand why responsible harvesting makes ecological and economic sense, then such a system is completely viable. Many of our common property resources are managed in such a manner as that suggested for the red-sided garter snake.

The promotion of proper harvest techniques should be the responsibility of the producer co-operative and the wildlife branch. If commercial harvesters are to become stewards of the resource they must be advised on the proper stewardship techniques to follow. An educational video to promote proper harvesting techniques an the requirements

of the co-operative and natural resources department to allow a person to receive a license to harvest snakes could be developed. This video could demonstrate to the pickers how to harvest and how to monitor their impacts on dens being harvested. Another avenue or one that could be in addition to a video could be an annual one day training seminar on how to harvest snakes properly. Commercial harvesters would be required to attend in order to get their license renewed.

The producer co-operative management scenario places the responsibility for the management of the resource into the hands of the resource users. If there is to be a long-term economic gain from the collection of the snakes the users must manage the resource properly so that they can maintain that economic gain.

More biological information is badly needed for a harvest to be successful. It is recommended that no harvest be allowed until more information on the biological requirements of denning populations and the impacts of harvesting under various improved management techniques is carried out. Information on the distribution and abundance of snakes on a provincial basis should be obtained. More accurate information on reproduction and mortality for snakes is also needed. Ecological studies that determine the effect snake migration patterns between denning areas, predator relationships and its impact on survivorship, effects of habitat loss, reproductive behaviour, and the relation of environmental conditions to population size should be encouraged. A time period of 3 to 5 years should be sufficient time to generate basic data. Perhaps a certain portion of the profits could be diverted into a trust fund to be used for research purposes.

The ethical implications of a harvest need to be addressed here as well. Should the province allow the collection, sale and export of wildlife for the purpose of economic gain. There is bound to be some dissention from local interest groups and animal rights organizations with respect to this point. Consideration of the ethical implications of a harvest must be included in a final decision . There are many other economic ventures that exist for the snakes including tourism, viewing and merchandising. These ventures may

prove not only to be more financially lucrative but also more biologically benign if managed properly.

The concern by various scientists who use snakes from Manitoba in their research could be addressed easily under this scenario. Scientists could deal directly with the co-operative to express their needs. The co-operative could then fill the scientists order. A price different than that for snakes sold as pets should be considered. Scientists only require a small number of snakes annually or semi-annually, but they usually require snakes that meet certain imposed requirements duet to the nature of their research. A price that is more reflective to the availability and difficulty in collecting snakes for research should be considered.

The following actions are suggested as those major areas that the DNR should address to develop an appropriate management strategy for the snakes

1. It is recommended that no harvest be allowed until more information on the biology of denning populations and the impacts of harvesting is carried out. Information on sustainable harvest levels must be determined before any consideration for a renewed commercial harvest is undertaken. Research should be initiated to determine areas that have the potential to support large denning populations. An evaluation of a potential denning areas ability to support sustained harvests should be carried out.

2. The DNR should initiate communication between groups or individuals in Manitoba who may have an interest in the commercial harvesting of snakes to develop co-management criteria for a long term sustainable harvest subject to the satisfactory completion of recommendation #1.

IN THE EVENT OF A RENEWED HARVEST:

3. In the event that a harvest is re-established the DNR should encourage the initiation of research to develop the most appropriate combination of proper harvest techniques. Such appropriate harvest techniques should be a requirement by the Manitoba government with respect to the issuance of a snake picking license.

4. A pilot study of commercial harvesting prior to lifting the harvest moratorium to determine the feasibility of harvesting on a large scale should be carried out. The biological restrictions on harvesting techniques that should be addressed in such a pilot study should be extensive.

5. An extensive monitoring program dealing with the biological impacts of a commercial harvest should be a fundamental requirement to ensure that if significant negative impacts occur the commercial harvesting at dens could be postponed until populations bounce back.

6. The DNR should promote the development of responsible stewardship ethics among snake user groups in order to enforce the maintenance of a long term sustainable supply.

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Appendix 1

SNAKE SURVEY

Red Sided Garter Snakes found in dens around the Interlake Region of Manitoba are renowned internationally as a unique natural phenomena. These snakes represent one of the largest concentrations of a single species of reptiles in the world. In recent years concern has developed over the decline in snake populations at Narcisse. As a result of this concern, the Department of Natural Resources is reviewing the present management of the snakes. This questionnaire will help to determine how to mange the snakes in the future. Your participation is greatly appreciated.

1.) Please check the box that best represents you;

Residence

- ☐ Interlake Region
- ☑ Winnipeg
- ☐ Manitoba
- ☐ Other Province. Specify _____
- ☐ Other Country. Specify _____

Age

- ☑ 1-18
- ☐ 19-34
- ☐ 35-49
- ☐ 50-65
- ☐ Over 65

Sex

- ☑ Female
- ☐ Male

2.) Was the primary purpose of your trip to visit the Snakes at Narcisse ?

☐ Yes ☑ No

If no, please check the box that best describes the purpose of your trip

- ☑ Passing through
- ☐ Family Drive
- ☐ Vacation
- ☐ Picnic
- ☐ Camping
- ☐ Other, Specify _____

3.) Is this the first time that you have visited Narcisse to see the snakes ?

☑ Yes ☐ No

If no, please indicate the number of past trips to see the snakes

_____ Number of past visits to Narcisse

4.) How did you hear about the snakes at Narcisse ?

- ☑ A Friend
- ☐ At School
- ☐ The News Paper
- ☐ A Magazine Article
- ☐ The Radio
- ☐ Television
- ☐ Other, Specify _____

5.) Please check the box that best represents who you came with :

☐ alone ☑ with family

☐ with friends ☐ with a tour group

☐ other, specify _____

6.) Did you spend any money as a result of your trip to see the snakes at Narcisse ?

☑ Yes ☐ No

If yes, please check those boxes that best describe what you spent money on

☐ Transportation ☐ Tour Pakage
☑ Snack Food ☐ Accomodation
☐ Souvenirs (ie T-shirts)

Please indicate the estimated amount of money spent ?

☑ $ 0 - $ 20 . ☐ $ 50 - $100
☐ $ 20 - $ 50 ☐ $ over $100

7.) After viewing the snakes at Narcisse how much money would you consider spending to see the snakes.

☑ $ 0 - $ 20 ☐ $ 50 - $100
☐ $ 20 - $ 50 ☐ $ over $100

8.) Please indicate how strongly you feel about the following statements

	Strongly Agree ⟷ Strongly Disagree					No Opinion
	5	4	3	2	1	
It is important to protect the red sided garter snake and their denning areas in Manitoba	☐	☐	☑	☐	☐	☐
It is important to educate people about the red sided garter snake in Manitoba	☐	☑	☐	☐	☐	☐
It is important to do scientific research on the red sided garter snake	☑	☐	☐	☐	☐	☐
Tourism at Narcisse should continue	☐	☑	☐	☐	☐	☐
Admission to see the snakes should be charged	☐	☐	☐	☑	☐	☐
People should be able to derrive income from the collection and sale of the snakes to the pet trade	☐	☐	☐	☐	☑	☐

9.) After viewing the snakes have your feelings changed about snakes ?

☐ Yes ☑ No

If yes, what are your feelings now?

Like the snakes ☐ Don't care for the snakes ☑ Dislike the snakes ☐

Appendix 2

RED-SIDED GARTER SNAKE MANAGEMENT AND THE ASSESSMENT OF POTENTIALLY BIOLOGICALLY SUSTAINABLE AND ECONOMICALLY VIABLE USES OF SNAKES IN MANITOBA:

Purpose of Survey

The purpose of this survey is to obtain basic information on various uses (For example, Recreation and Tourism uses, Educational and Scientific uses, and commercial uses, such as, the collection and sale of snakes for economic gain), of the red-sided garter snake in Manitoba. The survey will also attempt to obtain views and suggestions on possible management strategies of future uses of the snakes in Manitoba. The opinions and information gained from this survey will contribute to the development of sound management decisions regarding the various possible uses of the snakes in Manitoba.

Why You Have Been Asked to Participate in the Survey:

Only by ensuring proper consultation with all parties with a vested interest in the various recreational and commercial uses of the snakes can an appropriate management (socially, biologically, and economically), option for the various uses of the red-sided garter snake be obtained. All responses to the survey will be considered **CONFIDENTIAL**. This is to ensure that people feel free to respond to questions without any concern over the possible implications of anonymity. Enclosed is a self addressed envelope to return responses of the completed survey. Your participation is greatly appreciated.

Background Information:

A number of commercial and recreational uses of red-sided garter snakes in Manitoba have existed in the past or exist presently. Such uses include the harvesting of snakes for sale to scientific and pet trade markets, and recreational tourism and educational viewing.

The management of the harvest of snakes prior to the 1989 moratorium consisted of a two week harvest season. This has led to problems with inefficient uses of the snakes due to collecting before the season in an attempt to make sure a pickers snakes were sold due to the uncertainty of demand by snake dealers. Licenses were issued on an individual and family basis which entitled the holder to pick snakes in Manitoba. There was no restrictions on the methods of collection and numbers of snakes collected except for the seasonal time restriction. The income gained by pickers was low $CND.50, per snake collected. Much of the income was made by dealers in the United States who had built up an extensive clientele list over the years that harvest has taken place.

A recreational tourism and education viewing facility at Narcisse, Manitoba which is approximately 100 Km north of Winnipeg, where three large dens have been set aside for interpretive purposes. These dens are protected from snake collectors in the area. The facility consists of trails and interpretive signs that help to educate the public about the snakes and there biological qualities. An estimated 10 000 people come to view the snakes each year generating various indirect economic benefits to local residents in the form of sales in food or snack items, gasoline for vehicle and souvenir items. The management of the recreation and tourism aspect of the snakes involved the protection of snakes and their dens at Narcisse, a few studies on various other possible future tourism and recreation

ventures in Manitoba, and the development and continued improvement of viewing facilities at Narcisse.

SNAKE HARVESTING, MARKETING AND MANAGEMENT SURVEY

1) Please indicate your particular involvement with red-sided garter snakes from Manitoba:

( ) University Researcher
( ) Natural Resources Employee
( ) Snake Picker
( ) Supply House Operator (Snake Dealer)
( ) Concerned Individual
( ) Other, Please Indicate _____

2) What do you think the major management concerns are for Manitoba red-sided garter snakes ?:

( ) Habitat destruction
( ) Land development
( ) Recent Drought Conditions
( ) Environmental Contaminants-Pesticides
( ) The harvesting of snakes
( ) Lack of scientific and ecological information on snakes
( ) Enforcement of regulations to protect the snakes
( ) Other Problems, Specify _____

3) Please indicate how you feel about the following statements. Where **1** indicates that you **strongly agree** with the statement, **2** indicates you **agree** with the statement, **3** indicates you **neither agree or disagree** with the statement, **4** indicates that you **disagree** with the statement, and **5** indicates that you **strongly disagree** with the statement.

	1	2	3	4	5
Past harvesting techniques are not sustainable	( )	( )	( )	( )	( ).
Past harvesting techniques do not provide adequate protection of snake populations	( )	( )	( )	( )	( ).
Information on sustainable harvesting techniques should be provided to Pickers:	( )	( )	( )	( )	( ).
Protection against abuse of harvesting regulations is not effective and should be improved :	( )	( )	( )	( )	( ).

	1	2	3	4	5
Tourism and viewing is important to snake management in Manitoba:	( )	( )	( )	( )	( ).
Community Involvement and Input is essential to sound management of snakes	( )	( )	( )	( )	( ).
Sustainable harvest populations must be known before harvest season is allowed to operate:	( )	( )	( )	( )	( ).
Successful management of snake populations requires educating snake collectors and buyers on the biological requirements of the snakes	( )	( )	( )	( )	( ).

4) Under past commercial harvesting conditions snake dealers paid pickers anywhere from $.20 to $.50 per snake. The market price paid for by consumers for snakes ranged from anywhere between $5.00 to $25.00.

a) Please indicate wether you think the past price of snakes paid to pickers was :

( ) Extremely High
( ) High
( ) About Right
( ) Low
( ) Extremely Low

b) In your opinion, should snakes be harvested in the future for the purpose of export and sale in the pet trade for economic gain:

Yes ( ) No ( )

c) In the event of a harvest season being able to re-open what price should snake pickers to receive per snake:

$_____

d) What do you think the market price for snakes should be,considering the price that you think snake pickers in Manitoba should receive if a harvest season was able to re-open ? (Please indicate whether in Canadian or American Currency)

$_____

e) In your opinion, if snakes are allowed to be harvested how many do you think should be harvested per year at the prices you have indicated:

( ) Under 1000
( ) 1000
( ) 5000
( ) 10 000
( ) 20 000
( ) Other Number, _____
( ) 50 000
( ) Unlimited Number

MANAGEMENT SCENARIOS FOR HARVEST OF SNAKES IN MANITOBA

Please indicate whether you agree or disagree with the following management scenarios for potential harvest of snakes in Manitoba. Where **1** indicates that you **strongly agree** with the statement, **2** indicates you **agree** with the statement, **3** indicates you **neither agree or disagree** with the statement, **4** indicates that you **disagree** with the statement, and **5** indicates that you **strongly disagree** with the statement.

Continue Harvest Under Past Conditions:

Under this scenario the harvesting of snakes in Manitoba would be allowed to continue under past management techniques. Under this scenario anyone who purchases a collecting license from the DNR can collect snakes for the purpose of sale to snake buyers. The season lasts a period of two weeks during the fall. Snake buyers who were usually local residents bought snakes from collectors and sold the snakes to American Dealers who had to obtain export permits to take the snakes into the United States. The harvest of snakes would occur under past management strategies with no significant changes.

1 2 3 4 5
( ).....( ).....( ).....( ).....( )

Restrict Numbers Collected Per Den

Under this scenario a harvest of snakes would be allowed on the basis that there would be a restriction on the maximum number of snakes collected per den site. Snake collectors would be able to collect as many snakes as they wanted so long as they only collected a certain number from a den site. This number could be a percentage of total snakes visible at the site or could be a set number determined to be sustainable regardless of dens conditions or size.

1 2 3 4 5
( ).....( ).....( ).....( ).....( )

Size Restrictions on Snakes Collected

Under this scenario the DNR would issue licenses for the harvesting of snakes with the requirement that any snakes collected would have to be a certain length. This help to maintain those snakes that are the best fit and most actively reproductive since older snakes and female are on average generally large in size than younger male snakes. A maximum length of 45 cm has been suggested as an appropriate size restriction on the size of snakes harvested.

1 2 3 4 5
( ).....( ).....( ).....( ).....( )

Quota Numbers Per Snake Collector

Under this scenario a collector would be issued the harvest rights for a predetermined number of snakes. World demand is currently estimated to be at approximately 30 000 snakes. Quota's could be issued to collectors by the DNR. It is possible to add certain requirements such as size restrictions and maximum number picked per den as a pre-condition of obtaining an retaining a harvest quota. If the collector wants to leave the collecting industry the quota the DNR should have the right to buy back the quota. If the department defers the right then the collector can sell his Quota to any one person interested in obtaining harvesting rights.

1 2 3 4 5
( ).....( ).....( ).....( ).....( )

Trap Line Idea: Area Quota's

Under this scenario snake collectors will be issued an annual license which would allow them to collect snakes in a certain area. The department could assign each collector a certain area from which they would be entitled to collect snakes. This right to collect snakes would be the holder of the license only. Another suggestion using area Quota's is that the department could change these areas each year to allow snake populations to rebound from harvest pressures. Collectors would be assigned areas based on -past harvesting pressures and the expected world demand. Again, size and number restrictions could be a pre-condition of being allowed to collect snakes in designated areas.

1 2 3 4 5
( ).....( ).....( ).....( ).....( )

No Harvest

Under this scenario the moratorium would continue and collectors would not be allowed to harvest red-sided garter snakes in Manitoba.

1 2 3 4 5
( ).....( ).....( ).....( ).....( )

Captive Breeding Supplemented by Small Wild Harvest

Under this scenario the development of a biological breeding facility for red-sided garter snakes as well as possible other reptile and amphibian species would take place. Such a facility would be run by local residents in an area where the harvest of snakes was previously a source of income. Such an operation could be publicly owned or privately owned. A co-management venture with any interested Native band and the DNR could also be a possibility. Such an operation could supply the world demand for red-sided garter snakes and would relieve the pressures associated from the collection of snakes in the wild. A small annual or semi-annual harvest of snakes could be included in this operation to maintain healthy stock.

1 2 3 4 5
( ).....( ).....( ).....( ).....( )

Locally Operated Marketing Board

Under this scenario a marketing board could work with buyers and dealers in Manitoba and The United States to pre-determine the world demand for snakes before a season. The marketing board could then issue various snake collectors contracts to pick a pre-determined number of snakes at a price set in relation to the world demand. Again, harvesting restrictions could be applied as a precondition to obtaining a contract to collect snakes. This marketing board could be privately or publicly operated.

1 2 3 4 5
( ).....( ).....( ).....( ).....( )

Locally Operated Producer Co-operative:

Under this scenario those people involved in the picking of snakes would form a snake co-operative from which the snakes could be marketed. The co-operative could work in cooperation with the DNR to determine appropriate harvesting methods and numbers of snakes to be harvested. Each of the snake pickers would be allowed to pick a determined amount of snakes. These snakes would be temporarily held in an appropriate area until they could be distributed to potential buyers. After costs of operation were taken care of , the pickers would appropriately divide profits among them.

If you have any other suggestions or comments regarding the management of snakes please describe below.

Appendix 3

Survey Questions

1.) Did you receive your supply of Red-sided garter snakes from Manitoba?

2). Who did you receive the snakes from ?

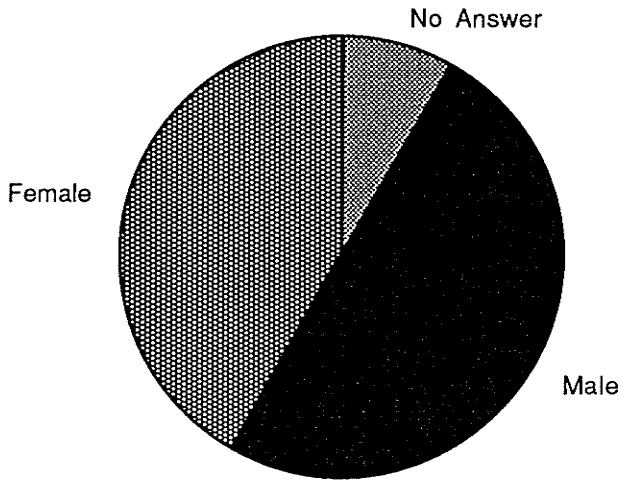
3). How many Snakes did you receive on an annual basis from 1971 to 1989 ?

4). How many snakes did you sell and who did you sell them to (include International customers if any, Please) on an annual basis from 1971-1989 ?

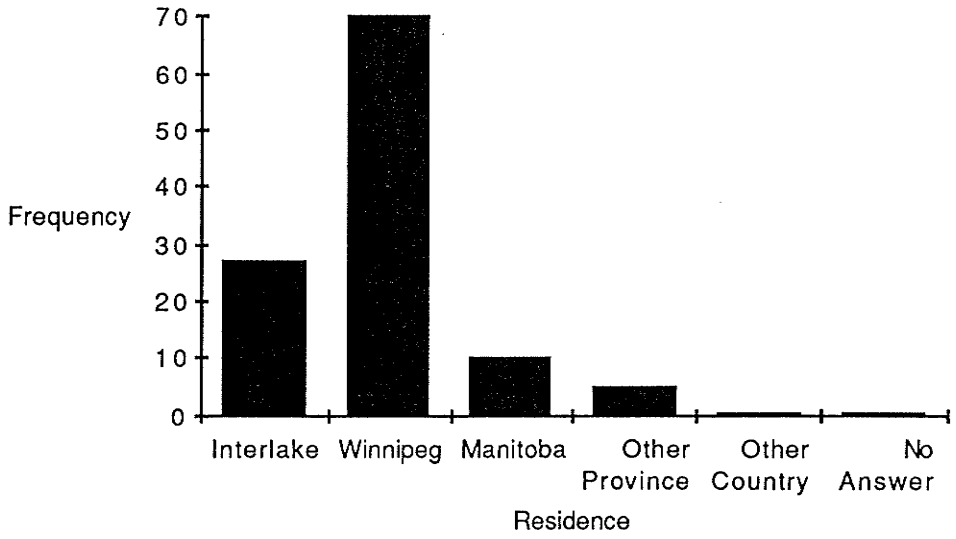
5). Please include any other pertinent quantitative data regarding markets for the snakes that you may have ?

6). Please include any general comments that you regard as important with respect to the market for red-sided garter snakes.

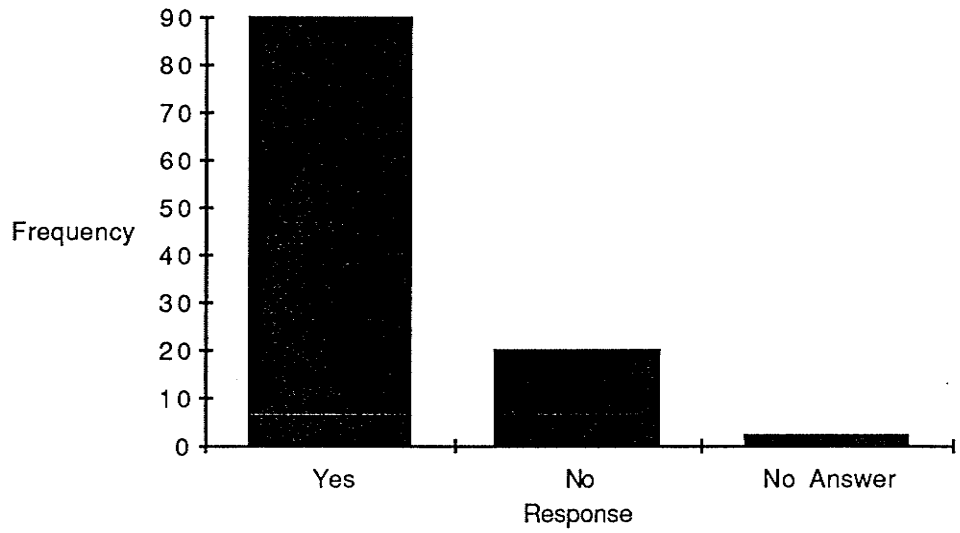
Appendix 4



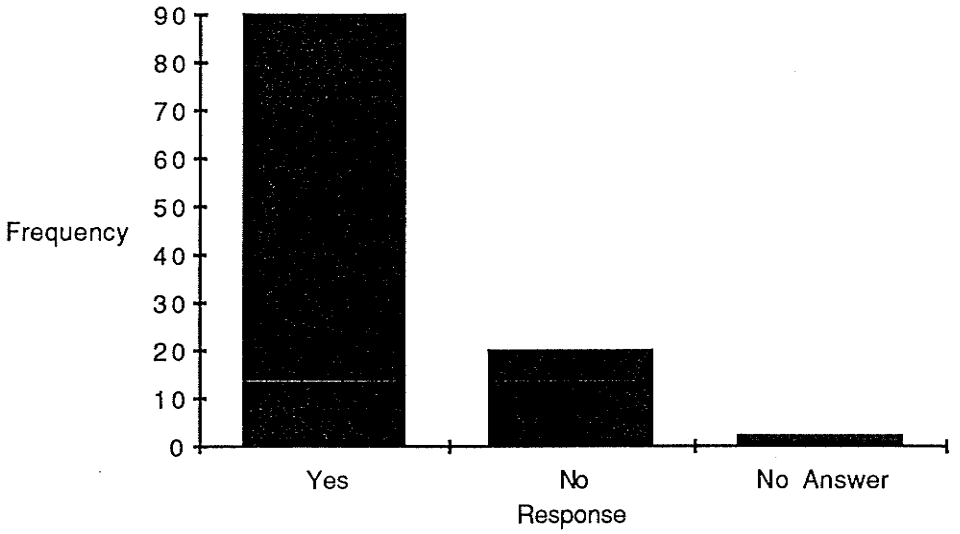
The sex of respondents surveyed at the Narcisse snake dens (n=112).



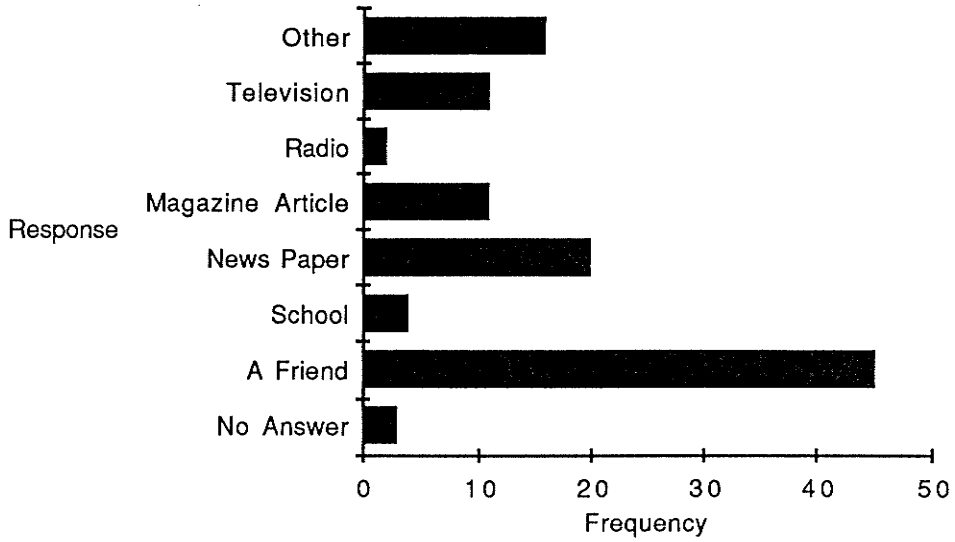
The residence of respondents surveyed at the Narcisse snake dens (n=112).



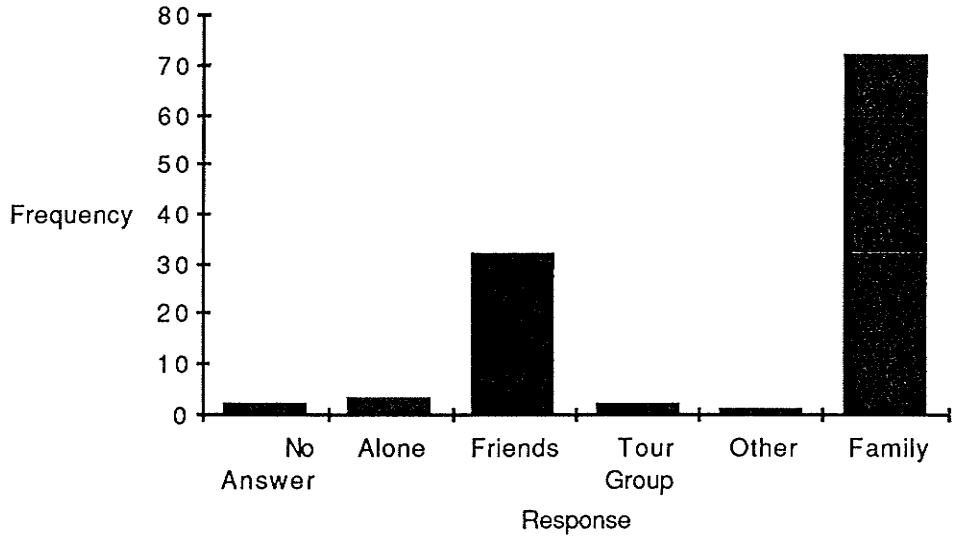
Frequency of respondents travelling to Narcisse to view the snakes as their primary purpose (n=112).



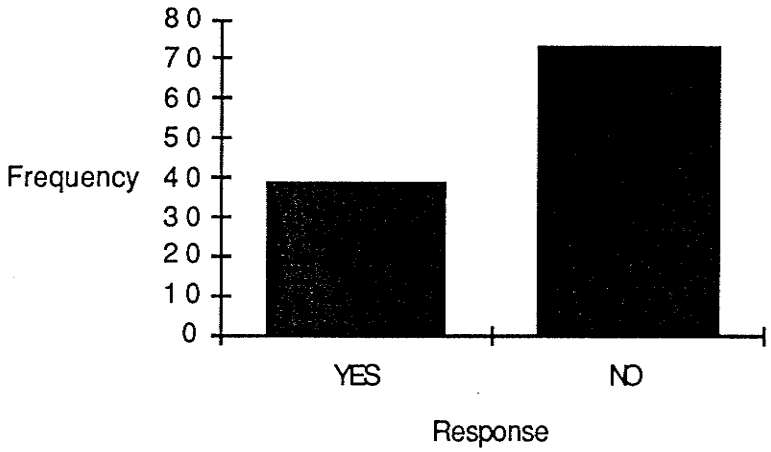
Frequency of respondents travelling to Narcisse for the first time (n=112).



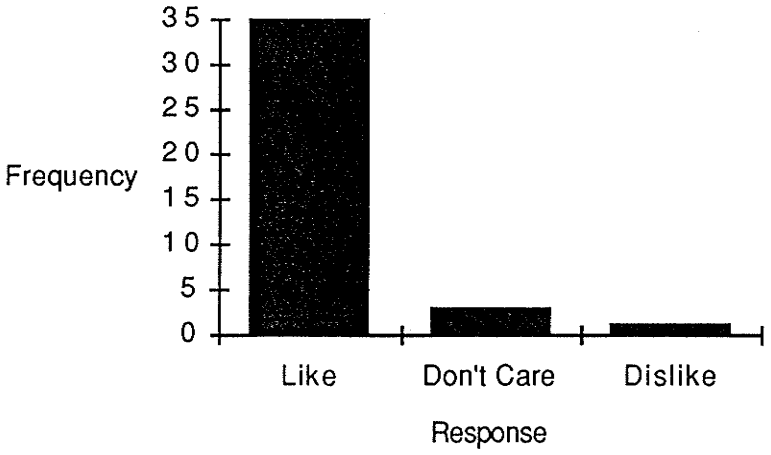
Response of surveyed individuals about how they came to be aware of the snakes at Narcisse (n=112).



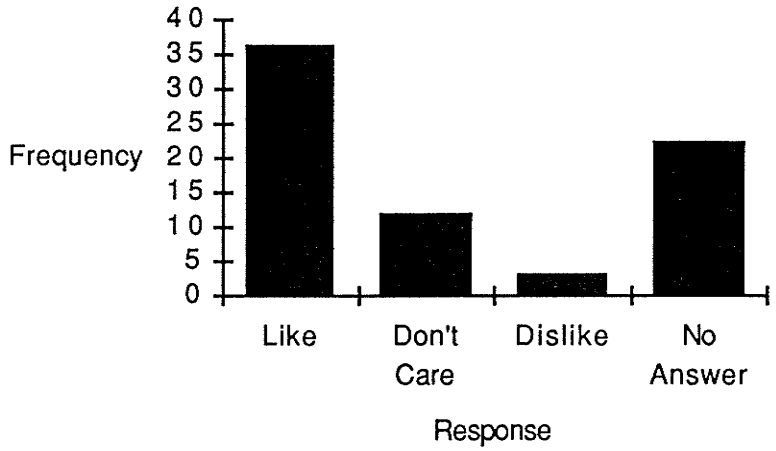
Response of individuals surveyed regarding who they were with when viewing the snakes at Narcisse (n=112).



Response of those individuals surveyed indicating whether their feelings toward snakes had changed after viewing the snakes and their dens at Narcisse (n=112).



Response of those individuals whose feelings did change toward snakes after viewing the dens at Narcisse (n=112).



Response of those individuals whose feelings did not change toward the snakes after viewing the dens at Narcisse (n=112)

Appendix 5

SUGGESTED FUTURE RECREATIONAL VENTURES:

Consultations with DNR staff, Manitoba Parks Staff, Tourism Manitoba staff, and an examination of respective departmental records were carried out by the researcher to determine potential recreation and tourism oriented projects related to the viewing of snakes in Manitoba. The following list of possible tourism projects was developed;

1) Enhancement of Narcisse Site Facilities:

This development of a semi-permanent or permanent on site structure offering viewers food items and souvenirs during the snake viewing season. This would most likely be operated on an experimental basis initially , and in fact was carried out at a less developed level during the 1991 season as mentioned above. The facility could either be run by a local entrepreneur, or a local organization, such as a Native band council or Dennis Lake Wildlife Organization.

An educational section could be included in this facility to help inform visitors about the snakes and their requirements. The facility could include information posters, pamphlets, videos, and live snakes. The facility could be staffed by an interpreter to help with visitor inquiries . This area could also act as an organizational point where viewers would meet before being escorted on guided tours of the snakes dens by interpreters. Such a facility could either be operated by a local organization with resource help from the DNR wildlife branch in terms of providing educational information about the snakes. The DNR may chose to operate such a facility itself instead of assisting a local organization.

2) Development of a Island tour concept with the tour being operated by local interested Native Band Council:

Under this concept a local Native band council could develop a tourism package that would include tours to islands harboring red-sided garter snakes. The tours to snake islands could be part of a comprehensive wildlife and Native culture tourist package marketed throughout North America and Europe. The term "Eco-Tourism" is an area that is becoming more popular with Europeans, and other developed countries . This type of

tourism is based on viewing natural ecosystems and the wildlife in these ecosystems. The wildlife in central Manitoba could possibly support such an industry, and the snakes and their dens as well as other unique natural phenomenons of wildlife could help to attract eco-tourists.

3) Development of a Circle tour of Interlake Manitoba based from Winnipeg or Hecla Island with snake dens as one of the possible wildlife destinations on the tour (Other Wildlife destinations could include Birds at Hecla Island, or Oak Hammock Marsh, for example):

The possibility of Hecla Island becoming a National Park could result in an increase in visitation by tourists to the Interlake region. Regardless of whether a National park is created their are possibilities for regional wildlife tours which could include viewing selected snake den sites in the Interlake.

4) Development of Day tour Originating from Hotels in Winnipeg and/or Special Interest Organizations:

Day tours already exists that involve viewing the snakes during the spring emergence by the Manitoba Naturalists society. There is potential to increase the availability of such tours to a greater number of visitors and or regional populations. An interested party might develop a tour promotional package that could be promoted at various hotels in Winnipeg.