Heritage Resources Centre
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A Preliminary Bibliography for the Herpetofauna of Ontario, with Special Emphasis on Long Point and the North Shore of Lake Erie

Long Point Environmental Folio
Publication Series

Technical Note 3

Long Point Environmental Folio Publication Series
Managing Editors: J. Gordon Nelson and Patrick L. Lawrence

A study team at the Heritage Resources Centre is developing an Environmental Folio for the Long Point Biosphere to assist management agencies and local citizens in understanding the human and natural components of the ecosystem. The folio will consist of a series of maps and text that would outline current major management issues and areas of concern. A series of project publications is being prepared to accompany the folio. These reports will consist of supplementary information collected during the study. This project is supported by the Royal Canadian Geographic Society and the Social Sciences and Humanities Research Council of Canada.

A Preliminary Bibliography for the Herpetofauna of Ontario, with Special Emphasis on Long Point and the North Shore of Lake Erie

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Preface

Increasingly, land use pressures associated with domestic and industrial development within the Great Lakes coastal zone of southern Ontario are creating many changes in the natural landscape, consequently disrupting populations of native fauna and flora. Many of these landscape alterations and their ecological consequences have long been recognized and investigated by environmentalists. Natural resource planners and managers are now taking a more holistic approach in understanding the implications of various land use activities, employing ecosystem principles and methods in their analysis of environmental issues. In association with government and private research organizations, concerned citizens are also contributing toward monitoring efforts, participating, for example, in regional bird counts and creel census fish surveys. Although large fur-bearing mammals and migratory birds have traditionally received much attention from wildlife managers in Ontario and Canada, several species have been neglected even though they are important components of the food web and make up a considerable portion of the biological diversity found in Canada.

Amphibians and reptiles are examples of the many species that continue to receive little or no attention from environmental planners and managers. Although they have not been intensively managed per se, Ontario herpetofauna appear extensively in the scientific literature. A growing concern for loss of global biodiversity at the genetic and species levels, resulting from rapid declines in population numbers and increasing rates of species extinction, has inspired much needed discussion and implementation of monitoring programs aimed at protecting and, in some cases rehabilitating, individual populations or species as well as entire communities and ecosystems. Whereas several northern populations of frogs, toads, salamanders, snakes, and turtles are likely to experience long-term fluctuations caused by natural climatic variation, some species seem to be rapidly declining as a result of unnatural and accelerated modification of their habitats. Amphibians and reptiles are thus believed to be good indicators of ecosystem health. In addressing problems associated with the planning for and management of biodiversity in Canada, research and monitoring efforts must examine the various environmental stresses and their impact on such vulnerable species, especially those which are currently in danger of extirpation from Canada.

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Introduction

Herpetology refers to the study of amphibians and reptiles, and generally pertains to the analysis of extant (living) species. According to Cook (1984), the Class Amphibia is represented by two orders in Canada, the Anura (frogs and toads) and the Caudata (salamanders and newts). These two groups of species represent separate lines of evolution whose history, or phylogeny, is distinct from that of reptiles. The Class Reptilia includes the Order Squamata, which comprises the Sub-Orders Lacertilia (lizards and skinks) and Serpentes (snakes), and the Order Testudines (turtles and tortoises). Not counting confirmed hybrid species, there are records for some 52 species and subspecies in Ontario alone. The known taxa and their phylogentic groupings are conveniently listed according to Cook's (1984) classification at the end of this section. This list is based on one of the most recent and inclusive herpetofaunal inventories of Ontario (Weller and Oldham, 1988), and does not include confirmed hybrids.

People have traditionally exhibited an aversion toward amphibians and reptiles, which are among the most unappreciated and undervalued species of our native fauna. The term "cold-blooded" has often been used to describe these creatures as opposed to the proper term ectothermic which refers to a reliance on thermal sources external to the body for regulation of internal physiological processes (e.g. digestion and excretion) as well as behavioural/ecological patterns. Not surprisingly, climate is an important factor restricting the range and diversity of herpetofauna in Canada. In southern Ontario, the moderating effect of the Great Lakes coupled with a variety of ideal habitats permits the existence of a rather diverse assemblage of amphibian and reptile species, most of which represent the northern limits of a more continuous southern distribution.

Amphibians and reptiles in Ontario do not attain the large size of some of their relatives to the south, nor do they pose a serious threat to humans as they do in other parts of the world. They do not play much of a direct role in Ontario's economy, although bullfrogs and snapping turtles have been harvested and may still continue illegally to some extent. Logier (1952) stated the economic value of amphibians in terms of human food or as food for animals useful to man; as a predator (and biological control) of agricultural pests; as an important carrier of disease or as a host for disease producing organisms; and in terms of their use as scientific, medical, and educational specimens. Though they are largely undesirable to many residents living in rural areas, reptiles, especially snakes, are beneficial predators of unwanted domestic pests such as mice and rats, and also play an integral role in the food chain. Species and subspecies may also be of general zoological interest owing to the fact that many local populations may be genetically unique and may confer information about tolerance to particular climatic or habitat conditions (Cook, 1977). A combination of natural and anthropogenic stresses is expected to affect populations of amphibians and reptiles in Ontario, including climate change, increased ultraviolet radiation, flooding, and high rates of depredation by natural predators such as skunks and raccoons whose populations are kept artificially high by human garbage. Land use pressures such as accelerated residential and industrial development, agriculture, as well as recreation and tourist activities have contributed either to the fragmentation of forests or the drainage of wetlands in southern Ontario, promoting the deterioration of valuable amphibian and reptile habitat. This is especially evident in coastal areas of the lower Great Lakes basin. Related to population growth and subsequent habitat loss, road mortality is common among amphibians and reptiles, and accounts for several Ontario herpetofaunal records. Controlled laboratory and field studies examining toxicological effects on amphibians (IJC, 1986) and reptiles have indicated that some species are good indicators of environmental health.

The purpose of this bibliography is to reveal the current scope and nature of research on the herpetofauna of Ontario. The objectives are to describe and classify a sample of the herpetological literature, and to discuss research and monitoring needs. This annotated bibliography was assembled within the context of the Environmental Folio of the Long Point Biosphere Reserve (Nelson et al., 1993), a comprehensive and systematic enquiry into the abiotic, biotic, and cultural components of this particularly unique and dynamic ecosystem that is situated within the Great Lakes-St. Lawrence Valley region of southwestern Ontario.

Methods

Research for this bibliography began in October 1993 to review and document as much herpetological literature as was available pertaining to the Long Point region of Ontario. In order to better reflect the scope of herpetology in Ontario, and to reflect the diversity of herpetofauna within this province, a sample of herpetological investigations conducted in other areas of Ontario was also reviewed for inclusion in this preliminary annotated bibliography. In addition to the emphasis placed on Long Point, an attempt was made throughout the study to obtain citations relevant to the remaining two major sand spit peninsulas, Rondeau and Point Pelee, which are also located on the north shore of Lake Erie. These coastal areas, while biologically and physically unique, are all representative of Great Lakes ecosystems, containing significant wetland habitat and an exceptional diversity of wildlife. Amphibians and reptiles inhabiting these coastal ecosystems are significant because they represent the northern limits of their range, and some species are among the many varieties of flora and fauna that are threatened and in danger of extirpation from Canada.

Using the Annotated Checklist of the Herpetofauna of Haldimand-Norfolk County by Gartshore (1987), and the Ontario Herpetofaunal Summary by Weller and Oldham (1988) as starting points, references cited within these works were first reviewed at the Universities of Waterloo and Western Ontario, and at the Canadian Wildlife Service in London, Ontario. As time and resources permit, the Zoological Record index for amphibians and reptiles is continually being searched geographically. Therefore, it is expected that citations will be added indefinitely to this bibliography.

Once research for the bibliography had progressed sufficiently, citations were arbitrarily grouped into seven categories or sections and assigned headings which generally reflect the literature content. In this manner, an *Organizational Framework* for the bibliography was constructed (below) to depict the scope and nature of herpetological research in Ontario. At least one citation within each section was annotated to provide an abstract of a study or investigation which the author considers to be most informative in zoological sense. Annotations are generally given for papers particularly concerned herpetofauna studied at either Long Point or the north shore of Lake Erie, although an exception was made in the section entitled *Parasitology* as none of the articles in this section met this criterion. Similarly, citations placed in the section *Introducing Canadian Herpetofauna* cover wider geographic regions within Ontario and Canada and do not pertain specifically to Long Point or the north shore of Lake Erie.

Results and Discussion

Citations came from a variety of sources. The bibliography comprises published scientific articles, essays and notes from journals, unpublished reports to the Canadian Wildlife Service (CWS) and Ontario Ministry of Natural Resources (OMNR) pertaining to the Long Point region, and status reports (published and unpublished) prepared for review by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). A few graduate dissertations are also included in the bibliography.

This bibliography represents one attempt of compiling the broad spectrum of research conducted on amphibians and reptiles found within Ontario. The document presents a wide range of herpetological studies that were undertaken along the north shore of Lake Erie, particularly in the Long Point region, and thereby provides information relevant to the Environmental Folio (Nelson et al., 1993) of this World Biosphere Reserve. This area in southwestern Ontario has traditionally received much attention from herpetologists and wildlife biologists in general. Specifically, the Long Point and Big Creek National Wildlife Areas, both administered by the CWS, and adjacent mainland areas in Haldimand-Norfolk County falling under the jurisdiction of a variety of government and non-government research and management organizations, have been the focus of several investigators who have undertaken studies ranging from genetic analyses of individual toad populations to evaluations of proposed habitat alterations and discussions of human impacts on entire communities of amphibians and reptiles. Salamander populations at Point Pelee National Park and Pelee Island have been sampled by researchers in the Canada and the United States for use in genetic analyses, whereas the incidence of new parasites in amphibians has been investigated at Algonquin Provincial Park in central Ontario. Only a checklist of amphibians and reptiles occurring at Rondeau Provincial Park was available for inclusion within this bibliography. The apparent information gap for this noteworthy area, which supports a diverse community of herpetofauna, is probably the result of unpublished literature, which, if available, will eventually be obtained and added to the bibliography at a later date. The scope of herpetology in Ontario was found to be broad, as demonstrated by the following *Organizational Framework,* which provides a more thorough discussion of the nature of herpetological research covered by this preliminary bibliography.

Organizational Framework

Introducing Canadian Herpetofauna - This section contains guide books providing colour plates, hand sketches, range maps, and complimentary text in such a manner as to develop an awareness and interest toward herpetology. These references are highly recommended for beginner, amateur and professional herpetologists.

Species Inventories and Distribution in Ontario - This section is subdivided into three clusters of species accounts which elaborate on distribution, range, boundaries, and habitat characteristics i) within Ontario, ii) along the north shore of Lake Erie (i.e. Rondeau, Point Pelee and the Lake Erie Archipelago), and iii) at Long Point. Though many of the references appear outdated and mainly offer qualitative discussions and little quantitative information, they contain valuable historical notes on the former occurrence and abundance of many amphibian and reptile species in Ontario,

whereas the more recent inventories constitute an updated zoogeographical resource base for the herpetofauna of Ontario.

Status and Conservation - Many species of amphibians and reptiles now considered rare in Canada are present and even abundant in Ontario. The primary objective of citations within this section is to report on the status of amphibian and reptile populations in Canada, and to provide general discussions on general ecology (habits, intra- and inter-specific competition, reproduction and growth, population sizes and trends), and conservation. An additional benefit of these reports is that they elucidate significant areas in Ontario, such as Long Point, Point Pelee, and Pelee Island, where vulnerable populations may be found.

Autecology - This section primarily contains scientific articles which together cover a wide range of disciplines of biology. Areas of research contained under this heading include behavioural ecology, environmental physiology, courtship and reproduction, and evolutionary biology. Each study examines how environmental and physiological factors influence the behaviour, ecology, and evolutionary history of particular species. The scope of this literature category is broad to facilitate incorporation of additional citations into the bibliography, at which time further literature subheadings may be sought by the author.

Hybridization and Population Genetics - Most of the articles cited in this section describe molecular analyses which examined cell size and chromosome numbers in order to determine genetic characteristics of specific populations of salamanders (*Ambystoma* spp.) inhabiting areas along the north shore of Lake Erie. A few studies deal with ecological, behavioural, or physiological implications of genotypes arising from hybridization of two closely related species. One study, for instance, describes the resulting mating call characteristics of hybrid toads (*Bufo woodhousii fowleri* X *B. americanus*) at Long Point Two studies demonstrate the efficacy of using electrophoretic analysis of proteins in the identification of *Ambystoma* salamanders from Pelee and Kelley's Islands in western Lake Erie.

Parasitism - Literature reviewed for inclusion in this section deals with the prevalence of parasites in frogs and toads collected in Algonquin Park. Detailed observations have also been made on the development and life-cycles of parasites in experimentally infected frogs taken from this Ontario provincial park. The ability to distinguish between *Trypanosoma* parasites on the basis of morphology and host species is also discussed in one article. No studies were encountered that provided evidence of parasitic interactions with amphibians elsewhere in the province of Ontario.

Mortality - This section is reserved for citations dealing with various causes of mortality among amphibians and reptiles. In general, articles linking exposure to environmental toxins and decreased fecundity, or survivorship, are placed within this category, as are papers that specifically discuss and/or speculate on the causes for declines in population density in an area.

In terms of research needs, continued monitoring of amphibians and reptiles is essential and entails updating the current information base for Ontario. Although there is abundant information about the former and present occurrence of species in Ontario, quantitative data regarding exact distributions, densities, and life-histories for many species are severely lacking. Many species, especially amphibians, are highly conspicuous and secretive, primarily because they are active at only certain times of the day or night, and remain dormant for a considerable portion of the year in temperate regions. Therefore, amphibians and reptiles can be difficult to study in their natural environment, which is continuously being altered by natural and artificial impacts. Toxicological studies have so far focused on only a few species known to inhabit the Great Lakes zone, therefore

the environmental tolerance limits of many local populations remain unknown. With the exception of Mole salamanders (*Ambystoma* spp.) and Fowler's toads, the genetic variation exhibited by other species and subspecies of herpetofauna found in Ontario are less well known. The apparent decline of many populations makes it increasingly necessary to ensure that, at a minimum, viable population numbers are maintained, and to recognize that rehabilitation and recovery programs for certain species are imminent. Considerable concern over apparent declines in amphibian populations in Canada and elsewhere prompted a workshop in 1991 to examine the status of several threatened and endangered species, and to develop a protocol for addressing this pressing issue in Canada (Bishop and Pettit, 1992).

In addition to the recent call for a nationwide amphibian monitoring strategy (Bishop and Pettit, 1992), recovery plans are expected to be implemented in 1994 in Ontario for Blanchard's Cricket Frog, Blue Racer, Lake Erie Water Snake, Eastern Massassauga Snake, and Eastern Spiny Softshell Turtles (Nadeau, 1994). The first three species are on the Canadian endangered species list, and all are restricted to wetlands along the north shore of Lake Erie, whereas the Eastern Massassauga and eastern populations of Softshell Turtles are considered threatened in other parts of the province according to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Fowler's Toads and Spotted Turtles, both of which occur in substantial numbers at Long Point but are uncommon or rare in other parts of their restricted range in southwestern Ontario, and Smallmouth Salamanders, which are confined to Pelee Island, are all listed as vulnerable by COSEWIC. Protection of appropriate breeding and feeding habitat in this region of Ontario should therefore be of special concern to those management agencies responsible for the stewardship of these areas, as it is essential for the continued survival of these particular species of herpetofauna in Ontario and Canada.

A summary of the protection and conservation of Ontario's herpetofauna through government legislation was given by Coulon and Weller (1988). In addition to the protection some species gain through the Game and Fish Act of the Ontario Ministry of Natural Resources, provincial and federal legislation also protects amphibians and reptiles and their habitat through the Provincial Parks Act and the National Parks Act, respectively, although this "protection" is somewhat incomplete for many species. Although many populations may be afforded some protection because they are within the boundaries of provincial and national parks, wildlife reserves, or privately held lands with restricted access (e.g. Long Point Company Marsh), there are no federal, provincial, or municipal laws or regulations specifically affecting such rare and vulnerable species as Fowler's Toad in Canada (Green, 1989). Although National Parks, Provincial Parks, and land designated as a Biosphere Reserve, an Area of Concern or an Area of Natural and Scientific Interest may act as a partial refugium from artificial disturbances such as development, there are currently no management plans that specifically refer to amphibians and reptiles inhabiting such areas. Species inventories compiled on an incidental basis generally provide insufficient information concerning long-term population dynamics, are often outdated, and therefore unreliable for use in a wildlife management plan. At present, there is ample opportunity for park managers and biosphere reserve committees in Ontario to seek a management strategy that will offer herpetofauna long-term protection with some legislative support. Finally, the goal of such management schemes must be to offer not only short-term solutions relevant to single species but rather to trend toward the conservation of groups of species and their habitat.

Phylogenetic List of Species and Subspecies

(COSEWIC Designations: *Endangered; †Threatened; §Vulnerable)

Class AMPHIBIA

Order Caudata (Salamanders and Newts)

Family Proteidae:
Necturus maculosus (Mudpuppy)

Family Salamandridae:
Notophthalmus viridescens viridescens (Red-spotted Newt)
Notophthalmus viridescens louisianensis (Central Newt)

Family Ambystomatidae
Ambystoma jeffersonianum (Jefferson Salamander)
Ambystoma laterale (Blue-spotted Salamander)
Ambystoma texanum (Smallmouth Salamander)§
Ambystoma maculatum (Yellow-spotted Salamander)

Family Plethodontidae
Eurycea bislineata (Two-lined Salamander)
Hemidactylium scutatum (Four-toed Salamander)
Plethodon cinereus (Eastern Redback Salamander)

Order Anura (Frogs, Peepers, and Toads)

Family Bufonidae
Bufo americanus (American Toad)
Bufo woodhousei fowleri (Fowler's Toad)§

Family Hylidae
Hyla (=Pseudacris) crucifer (Spring Peeper)
Hyla versicolor (Gray Treefrog)
Pseudacris triseriata triseriata (Midland Chorus Frog)
Pseudacris triseriata maculata (Boreal Chorus Frog)
Acris crepitans blanchardi (Blanchard's Cricket Frog)*

Family Ranidae
Rana sylvatica (Wood Frog)
Rana pipiens (Northern Leopard Frog)
Rana palustris (Pickerel Frog)
Rana clamitans melanota (Green Frog)
Rana septentrionalis (Mink Frog)
Rana catesbeiana (Bullfrog)

CLASS REPTILIA

Order Testudines (Turtles)

Family Chelydridae
Chelydra serpentina (Common Snapping Turtle)

Family Kinosternidae
Sternotherus odoratus (Musk Turtle)

Family Emydidae
Chrysemys picta belli (Western Painted Turtle)
Chrysemys picta marginata (Midland Painted Turtle)
Pseudemys scripta elegans (Red-eared Slider)
Graptemys geographica (Map Turtle)
Emydoidea blandingii (Blanding's Turtle) [†Nova Scotia Population]
Clemmys insculpta (Wood Turtle)
Clemmys guttata (Spotted Turtle)§
Terrapene carolina (Eastern Box Turtle)

Family Trionychidae
Trionyx spiniferus (Eastern Spiny Softshell Turtle) [†Eastern Population]

Order Squamata

Sub-Order Lacertilia (Lizards and Skinks)

Family Scincidae
Eumeces fasciatus (Five-lined Skink)

Sub-Order Serpentes

Familae Colubridae
Thamnophis sirtalis sirtalis (Eastern Garter Snake)
Thamnophis sirtalis parietalis (Red-sided Garter Snake)
Thamnophis sauritus septentrionalis (Northern Ribbon Snake)
Thamnophis butleri (Butler's Garter Snake)
Nerodia sipedon sipedon (Northern Water Snake)
Nerodia sipedon insularum (Lake Erie Water Snake)*
Regina septemvittata (Queen Snake)
Storeria occipitomaculata (Northern Redbelly Snake)
Storeria dekayi (Brown Snake)
Opheodrys vernalis vernalis (Eastern Green Snake)
Diadophis punctatus edwardsi (Northern Ringneck Snake)
Heterodon platyrhinos (Eastern Hognose Snake)
Elaphe obsoleta (Black Rat Snake)
Elaphe vulpina gloydi (Eastern Fox Snake)
Lampropeltis triangulum (Eastern Milk Snake)
Coluber constrictor foxi (Blue Racer)*

Family Viperidae
Sistrurus catenatus (Eastern Massassauga)†

Bishop, C.A., and K.E. Pettit (Editors). 1992. Declines in Canadian amphibian populations: designing a national monitoring strategy. Canadian Wildlife Service, Occasional Paper No. 76. Environment Canada. 120 pp.

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Cook, F.R. 1984. Introduction to Canadian Amphibians and Reptiles. National Museum of Natural Sciences, Ottawa, Ontario. 200 pp.

This handbook is intended to be a comprehensive, readable but authoritative guide, providing identification and distribution maps as well as some general information on the natural history of herpetofauna. Following a short discussion of diversity and phylogenetic classification, Canadian amphibians and reptiles are presented through illustrations and individual accounts of the variety species and subspecies that are present in Canada. This text, though not a field guide in itself, provides summaries of important ecological characteristics such as ectothermy, as well as the unique behavioural and morphological traits which are traditionally used to define the various taxonomic groups (i.e. orders, families, genera, species) of amphibians and reptiles.

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This 1986 Ontario Herpetofaunal Summary comprises over 6,100 amphibian and reptilian records, and is the third such report prepared since the project began in 1984. Information on the distribution and ecology of each species and subspecies of Ontario amphibian and reptile reported in 1986 is presented in a series of species accounts, which are supplemented by maps and graphs. The actual records on which this report is based are contained in a separate document, the Ontario Herpetofaunal Summary 1986 Technical Supplement. (See also Oldham and Weller, 1992 under *Status and Conservation* section).

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Seburn, C.N.L. 1993. Spatial distribution and macrohabitat use in the five-lined skink (*Eumeces fasciatus*). Canadian Journal of Zoology 71: 455-450.

Patterns of spatial distribution and microhabitat use in *Eumeces fasciatus* were examined in a population at Point Pelee National Park, Canada. Each individual was uniquely marked and classified as either an adult male, adult female, yearling, or hatchling. At each microsite sampled, measurements were made of thickness and surface area of cover, degree of shading, and distance to nearest neighbouring microsite. Significant aggregation was found among individuals within age and sex classes. Males and females associated significantly during the breeding season but not at other times. The number of captures made at a microsite was positively correlated with cover surface area and negatively correlated with cover thickness. Nest sites were used more frequently than other sites. Evidence suggested that some females shift home range, once prior to oviposition, and again after hatching of eggs. Males demonstrated reduced activity after oviposition and may aestivate.

Long Point

Adams, M.S. and H.F. Clark. 1958. A herpetological survey of Long Point, Ontario, Canada. Herpetologica 14: 8-10.

Campbell, C.A. 1979. Preliminary herpetological survey and evaluation of proposed habitat alterations at Big Creek National Wildlife Area, Port Rowan, Ontario. Unpublished Report to Canadian Wildlife Service, London, Ontario. 40 pp.

Dewey, K. 1981. Fish inventory, hydrographic mapping, biolimnological sampling, bird, reptile, amphibian, and large mammal utilization of six inland ponds in Gravelly Bay area of Long Point National Wildlife Area. Unpublished Report to Canadian Wildlife Service, London, Ontario. 79 pp.

Dewey, K., J. Ashenden, and W. Wierciniski. 1982. Initial inventory of the Thoroughfare Point Unit, Long Point National Wildlife Area. Unpublished Report to Canadian Wildlife Service, London, Ontario. 42 pp.

Gartshore, M.E. 1986. The amphibians and reptiles of Backus Woods, Backus Woods Study. Unpublished Report to Ontario Ministry of Natural Resources. 17 pp.

Gartshore, M. 1987. Annotated Checklist to the Herpetofauna of Haldimand-Norfolk. *In* The Natural Areas Inventory of Haldimand-Norfolk, Volume 2, Annotated Checklists. *Edited by* M.E. Gartshore, D.A. Sutherland, and J.D. McCracken. Simcoe, Ontario. Part 4 (21 pp.).

This section of the Natural Areas Inventory (NAI) provides an analysis of a herpetofaunal survey conducted in the Regional Municipality of Haldimand-Norfolk for the purposes of assessing the status of each species in the region, generating species lists in "Significant Natural Areas" and "Significant Sites" while identifying critical habitats and areas for significant species. Herpetological information was collected using unstructured surveys incidental to other field work. A total of 34 species of amphibians and reptiles were documented from over 2100 records collected during the two year study. Two species formerly present in the region at one time were not reported by the NAI: Massassauga (*Sistrurus catenatus*) and Queen Snake (*Regina septemvittata*). The former may now be extirpated. The occurrence of Jefferson and Blue-spotted Salamanders was confirmed through electrophoretic identification of these species. Most species were found to be widespread and common in the region, although Pickerel Frogs and Fowler's Toads were restricted in distribution. Large Bullfrog choruses were heard at Long Point, Big Creek Marsh and Hunger lake, and smaller choruses were also common on farms. In her discussion of management, Gartshore discusses implications of public education, commercial trade, environmental threats and documentation of adequate data. A rationale for determining rarity in the region, within the Province of Ontario, and in Canada is also given by Gartshore. This is followed by detailed accounts and regional maps for all species recorded by the NAI.

Haggeman, J.G. 1981. Some characteristics of a population of Spotted Turtles and a population of Blanding's Turtles. Unpublished Report, Department of Zoology, University of Guelph, Ontario. 15 pp. + figures.

Hamilton Naturalist's Club. 1982. Biotic contents of Spooky Hollow Sanctuary and Short Hills Wilderness Area Nature Reserves. Hamilton Naturalists' Club, Hamilton, 108 pp.

Hubbs, F.T. 1979. Endemic herpetofaunal species and their distribution in Big Creek Marsh, Port Rowan, Ontario. Unpublished Report to Canadian Wildlife Service, London, Ontario. Unpaginated.

Langdon, M. 1969. Reptiles and amphibians of Norfolk County. The Wood Duck 23: 17-21.

Logier, E.B.S. 1931. The amphibians and reptiles of Long Point. *In* A faunal investigation of Long Point and vicinity Norfolk County, Ontario. *Edited by* L.L. Snyder and E.B.S. Logier. Transactions of the Royal Canadian Institute 18: 117-236.

Patch, C.L. 1919. A rattlesnake, melano garter snakes and other reptiles from Point Pelee, Ontario. The Canadian Field-Naturalist 33 (3): 60-61.

Planck, J.T. 1981a. Amphibian and reptile distributions along a proposed Gravelly Bay walking trail, Long Point National Wildlife Area. Unpublished Report to Canadian Wildlife Service, London, Ontario. Unpaginated.

Planck, J.T. 1981b. Amphibian and reptile distributions at Bluff Point, Long Point National Wildlife Area. Unpublished Report to Canadian Wildlife Service, London, Ontario. 39 pp.

Purves, S. 1980a. Turtle studies in the Big Creek National Wildlife Area in 1980, Unpublished Report to Canadian Wildlife Service, London, Ontario. Unpaginated.

Purves, S. 1980b. Turtle studies in the Long Point National Wildlife Area in 1980, Unpublished Report to Canadian Wildlife Service, Unpaginated.

van Patter, M., J. Antoszek, C. Boyd, and C. Clarke. 1979. Carolinian trails of the Backus Tract. Long Point Region Conservation Authority, Simcoe. (Table 9, pp. 78-80).

Status and Conservation

General

Cook, F.R. 1964. Endangered Canadian amphibians and reptiles. Canadian Amphibian and Reptile Conservation Society Bulletin, February 1964: 1-3.

Cook, F.R. 1971. Endangered wildlife - reptiles and amphibians. *In* Endangered Wildlife in Canada. Canadian Wildlife Federation, Ottawa. pp. 10-11.

Cook, F.R. 1970. Rare or endangered Canadian amphibians and reptiles. The Canadian Field-Naturalist 84 (1): 9-16.

Cook, F.R. 1977. Review of the Canadian herpetological scene. *In* Proceedings of the symposium of Canada's threatened species and habitats. *Edited by* T. Mosquin and C. Suchal. Canadian Nature Federation. pp. 117-121

This is the first of three articles dealing with Canadian herpetofauna, as it appeared in the proceedings of a symposium co-sponsored by the Canadian Nature Federation and the World Wildlife Fund (Canada), held 20-24 May 1976 in Ottawa. Although not a study in itself, the article is largely concerned with the status of amphibians and reptiles in Canada, which are reviewed in terms of their population numbers at various provincial localities. Cook identifies areas of restricted and declining populations of amphibians and reptiles in Ontario and the rest of Canada. These areas include Point Pelee and Pelee Island (limits for the blue racer and island water snakes, eastern tiger salamander, Blanchard's cricket frog, and small-mouthed salamander); Southern Ontario (limit for the Jefferson and silvery salamanders); Southwestern Ontario (limit for the Queen snake and Butler's garter snake); Georgian Bay area and eastern central Ontario (limit for the eastern hognose snake); Eastern disjunct localities for the spotted turtle, which also occurs in Georgian Bay and southern Ontario regions; Rideau Lakes area where the black rat snake occurs as populations disjunct from the southern Ontario range; and Ottawa-St. Lawrence-Richelieu Rivers where the eastern spiny softshell occurs, apparently disjunct from Lake Erie populations. Fowler's toad was also mentioned as being restricted to Long Point and other sandy areas along Lake Erie, where it is still abundant today. None of the threatened and extirpated species mentioned in this article are unique to Canada, nor have they ever exhibited extensive Canadian distributions. The primary concern here is for a loss of Canadian fauna and possibly of genetically unique forms and subspecies particularly well suited to specific habitat and/or climatic conditions. Elimination of these northern populations is a warning sign for the elimination of Canadian habitat and for the potential loss of biological diversity in Canada.

COSEWIC. 1986. Amphibians and reptiles, Committee on the Status of Endangered Wildlife in Canada, subcommittee report. Appendix 3, 1 p.

Francis, G.R. 1977. Summary observations on Canadian reptiles and amphibians. *In* Canada's threatened species and habitats. *Edited by* T. Mosquin and C. Suchal. Canadian Nature Federation. pp. 133-135.

Green, D.M. 1992. Fowler's Toads (*Bufo woodhousei fowleri*) at Long Point, Ontario: changing abundance and implications for conservation. Canadian Wildlife Service, Occasional Paper No. 76: 37-43.

Oldham, M.J. 1983. An update on the status of the blue racer *(Coluber constrictor foxi),* Lake Erie water snake *(Nerodia sipedon insularum),* Blanchard's cricket frog *(Acris crepitans blanchardi),* and small mouth salamander *(Ambystoma texanum)* on Pelee Island, Ontario. Unpublished Report, Wildlife Branch, Ontario Ministry of Natural Resources, Toronto.

Oldham, M.J., and W.F. Weller. 1992. Ontario Herpetofaunal Summary: compiling information on the distribution and life history of amphibians and reptiles in Ontario. Canadian Wildlife Service, Occasional Paper No. 76: 21-22.

Ontario Ministry of Natural Resources. 1986. Ontario lists of rare, threatened, endangered, and extirpated or extinct species. 3 pp.

Amphibians

Berrill, M., S. Bertram, P. Tosswill, and V. Campbell. 1992. Is there a Bullfrog decline in Ontario? Canadian Wildlife Service, Occasional Paper No. 76: 32-36.

Campbell, C.A. 1977 a. Some threatened frogs and toads in Ontario. *In* Proceedings of the symposium on Canada's threatened species and habitats. *Edited by* T. Mosquin and C. Suchal. Canadian Nature Federation. pp. 130-131.

Campbell stresses the need for habitat protection and suitable management for Blanchard's cricket frog, *Acris crepitans blanchardi*, and Fowler's toad *Bufo woodhousii fowleri*, both of which have been affected by a combination of natural and human impacts that have eliminated crucial habitat for these two species. At the time, the former was considered to be the most endangered frog or toad in Canada, restricted to a few breeding ponds on Pelee Island. Causes for its decline on Point Pelee were not known, but on Pelee Island it had declined more than 50% since 1970, as a result of extensive natural flooding of its marshy habitat, land filling, and possibly depredation by increasing numbers of waterfowl, and anglers using cricket frogs as bass bait. The latter species has been affected by loss of lakeshore breeding pools caused by landfill and other development, increased road traffic, and possibly pollution. Fowler's toads have been sampled for toxic chemicals as part of a Canadian Wildlife Service program, and some effort has been made to protect the last spawning pools of a population of Fowler's toads at Rondeau Provincial Park. Further enquiry into the possible causes for the decline of pickerel frog, *Rana palustris*, in areas ranging from theWaterloo region to the Parry Sound District, and Ottawa, was also suggested by Campbell.

Campbell, C. A. 1977b. Range, status, ecology, and dorsal spot fusion of Pickerel Frog *(Rana palustris)*. Unpublished Report to Canadian Wildlife Service, London, Ontario. 49 pp.

Green, D.M. 1983. The status of *Bufo fowleri* (Fowler's Toad) in Canada. COSEWIC Status Report, Ottawa, Ontario. 31 pp.

Green, D.M. 1985. The biology and population status of *Bufo woodhousei fowleri* (Fowler's Toad) in Canada. COSEWIC Status Report, Ottawa, Ontario. 42 pp.

Green, D.M. 1989. Fowler's Toad, *Bufo woodhousei fowleri*, in Canada: biology and population status. The Canadian Field-Naturalist 103 (4): 486-496.

Fowler's Toads, *Bufo woodhousii* fowleri are widespread throughout the eastern United States but is restricted to sandy or rocky points and sandy beaches along the northern shore of Lake Erie in Ontario, Canada. Beetles and ants are its major food and garter snakes its major predator. Adults are primarily nocturnal and active at between 14 and 15 degrees C. They breed from early May to mid-June in marshy shallows adjacent to sand dunes, savannah or open forest. Clutch size is 4000 to 10 000. Tadpoles transform by the end of July. Males breed first as two-year olds at 50 mm snout-vent length, females are older and larger at first laying. Although the species has disappeared from at least two sites at the western end of Lake Erie within the last 30 to 40 years, and is discontinuously distributed, it appears to be stable at most recorded localities and abundant at Long Point. Hybridization with the American Toad, *B. americanus*, is recorded widely in the United States but confirmed only at Long Point in Canada. Many areas where it occurs are within parks or other managed lands where there seem to be no immediate threats from industry and development. However, it has disappeared from one intensively used park (Point Pelee) and an agricultural area with heavy chemical use (Pelee Island). This toad is classified as *Rare* in Canada because of its restricted distribution, which makes it vulnerable to further habitat loss.

Addendum: Rare status assigned by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in April 1986. The original report on which this paper is based (Green 1985; see above) is available at cost from The Canadian Nature Federation, Ottawa, Ontario. Status changed to Vulnerable by COSEWIC, April 1990, as part of transfer of all species previously designated Rare to this category.

Green, D.M. 1992. Fowler's Toads (*Bufo woodhousei fowleri*) at Long Point, Ontario: changing abundance and implications for conservation. Canadian Wildlife Service, Occasional Paper No. 76: 37-43.

Oldham, M.J. and C.A. Campbell. 1986. Status report on Blanchard's Cricket Frog. COSEWIC Status Report, Ottawa, Ontario. 79 pp.

Oldham, M.J. 1992. Declines in Blanchard's Cricket Frog in Ontario. Canadian Wildlife Service, Occasional Paper No. 76: 30-31.

Reptiles

Campbell, C. A. 1977b. The status of Black Rat Snake *Elaphe obsoleta obsoleta* in Ontario and particularly in Haldimand-Norfolk Region. Unpublished Manuscript. 15 pp.

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Campbell, C. A. and D.W. Perrin. 1979. A survey of the Queen Snake *(Regina septemvittata)* in southwestern Ontario. Unpublished Report to Ontario Ministry of Natural Resources. 50 pp.

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Oldham, M. J. 1982. The status of the Spotted Turtle *(Clemmys guttata)* in Canada, Unpublished Report to Ontario Ministry of Natural Resources, Toronto. 127 pp.

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Resource Conservation, 1986. Herptile monitoring 1986 - Point Pelee National Park. Parks Canada.

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Autecology

Brooks, R.J., M.L. Bobyn, D.A. Galbraith, J.A. Layfield, and E.G. Nancekivell. 1991. Maternal and environmental influences on growth and survival of embryonic and hatchling snapping turtles *(Chelydra serpentina)*. Canadian Journal of Zoology 69 (10): 2667-2676.

Brooks, R.J., G.P. Brown, and D.A. Galbraith. 1991. Effects of sudden increase in natural mortality of adults on a population of the common snapping turtle *(Chelydra serpentina)*. Canadian Journal of Zoology 69 (5): 1314-1320.

Brown, G.P., and R.J. Brooks. 1991. Thermal and behavioural responses to feeding in free-ranging turtles, *Chelydra serpentina*. Journal of Herpetology 25 (3): 273-278.

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Camin, J.H., and P.R. Ehrlich. 1958. Natural selection in water snakes (*Nerodia sipedon* L.) on islands in Lake Erie. Evolution 12: 504-511.

Chippindale, P.T. 1989. Courtship and nesting records for spotted turtles, *Clemmys guttata,* in the Mer Bleue Bog, southeastern Ontario. The Canadian Field-Naturalist 103: 289-291.

Ehrlich, P. R. and J. H. Camin. 1960. Natural selection in Middle Island water snakes (*Natrix sipedon* L.). Evolution 14: 136.

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Green, D.M., C.W. Zeyl, and A. El Yassir. 1992. Spring emergence and abundance of Fowler's Toads, *Bufo woodhousei fowleri,* at Long Point, Ontario, in 1991: Implications for conservation. Unpublished Report to Canadian Wildlife Service, London, Ontario. ?pp.

Green, D.M., A. Vallachovic, J. Tambasco, and A. Kelmer. 1993. Spring emergence, age structure, and abundance of Fowler's Toads, *Bufo woodhousii fowleri,* at Long Point, Ontario, in 1992. Unpublished Report to Canadian Wildlife Service, London, Ontario. ?pp.

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Judd, W.W. 1955. Observations on the habitat and food of the Queen Snake, *Natrix septemvittata,* at London, Ontario. The Canadian Field-Naturalist 69 (4): 167-168.

King, R.B. 1986. Population ecology of the Lake Erie water snake, *Nerodia sipedon insularum.* Copeia 1986: 757-772.

Population ecology of the Lake Erie water snake, *Nerodia sipedon insularum*, is described based on a 5 year capture-mark-recapture study involving 1449 captures of 1247 individuals. Water snakes are widespread in the island area of Lake Erie but have declined in numbers and have disappeared from one island within the last 50 years. Population estimates for adult snakes range from 25 to about 500 individuals on seven islands, including Pelee Island in Ontario. Snakes are active from late April until early October. Males are caught most often during the breeding season in May and June, whereas females are taken more often later in summer. Females appear to feed over a longer portion of the active season than males, grow at a faster rate, and attain a larger body size. Weight gain occurs throughout the active season in adult females but is restricted to mid-summer in adult males. Some females reproduce annually but smaller females may skip opportunities to reproduce. Number and size of offspring are positively correlated with female size. Comparisons with data from mainland populations elsewhere in the range of this species indicate that water snakes differ in having larger adult body sizes, lower growth rates, and shorter tails. In addition, litter size is less strongly correlated with female body size in island populations. Differences may also exist in size of newborns, diet, and intensity of predation.

King, R.B. 1987. Color pattern polymorphism in the Lake Erie water snake, *Nerodia sipedon insularum*. Evolution 41: 241-255.

King, R.B. 1992. Lake Erie water snakes revisited: morph- and age- specific variation in relative crypsis. Evolutionary Ecology 6 (2): 115-124.

Laurin G., and D.M. Green 1990. Spring emergence and male breeding behaviour of Fowler's Toads at Long Point. The Canadian Field-Naturalist 104 (3): 429-434.

In 1988, emergence of Fowler's Toads (*Bufo woodhousii fowleri*) at Long Point, Ontario coincided with heavy thunder showers. The breeding population was small, consisting of only 14 males, which were observed and tagged over a two-week breeding season. Male Fowler's Toads tended to alternate their calls with those of close neighbours and call from stationary positions, either in small groups or individually. Active searching behaviour was not observed. Individual males exhibited strong calling site fidelity over successive nights. Calling rate and body temperature were significantly correlated. The Fowler's Toads emerged relatively late compared to previous years and there was only a short period of overlapping breeding seasons with sympatric American Toad's, *B. americanus*. The two species of toads maintained separate choruses.

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Planck, J.T. 1983. Eastern spiny softshell nesting at Long Point National Wildlife Area: Management concerns at critical habitats. Unpublished Report to Canadian Wildlife Service, London, Ontario. 37 pp.

Pough, F.H. 1978. Ontogenetic changes in endurance in water snakes *(Natrix sipedon)*: Physiological correlates and ecological consequences. Copeia 1978: 69-75.

Quinn, N., and D.P.Tate 1991. Seasonal movements and habitat of wood turtles *(Clemmys insculpta)* in Algonquin Park, Canada. Journal of Herpetology 25 (2): 217-220.

Saumure, R.A. 1992. A report on the pilot year of a mark-recapture study on four species of turtles inhabiting Big Creek Marsh National Wildlife Area, Long Point, Ontario. Unpublished Report to Canadian Wildlife Service. 28 pp.

Seburn, C.N.L. 1990. Population ecology of the five-lined skink, *Eumeces fasciatus*, at Point Pelee National Park, Canada. University of Windsor thesis, Windsor, Canada. 165 pp.

Schwartzkopf, L., and R. J. Brooks. 1985. Sex determination in northern painted turtles: effects of incubation at constant and fluctuating temperatures. Canadian Journal of Zoology 63: 2542-2547.

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Weatherhead, P.J., and M.B. Charland. 1985. Habitat selection in an Ontario population of the snake, *Elaphe obsoleta*. Journal of Herpetology, 19: 12-19.

Hybridization and Population Genetics

Austin, N.E., and J.P. Bogart. 1982. Erythrocyte area and ploidy determination in the salamanders of the *Ambystoma jeffersonianum* complex. Copeia 1982 (2): 485-488.

Bogart, J.P. 1982. Ploidy and genetic diversity in Ontario salamanders of the *Ambystoma jeffersonianum* complex revealed through an electrophoretic examination of larvae. Canadian Journal of Zoology 60: 848-855.

Bogart, J.P., L.E. Licht, M.J. Oldham, and S.J. Darbyshire. 1985. Electrophoretic identification of *Ambystoma laterale* and *Ambystoma texanum* as well as their diploid and triploid

interspecific hybrids (Amphibia: Caudata) on Pelee Island, Ontario. Canadian Journal of Zoology 63: 340-347.

Ambystoma salamanders from Pelee Island, Ontario, were compared with mainland populations of *A. jeffersonianum*, *A. laterale*, and *A. texanum* using erythrocyte area measurements, chromosome counts, and electrophoretic analysis of proteins coded by 32 loci. The mainland species are characterized by relatively low heterozygosity (H = 0.053-0.11) and high Nei's genetic distances (D = 0.896-1.067). Nine diagnostic loci were found in *A. jeffersonianum* and five in each of *A. laterale* and *A. texanum*. Two loci (SOD-1 and GOT-1) diagnose all three mainland species and provide gene dosage for assessing genome contributions of *A. laterale* and *A. texanum* in Pelee Island salamanders. Diploid and triploid female *A. texanum* x *A. laterale* hybrids as well as *A. laterale* and *A. texanum* occur on Pelee Island.

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Green, D.M. 1984. Sympatric hybridization and allozyme variation in toads *Bufo americanus* and *B. fowleri* in southern Ontario. Copeia 1984: 18-26.

Hybridization in the toads *Bufo americanus* and *B. fowleri* in Ontario was investigated by electrophoretic examination of allozyme variation of 26 gene loci. Both species of toads were highly polymorphic, in amounts consistent with previous reports. Heterozygosity averaged 11.4% in *B. americanus* and 7.2% in *B. fowleri*. Clines or other patterns of geographic divergence were not present or notable. Hybrid individuals were encountered at Long Point, Ontario, on Lake Erie in association with both species. Hybrids were intermediate in morphology and genotype and appeared to be first generation progeny with high individual heterozygosity averaging 19.6%. There was no evidence of any substantial introgression between species. Hybridization between *B. americanus* and *B. fowleri* appears to be a widespread but scattered natural phenomenon that does not interfere with their maintenance of separate gene pools.

Licht, L.E., and J.P. Bogart. 1989. Growth and sexual maturation in diploid and polyploid salamanders (genus *Ambystoma*). Canadian Journal of Zoology 67 (4): 812-818.

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Lowcock, L.E., and J.P. Bogart. 1992. Electrophoretic identification of the Marbled Salamander, *Ambystoma opacum*, on Kelley's Island. The Canadian Field-Naturalist 106 (2): 196-199.

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Lowcock, L.A., H. Griffith, and R.W. Murphy. 1990. Size in relation to sex, hybridity, ploidy, and breeding dynamics in Central Ontario populations of the *Ambystoma laterale-jeffersonianum* complex. Journal of Herpetology 26 (1): 46-53.

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During June and July of 1988, 264 amphibians from Algonquin Park, Ontario were examined for eimeriid coccidian parasites. The species examined were *Rana catesbeiana* Shaw, *Rana clamitans* Latreille, *Rana septentrionalis* Baird, and *Rana sylvatica* LeConte. Two distinct types of oocytes were observed in the feces of the frogs. The highest prevalence of infection was recorded from young adult frogs and two new species of *Eimeria* are described from these animals. Oocytes of *Eimeria algonquini* n.sp. are spherical, 15.8 (14.5-16.1) μm in diameter, with a thin single-layered wall; micropyle and polar granule absent; large granular oocyte residuum present. Sporocytes banana-shaped, 19.5 (18.7-20.4) x 4.2 (3.8-4.6) μm with prominent granular residuum; Stieda body absent. Oocytes of *Eimeria kermiti* n. sp. are ovoid, 25.1 (24.7-26.6) x 19.5 (17.6-20.1) μm with thin single-layered wall; polar granule present; micropyle absent; large granular oocyst residuum present. Sporocytes ovoid, 9.9 (9.3-10.4) x 6.6 (6.0-7.1) μm with Steida body and prominent granular residuum.

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Bishop, C.A., R.J. Brooks, J.H. Carey, P. Ng, R.J. Norstrom, and D.R.S. Lean. 1991. The case for a cause-effect linkage between environmental contamination and development in eggs of the common snapping turtle *(Chelydra s. serpentina)* from Ontario, Canada. Journal of Toxicology and Environmental Health 33 (4): 521-547.

Concentrations of polychlorinated biphenyls (PCBs), dibenzo-p-dioxins, and dibenzofurans, organochlorine pesticides, and their metabolites were measured in eggs of the common snapping turtle collected from four wetlands on the shorelines of Lakes Ontario (Lynde Creek, Cranberry Marsh, and Cootes Paradise, Hamilton Harbour), and Erie (Big Creek Marsh), and one control location in Central Ontario (Lake Sasajewun, Algonquin Park). Snapping turtle eggs from these sites were also artificially incubated to determine hatching success, and incidence of deformities in embryo and hatching turtles. The hypothesis that elevated incidences of egg death and/or deformities of hatchling turtles would occur in populations with high concentrations of organochlorine contaminants in eggs was tested.

Unhatched eggs and deformities occurred at significantly higher rates in eggs from Lake Ontario wetlands. Two of three sites from Lake Ontario had substantially higher levels of PCBs, dioxins,

and furans compared to eggs from Lake Erie and the control site. Excellent hatching success and low numbers of deformities in eggs from the control site were considered representative of development in healthy eggs. The statistical association between contaminant levels in eggs and poor development of these eggs supported the hypothesis that eggs from sites with greatest contamination had the highest rates of abnormalities. PCB's were the most strongly associated chemicals, although possible effects due to the presence of other chemicals in eggs was a confounding factor. Furthermore, several of these chemicals present in these wild-caught snapping turtle eggs cause similar reproductive effects in other species. Therefore, a specific chemical effect was not identified.

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Surveys of road mortality were conducted Monday and Friday mornings, during the months of May through August and on 3 September 1982, on a section of Highway 59 which connects Long Point with the mainland. Mortalities were registered as being either being on the marsh or bay side of the Causeway with the centerline constituting the boundary. Data comparison to previous years was not possible. Four amphibian species are represented as road kills and constituted 94.1% of the total kill during the study period. This proportion was based nearly entirely on the northern leopard frog (N=4865) which alone accounted for 93.3% of the total kill and 99.1% of all amphibians killed. The remaining amphibian species encountered during the study, in decreasing order of total mortality, included 28 Bullfrogs, 10 American Toads, 6 Green Frogs, and one unidentified frog. The steady increase in leopard frog mortality throughout the study period, especially in August, was attributed to the eastward migration of recently metamorphosed frogs from the spawning habitat to the west. Concentrations of frogs are inevitable along the Causeway since it represents the physical boundary marking the last suitable habitat to the east of the spawning grounds. Six reptile species (2 snakes and 4 turtles) comprised 0.7% of the total road kill. Turtles represented the majority (89.5%) of total reptile mortality during the study period. Midland painted turtles were found dead most often (N=19) and represented 50% of reptilian mortality and 55.9% of the turtle kill. Other reptiles occurring as road kills included 10 Snapping turtles, which constituted 29.4% of the turtle kill, as well as 4 Map turtles, 3 Eastern Garter snakes, 1 Fox snake, and 1 Blanding's turtle. The greatest incidence of reptile mortality occurred in May. Regarding turtles, this was considered indicative of movement just prior to the main nesting season, and therefore of dispersal to nesting areas. Juvenile and recently hatched individuals made up a considerable portion of the map and snapping turtle kill total. The single Blanding's turtle was an adult, whereas 10.5% of the Painted, 70% of the Snapping and 50% of the Map turtles were immature. Snakes did not make up an appreciable portion of the reptilian kill (10.5%).

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