State of the Park Report 2004

St. Lawrence Islands National Park of Canada

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Executive Summary

As a small protected area in a relatively developed part of southeastern Ontario St. Lawrence Islands National Park is subject to environmental stressors that originate from within and outside its boundaries. It is understood that the park, within the context of the Greater Park Ecosystem, must actively engage in partnerships with a wide variety of stakeholders. Such actions are necessary to meet the commitment of ecological integrity, which is the first priority in the management of national parks as directed by the Canada National Parks Act.

The State of the Park Report for St. Lawrence Islands National Park is a reflection of the degree of integrity at an ecosystem level. The report presents a detailed review of the park's place in the Greater Park Ecosystem, a visual model of ecosystem interactions, a description of ecosystem stressors, a review of park management over the term of the current management plan, and the analysis of a suite of indicators and measures that outline the condition and trend of the integrity of St. Lawrence Islands National Park and the Thousand Island Ecosystem.

Condition and Trends of Ecological Integrity St. Lawrence Islands National Park

EI Indicator		Condition	Trend
Toxics and Pollutants		GOOD	↔
Human Footprint	Within Park	FAIR	↑
	Outside Park	FAIR	↓
Terrestrial Habitat Change		FAIR	↓
Aquatic Habitat Change		FAIR	↔
Wetland Habitat Change		FAIR	↔
Condition of Biodiversity		FAIR	↓
Stewardship		FAIR	↑

Recognizing that this is the first State of the Park Report for this park, much of the analysis has developed a baseline for future comparison; it is not possible to detect long-term trends at this time and many of the maximum or minimum thresholds of change are unknown or have not yet been reached. With the evidence of increasing trends in the human footprint, gradually decreasing populations of species such as Eastern Ratsnake, and an increase in the list of species at risk in the Thousand Island Ecosystem the overall condition of ecological integrity at St Lawrence Islands **is fair** supporting a future trend **of fragile stability**. In order to improve the state of ecological integrity a new strategic objective and vision will offer guidance through the next management plan review.

"**St. Lawrence Islands National Park aims to protect the ecological integrity of the park and surrounding area and provide its visitors with a range of enjoyable experiences that coincide with ecological protection. It also strives to create partnership opportunities with regional stakeholders. The park is presented with many obstacles to this objective such as its fragmented holdings, the large number of external park stressors, and its high visitor densities.**

- **St. Lawrence Islands National Park will have a greater level of ecological integrity and be a biologically diverse keystone to the Algonquin to Adirondack wildlife corridor within an internationally based heritage areas network centred in the Thousand Islands-Frontenac Arch and St. Lawrence River environment.**

- **Canadians will learn about the natural and cultural heritage and regional role of the Thousand Islands – Frontenac Arch and St. Lawrence River environment.**

- **St. Lawrence Islands National Park will offer Canadians the opportunity for memorable visitor experiences that range from intimate forested islands, to sheltered harbours to views from rocky promontories of the Thousand Islands archipelago.**

- **The public will recognize the contribution of St. Lawrence Islands National Park to the region's economy and sense of pride.**

The goals and objectives outlined in the EIS consider these problems but maintain an attempt to guide ecosystem management efforts to restore, maintain and improve the ecological health of SLINP and the TIE".

The following recommendations will give direction during the current management plan review to strengthen the condition of the park's ecosystem and contribute to a positive trend in integrity.

Monitoring and Ecological Integrity Assessment Recommendations

- **Development of Conceptual Habitat Models for the Thousand Island Ecosystem** – In order to accurately assess the level of ecological integrity it is importation to understand the interactions between habitat communities and ecosystem functions. Work is currently underway to develop a conceptual model for wetland habitat and it is recommended that aquatic and terrestrial models also be developed.

- **Development of Thresholds and Index Values for Ecological Integrity Indicators** - The value of the results of analysis on indicators and measures is greatly enhanced if they can be expressed as a quantified value and applied to maximum or minimum thresholds. Development of thresholds and indexes will begin upon approval of this document.

- **Re-assessment of the Status of Ecosystem Stressors** – The levels and types of stress and ecosystem response to stress are not static but are constantly evolving. Periodic evaluation of ecosystem stressors is required to accurately determine the condition and trends of ecological integrity. An assessment of ecosystem stressors must be undertaken prior to the next State of the Park Report.

Ecosystem Management Recommendations

- **Increase the Area of Lands with Conservation Protection** – St. Lawrence Islands National Park is currently involved in developing a protected area strategy for the Thousand Islands Ecosystem. By means of land acquisition and the establishment of conservation easements on sensitive areas in strategic locations a higher degree of ecological integrity can be achieved.

- **Integrated Vegetation Management Initiative** – Work has started on a vegetation management plan for St. Lawrence Islands National Park, which will be integrated with land management needs and objectives outside of the park boundaries. Implementation of this plan will have a positive impact on regional ecosystem sustainability and ultimately the ecological integrity of the park.

- **Meet the Commitments to the Canada Species at Risk Act** – St. Lawrence Islands National Park has a high number of species at risk and therefore a high commitment to the recovery of these species. The park must work with partner agencies on recovery committees to develop recovery strategies and action plans as directed by the Act.

Communication and Outreach Recommendations

- **Development and Maintenance of Partnerships** – Communication and cooperation between stakeholders with respect to environmental sustainability is paramount to prudent land stewardship within the Thousand Island Ecosystem. Although there are ecosystem conservation efforts ongoing in both Canada and the United States there must be a higher priority in establishing stronger international relationships.

- **Encourage Local Landowners to Engage in Habitat Restoration** – As most of the land within the Thousand Island Ecosystem is privately owned restoration activities at the park should be developed as demonstrations of prudent land stewardship. Encouragement will be given to willing landowners to undertaken restoration activities.

National Park Limits of Acceptable Change Recommendations

- **Offer and Promote Sustainable Visitor Activities** – An evaluation of visitor activities is required to ensure that the sensitive and representative natural resources of St. Lawrence Islands National Park are adequately protected. The park will continue to offer services that ecosystems can sustain while providing an enjoyable and appropriate national park experience.

Although there are many examples of successful habitat restoration initiatives within the Thousand Islands Ecosystem we must eliminate impairment to sensitive ecosystem communities and functions to secure the current level of integrity. This can only be achieved through the civic commitment of stakeholders to a vision of sustainability and appreciation for the natural environment. St Lawrence Islands National Park will play a leadership role to attain the goal of maintaining an acceptable level of ecological integrity in the Thousand Islands Ecosystem.

Approval Page

Recommended by: _____ Date: _____
Ecosystem Scientist
St Lawrence Islands National Park

Recommended by: _____ Date: _____
Manager Natural Resource Conservation
St Lawrence Islands National Park

Approved by: _____ Date: _____
Park Superintendent
St Lawrence Islands National Park

Approved by: _____ Date: _____
Field Unit Superintendent
Eastern Ontario Field Unit

1.0 INTRODUCTION

Located at the intersection of the St. Lawrence River and the Frontenac Arch, St. Lawrence Islands National Park (SLINP) provides educational, recreational, research and stewardship opportunities to its visitors, regional residents and stakeholders. The park is in its Centennial Year and it continues to play an important role as a conservation leader in the Thousand Islands Ecosystem.

1.1 Purpose of the State of the Park Report

The following State of the Park Report (SOPR) provides an assessment of St. Lawrence Islands National Park's ecological integrity, the best possible description of the state of the park's ecosystems and the long term trends that affect their condition (SOPR Guidelines, 2002). The SOPR also includes an assessment of SLINP's progress towards ecological management objectives stated in the current (1998) Park Management Plan. As directed by Parks Canada, the SOPR is focussed exclusively on ecological integrity and does not consider cultural resources however, this issue will be evaluated during the Management Plan review in 2005 (Parks Canada, 2002).

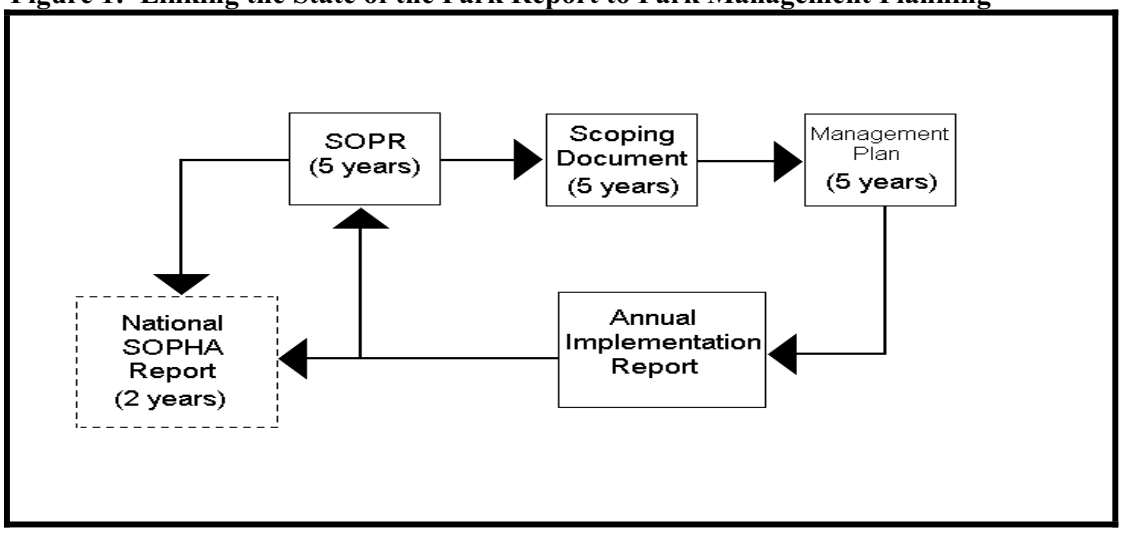
The purpose of the SOPR for St. Lawrence Islands National Park is to present;

- The park vision and strategic goals.
- The state of ecological integrity in the park and the larger ecosystem.
- The status of ecological stressors affecting the park.
- An evaluation of current management efforts directed towards ecosystem conservation.

During the National Parks Act (1988) amendment process, the inclusion of section 5(1.2) made the maintenance of ecological integrity a legislated objective of national parks. Further guidance was later provided from policy stating that; "*Protecting ecological integrity and ensuring commemorative integrity takes precedence in acquiring, managing, and administering heritage places and programs*" (Parks Canada, 1994). In the Canada National Parks Act (2000) the statement, "…*the maintenance or restoration of ecological integrity, through the protection of natural resource and natural processes, shall be the first priority of the Minister when considering all aspects of park management*" and the reference to providing future generations with unimpaired enjoyment of their National Parks gives clear direction. A SOPR supports these statements by providing SLINP with an opportunity to examine the ecological successes and challenges of park management decisions. The park's ability to use the ecological monitoring information for effective park management decisions will determine the success of SLINP at achieving ecological integrity.

The SOPR is one of the first steps in the park management planning process and will be the main information source for ecosystem management at SLINP (Parks Canada Agency, 2002). The Parks Canada Guide to Management Planning (2000) identifies a five-year cycle between management plan reviews and that the SOPR is linked to the park scoping document and ultimately the park management plan. National Parks must then provide annual implementation reports that will be included in the State of Protected Heritage Areas Report (SOPHA) presented to Parliament and Canadians every two years. Figure 1 (Parks Canada, 2002) illustrates the relationship between the SOPR and the park management planning process.

Figure 1: Linking the State of the Park Report to Park Management Planning



from: Parks Canada, 2002

1.2 Information Sources and Summary

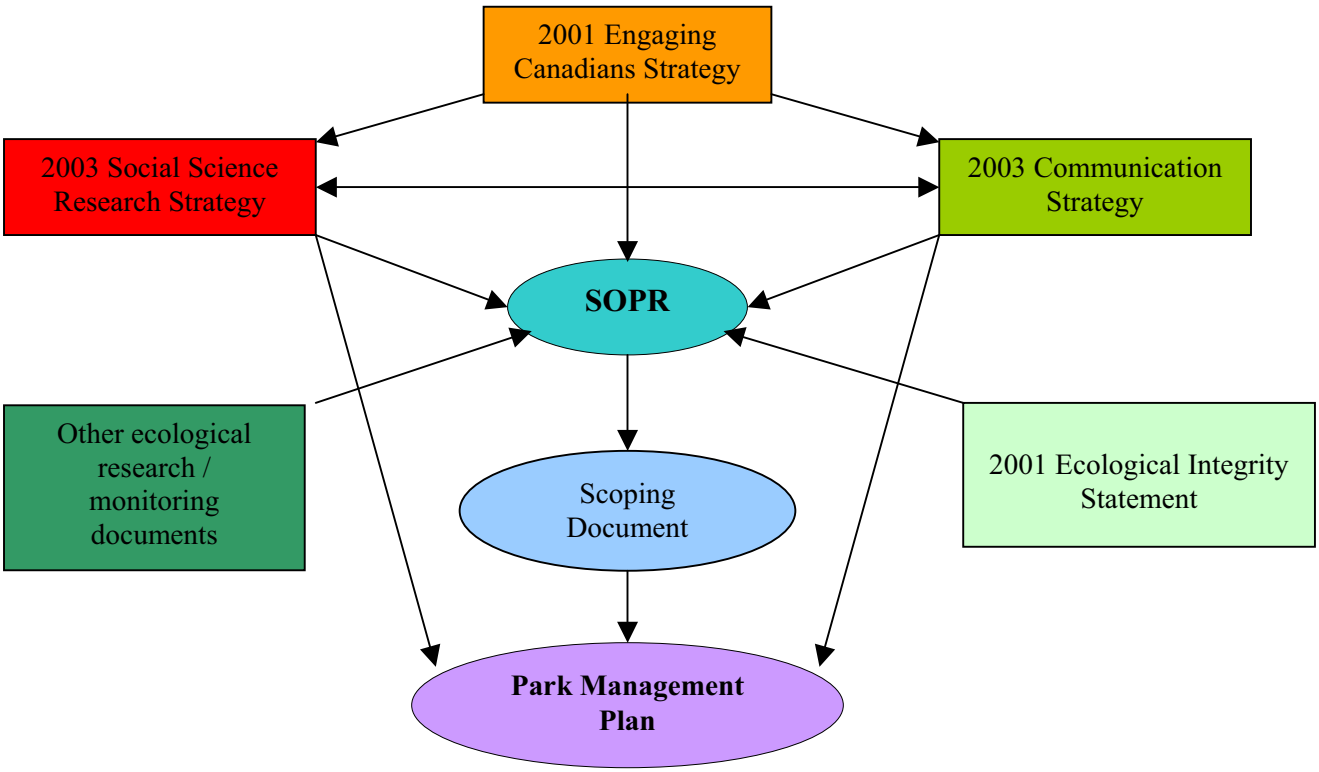
The SOPR for SLINP uses many core pieces from the 2001 Ecological Integrity Statement (EIS). Using previously established ecological integrity targets from the 2001 EIS, the SOPR extends a step further to include an evaluation component which measures ecological integrity and assesses management actions within SLINP.

It must be recognized that this is the first effort of SLINP to report on the condition of the park's ecological integrity and much of the information presented is derived from baseline data. As ecological monitoring programs progress, statistically credible trends will provide much greater insight into ecosystem stressors and the direction of the park's ecological health.

SLINP obtains ecological data concerning issues within the park boundaries from seasonal monitoring and inventory programs. Some programs concerning the eastern ratsnake (*Elaphe obsolete*) for example, have been consistent for the past twenty years while others such as bridle shiner *(Notropis biffrenatus)* and pugnose shiner *(Notropis anogenus)* inventories have just recently begun. Some research initiatives are done in collaboration with partners such as the Queen's University Biological Station (QUBS) and the Ontario Ministry of Natural Resources (OMNR). As a Parks Canada entity, the Ontario Service Centre (OSC) provides the park with specific direction when designing and implementing park visitor and regional resident surveys. The information SLINP collects itself and receives from its partners contributes significantly to evaluating the level of ecological integrity in the park. Ecological data regarding issues beyond SLINP's boundaries is also obtained from partners such as the OMNR, Department of Fisheries and Oceans (DFO) and the Ontario Ministry of the Environment and Energy (MOEE).

Figure 2 illustrates the linkages between various social and natural science information sources to the SOPR and the park management plan.

Figure 2: Links Between Various Information Sources, the State of the Park Report and the Park Management Plan



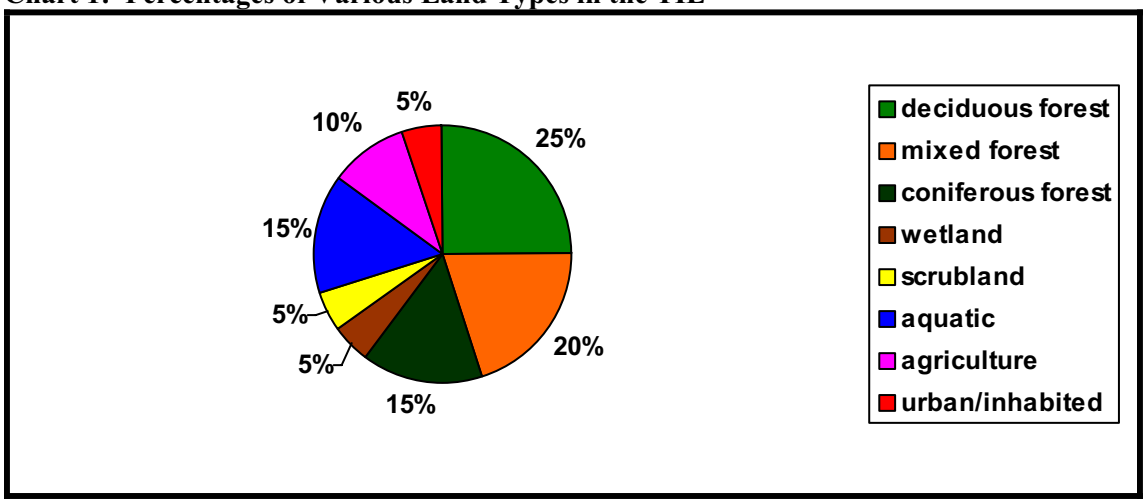
2.0 ECOLOGICAL CONTEXT

St. Lawrence Islands National Park is one of two core protected areas in the Thousand Islands Ecosystem and the Thousand Islands – Frontenac Arch Biosphere Reserve. Its ecological and educational significance is vast as it is responsible for the protection of fourteen species at risk and non-designated species and their habitats while providing its many visitors, regional residents and stakeholders with opportunities to experience the park.

2.1 Thousand Islands Ecosystem

The Greater Park Ecosystem (GPE) or what is commonly referred to as the Thousand Island Ecosystem (TIE) is an area of about 5000 km^2 that is bisected by the international border between Canada and the United States. The boundary of the TIE is based on watersheds and extends from Brockville, west to Kingston, Ontario and from the Rideau Waterway south to Black River and Indian Lake in New York State (Snetsinger, 2003). Much of the landscape is made up of a mosaic of human land use, such as agriculture, urban development, and natural areas. Chart 1 illustrates the proportions of these different land types (CTIHC, 2002).

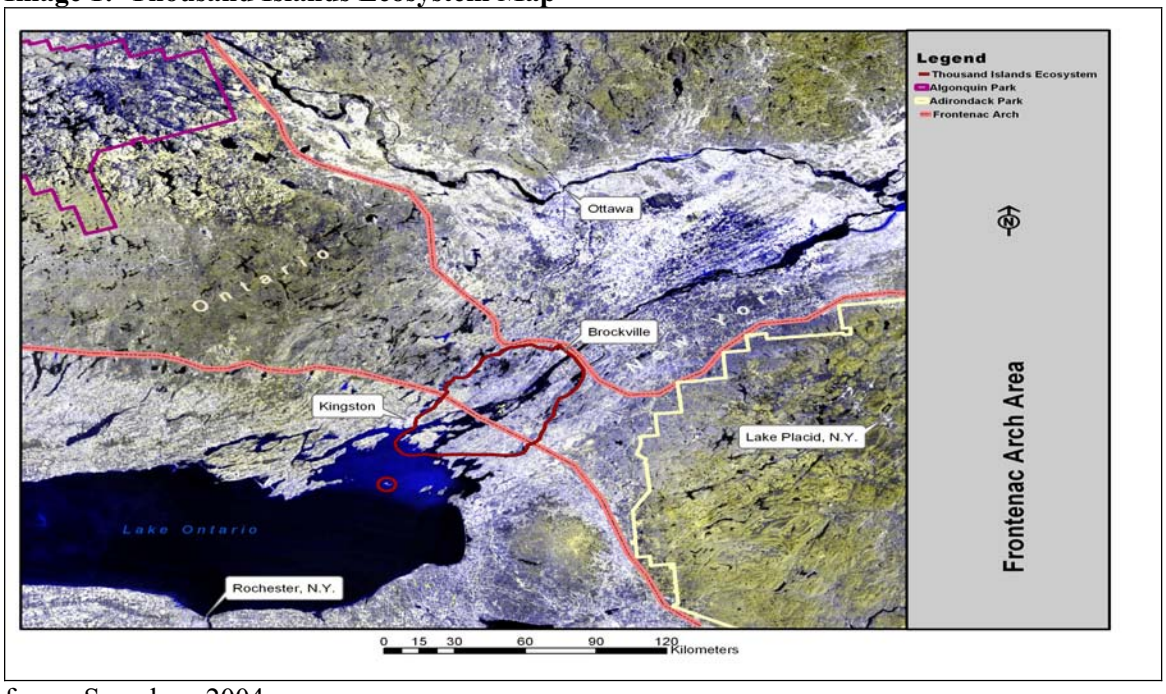
Chart 1: Percentages of Various Land Types in the TIE



from: CTIHC, 2002

The park is located at the meeting point of two continental scale bio-geographic features. The St. Lawrence River and the Frontenac Arch both have a great influence on the biodiversity of SLINP. The rugged granite knob topography of the Arch and a transition zone between boreal and deciduous forest species create a series of microhabitats, which help to support one of the highest biodiversities in Canada (SOPHA, 2001). The rugged nature of the Frontenac Arch has resulted in less anthropogenic landscape modification than most of southern Ontario and as a result, the area remains important for migrating and local species of flora and fauna (Snetsinger, 1997). The islands of SLINP are considered to be important "stepping stones" in the connectivity corridor linking Algonquin Provincial Park in Ontario to Adirondack State Park in New York State (Snetsinger, 2001) (Image 1).

Image 1: Thousand Islands Ecosystem Map



from: Saunders, 2004

St. Lawrence Islands National Park is one of several protected areas that offer varying levels of ecological protection, research and monitoring capacities in the TIE. Numerous provincial and state parks and provincial Conservation Authority properties are scattered throughout the region. Private conservation easements and land trust properties also contribute significantly to the EI goals of SLINP.

SLINP has one of the highest overall biodiversities of all Canadian National Parks (Rivard, 2000). Species at Risk (SAR) have become a major concern for Parks Canada and other government and non-government organizations (Table 1). This fact emphasizes the importance of SLINP as a contributor to the protection and preservation of ecological integrity in the TIE.

Table 1: Species at Risk Found in the TIE and SLINP

Common Name	Scientific Name	COSWEIC Designation*	Found in TIE	Found in SLINP
Eastern Loggerhead Shrike	Lanius ludovicianus migrans	E	✓	✓
American Ginseng	Panax quinquefolius	E	✓	✓
Blunt-lobed Woodsia	Woodsia obtuse	E	✓	
Least Bittern	Lxbrychus exillis	T	✓	✓
Peregrine Falcon	Falco peregrine antum	T	✓	
Black Rat Snake	Elaphe obsolete obsolete	T	✓	✓
Stinkpot Turtle	Sternotherus odoratus	T	✓	✓
Deerberry	Vaccinium stamineum	T	✓	✓
Pugnose Shiner	Notropis anogenus	T	✓	
Southern Flying Squirrel	Claucomys volans	SC	✓	✓
Red Shouldered Hawk	Bulco liniatus	SC	✓	✓
Cerulean Warbler	Dendroica cerulea	SC	✓	✓
Red Headed Woodpecker	Melanerpes crythrocephalus	SC	✓	✓
Eastern Milksnake	Lampropeltis trangulum	SC	✓	✓
Northern Ribbonsnake	Thamnophis sauritus	SC	✓	✓
Five Lined Skink	Eumeces fasciatus	SC	✓	✓
Northern Map Turtle	Gratemys geographica	SC	✓	✓
Bridle Shiner	Notropis biffrenatus	SC	✓	✓
Monarch Butterfly	Danus plexippus	SC	✓	✓
Broad Beech Fern	Phegopteris hexagonoptera	SC	✓	
Eastern Prairie Fringed Orchid	Platanthera leucophaea	SC	✓	

From: SLINP, 2003

*COSEWIC Designations:

E = Endangered (A species facing future extirpation or extinction)

T = Threatened (A species likely to become endangered if limiting factors such as habitat destruction are not reversed)

SC = Special Concern (A species that are especially sensitive to human activities or natural events but are not endangered or threatened)

2.2 Thousand Islands Ecosystem Land Use History

The first evidence of human presence in the Thousand Islands Ecosystem (TIE) dates back about 8000 years when the land was used seasonally for fishing, hunting and limited agriculture (Snetsinger, 2001). During this Palaeo-Indian cultural period, the postglacial environment was hostile and human occupation was limited to small groups of nomadic hunters. As the glaciers retreated, aboriginal activity increased through the Archaic (8000 ~ 3000 BP) and Initial Woodland (3000~1200 BP) periods. Although humans remained hunters and gatherers, their degree of spiritual and technological sophistication increased. By the Terminal Woodlands Period (1200~ 400 BP) the development of agriculture and the dependence on crops for food led to the establishment of more permanent villages in eastern Ontario and northern New York (Snetsinger, 1997b). As the Terminal Woodlands Period

progressed, the Frontenac Arch was still recognized as an important area for subsistence hunting and fishing for the St. Lawrence Iroquois food supply.

Initial European contact occurred in the early 1600s and although its extent was limited, it was the beginning of the exploitation of fur bearing animals that supplied the European economic demand. By the mid 1700s tensions between the French and English led to further European influence as the St. Lawrence River was a very strategic transportation route to the interior of the continent.

It was not until the American Revolution and the Loyalist migration into Upper Canada that settlement would permanently alter the landscape. Large areas of land were cleared for grain production, primary resources such as lumber and fishing were depleted, and the construction of dams and canals altered natural watercourses (Snetsinger, 1997b). Despite this development, much of the Frontenac Arch area was spared because the thin acidic soils and rock ridges were unsuitable for agriculture. By 1850 the economy had shifted to livestock, crop and dairy farming and the Thousand Islands area also became recognized as an important tourist destination for people to relax in a relatively unspoiled area (Snetsinger, 1997). The region began to experience heavy recreational use and development at this time.

After World War II rural populations began to decline and a large amount of farmland in the Thousand Islands Ecosystem was abandoned allowing it to regenerate into forested areas. By 1970 most of the Canadian townships in the TIE hosted more woodland than pasture. Although the amount of area under agricultural influence has continued to decline in the TIE it is still an economic driver for the region. Livestock, crop, and machinery improvements have increased yields in more intensively managed farms. Residential development in urban and rural settings is increasing with an emphasis on large waterfront estates on the St. Lawrence River and most of the area's lakes. Expansion of the road network, most notably the Highway 401 and Interstate 81, have greatly increased the ease by which tens of millions of people can visit the Thousand Islands region each year.

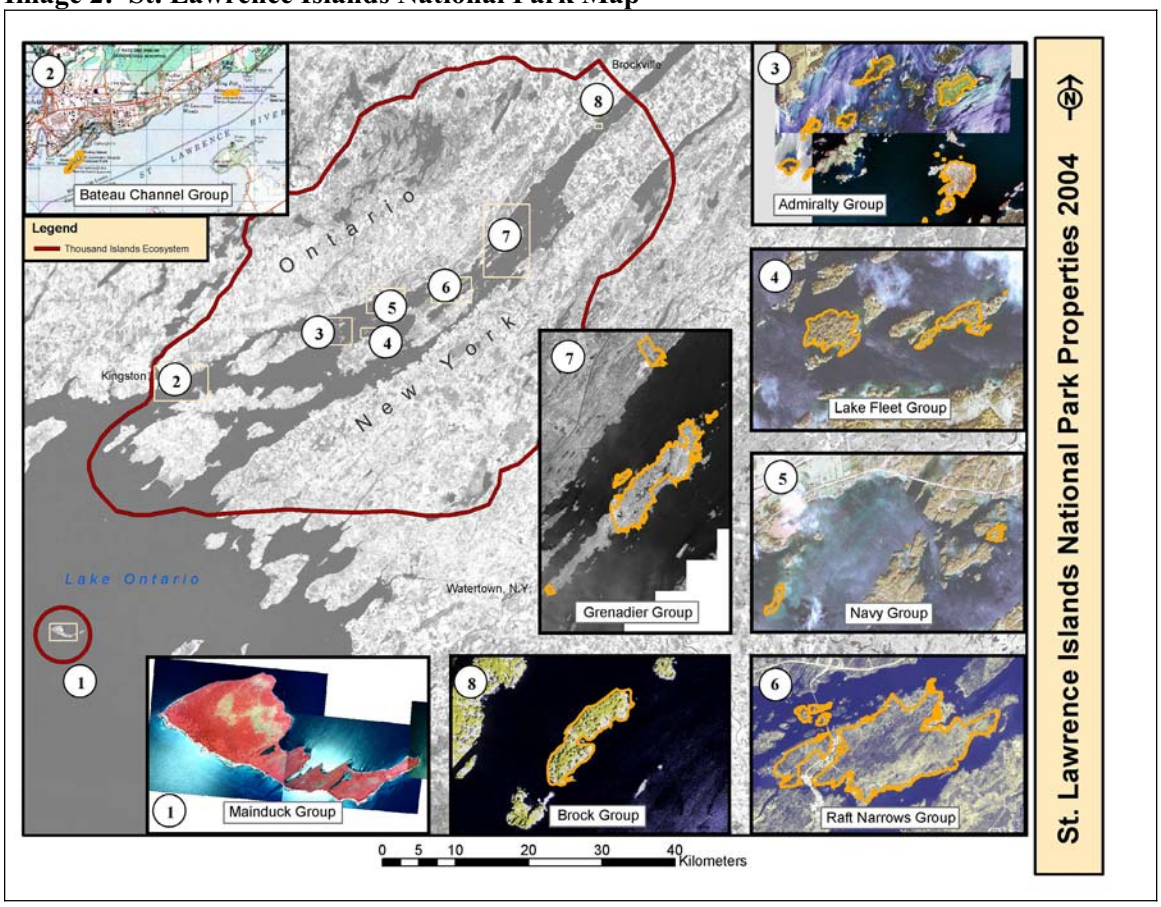
Future trends such as the growing demand for eco-tourism, the popularity of the TIE as a retirement area, and population growth will increase the interactions people have with the ecosystem and as in the past, have a significant impact on the ecology of the TIE (Snetsinger, 1997b).

2.3 St. Lawrence Islands National Park Description

2.3.1 Ecological Characteristics

Established in 1904, St. Lawrence Islands National Park of Canada is the oldest National Park east of the Rocky Mountains. The park's property holdings are spread among a 65 by 100 kilometre area of eastern Ontario (Image 2).

Image 2: St. Lawrence Islands National Park Map



from: Saunders, 2004

Park property is established on all or part of twenty six islands and many islets and shoals located along an 100 kilometre span of the St. Lawrence River which is the 12th largest river in the world. The park also includes a small mainland area at Mallorytown Landing. The wide distribution of park properties in the TIE make SLINP an integral part of the landscape/river mosaic in the Thousand Islands. As one of the core protected areas within the Thousand Island – Frontenac Arch Biosphere Reserve, SLINP is found at the crossroads of two natural corridors-the St. Lawrence River corridor and the Frontenac Arch. The park is also located where five major forest regions meet and result in a high level of bio-diversity. Some of the park islands such as Hill Island and Grenadier Island are a patchwork of park property, roads and private homes/cottages. St. Lawrence Islands National Park represents two natural regions; the Central Great Lakes – St Lawrence Precambrian Region and, in the western area, the Western St. Lawrence Lowlands Region and plays an important role as a protector of ecological integrity and provider of ecological education and experiences for Canadians and international visitors.

The interplay of rugged islands and hills, the St. Lawrence River and a moderate climate have created a unique ecosystem, including critical habitats for many plants and animals (SLINP Park Management Plan, 2000). Both the St. Lawrence River and the Frontenac Arch serve ecological roles as "corridors" for wildlife movement and dispersal in a largely settled and agricultural based landscape. As well, the St. Lawrence River acts as a partial barrier for the north-south species movement, with the Frontenac Arch providing the island "stepping stones" across that barrier (Snetsinger, 2001). As St. Lawrence Islands National Park is fragmented and widely dispersed in the TIE, the park's ecological goals apply to the broader ecosystem of which the park is a part (Snetsinger, 2001).

The unique combination of geological and climatic characteristics has given rise to a wide diversity of habitats and associated vegetation with the presence of ecologically diverse wetlands being of particular value. Located in a transition zone, the park is rich in biodiversity and provides habitat for certain species, such as the pitch pine *(Pinus rigida),* which are at the limits of their range. The park's habitat diversity has resulted in a rich breeding bird population, and since the Frontenac Arch acts as a "funnel" for wildlife movement and dispersal, numerous migrant species are found in the park (Snetsinger, 2001). Mammals characteristic of the West St. Lawrence Lowland are found in the park. SLINP is noted for its high diversity of reptile and amphibian species, including the eastern ratsnake *(Elaphe obsolete),* stinkpot turtle *(Sternotherus odoratus)*, eastern milksnake *(Lampropeltis trangulum)*, northern ribbonsnake *(Thamnophis sauritus)*, five line skink *(Eumeces fasciatus)* and northern map turtle *(Gratemys geographica)* which are recognized as being at risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Snetsinger, 2001). As previously noted, SLINP is host to over half of the Species at Risk in the Thousand Islands Ecosystem.

2.3.2 Park Visitor Use

Much of the park area is island based, therefore park infrastructure such as docks and shelters have been developed to service overnight and day use boaters. There is also a large camping area on Grenadier Island and number of small primitive camping areas located through-out the park; all of which are only accessible by boat. Typically, visitation is high during the summer months and concentrated during weekends throughout the spring and fall. SLINP has one of the highest visitor densities (total annual visitors / km^2) of all national parks in Canada at 7283/ km^2 (average of total visitation numbers between 2000 and 2003 divided by 11 km^2) which results in high levels of stress on the park ecosystems (Parks Canada, 2004). Heritage presentation services, such as outreach to school groups, take place all year round. During the summer months, interpreters communicate with park visitors through presentations and guided hikes on the islands. Interpreters also present information to regional visitors and residents at various fairs, area parks and other tourist attractions. Winter activities occur minimally on Grenadier Island.

2.4 Ungazetted Property

In addition to the gazetted park land, four ungazetted properties of varying ecological significance have been added to SLINP's collection since the approval of the 1998 Park Management Plan.

2.4.1 Main Duck Island-200 hectares and Yorkshire Island-14.5 hectares

Both of these islands were privately owned until 1977 when they were acquired by Parks Canada under the Agreement for Recreation and Conservation Program. They are near the centre of a chain of islands that extends from Long Point in Prince Edward County, Ontario to Stony Point in New York State. Main Duck Island consists of roughly two hundred hectares while Yorkeshire consists of only fourteen and a half hectares. Both are of relatively low topographic relief of about 30 metres.

Main Duck Island was found to have a high species area value with regards to vegetation while Yorkshire Island had a much lower value compared to that of most of the Thousand Islands (Vreekan, 1979). This high value is presumably because of the presence of the large proportion of wetland. Vegetation communities on the islands include dry deciduous forest, dry white cedar forest and deciduous swamp forest (Vreeken, 1979). Eastern garter snakes *(Thamnophis sirtalis sirtalis)* and northern water snakes *(Nerodia sipedon sipedon)* are very common on the islands and brown snakes *(storeria dekayi)* are present in smaller numbers. Snapping turtles *(Chelydra serpentina)* and midland painted turtles *(Chrysemys picta marginata)* are also present (Vreeken, 1979).

Visitors are self-regulating on Main Duck Island and take responsibility to ensure the island is kept clean. It is estimated that a few hundred visitors use the island during the boating season. The island is very infrequently monitored due to a lack of human and financial park resources (Andress, 2003).

2.4.2 Victoria Island-0.5 hectare

Donated to SLINP by The Honorable Judge John R. Matheson, PC, MP, QC, Victoria Island was accepted for inclusion into SLINP on October 23, 2000. This island is found in the St. Lawrence River approximately 100 metres south of St. Lawrence Park in the city of Brockville. There are no buildings on the island but a few signs of past and current human use are present. Grasses are the predominant ground cover while twenty provincially rare pitch pine trees are found on the western end. The island is small and predictably, biological diversity is low. Species on Victoria Island include a limited variety of mosses, ferns, coniferous and deciduous vegetation, avifauna, reptiles, amphibians and insects. It is assumed that because of the islands' small size, it simply acts as a 'stopover' or foraging spot for mammal and avifauna species (Snetsinger, 2003).

2.4.3 Skoryna Nature Conservancy Area-222 hectares

The Skoryna Nature Conservancy Area was donated to SLINP by Dr. Stanley Skoryna and Mrs. Jane Skoryna. On January 8, 2001 the lands were accepted on behalf of the Department of Canadian Heritage, Parks Canada Agency to be managed for the purposes of nature conservation in a manner sympathetic with the management of SLINP. Currently it is not considered a part of the National Park but this acquisition clearly supports the Algonquin-to-Adirondack organization whose focus is to "restore, enhance and maintain ecological connectivity, ecosystem function and native bio-diversity" in the Frontenac Arch (Parks Canada, 2002), as reflected in the park's Ecosystem Conservation Plan and 2001 Ecological Integrity Statement. This fairly isolated parcel of land is located on the rugged lands of the Canadian Shield with frontage on Lower Beverley Lake. Most of the property shows minimal evidence of human presence while select locations have indications of moderate to heavy human use. The property is predominantly forest-covered but it supports a diversity of habitat types such as wetland and abandoned agricultural areas succeeding into old-field habitat. The regionally significant Oak Bay ANSI (Area of Natural and Scientific Interest) and the provincially significant Lower Beverley Lake wetland are two identified areas of ecological interest, which partially overlap the Skoryna Nature Conservancy Area (Snetsinger, 2002).

2.5 Thousand Islands Ecosystem/St. Lawrence Islands National Park Ecosytem Model

The conceptual model for St. Lawrence Islands National Park and the Thousand Islands Ecosystem is intended to capture the following;

- The major ecological forces shaping the Thousand Islands Ecosystem,
- The interaction among these forces,
- The major stressors impacting the interaction among these forces,
- These stressors can shift the level of ecological integrity of the ecosystem positively or negatively.

This model (Image 3) emphasizes the interdependence of biodiversity and functions in the aquatic, terrestrial and wetland communities and the effects of stressors. Functions are represented as cyclic processes that are integrated into and between each of the community types. Each community type is represented as a system of living organisms within their physical and geographical environments. Together they make up the Thousand Islands Ecosystem.

Major stressors are identified as the human footprint, toxics and pollutants, and habitat change with likely effects on each community reflected by the response to stressors. Collectively or individually, the responses to these stressors can negatively affect functions, lead to a decrease in biodiversity of the TIE and ultimately compromise ecological integrity within St. Lawrence Islands National Park.

It is recognized that severe degradation within one of the ecosystem communities leads to a stressed state of ecological integrity in the entire Thousand Islands Ecosystem. For example, if the condition of the terrestrial ecosystem showed signs of improvement but the aquatic ecosystem showed signs of degradation the ecological integrity of the entire TIE would be compromised.

2.6 Key Challenges for St. Lawrence Islands National Park

The following issues are the key ecosystem management challenges for SLINP. Each issue presents its own set of complications and some of these build upon each other. For example, the issue of uncontrolled park access is directly impacted by high visitor density.

International Stage: Since SLINP and the TIE are in such close proximity to the American border, complications arise regarding ecosystem management projects and decisions. Management and research priorities differ between the American and Canadian sides of the St. Lawrence River and it is difficult to create collaborative projects or solutions.

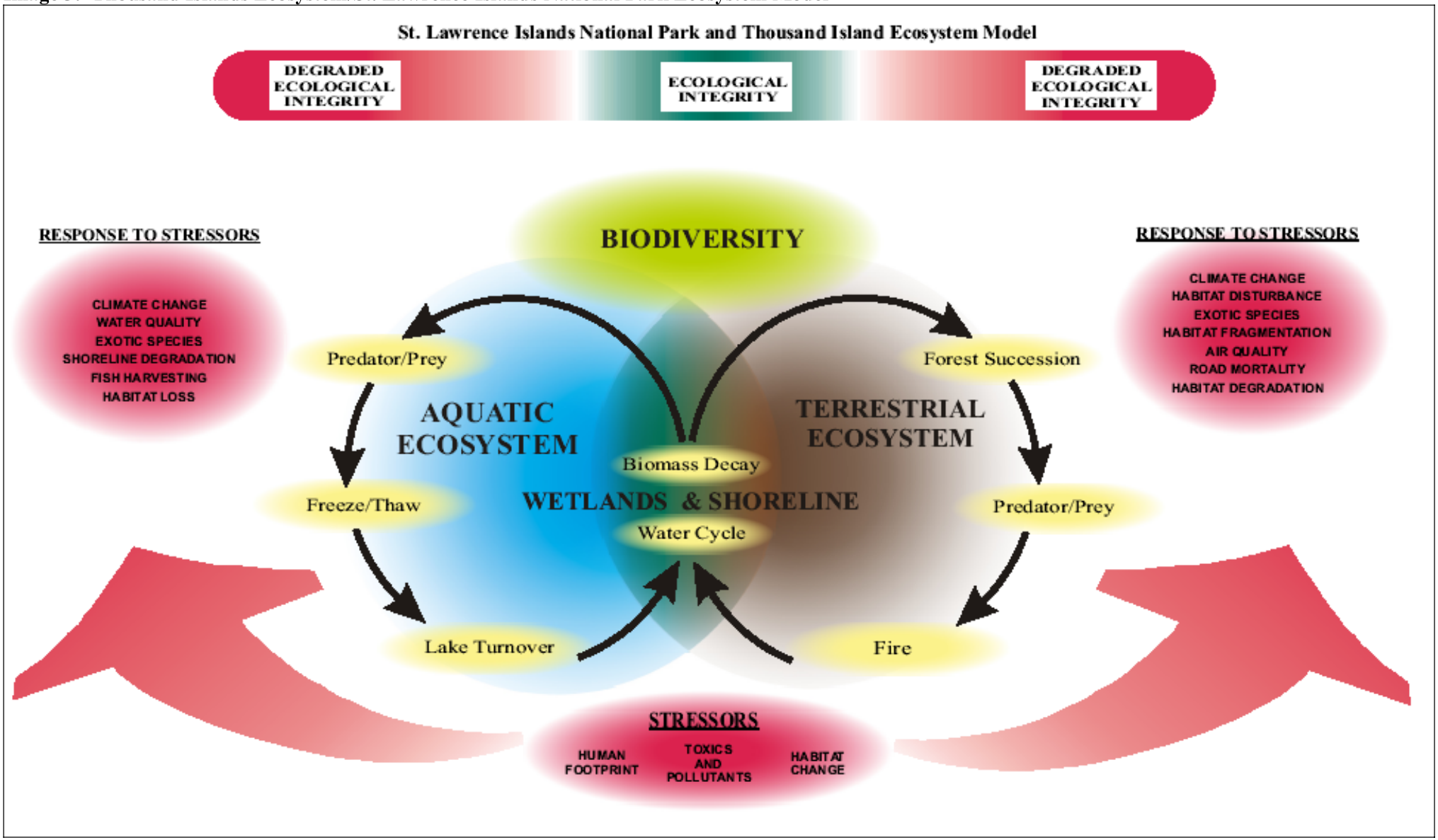
Uncontrolled Park Access: A majority of SLINP's accessible property is island based which provides an unlimited number of access points for visitors. Uncontrolled access also creates challenges for delivering park messages and monitoring visitor activities. This increases the number of non-designated hiking trails on each island and the level of shoreline degradation.

Small and Fragmented Land Holdings: The twelve square kilometres of SLINP are fragmented because of the park's island orientation on the St. Lawrence River. The islands are scattered along 100 kilometres of the river which limits the level of connectivity and species movement within the park.

High Visitor Density: SLINP has one of the highest visitor densities of all Canadian National Parks. Each year there are approximately 7283 visitors per square kilometre of park property, which cause adverse effects on the parks' natural resources (Parks Canada, 2004).

Windsor-Quebec Corridor (Human Footprint): SLINP is located in extremely close proximity to major transportation routes such as Highway 401 and the St. Lawrence River. The river acts as a partial barrier for species movement while the 401 severely fragments habitats. Traffic and road density in the TIE is high which leads to severe levels of road mortalities for some species such as turtles (Bradford and Leggo, 2003).

Image 3: Thousand Islands Ecosystem/St. Lawrence Islands National Park Ecosystem Model



Species at Risk: As previously discussed in this report, the park and TIE have a naturally high level of species diversity and of ecosystem stressors. This leads to a relatively excessive number of COSEWIC designated species.

Hyper abundant Wildlife: White tailed deer (*Odocoileus virginianus)* and raccoons (*(Procyon lotor)* are problem species at SLINP. White tailed deer cause vegetation to deteriorate because of excessive browsing. Raccoons are a threat to human and non-human species as they have the immediate potential of carrying rabies while being a major nest predator of turtles.

2.7 Regional Contributions of St. Lawrence Islands National Park

A large portion of the Thousand Islands Ecosystem has recently become internationally recognized as the Thousand Islands and Frontenac Arch Biosphere Reserve that covers an area where *"…agriculture, forestry, recreational land use, urban areas, various levels of government, federal and provincial parks, conservation authorities and the university community can and want to work together to co-ordinate efforts and link conservation and sustainable economic development* (TIHC, 2002)". SLINP is an integral part of this with the Park Superintendent participating on the Biosphere Reserve Steering Committee and the park involving itself in numerous working relationships with other stakeholders. Staff at SLINP have been focussed on co-operative projects with the Algonquin to Adirondack Conservation Initiative (A2A), which aims to "…restore, enhance and maintain ecological connectivity, ecosystem function and native bio-diversity….". The Canadian Parks and Wilderness Society (CPAWS), Eastern Ontario Model Forest (EOMF), Leeds County Stewardship Council and the Thousand Islands Area Residents Association (TIARA) are a few of the other organizations that SLINP works with to support a larger degree of EI and regional based stewardship efforts. With the protection and preservation of the Thousand Islands Ecosystem being a common priority for so many government and non-government agencies, the partnerships are resulting in enhanced policy development, data collection and program improvement, all of which contribute towards achieving EI in the TIE and SLINP area.

2.8 Park Management Planning Perspective

The current Park Management Plan (1998) indicates that the 'ecological approach' to national park management requires the consideration of conservation on a regional scale. For example, management decisions at SLINP will be effective if they consider the park as part of the mosaic of land uses in the regional landscape including other core protected areas, ecological buffer zones, urban development, agriculture and recreation. The Park Management Plan recognizes EI threats such as habitat fragmentation and intensive visitor use of the area and the importance of examining SLINP's issues as part of the 'big ecological picture' (Parks Canada, 1998). It also identifies the importance of park visitors developing an understanding and appreciation for the park's natural resources and a regional communications program that enhances public understanding of the ecosystem concept. The Park Management Plan specifies certain objectives and requirements to direct management decision-making at SLINP to support ecological integrity. These are presented section 5.0.

3.0 ST. LAWRENCE ISLANDS NATIONAL PARK VISION AND OBJECTIVES

3.1 1998 St. Lawrence Islands National Park Vision

There are three vision categories dedicated to guiding particular focuses at SLINP for natural environment, cultural environment, and public understanding and use issues. These originate from the 1998 Park Management Plan and the table below highlights the key points from each one.

Table 2: Key Concepts of the 1998 Park Vision

The Natural Environment Vision	The Cultural Environment Vision	Public Understanding, Use and Enjoyment Vision
❑ The ecological integrity of the Park's natural resources will be maintained and enhanced through an ecosystem approach to resource management. ❑ This success will be achieved through co-operative efforts by developing partnerships with federal, state, and provincial agencies and private land owners, and through a regional communications program that enhances public understanding of the ecosystem concept. ❑ The understanding Park visitors have of these resources will be enhanced through exploration of the ecosystem approach to resource management and its application to the Park's regional setting and through other corporate messages, all presented through the Park's public education program.	❑ The Park's cultural resources will continue to be highly valued, respected, protected, and preserved. ❑ The involvement of local people, including Aboriginals, will be sought in identifying, interpreting, and protecting the Park's cultural resources. ❑ A Cultural Resource Management Plan will provide strategies for preservation and use of the Park's cultural resources, which form part of the cultural landscape of the region. ❑ Visitor understanding of these resources will be enhanced through exploration of human history themes presented through the Park's public education program.	❑ The park will place an emphasis on serving groups for which learning is an important component of their overall experience. ❑ The Park will be positioned in the regional market as a leader in heritage presentation and preservation. ❑ Mallorytown Landing will move from the existing recreation-oriented focus to a role that is more supportive of environmental learning. ❑ The diversity of experience opportunities available at the Park islands has been recognized and will be sustained where financially feasible and remodelled where needed to better meet client needs. ❑ Partnerships and co-operation with the private and public sectors will be a key to reaching the local residents and regional tourists. ❑ Visitors will continue to pay an equitable share for the services and programs that benefit them directly.

From: Parks Canada, 1998

3.2 Future Direction of the Park Vision

Initiated by the need to refocus the park vision to better reflect the priorities of SLINP and Parks Canada, a recent effort has been made to create a new park vision and objectives. The 2001 Ecological Integrity Statement vision and ideas presented in the 2003 SLINP Social Science Research Strategy are major contributing documents to the new proposed park vision. Park staff, Ontario Service Centre staff and members of the Thousand Islands Community have been involved in the development of the proposed vision and objectives.

3.2.1 Ecological Integrity Statement Contributions to Proposed Vision

The current SLINP management plan was approved in 1998 and reflects much of the ecological integrity direction from the 1988 National Parks Act (NPA) amendments and the 1994 Guiding Principals and Operational Policies.

The vision and strategic goals from the 1998 Management plan were formalized in the 2001 Ecological Integrity Statement. The following table highlights the main vision concepts from the EIS.

Table 3: EIS Vision Concepts Contributing to the Proposed SLINP Vision

Ecosystem Conservation and Protection	Community/Cultural Heritage	Visitor Use and Management
❑ In 2016 the greater park ecosystem will support greater native biological diversity than occurred in 2001. ❑ Supporting the region's biodiversity, the islands will continue to play their ecological role with respect to species distribution and connectivity.	❑ Strong goal-oriented, working partnerships will be in place between government, non-government organizations, and citizens. ❑ Healthy natural areas will remain, and the landscape along the river will also continue to provide scenic and spiritual benefits because its topography and natural vegetation will remain the prominent visual features.	❑ Recognizing the link between human use, development, consequent ecosystem degradation, and recognizing that SLINP cannot support the current levels of these human disturbances while attempting to maintain or improve ecological integrity.

from: Snetsinger, 2001

3.2.2 Social Science Research Strategy Contributions to Proposed Vision

During 2002-03, a Social Science Research Strategy (SSRS) was developed at SLINP that resulted in a *draft* park vision, the identification of primary and secondary markets, key messages, a list of information required to work effectively with these markets and suggested methods and timeframes to collect this information. The draft park vision resulting from the SSRS was a product of the summarization of many park and TIE ecological, community, cultural and visitor management goals and values that park staff discussed and agreed upon. The following table outlines these concepts.

Table 4: Social Science Research Strategy Concepts Summarized in the Proposed SLINP Vision

Ecosystem Conservation and Protection	Community/Cultural Heritage	Visitor Use and Management
❑ SLINP should remain a core protected area with the Biosphere Reserve while being a stepping stone for species in the north-south corridor.	❑ SLINP should support the preservation and communication of the regions' cultural heritage including First nations.	❑ SLINP should provide land and water visitors with an experience of natural shorelines and islands as well as quality educational opportunities.
❑ SLINP should participate with others outside of the park boundaries to protect a viable representative sample of native biodiversity and to serve as a natural link to other terrestrial and marine protected habitat areas.	❑ As a key component of the 1000 Islands area, the park should continue to contribute strongly to a regional sense of place and civic pride.	❑ Visitors should have minimal impact on the TIE while enjoying and appreciating the area.
❑ The park should be active in ensuring conservation is continued past the shoreline while being an important aspect of the 1000 Islands watershed. A sustainable ecosystem and sustainable enjoyment for all visitors should be prominent within SLINP.	❑ The park should also serve as a catalyst in moving the community towards optimizing the environment and economics so the quality of life in the community is maintained and valued.	❑ As pressures on the TIE continue to increase, the profile and responsibilities of the park regarding conservation, education and recreation should increase.

from: SLINP, 2003

3.2.3 Proposed St. Lawrence Islands National Park Vision

By integrating ideas presented in the EIS and SSRS the proposed vision for St. Lawrence Islands National Park is presented below. This vision will be discussed, altered and expanded upon during the Park Management Plan review.

Vision 2020

- **St. Lawrence Islands National Park will have a greater level of ecological integrity and be a biologically diverse keystone to the Algonquin to Adirondack wildlife corridor within an internationally based heritage areas network centred in the Thousand Islands-Frontenac Arch and St. Lawrence River environment.**

- **Canadians will learn about the natural and cultural heritage and regional role of the Thousand Islands – Frontenac Arch and St. Lawrence River environment.**

- **St. Lawrence Islands National Park will offer Canadians the opportunity for memorable visitor experiences that range from intimate forested islands, to sheltered harbours to views from rocky promontories of the Thousand Islands archipelago.**

- **The public will recognize the contribution of St. Lawrence Islands National Park to the region's economy and sense of pride.**

3.3 Proposed St. Lawrence Islands National Park Strategic Objectives

St. Lawrence Islands National Park aims to protect the ecological integrity of the park and surrounding area and provide its visitors with a range of enjoyable experiences that coincide with ecological protection. It also strives to create partnership opportunities with regional stakeholders. The park is presented with many obstacles to this objective such as its fragmented holdings, the large number of external park stressors, and its high visitor densities. The goals and objectives outlined in the EIS consider these problems but maintain an attempt to guide ecosystem management efforts to restore, maintain and improve the ecological health of SLINP and the TIE (Snetsinger, 2001). The SSRS also identified strategic park goals, which focus upon ecological, visitor, regional resident and community communications. The integration of the EIS and SSRS goals has resulted in a proposed set of strategic objectives for St. Lawrence Islands National Park. These will also be examined further during the Management Plan review process.

Proposed St. Lawrence Islands National Park Objectives

1. **To actively work towards improving the ecological health of the Thousand Islands Ecosystem by:**
    - Developing, nurturing and maintaining strong working partnerships and support for the Thousand Islands-Frontenac Arch Biosphere Reserve Network.

2. **To maintain and restore the wholeness and health of SLINP by:**
    - Improving the status of native biodiversity in the Thousand Islands Ecosystem.
    - Upholding and strengthening habitat connectivity, particularly between the park land holdings and other protected areas in the Thousand Islands Ecosystem.

- Preserving and restoring the natural landscape, with natural landforms and native vegetation being the prominent features within the Thousand Islands Ecosystem.

3. To provide valued natural and cultural experiences to Canadians including the park visitor, the public, agencies and organizations by:

- Showing leadership in developing, delivering and evaluating effective communication programs which inform, influence and involve Canadians with respect to their natural and cultural heritage.
- Encouraging human use and enjoyment of St. Lawrence Islands National Park and the Thousand Islands Ecosystem to support the enhancement, preservation and protection of ecological integrity.

4. Reducing the ecological footprint in the park and region by:

- Becoming a center for environmental innovation by working with regional partners to encourage and implement environmental management systems in St. Lawrence Islands National Park and the Thousand Islands Ecosystem.

4.0 ASSESSMENT OF ECOLOGICAL INTEGRITY AT ST. LAWRENCE ISLANDS NATIONAL PARK

4.1 Ecosystem Stressors

In 1994, a national Park Ecosystem Stress Questionnaire was completed by each National Park to obtain a 'comprehensive, comparable picture of the stresses on park ecosystems in Canada' (Parks Canada, 1994). SLINP staff concluded that all of the thirty listed stressors occur in the TIE and may affect SLINP. Of these, 9 were found to be the most significant. Table 5 lists these stressors, their description and whether they originate inside or outside of park boundaries. They are listed from most to least significant.

Table 5: Top 9 Ecosystem Stressors at SLINP

Stressor	Description	Origin
Human Disturbance	Impact on wildlife species (including vegetation)	Inside and Outside
Exotic Invertebrates	Out competing or filling niches vacating species	Inside and Outside
Urbanization	Increasing human development adversely effecting EI	Outside
Exotic Vegetation	Out competing or filling niches vacated by native species	Inside and Outside
Sport Fishing	Extraction pressure on game fish species	Outside
Climate change	Global warming	Outside
Heavy Metals	By-product pollution	Outside
Transportation and Utility Corridors	Effecting habitat connectivity	Outside
Forestry	Forest habitat loss due to extraction	Outside

(Parks Canada, 2000)

More than half (67%) of the top nine stressors originate outside of the park boundaries. Thirty three percent of them originate on both sides of the boundaries. This is significant and indicates that a large portion of park efforts and resources should be focussed on issues such as human disturbance that permeate politically defined boundaries. As stated in the 1998 Park Management Plan, achieving ecological integrity within and beyond the park boundaries can occur by focussing resource conservation programming on encouraging native species' existence along the Frontenac Arch.

Developing partnerships with external organizations and agencies and providing visitors, regional residents and other stakeholders with the opportunity to enjoy and become educated about SLINP were also stated as crucial to supporting ecological integrity.

4.2 Ecological Integrity Monitoring Indicators and Measures

There are several measures that are used to assess the state of the eight ecological integrity indicators at St. Lawrence Islands National Park. The following table indicates the link between these measures and indicators.

Table 6: EI Indicators, Corresponding Measures, Conditions and Trends for St. Lawrence Islands National Park

			INDICATORS						
EI MEASURES	**Condition**	**Trend**	**Toxics and Pollutants**	**Human Footprint**	**Terrestrial Habitat Change**	**Aquatic habitat Change**	**Wetland Habitat Change**	**Condition of Biodiversity**	**Stewardship**
Water Quality	**Good**	**Stable**	•			•			
Air Quality	**Good**	**Stable**	•						
Human Impact within Park	**Fair**	**Improving**		•					
Park Visitor Numbers	**Fair**	**Stable**		•					
Regional Population Densities	**Fair**	**Deteriorating**		•	•		•		
Regional Building Densities	**Fair**	**Deteriorating**		•	•		•		
Regional Road Densities	**Poor**	**Deteriorating**		•	•		•		
Habitat Fragmentation	**Fair**	**Deteriorating**			•				
Significant Woodlands	**Fair**	**Deteriorating**			•				
River Hydrological Dynamics	**Poor**	**Deteriorating**				•			
Fish Population Dynamics	**Fair**	**Deteriorating**				•			
Exotic Aquatic Species	**Fair**	**Stable**				•			
Significant Wetlands	**Fair**	**Stable**					•		
Herpetile Species Diversity	**Fair**	**Deteriorating**						•	
Eastern Ratsnake	**Poor**	**Deteriorating**						•	
Bull Frogs and Green Frogs	**Good**	**Stable**						•	
Bald Eagles	**Poor**	**Improving**						•	
Common Terns	**Poor**	**Improving**						•	
Other Avifauna	**Fair**	**Improving**						•	
Engaging Canadians	**Poor**	**Improving**							•
Local Land Use	**Poor**	**Improving**							•
Park Visitor Satisfaction	**Fair**	**Improving**							•

4.3 INDICATOR: TOXICS AND POLLUTANTS

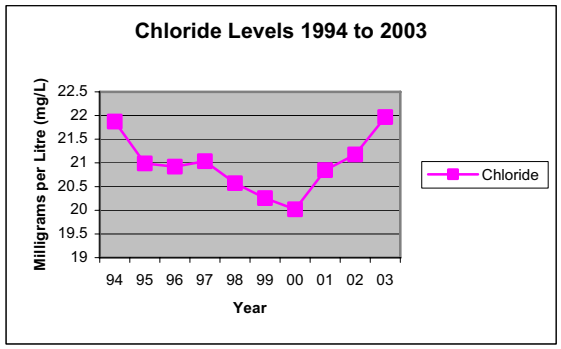
Within SLINP there are virtually no sources of toxics and pollutants that affect the ecological integrity of the park. Fossil fuels are stored in quantity at one site according to federal government regulations and waste is disposed of in an appropriate fashion. Although there is always the possibility of a catastrophic event on the major transportation routes (e.g. St Lawrence Seaway, 401 Highway) most pollutants are non-point source and are carried by air and water.

4.3.1 Measure: Water Quality

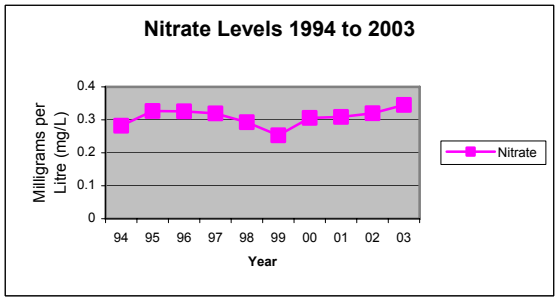
Although long-term point-source contamination has been documented for the Cornwall and Massena areas, overall, there are few concerns with water quality in the Kingston to Brockville portion of the St. Lawrence River. There are no large-scale industries, and few contaminants are believed to be migrating from areas of concern around Lake Ontario (Kristensen, 1999). Since 1971 agricultural activity within and around the TIE has occupied less land (-34.1%) but fertilizer use has increased 74.1% and pesticide and herbicide use has increased by 20.4% and 49.5% respectively (Statistics Canada, 2003). Surface water runoff from farm fields may increase levels of these substances in water bodies within the TIE.

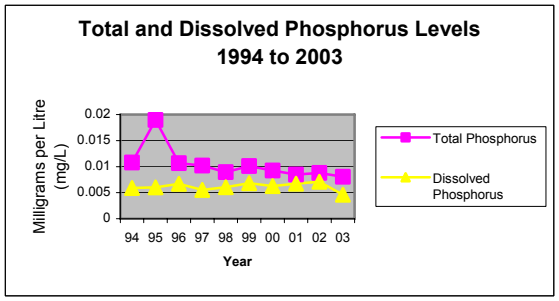
The *Surface Water Monitoring and Assessment 1997 Lake Ontario Report* produced by the Ontario Ministry of the Environment (MOE) highlights the results of numerous core water monitoring programs for Lake Ontario. The Provincial Water Quality Monitoring Network selected three parameters to assess overall water quality at various points around the Lake Ontario watershed and they are chloride, turbidity, and nutrients (phosphorus and nitrates). In addition to these parameters Atrazine and Metolachlor, which are the two most common herbicides in Ontario, have also been selected for analysis in this report because the increasing trend in concentrations in the St. Lawrence watershed has created some concern (Kristensen, 1999).

Road salt is the single largest source of chlorides entering Lake Ontario from local sources. Concentrations of chloride in Lake Ontario are generally below guidelines for safe domestic, industrial, and ecosystem use although concentrations can peak during spring snowmelt. During this melting period, chloride levels can reach amounts high enough to harm aquatic life. Chloride is a good tracer for other pollutants associated with runoff from roads and urban areas (MOE, 1999). Data recorded from the Wolfe Island monitoring station in Kingston between 1994 and 2003 are considered low by MOE standard and an Auto-Regression Integrated Moving Averages (ARIMA) statistical test was employed to evaluate the trend in chloride levels and changes were found to be insignificant (Zorn, 2004).

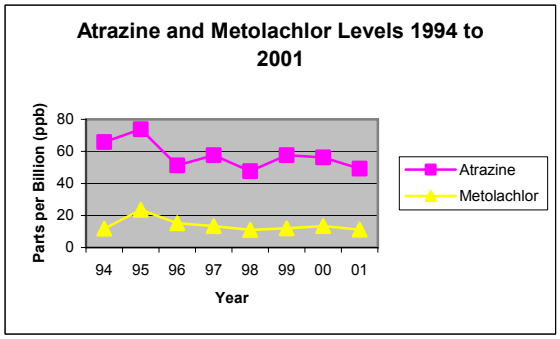


Phosphorus can originate from agricultural runoff containing fertilizer, faulty septic operations, sewage treatment plant discharges, and other anthropogenic sources. Nitrate levels normally respond to similar urban and rural land use as phosphorus. High levels of phosphorus are responsible for the increased production of algae, which results in the enrichment of organic matter, the depletion of oxygen and the 'crowding out' of some plant species. This can threaten aquatic habitats and impair the aesthetic value of water bodies. These levels can also be affected by naturally occurring nitrogen processes therefore this indicator is less effective as a tracer of human activity and pollution than phosphorus (MOE, 1999).



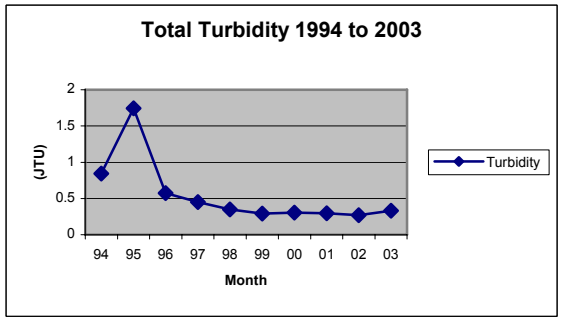


Levels of nitrate and phosphorus from Kingston are at medium and low levels respectively and the ARIMA test found both 1994 to 2003 trends to be not significant (Zorn, 2004).



Atrazine and Metolachlor, are used for the control of several annual grassy weeds and certain broad-leafed weeds associated with corn, soybean, and other crops. They are a very good tracer of increases in local and regional agricultural intensity. Pre-emergence herbicides have usually been considered to have a minimal environmental risk because they have a low toxicity to test species but they can affect microbial communities and reduce the level of dissolved oxygen. Most of the Atrazine and Metolachlor in water samples analyzed at Cornwall, Ontario were from Lake Ontario therefore it is unlikely that significant amounts are from sources within the TIE (Pratt. *et. al*., 1997). Levels of both Aztrzine and Metolachlor at the Kingston monitoring station are well below threshold levels of 1800 and 7800 ppb. The ARIMA test of the 1994 to 2001 trend identified no significant changes (Zorn, 2004) however, levels are expected to persist as long as there is agricultural activity in the TIE and Lake Ontario basin.

Turbidity is a measure of water clarity and is an indicator of total suspended solids. Similar to chloride, water turbidity does not directly cause stress on aquatic life or human water use for most of the year.



Concentrations vary throughout the year because of the link with the flow of suspended solid concentrations in Lake Ontario tributaries and tributaries mouths. Turbidity is a good tracer of metals and trace organics and these are found in significant concentrations in areas with high levels of turbidity (MOE, 1999). Current turbidity levels are below MOE standard and the ARIMA test recognized the 1994 to 2003 trend as a significant decreasing trend (Zorn, 2004).

As most of the contaminants discussed above fell below thresholds and trends were not found to be significant, the condition of this measure is good and the trend is stable.

4.3.2 Measure: Air Quality

The MOE uses levels of ozone, fine particulate matter, nitrogen oxides, carbon monoxide, sulphur dioxide, total reduced sulphur, and ambient mercury to evaluate air quality. Most of the parameters measured have decreased over the last 32 years (MOE, 2002) with only ozone showing an increase in the Kingston region.

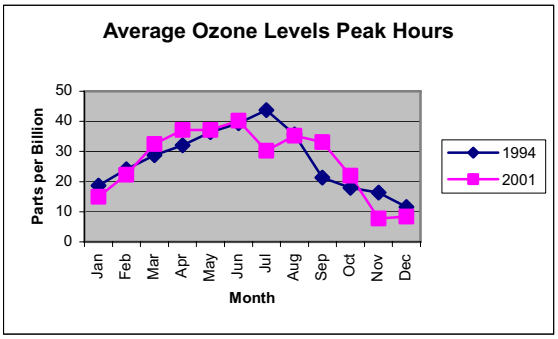
The reduction of sulphur from industrial sources in central North America has had some success in reducing the effects of acid rain on lakes in Ontario and Quebec (Jeffries *et al.*, 2000) however, unless further reduction targets are met, up to 25% of lakes in eastern Canada will remain chemically damaged. Although there is a high buffering capacity for acid deposition over much of the TIE acid levels in soil approaching or exceeding maximum thresholds for long-term effects have been recorded within the Eastern Ontario Model Forest (Johnson, 1999).

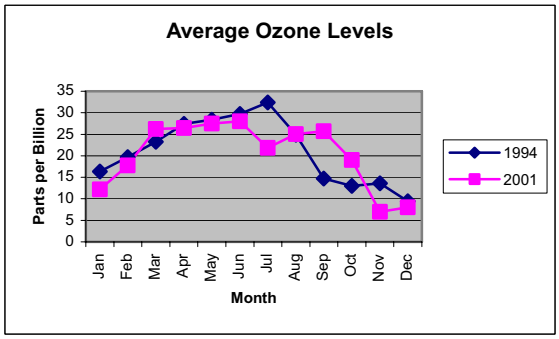
Carbon Monoxide levels have dropped 87% since 1971 and 55% from 1992 to 2002 in Ontario. As the transportation sector accounts for 85% of emissions most of the high readings were recorded in the Toronto area while Kingston levels were not reported. Ambient Mercury levels have only been recorded in the Toronto area since 2000 and are currently well below threshold (MOE, 2002).

Ozone is a photochemical oxidant formed from reactions involving nitrogen oxide and Volatile Organic Compounds (VOC) in the presence of sunlight and most of the anthropogenic emissions of nitrogen oxide and VOC originate in the United States (CUSAQC, 1999). Despite a decreasing trend in nitrogen dioxide in Ontario from 1972 to 2002 the summer and winter mean Ozone values have increased since 1980 by 23% and 27% respectively. Averages in rural Ontario tend to be higher that urban areas (MOE, 2002). Although the Canadian air quality standard for ambient ozone is 82 parts per billion (ppb), on an hourly average some researchers have concluded vegetation damage and reduced primary productivity can result in much lower concentrations. Broadmeadow (1997) reported that concentrations of 40 ppb may in-fact be low enough to predict chronic tree injury and Foot *et. al.* (1996) found that exposure to 70 ppb of ozone for 8 hours per day can increase susceptibility to frost mortality. Research conducted by Chappelka and Samuelson (1998) indicted that effects of ozone on forest trees in the eastern United States is dependent on species, stage of development, climate, interacting stress, and other factors. In 2004, SLINP established a baseline set of Environment Canada EMAN plots to obtain data on primary productivity that may be able to reflect the status of ecosystem stress resulting from ozone.

Ozone levels in Kingston occasionally exceed the maximum hourly value of 82 ppb but summer and peak hour values (0800 to 2000 hrs) are not often over 40 ppb. Of the air pollution parameters monitored by MOE, Ozone is one of the most likely to adversely effect the ecological integrity of the TIE, however records from the Kingston station do not appear to be increasing at province level rates. Changes in 1994 to 2001 trends were found to be insignificant using an ARIMA test (Zorn, 2004).

Air borne particulate matter includes aerosols, smoke, dust, fly ash, pollen, and many other sources. Some of the highest values were recorded at Peterborough and Ottawa in July of 2002 due to forest fires burning in Quebec. Combining elevated levels of ozone, hot summer weather, and particulate creates smog.





Although the Kingston region has an air quality index of good or very good levels 93% of the time there are also some occasions of poor air quality (MOE, 2002). Please see the above tables. Trend status for smog was not presented in the 2002 air quality report. The overall condition of air quality is stable and is expected to remain so. Data shows that the status of this measure is below established human health thresholds and can be listed as good while the trend is stable.

Summary of Toxics and Pollutants Measures

- Most toxins and pollutants occurring in the TIE are non-point source originating from outside of the park boundaries.
- Many air and water borne pollutants in the Great Lakes / St. Lawrence Lowlands are decreasing due to international pollution reduction agreements with the United States.
- No increasing trends in water pollutants have been observed.
- Increasing trends in ozone have been observed in Ontario but this trend is not reflected in the Kingston data.

➢ **The condition of this measure is fair as air and water quality fall within the established human health thresholds. The trends are stable.**

➢ **Recommendation: There is a possibility that EI is more sensitive to threshold values developed for human health. Investigation into suitable thresholds should continue.**

4.4 EI INDICATOR: HUMAN FOOTPRINT

The term Human Footprint can be defined as the extent of human influence on a given area taking into account the amount of land/water necessary to support the consumption habits of a given population. Population, building and road densities are all components of determining the human footprint in the Thousand Islands Ecosystem.

4.4.1 Measure: Human Impact Within the Park

Throughout the summer field seasons of 2000 to 2002 inclusive, 57 designated hiking/walking trails on the park islands and mainland were monitored for changes in their condition. The Limits of Acceptable Change study began in order "to determine the human impact on the hiking trails" (Bradford, 2002). When use of trails becomes excessive, adverse effects on the physical environment occur. Exposed vegetation roots and rocky surfaces, decreased vegetation growth and surface water pooling are all direct results of excessive levels of human use. Many species, including COSEWIC designated species may be affected.

Trail compaction and the depth profile of each trail were recorded and analyzed. By examining the results of the data from 2000 to 2002, it was concluded that the overall trail system condition was stable, however some areas showed an increase in degradation. Specifically, as of 2002 ten monitored trails remained unchanged compared to previous data, 27 had shown a decrease in negative impact and 20 had shown an increase (Bradford, 2002). St. Lawrence Islands National Park currently has a high trail density with 197 metres of trail per hectare of park property, many of which are non-designated social trails (Bradford, 2002). In addition to degradation of the physical environment, excessive trail use may also have a negative effect on biodiversity. Miller (1998) found that species richness of breeding birds declined with a decrease in birds that are sensitive to human activity. In cases where trails are being negatively impacted, mitigation measures such as re-routing, bordering, building boardwalks, and wood chipping are being implemented and the use of social trails is being discouraged. The applied mitigation has probably contributed to the decrease in negative impact on many trails therefore indicating an improving trend for the future. A threshold is in the process of being developed.

4.4.2 Measure: Park Visitor Numbers

The number of people visiting St. Lawrence Islands National Park and the small size of the park leads it to have one of the highest visitor densities of all Canadian National Parks (Rivard, 1985). National Parks in the Great Lakes Bio-Region area are currently developing a method to evaluate this measure in relation to park ecosystem health. The following table organizes the number of people visiting the park based on year and type.

Table 7: SLINP Visitor Use Statistics, 2000-2003

User Type	2000		2001		2002		2003	
	#	%	#	%	#	%	#	%
Mallorytown Landing[1]	24 749	34.07	35 274	36.15	32 803	40.04	30 297	44.33
Non-Facility Users[2]	19 005	26.16	21 588	22.12	15 350	19.03	17 647	25.82
Seasons Pass Holders[3]	9 827	13.53	10 635	10.90	9 240	11.28	9 412	13.78
Day Visitor[4]	8 112	11.16	17 936	18.38	15 540	19.07	1 405	2.06
Camping Visitors[5]	1 986	2.73	2 503	2.56	1 823	2.23	2 358	10.57
Overnight Visitors[6]	8 950	12.32	9 619	9.86	7 173	8.35	7 222	3.44
TOTAL	**72 629**	**100**	**97 555**	**100**	**81 929**	**100**	**68 341**	**100**

From: SLINP, 2003
1 Mallorytown Landing User: A person visiting the Mallorytown Landing area for daytime activities.
2 Non-facility Users: Regional visitors who do not use park facilities but are using the immediate offshore area.
3 Seasons Pass Holders: Park visitors who use a seasons pass to access the park.
4 Day User: A person visiting an island for day use only.
5 Camping Users: Overnight visitors to the island who camp on designated campsites.
6 Overnight Users: Individuals who use docks or mooring buoys for overnight use.

As weather plays an important role in park visitation it is not uncommon to have this level of variation from year to year. The condition of this trend is fair and normal and expected to remain stable into the future. No thresholds have been developed.

4.4.3 Measure: Regional Population Densities Outside of Park Boundaries

Although key to economic and community development, population growth results in a number of factors which can be detrimental to ecosystem health. Results of studies have confirmed that there is a direct effect of human population densities on species extinctions (Thompson and Jones, 1999). The presence of towns and cities in a 100-kilometre buffer around Canadian National Parks correlates closely with species extinctions within parks. It has also been stated that external park stresses may be as severe as stresses located within park boundaries (Parks and Harcourt, 2002).

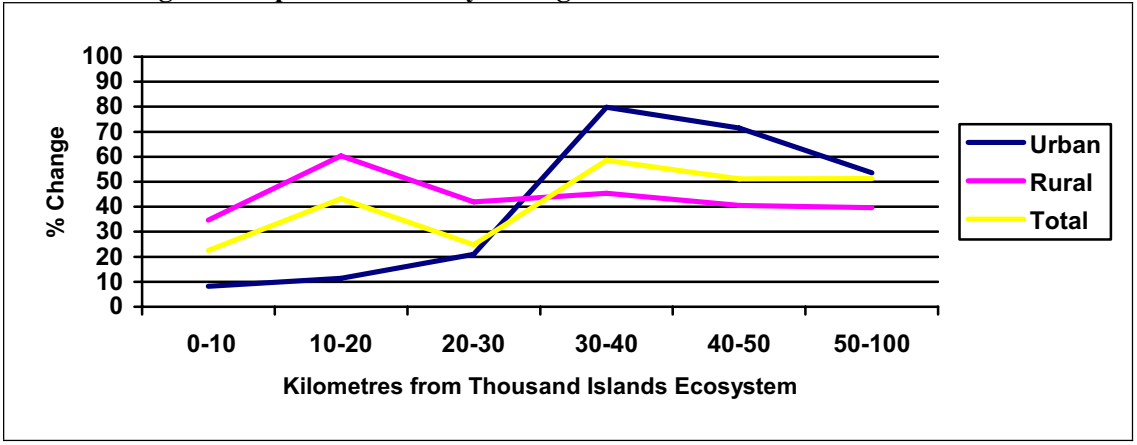
The table below presents information compiled by Statistics Canada regarding population densities within various distance increments from the Thousand Islands Ecosystem (TIE) boundary. The information is divided into urban and rural population changes in addition to the total change for each distance increment. Analysis has shown that every increment and category experienced a population increase and summer populations may be even higher than indicated below.

Table 8: Regional Population Densities Trends 1971 vs. 2001

Distance (from the TIE boundary)	Urban (%)	Rural (%)	Total Population (%)	Projected Trend
0-10 km	+ 8.2	+ 34.6	+ 22.5	↑ **rural**
10-20 km	+ 11.4	+ 60.4	+ 43.2	↑ **rural**
20-30 km	+ 21.0	+ 42.0	+ 24.8	↑ **rural**
30-40 km	+ 79.8	+ 45.4	+ 58.6	↑ **urban**
40-50 km	+ 71.5	+ 40.5	+ 51.2	↑ **urban**
50-100 km	+ 53.6	+ 39.7	+ 51.3	↑ **urban**
TOTAL	↑ **49.1**	↑ **41.2**	↑ **47.3**	↑

from: Statistics Canada, 2004

Chart 2: Regional Population Density Changes Over Distance 1971 to 2001



from: Statistics Canada, 2004

Chart 2 indicates that rural sprawl is prominent in the TIE. Rivard et al (2000) states that species richness, extirpations and alterations were more strongly related to characteristics of the areas *surrounding* the parks rather than to the characteristics of the parks themselves. This indicates that the increasing population densities in and around the Thousand Islands Ecosystem may become a threat to the health of the region and ultimately the park. Parks and Harcourt (2002) emphasize this by stating that small parks and regions with characteristics like SLINP and the TIE suffer more intense edge effects, lack of habitat connectivity and high human population densities. This information maintains the claim that the condition of this measure is fair and the data provided by Statistics Canada predicts that it will continue to deteriorate over time. A threshold has not yet been developed.

4.4.4 Measure: Regional Building Densities Outside of Park Boundaries

As the urban and rural populations in the TIE continue to grow, the demand for building development follows. Linked with this development is the increased need for recreational opportunities, infrastructure such as roads, power and water sources resulting in an increase in the overall stress on the physical environment. Habitat fragmentation, species displacement or extinction, increased wildlife road mortality, and increased amounts of toxics and pollutants are potential results of this development

that may create stress on the park. The following table shows that there is a large increase in the number of dwellings at all distance increments surrounding the TIE.

Table 9: Regional Building Densities 1971 vs. 2001

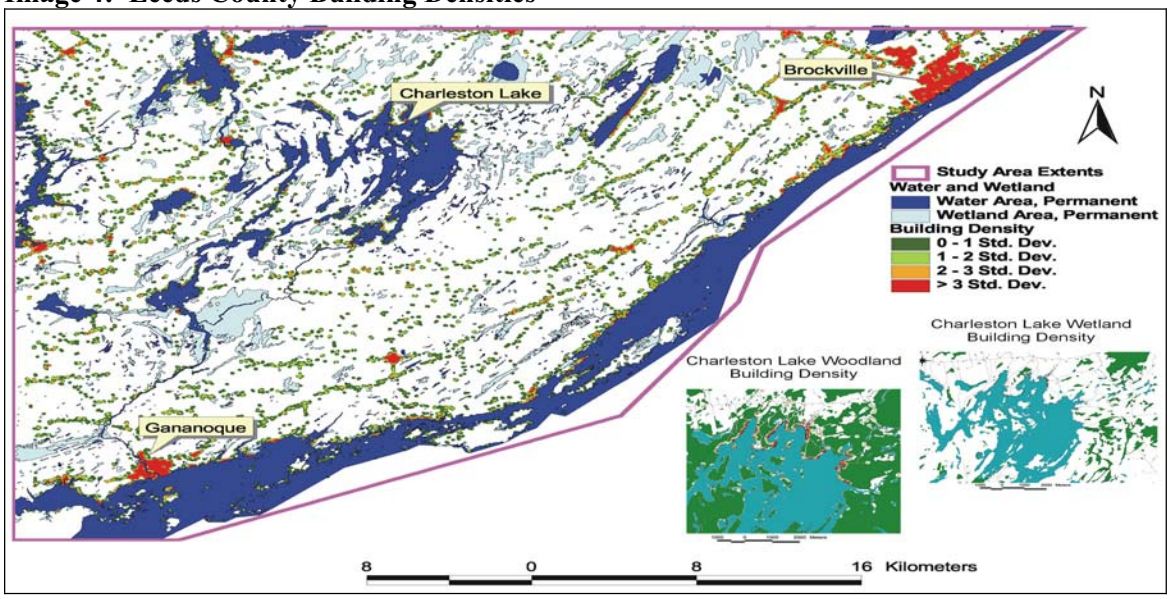
Distance (from the TIE boundary)	1971	2001	% Change
0-10 km	16 589	36 097	117.6
10-20 km	7 193	17 261	140.0
20-30 km	30 241	58 488	93.4
30-40 km	7 813	18 181	132.4
40-50 km	8 063	17 930	122.4
50-100 km	240 627	532 491	121.3

from: Statistics Canada, 2004

Rivard et al (2000) indicate that the variation in species richness among parks is correlated with several individual measures of human activity variables such as building development. For example, bird and mammal richness was positively related to the presence of roads, towns and human influenced land cover and fragmentation. Therefore, management of the areas, specifically those with high building densities surrounding the park, is likely equally important to regional flora and fauna as internal park management. St. Lawrence Islands National Park actively participates in community and regional communications and co-operative relationships to encourage ecological understanding and appreciation throughout the area.

This increased building density trend is collaborated by a landscape evaluation of building densities on the Canadian side of the TIE using Ontario Base Map data. The map below illustrates the most densely developed areas in Leeds County of the Canadian portion of the TIE (information for the balance of the TIE and the American side was not available). High density areas are shown in red and tend to occur within or around urban areas, land based transportation corridors and shorelines. Please note that this data is from 1991 and it should be assumed that building densities exceed what is presented in Image 4 and Table 10.

Image 4: Leeds County Building Densities



from: Saunders, 2004

Map inserts show areas with high building densities in and around significant woodland and wetland areas. The following table indicates what type and how much land in the Thousand Islands Ecosystem falls within each standard deviation from the mean of 17.61 buildings km^2. The ecological significance of woodland and wetland types will be discussed in upcoming sections.

Table 10: Building Density Levels within Various Land Types

Standard Deviations	Value Range (buildings/ km^2)	Leeds County All Areas (km^2)	All Woodlands (km^2)	High Value Woodlands (km^2)	Wetlands (km^2)
0 to 1	17.61 to 103.13	127.25	34.611	15.89	4.60
1 to 2	103.13 to 188.64	24.25	5.24	1.67	0.62
2 to 3	188.64 to 274.53	12.46	2.73	0.74	0.34
> 3	> 274.53	16.14	1.78	0.55	0.12

from: Saunders, 2004

The condition of building density levels in the TIE mirrors that of population densities. A fair status and deteriorating trend are evident for reasons sited by Parks and Harcourt (2002). Small parks and regions with characteristics like SLINP and the TIE suffer more intense edge effects, lack of habitat connectivity and high human population densities. A threshold has not yet been developed.

4.4.5 Regional Road Densities Outside of Park Boundaries

Areas that host high road density levels present opportunities for ecosystem degradation. Although road mortality is thought to be one of the primary disturbances of species populations, populations can also become subdivided which can lead to adverse genetic and demographic consequences (Forman and Alexander, 1998). Traffic noise, visual disturbance, pollutants and predator movement along roads also have negative effects on species. For example, Richard et al. (1998) stated that 60% of the bird species in the study region had lower densities near highways. In addition, the probability of small mammals crossing even lightly travelled roads of a 6-15 metre width may be less than 10% of the movements found within adjacent habitats.

A road density threshold of 0.6km/ km^2 applies to a naturally functioning landscape containing sustained populations of large predators (Forman and Alexander, 1998). The table below shows that the Canadian portion of the TIE has a road density that exceeds the Canadian and American averages of .10km/ km^2 and .75 km/ km^2 respectively and the road density threshold of 0.6km/ km^2 therefore indicating an immediate impact to species populations resulting from habitat fragmentation. Please note that the figures for the American Portion of the TIE only reflect *major road* densities.

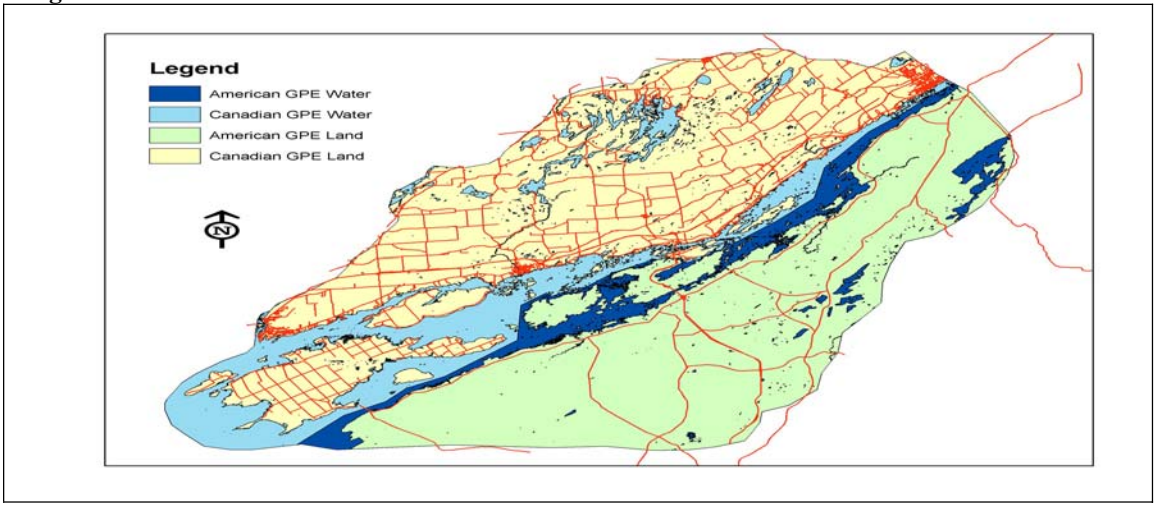
Table 11: Road Densities in the Thousand Islands Ecosystem

	Water (water and wetlands included, km/km^2 of the TIE)
Canadian Portion of TIE	.94
American Portion of TIE	.31

from: Saunders, 2004

The figure below illustrates the various sections of the TIE, which were analyzed in Table 11.

Image 5: Road Densities in the Canadian and American Portions of the TIE



from: Saunders, 2004

As this is the first time that staff have evaluated road density data at SLINP this will be a baseline to determine future trends. The threshold of 0.6km/ km^2 is currently being exceeded which indicates that the condition of this measure is poor and it is predicted that with increasing population and building densities, the trend will deteriorate.

Summary of Human Footprint Measures

- Mitigations measures are leading to an improvement in the condition of park trails and adjacent areas.
- SLINP experiences a very high visitor density each year and as the popularity of the region remains, the visitor density is expected to remain stable.
- Population densities in the region are high and they continue to grow with rural growth being the most prominent in the area immediately adjacent to the park.
- Building densities are also increasing to accommodate the region's population increase.
- Road densities are currently exceeding thresholds and averages.

- **The condition of park related Human Footprint measures is fair and predicted to improve. External measures were found to be fair and will continue to decline into the future.**

- **Recommendation: Although it is clear that human footprint measures are increasing, the park has not yet developed reliable threshold values. Investigation into the development of these values should continue.**

4.5 EI INDICATOR: TERRESTRIAL HABITAT CHANGE

The terrestrial habitat of the TIE is a mosaic of mixed conifer and deciduous forest, agricultural fields, and urban development. Since the early 1970s much of the area has experienced an increase in the amount of forested area however, there has also been a significant increase in population and rural residential development over the same time period (Statistics Canada, 2003). With the increase in population comes an increase in the human footprint leading to a reduction of the total area and quality

of habitat and habitat loss, which can result in a loss of connectivity between habitat patches at the landscape level.

4.5.1 Measure: Habitat Fragmentation

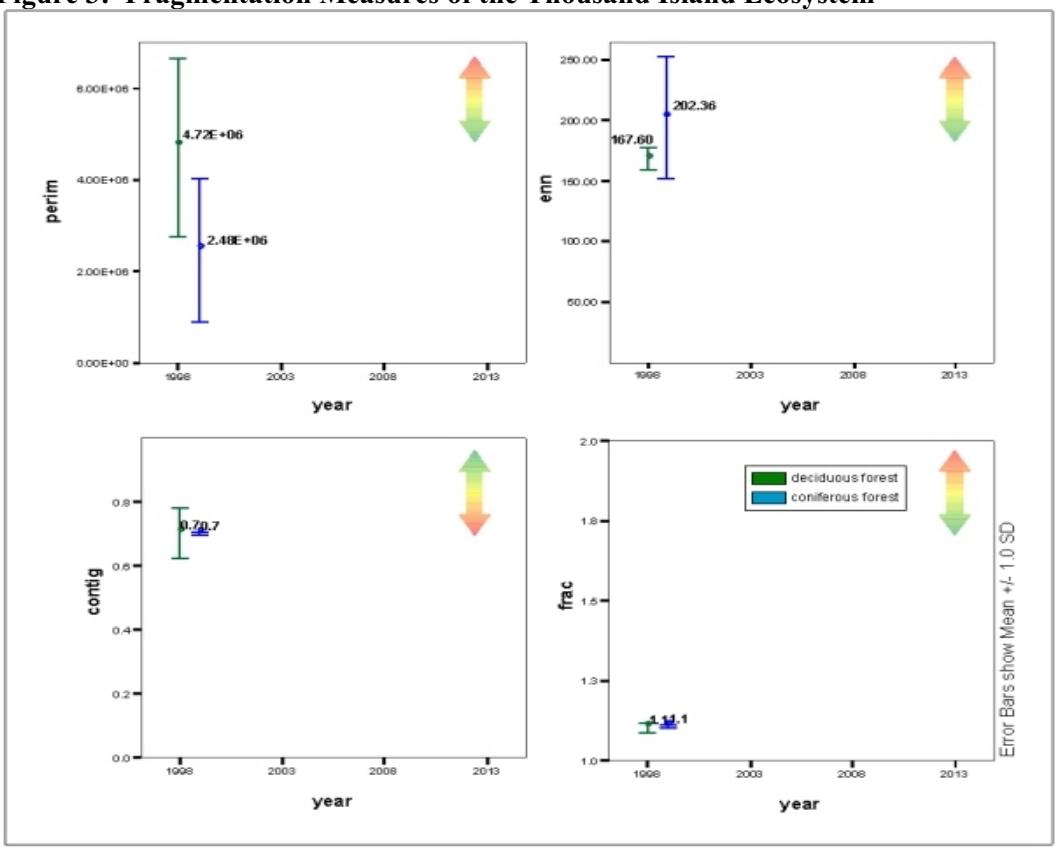
Habitat loss refers to the destruction of habitat cover by anthropogenic process leading to habitat fragmentation (Fahrig, 1997). Habitat fragmentation is the result of a habitat loss event that creates a number of habitat patches that are smaller than the original tract of habitat (Bender *et. al.,* 1998). When a landscape becomes fragmented individual species form smaller isolated groups or metapopulations that can persist if interaction is possible. Individual populations may become locally extinct but can be re-established depending on spatial relationships between patches, dispersal characteristics of the organism, and temporal changes in the landscape structure if the population decline is not synchronous (Fahrig and Merriam, 1993). Bender *et. al.* (1998) found that in landscapes undergoing habitat loss, habitat generalists tend to decline at a rate predicted for pure habitat loss alone, edge habitat species tend to decline at a rate less that predicted for pure habitat loss alone, interior species decline at a greater rate than predicted by pure habitat loss alone, and migratory species will generally suffer less of a decline than resident species. Competitively superior species and rare species tend to be at greater risk of the "extinction debit effect" in which once a habitat loss threshold is reached an irreversible population decline that could last for decades will lead to extinction (Loehle and Li, 1996).

A classified satellite image of the Thousand Islands Ecosystem was analyzed using the software package Fragstats and study results are the baseline values for comparing future analysis to identify trends. Figure 3 shows the values of 4 selected fragmentation metrics representing trends in patch edge, shape, and isolation for coniferous and deciduous forests in the TIE. The coloured arrow in the top right corner of each chart indicates the desired trend for ecological integrity. If trends move towards the red portion this indicates a negative trend for ecological integrity (Zorn, 2004).

The shape measures (CONTIG and FRAC) indicated that forest patches do not possess a high degree of edge habitat due to patch shape and, on average, will contain interior forest habitat commensurate with their size. Measures for mean patch edge (PERIM) show relatively large variation as indicated by their wide tails. This level of variation in patch edge is consistent with the range of patch sizes for each forest type. Mean patch isolation (ENN) is 168m and 202m for deciduous and coniferous forest patches respectively. Species needing to move between these patches to find required resources must, on average, travel this distance possibly through marginal or hostile environments (Zorn, 2004).

It must be noted that the degree of threat between patches varies from species to species and depends on the type of land use. For example, a road with high traffic volume may not have an effect on migratory birds but does effect nesting turtles (Gibbs and Shriver, 2002). Further investigation into individual species response to terrestrial habitat change is required.

Figure 3: Fragmentation Measures of the Thousand Island Ecosystem



from: Zorn, 2004

The condition of habitat fragmentation is relatively fair but is deteriorating due to increased population, building and road development intensity and extent.

4.5.2 Measure: Significant Woodlands

The province of Ontario Planning Act provides guidance and direction to municipalities on matters of land use planning. This act states, "planning authorities shall have regard to policy statements issued under this act". The Provincial Policy Statement defines woodlands as "treed areas that provide environmental and economic benefits such as erosion prevention, water retention, provision of habitat, recreation and the sustainable harvest of woodland products". Significance is defined as "woodlands important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system". As identification and evaluation of significant woodlands is the responsibility of the planning authority, standards vary across Ontario (Rowsell, 2003).

The criteria for identification of significant woodland in eastern Ontario were developed by a review of initiatives from other parts of southern Ontario, suitability of available data, and recommendations of a technical and steering committee. The criteria selected to be used to determining the significant forest area for the TIE is shown in Table 13.

Although there are several data sources for vegetation cover in eastern Ontario there are no contiguous GIS layers with forest community and condition layers. For this reason the database selected is the 1991 WOODAREA layer from the OMNR Natural Resources Values & Information System (Rowsell,

2003). Work is currently underway to create a vegetation community layer but unfortunately only spatial attributes of forested areas contributed to the results in Table 12.

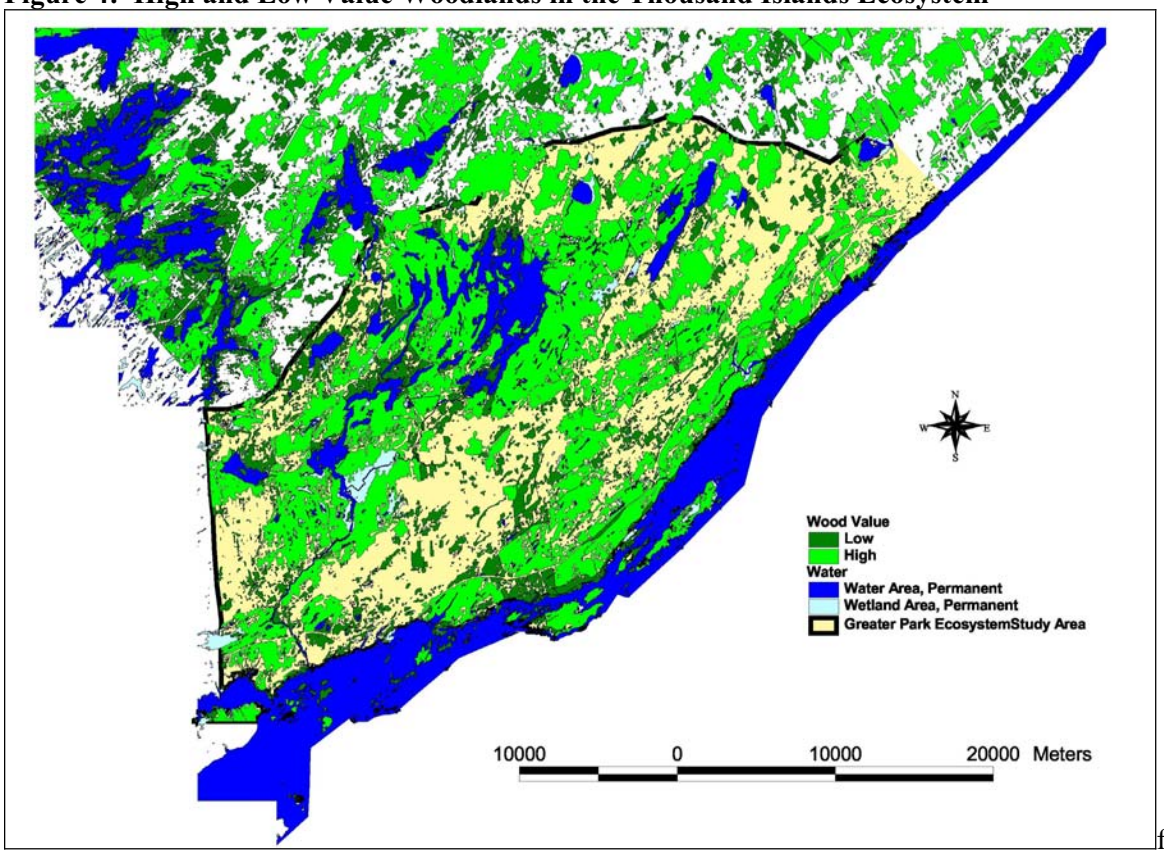
Table 12: Results of Woodland Valuation System for Leeds and Grenville Counties

Value	Forest Patch Size			Proximity to Other Woodlands			Proximity to Water		
	# of patches	Area (km^2)	%	# of patches	Area (km^2)	%	Area (km^2)		%
High (3)	≥ 200 ha	53.8973	11.74	≤ 100 m	8694	.19	≤ 30 m	12.9512	2.95
Medium (2)	>20 to <200 ha	1 055 118	22.99	>100 m to <250m	48 155	1.04	>30m to < 50m	3.7132	.85
Low (1)	≤ 20 ha	2 994 760	65.26	≥ 250m	4532002	98.77	≥ 50 m	442.2207	96.20

From: Saunders, 2004

Figure 4 illustrates the areas of low and high value woodlands in the Thousand Islands Ecosystem according to criteria presented in the preceding table.

Figure 4: High and Low Value Woodlands in the Thousand Islands Ecosystem



from: Saunders, 2004

It is evident that a large proportion of the woodland in Leeds and Grenville Counties has a relatively small patch size and is a large distance from other woodlands and water bodies. These negative attributes determine that most of the woodland in the counties are of low ecological value. As previously mentioned, despite the increase in the regions forest cover, the intensification of rural

development indicates that woodlands will face further fragmentation in the future. The condition of this measure is fair but expected to deteriorate.

Table 13: Forest Valuation Criteria

Criterion	General principle	Why it matters	How we measured it	Thresholds		Scores
				Urban	Rural	
Patch Size	Bigger is Better	A larger forest patch can provide habitat for a wider range of species. A small patch can only provide habitat to species with more limited habitat requirements. Different thresholds were used for woodlands in urban areas and in rural areas.	Size of patch in hectares (ha) as determined by geographic information system (GIS) analysis.	≥ 4 ha > 2 to < 4 ≤ 2 ha	≥ 200 ha > 20 to < 200 ha ≤ 20 ha	3 2 1
Forest Interior	More Interior forest is better	The species composition and structure of a forest are quite different around the edge of a patch compared to deep in a continuous forest, because the growing conditions are quite different. Human activity has fragmented forests into smaller patches, creating much more edge forest and less interior forest. As a result there is less habitat for plant and animal species that depend on interior habitat. Patches that provide forest interior have become more rare and more valuable.	The presence of at least 4 ha of interior forest, after allowing for an increasingly deeper zone of edge (from 100 to 200 metres)	≥ 4 ha interior within a 200 m edge ≥ 4 ha interior with a 150 m edge ≥ 4 ha interior within a 100 m edge < 4 ha interior with a 100 m edge		3 2 1 0
Proximity to Other Woodlands	Closer is better	Many species will make use of habitat in several patches if they are able to move among them.	Distance between closest edges of a path and the next nearest patch.	≤ 100 m > 100 to < 250 m ≥ 250 m		3 2 1
Proximity to Water	Closer is better	Many wildlife species need access to both forest habitat and water. Nearby forest also helps maintain water quality.	Distance of woodland from a water feature's shore.	≤ 30 m > 30 to < 50 m ≥ 50 m		3 2 1
Slope	Steeper is more valuable	Forest cover is very important on steep slopes to prevent soil erosion, which in turn prevents harmful sedimentation of water.	Slope angle (%) as determined by GIS analysis.	≥ 30% > 15 to < 30% ≤ 15%		3 2 1
Islands	Forested islands have high value	Woodlands on islands help maintain valuable shoreline habitat, but islands are highly susceptible to development in this region. Islands in natural condition are highly valued by the community.	Woodlands on islands are given additional points	Island		3

From: Thousands Island Ecosystem Community Atlas 2004 . Canadian Parks and Wilderness Society (CPAWS) Ottawa Valley Chapter.

Summary of Terrestrial Habitat Change Measures

- Woodland maps are based on spatial attributes of wooded areas.
- Mean patch isolation values for coniferous and deciduous forests are relatively high.
- A large portion of woodlands in the TIE is of low ecological value due to high levels of development.

- **The condition of terrestrial habitat change is fair but the trend is declining .**

- **Recommendation: Forest community type mapping is required to accurately assess the condition of terrestrial habitat. The park and partners should develop a landscape level forest community GIS layer and condition thresholds for the TIE.**

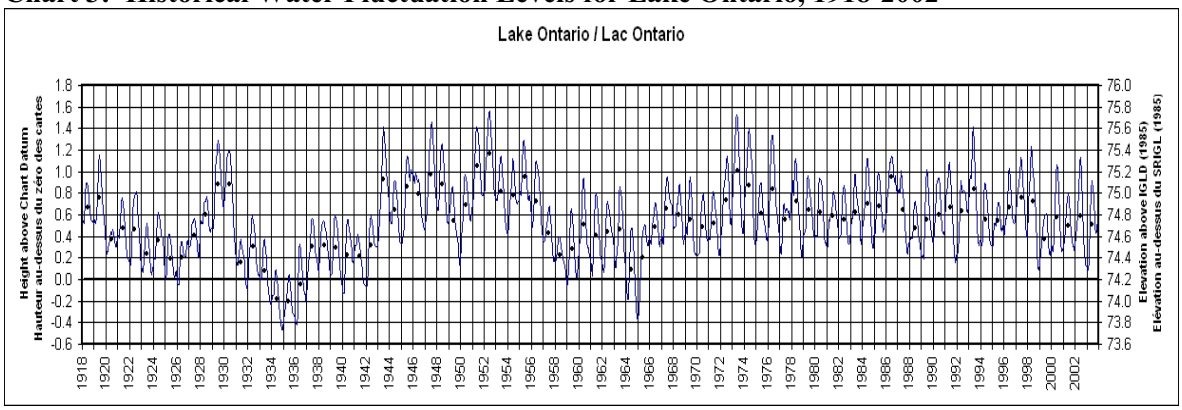
4.6 EI INDICATOR: AQUATIC HABITAT CHANGE

Since the 1870's increasing numbers of people have been choosing to develop the shorelines of the St. Lawrence River which is resulting in species habitat destruction and fragmentation. Changes in the aquatic vegetation community structure, increased shoreline hardening and/or erosion are potential results of shoreline development and negatively affect aquatic species. Increased shipping traffic and adverse changes in water characteristics are among the many stresses this ecosystem faces.

4.6.1 Measure: St. Lawrence River Hydrological Dynamics

The St. Lawrence Seaway was created in 1959 and has resulted in many adverse effects to the St. Lawrence River ecosystem. Dams located downstream at Cornwall-Massena and Beauharnois have reduced the fluctuation in water levels from 4.88 metres to 2.44 metres (Kristensen, 1999) and Chart 3 illustrates this change. The dams have also increased opportunities for shoreline development because the risk of flooding has been removed in many areas.

Chart 3: Historical Water Fluctuation Levels for Lake Ontario, 1918-2002



from: Environment Canada, 2004

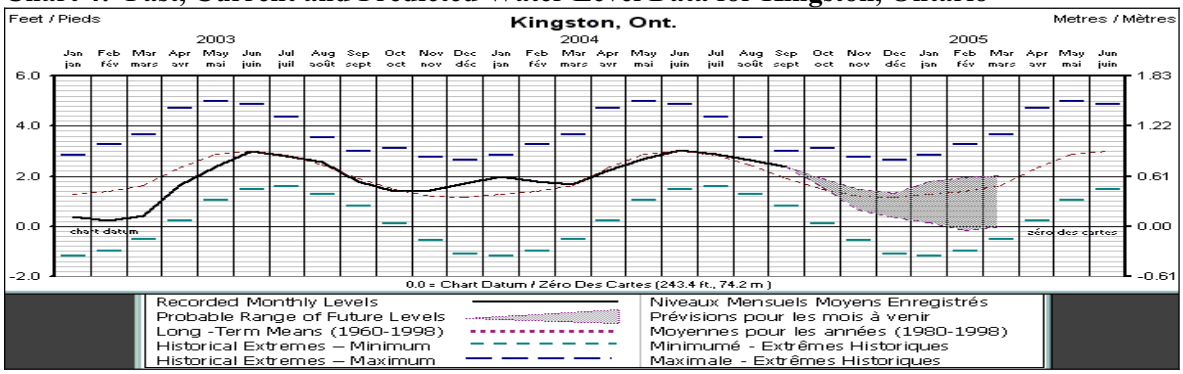
As a result of this overall reduction in water level fluctuations, there has been an undesirable transformation of littoral zone and wetland community structure (Kristensen, 1999). Specifically, the intensity of disturbance regimes caused by the fluctuations have been lessened which has transformed rush and grass dominated habitats to cattail stands. This has limited the opportunities and value of spawning habitat for species such as northern pike (*Esox lucius)* and muskie (*Esox masquinongy*). Changes in wetland species composition, productivity and distribution of wetland plants are likely

linked to the quality of habitats available for aquatic fauna (Hudon, 2004). Regulated water levels have also been linked to increased levels of ice and substrate scouring, leading to reduction of littoral zone macrophyte beds. Species habitat is reduced through this and has led to noticeable declines in some species, including muskrats (*Ondatra zibethicus*).

Increased development resulting from a lower risk of flooding may also be contributing to a decline of this ecosystem's health. Trombulak and Frissell (2000) indicate that the presence of unpaved surfaces such as those linked with new areas of development, can increase sediment content in water, which increases turbidity and reduces productivity and the survival or growth of fish. Paved surfaces contribute to increased runoff resulting in higher levels of erosion and contaminants in the water body.

Decreasing water levels are a concern for the ecological integrity of the St. Lawrence River. Research indicates that the Thousand Islands region will experience a continued warming trend ranging between 1 and 7.5 degrees Celcius which will increase evaporation rates and lower water levels (Painchaud and Villeneuve, 2003). Chart 4 supports this claim by predicting the probable decrease of future water levels for Kingston, Ontario. Linked with lower water levels, high light intensity, warm temperatures and nutrients leads to significant algal growth which can choke out other aquatic species. Increased non-native species have been reported to invade areas experiencing water regulation and low water levels also deprive aquatic fauna of shelter and food sources (Hudon, 2004).

Chart 4: Past, Current and Predicted Water Level Data for Kingston, Ontario



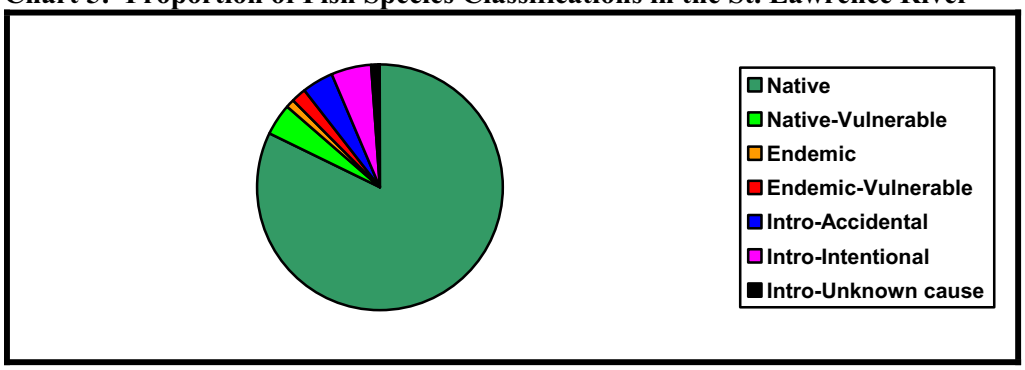
from: Environment Canada, 2004

Due to a decrease in the overall water levels and the minimized fluctuation, the condition of this measure is degraded. Data suggests that this will continue to deteriorate as global factors such as climate change and regional factors such as development persist and/or worsen.

4.6.2 Measure: Fish Population Dynamics

There are approximately 95 fish species that potentially or actually inhabit the St. Lawrence River (Snetsinger, 1999). Chart 5 indicates the proportion of these species that are native, endemic or have been introduced to the area. A large number (86%) of these species are native or endemic and are deemed to have stable population numbers although there are 6 that may be vulnerable to population decline or extirpation if effective management actions are not implemented. Two of these are of particular concern because of their COSEWIC designation. These are the bridle shiner (*Notropis bifrenatus*) and pugnose shiner (*Notropis anogenus*).

Chart 5: Proportion of Fish Species Classifications in the St. Lawrence River



from: Snetsinger, 1999

A 1995 study conducted in the littoral zone of Johnstown Bay which is located approximately 45 kilometres downstream of SLINP headquarters obtained data regarding 32 of the 95 potential fish species in the St. Lawrence River. This data is valuable because fish community assemblages are powerful descriptors of environmental degradation and can provide an early indication of ecosystem change (Cassleman and Grant, 1995). The species composition for this area was similar to that reported in other regions of the river, and overall results indicate that:

- The fish community is diverse and relatively dense
- The biomass total is large and a high level of productivity is present.
- The human altered study area (rock infill), demonstrated a decrease in species diversity, biomass and species richness.

Sport fishing is an additional concern to fish populations. It has been noted that 78% of fishing on the American side of the St. Lawrence River is concentrated in the Thousand Islands area and this is assumed to reflect fishing activity on the Canadian side (Kristensen, 1999). In recent years, advanced sport fishing technology has placed additional stress on fish species. It has been agreed within the Canadian and American scientific, fishing and private citizen communities that certain game fish species populations are in decline. The table below lists these species and their associated, predicted trend.

Table 14: Predicted Trends for Thousand Islands-St. Lawrence River Fish Species

Common Name	Scientific Name	Trend	
		Improving	Declining
Small mouth bass	*Micropterus domomieui*		•
Northern Pike	*Esox lucius*		•
Yellow Perch	*Perca flavescens*	•	
White Perch	*Morone americana*		•
Brown Bullhead	*Ictalurus nebulosus*		•
Rock Bass	*Ambloplites rupestris*	•	
American Eel	*Anguilla rostrata*		•
Lake Sturgeon	*Acipenser fulvescens*	•	
Muskellunge	*Esox masquinongy*	•	
Chinook Salmon	*Oncorhynchus tshawytscha*	•	

from: Kristenson, 1999

Based on the information provided above, the condition of fish diversity biomass and richness is relatively fair. Human interference has been shown to degrade these fish characteristic therefore the trend is expected to deteriorate as shoreline development increases in intensity and extent. Fish community structure in shallow littoral zones is directly related to macrophyte abundance and presence of wetlands and their inflows (Cassleman and Grant, 1995) making decreasing river water and fluctuation levels an immediate concern to wetlands and ultimately fish population health.

4.6.3 Measure: Exotic Aquatic Species

Deliberate and accidental introduction of 43 exotic species has occurred since the opening of the St. Lawrence Seaway system. A large majority of these introduction have been a result of ship ballast waters of which no law or regulations apply (Kristensen, 1999). Table 15 lists the exotics known to occur in the Thousand Islands-St. Lawrence River and the likely consequences associated with each.

Table 15: Known Exotic Aquatic Species and Associated Consequences

Species	Reason for Introduction	Consequences
Zebra and Quagga Mussels	Ship ballast waters	-some clams are experiencing 100% mortality rates -the basis of the foodchain (phytoplankton) is experiencing drastic density declines -larval fish survivorship is degraded -potential filtering of chemical pollutants
Alewife and Smelt	Unknown	-decreased larval perch survivorship -increased food competition for native species -Alewife has likely contributed to the rise in Cormorant numbers
Kawartha Muskellunge	To create new sport fisheries	-interfering with recovery of the native species through interbreeding and resource competition
Ruffe	Unknown	-egg predation and food competition for native game fish -not yet in the St. Lawrence River but is predicted to arrive soon
Spiny Water Flea	Ship ballast waters	-rapid reproduction and foraging habits will influence the native biological community
Goby	Ship ballast waters	-increased competition for prime spawning sites used by traditional native species

From: Kristensen, 1999

Although positive results are occasionally associated with exotic species ie. the filtering of chemical pollutants by zebra mussels, the degradation they cause outweighs their benefits. This measure fair and is predicted to remain unchanged. No threshold has been developed.

Summary of Aquatic Habitat Change Measures

- Low water levels and reduced river fluctuation has adverse affects on aquatic life. These factors can also lead to increased shoreline development.
- Fish species richness and diversity levels are stable but sport fishing and adverse hydrological changes are placing stress on this measure.
- Exotic species have increased tremendously since the establishment of the St. Lawrence Seaway and are placing large amounts of stress on native species.

- **The condition of the St. Lawrence River aquatic habitat is fair and the trend is stable.**

- **Recommendation: The park has not yet developed reliable threshold values for the selected EI measures of Aquatic Habitat. Further investigation into suitable thresholds should continue.**

4.7 EI INDICATOR: WETLAND HABITAT CHANGE

Wetlands in the Thousand Islands Ecosystem provide habitat for many species and the loss of these ecosystems will inevitably reduce regional biodiversity (Findlay and Houlahan, 1997). Approximately 30% of the Species at Risk in the TIE rely on wetlands for their habitat (Parks Canada, 2003).

4.7.1 Measure: Significant Wetlands

Wetlands are a necessary component of the Thousand Islands Ecosystem. Increasing development pressure in rural areas is placing stress on these ecosystems, which is leading to their degradation and decline. Study results show a strong positive relationship between wetland area and species richness for plants, birds, herpetiles and mammals (Findlay and Houlahan, 1997). Results of this study also provide evidence that landscape level road construction and forest removal on adjacent lands pose significant risks to wetland biodiversity.

Paved Roads:
As discussed in previous sections, roads have negative impacts on levels of regional biodiversity. They disrupt species movement, increase mortality, modify wetland hydrology, increase amounts of edge habitats and facilitate the invasion of exotic species (Findlay and Houlahan, 1997). Species richness was found to decrease significantly with the presence of roads and different distance intervals were linked to this. Of particular interest to SLINP and the TIE is the statistic which shows that the herpetile richness decreased 19% when 2 metres of hard surfaced road was constructed within 2 kilometres of the wetland (Findlay and Houlahan, 1997). Mammals species richness was found to decline by 12% at this same distance interval while birds decreased by 14% at a 500 metre interval and plants reduced in species richness by 13% at a one kilometre distance (Findlay and Houlahan, 1997).

Forest Cover:
Results of reduced forest cover match most of those created by road presence including increased edge effects and migration barriers. A decline in herpetile and mammal species richness was also associated with a reduction in forest cover and an increase in human activity within adjacent lands. This did not apply to plants or birds. A 20% decline in forest cover was detected to reduce the species richness of mammals and herpetiles 11% and 17% respectively within two kilometres of the wetland (Findlay and Houlahan, 1997).

These changes in species richness may not become evident for at least 8 years and this lag can continue for as long as a few decades (Kindlay and Bourdages, 2000). This delay suggests that land management techniques in the Thousand Islands Ecosystem are having implications on regional wetlands. Relatively short term assessments of road effects may significantly underestimate the results of the road system, therefore cumulative impact assessments are necessary to conclude accurate results. SLINP is currently encouraging the Township of Leeds and the Thousand Islands to adopt cumulative impact assessments.

A decline in species richness is possible because the minimum amount of buffer zone that some taxa (avifauna) require to maintain a stable level of richness is 500 metres. Results of the Findlay and Bourdages (2000) and Findlay and Houlahan (1997) studies indicate that even if no new roads or other habitat disruption occur, wetland integrity will continue to decline in response to historical road construction and adjacent land use. As the intensity and extent of population and infrastructure development increase, the decline in species richness will be amplified.

The criteria for identification of wetland value in eastern Ontario was developed by a review of initiatives from other parts of southern Ontario, suitability of available data and recommendations of a technological and steering committee. Each criterion (presented in Table 16) can be affected by the factors of paved roads and forest cover previously discussed.

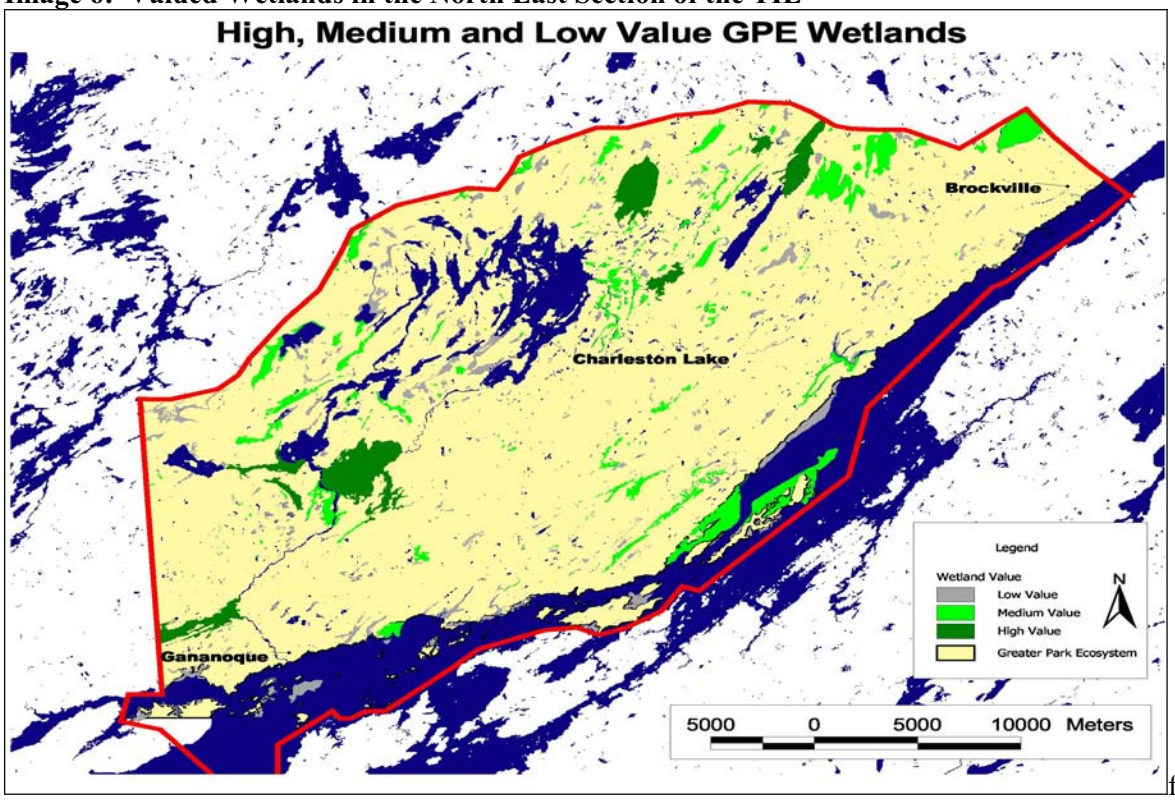
Table 16: Wetland Valuation Criteria

Criterion	General principle	Why it matters	How we measured it	Thresholds	Scores
Wetland Size	Bigger is better	A larger wetland can provide habitat for a wider range of species. Some species that use wetland habitat will not use a wetland if it is too small.	Size of wetland in hectares (ha) as determined by geographic information system (GIS) analysis.	> 200 ha > 20 and ≤ 200 ha ≤ 20 ha	3 2 1
Wetland Interior	More interior wetland is better.	The shape of a wetland influences the density, diversity, and type of species it can support. This criterion applies more to swamps than to other types of wetlands.	The presence of more than 4 hectares (ha) of interior wetland, after allowing for an increasingly deeper zone of edge (from 100 to 200 metres)	> 4 ha interior within a 200 m edge > 4 ha interior with a 150 m edge > 4 ha interior within a 100 m edge ≤ 4 ha interior within a 100 m edge	3 2 1 0
Wetland Edge	More water edge is better	"Edge" in this case refers to the interface between wetland vegetation and open water. This intermingling of habitats is important for many species. This criterion applies more to marshes than to other wetland types.	The perimeter of the open water as a proportion of the perimeter of the wetland. (A 1 to 1 ratio gives a proportion of 1.0)	≥ 1.0 ≥ 0.5 to < 1.0 < 0.5 No open water within or adjacent to wetland.	3 2 1 0
Adjacent vegetation	More adjacent natural vegetation is better	In addition to providing a buffer and filtering out excess nutrients, adjacent natural vegetation is critical for many wetland-dependent species.	Depth of buffer zone containing more than 50% natural vegetation. Wetland must also have natural vegetation adjacent to more than 50% of its boundary.	240 m buffer 120 m buffer 50 m buffer 50 m buffer ≤ 50% vegetated	3 2 1 0
Wetland Disturbance	Fewer roads nearby is better	Research shows that the species richness of birds, mammals, reptiles, amphibians, and plants in a wetland is negatively correlated with the density of paved roads in the landscape around the wetland.	Road density in wetland and within 2 Km of wetland, measured as metres of road per square kilometre (m/Km^2)	< 914 m/Km^2 ≥ 914 and < 2429 m/Km^2 ≥ 2429 m/Km^2	3 2 1
Wetland Habitat Linkage	Closer is better	Wildlife can make use of several wetlands if they are close enough together.	Straight-line distance to nearest wetland	< 500 m 500 to 750 m 750 to 1000 m ≥ 1000 m	3 2 1 0
Wetland Hydrological Linkage	More linked is better	Aquatic species can make use of habitat in several wetlands if they are connected by water. Hydrologically linked wetlands function together in reducing flood peaks in a watershed.	Shortest distance to nearest wetland following a water course	< 500 m ≥ 500 and < 1500 m ≥ 1500 and < 4000 m ≥ 4000 m	3 2 1 0
Headwater Wetland	Headwater wetlands have high conservation value	Wetlands in the headwaters of a watershed protect water quality and quantity.	Wetland is the source of a first order stream	Headwater wetland Not a headwater wetland	3 0
Wetland Flood Attenuation	Better flood control ability has a higher value	By reducing flood peaks in areas downstream, wetlands protect downstream shoreline areas from erosion and sedimentation. This protects fish spawning areas and other wildlife habitat. The ability to control flooding depends on the type of wetland.	Wetlands along rivers, called riverine wetlands, are the least effective. Those on the edges of lakes, called lacustrine wetlands, can be effective if the lake is not too large. Palustrine wetlands, with little inflow or outflow, are more effective. Isolated surface outflows are the most effective.	Isolated wetland Paulustrine wetland, or lacustrine wetland ≥ 50% size of lake Riverine wetland, or lacustrine wetland < 50% size of lake	3 2 1

From: Thousand Island Ecossytem Community Atlas, 2004. Canadian Parks and Wilderness Society (CPAWS) Ottawa Valley Chapter.

Image 6 illustrates where the high, medium and low value wetlands are located based on the evaluation of criteria listed in Table 16. Approximately 87% of the total wetlands in the north east GPE are of high value while medium and low values hold 22% and 6% of the land respectively.

Image 6: Valued Wetlands in the North East Section of the TIE



from : Saunders, 2004

The information presented in Table 17 indicates that the condition of wetlands in the TIE is fair. The trend is expected to remain stable. A large majority of wetlands have high levels of terrestrial and aquatic habitat linkages. The size of the wetlands interior is a concern as approximately 50% of wetlands in the two counties had very low value with regards to this factor.

Table 17: Results of the Wetland Valuation System for Leeds and Grenville Counties

Value	High (3)	Medium (2)	Low (1)	Lowest (0)
Wetland Interior				
# of wetlands	8 662 767	3 298 698	972 462	12 979 303
Area (km^2)	34.6511	13.1948	3.8898	51.9172
%	33.43	12.73	3.75	50.08
Wetland Patch Size				
# of wetlands	8 485 140	8 867 306	5 228 523	N/A
Area (km^2)	33.9406	35.4692	20.9141	N/A
%	37.57	39.26	23.15	N/A
Wetland Edge				
# of wetlands	65 852 964	16 593 977	2 179 830	1 286 459
Area (km^2)	23.41186	66.37591	8.71932	5.145836
%	22.58	64.03	8.41	4.96
Adjacent Vegetation				
# of wetlands	12 913 735	642 609	1 593 118	10 763 768
Area (km^2)	51.6549	2.5704	6.3725	43.0551
%	49.83	2.47	6.14	41.53
Wetland Habitat Linkage				
# of wetlands	24922538	645363	74696	270633
Area (km^2)	99.6902	2.5818	.2988	1.0825
%	96.17	2.49	.29	1.04
Wetland Hydrological Linkage				
# of wetlands	16 739 730	4 204 034	358 349	4 611 117
Area (km^2)	66.9589	16.8161	1.4334	18.4445
%	64.60	16.22	1.38	17.79

From: Saunders, 2004

A protocol for wetland monitoring in the Great Lakes Bio-region is being developed. Standardized monitoring methods makes monitoring results comparable among sites (Central Lake Ontario Conservation Authority, 2004). Landscape level management decisions regarding wetland conditions can be increased in number and enhanced in value with the assistance of standardized monitoring activities. These activities could include water quality, sediment quality, watershed land use, submerged aquatic vegetation, aquatic macroinvertebrates, fish, frogs/toads and breeding birds.

Summary of Wetland Habitat Change Measures

- Wetland species are very sensitive to the presence of paved roads and the removal of forest cover therefore species in the TIE are susceptible to population decline.
- Most wetlands in the north eastern portion of the TIE are of high ecological value.
- Standard monitoring protocols are being developed.

- **The condition of this measure is fair and the trend is stable. Thresholds will be developed.**

- **Recommendation: Selection of measures and thresholds has not yet been completed for the TIE. Further development of this indicator is required.**

4.8 EI INDICATOR: CONDITION OF BIODIVERSITY

Fahrig and Gray (1994) state that local extinctions of fragmented species populations are common, particularly among endangered species. This is emphasized by disturbances such as species habitat destruction and fragmentation. The following section will discuss various measures that reflect how natural and anthropogenic factors within the Thousand Islands Ecosystem are effecting species populations and their habitats.

4.8.1 Measure: Herpetile Species Diversity

The Thousand Islands Ecosystem hosts one of the highest levels of herpetofaunal species diversity in Canada (Bradford, 2003). As there is a documented decline in local and international herpetile communities, the SLINP monitoring program plays an important role in their protection. The program aims to determine the stability and abundance of amphibian and reptile populations and if it is in decline, a conservation plan will be designed and implemented. This is particularly crucial because the loss of even one amphibian/reptile species will have detrimental effects on the ecosystem.

There are 9 frogs and toad species, 6 salamander species, 5 turtle species, 1 lizard species and 9 snake species found within St. Lawrence Islands National Park. Two of these are COSEWIC designated as threatened (eastern ratsnake, stinkpot turtle) and 4 are listed as special concern (eastern milksnake, northern ribbonsnake, five lined skink, northern map turtle). For a complete list of these species please see Appendix 1.

There has been a noticeable decline in the number of turtles captured between 1994 and 2002. Road mortality and high predation rates appear to have an extremely significant impact on all turtle species. A 2% annual mortality rate exceeds the limit that turtles can absorb while maintaining a stable population. Mortality rates within the TIE for large bodied, land and small bodied turtles are 25%, 50% and 5% respectively (Bradford, 2003). The turtles found within the TIE travel on average between 100 and 1620 metres to forage, nest etc. This presents a serious concern since 93% of wetlands in the TIE are within at least 500 metres from a road. Raccoon predation rates, late sexual maturity and the road stresses described above suggest that, turtles in the TIE are facing a bleak future.

According to auditory monitors, pickerel (*Rana palustris*)and wood frogs (*Rana sylvatica*) appear to be the scarcest while spring peepers (*Psuedacris crucifer*), leopard frogs (*Rana pipiens*), bullfrogs (*Rana catesbeiana)* and green frogs (*Rana clamitns)* were the most common. Wood frogs and pickerel frogs were noted in 2004 which is positive due to their minimal presence in previous years.

The overall condition of species diversity within SLINP is fair but the trend is deteriorating. This is expected to be slightly more degraded outside of SLINP boundaries as the amount of protection available is limited. COSEWIC designated species are of particular concern. No thresholds have been developed yet.

4.8.2 Measure: Eastern Ratsnake

The eastern ratsnake is a COSEWIC designated ‘threatened’ species in Canada. St. Lawrence Islands National Park is host to this species and dedicates many resources to research, protection and public education efforts. This is done in partnership with other stakeholders that make up the recovery committee including, Queen’s University Biological Station (QUBS) and Ontario Parks.
In 2000, Weatherhead et al. reported on an on-going 18 year long study which was taking place at the Queen’s University Biological Station and SLINP. Both of these areas offer eastern ratsnake populations a relatively high degree of protection from human disturbance. The report indicated that both eastern ratsnake populations were in decline but for different reasons. The QUBS population was

decreasing due to a drop in recruitment and although the Hill Island population was experiencing a stable survivorship and increased recruitment, the population trend was negative.

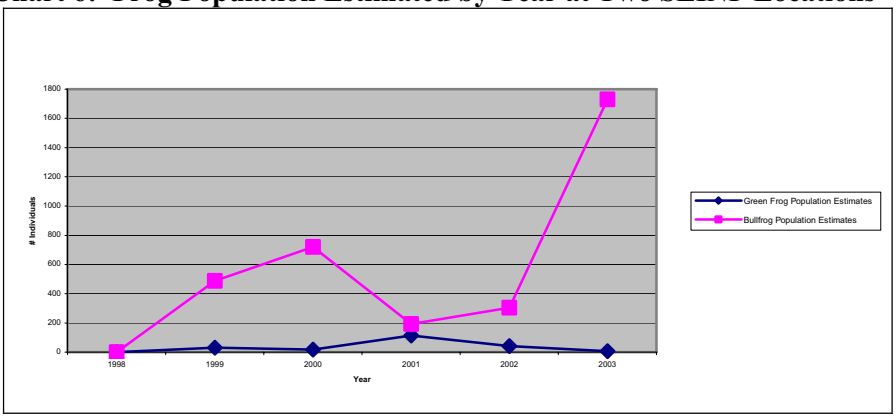
The concern for this species is heightened for two reasons. First, the populations are declining despite the fact that the snakes are located within protected areas. This decline will be emphasized if human disturbance and habitat loss are added to the natural population dynamics such as late age of sexual maturity. This mixture of negative factors are most likely emphasized on private property where many eastern ratsnakes habituate. Secondly, since the populations are declining synchronously, this threat is increased because species dispersal is unable to 'rescue' separate populations. The study concluded that each population had very different dynamics (ie. age structure) therefore different conservation/protection strategies needed to be in place for each population. The condition of this species population is poor and deteriorating. Thresholds are being developed.

4.8.3 Measure: Bull Frogs and Green Frogs

Bullfrog (*Rana catesbeiana)* and green frog (*Rana clamitns)* monitoring has been in place at SLINP since 1997 in an attempt to gauge the rate and extent of human disturbance within the park and Thousand Islands Ecosystem (Leggo et al. 1999). Bull frogs are excellent species/population indicators which is relevant due to the local and global amphibian decline.

Chart 6 illustrates the healthy predator-prey relationship between the bullfrog and green frog populations. As one population rises, the other declines and vise versa (Bradford, 2003).

Chart 6: Frog Population Estimated by Year at Two SLINP Locations



from: Bradford, 2003

Between 1999 and 2000, the sex ratio of the bull frogs remained relatively unchanged. The number of adult frogs dropped from 96% to 49% while the juvenile proportion increased significantly. This trend corresponded with the increase in the proportion of bull frogs captured versus green frogs; 66% in 1999 to 88% in 2000 (Leggo et al., 1999). This measure will continue to be monitored in the future which will allow for an enhanced understanding of pond health and bullfrog-greenfrog interactions and the development of a threshold. Currently the condition is good and the trend is stable.

4.8.4 Measure: Bald Eagles

By the 1970's, the bald eagle (*Haliaeetus leucocephalus*) was extirpated from the Great Lakes basin due partially to drastic reductions in reproductive success resulting from organochlorine contaminants (Andress, 1994). SLINP staff are working actively with other organizations such as the Bald Eagle Working Group and the New York State Department of Environmental Conservation to increase the population of this species in the Thousand Islands region.

These efforts have resulted in strengthening the overwintering population of Bald Eagles in the Thousand Islands region to approximately 100 individuals in any given year (Andress, 2004). A summer nesting pair of Bald Eagles had not been observed since 1937 but in 1999 an artificial nesting platform was installed which attracted a pair of Bald Eagles that have produced 9 offspring since then. Landowners and the organizations previously mentioned were involved in the banding and processing of these birds. A radio telemetry program is being organized which would enable the juvenile(s) produced in 2005 to be tracked while contributing data to the Ontario Bird Studies Canada Telemetry study currently underway. In partnership with university researchers, critical Bald Eagle habitat has been identified and mapped.

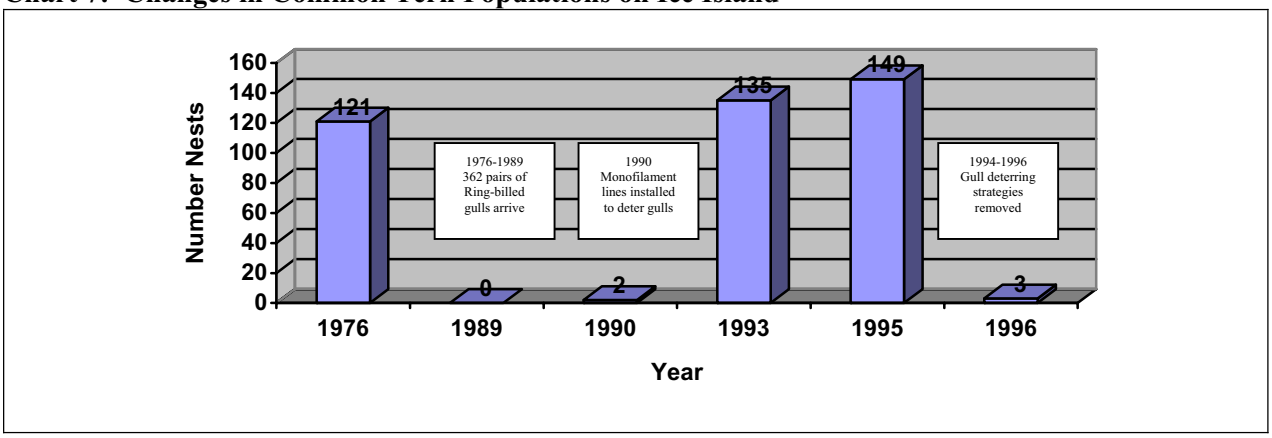
The results described above indicate that with the continued dedication of organizations and individuals, the over-wintering and summer nesting populations of Bald Eagles have the potential to become prevalent in the Thousand Islands region. The condition of this species population is poor but their population numbers are improving. A threshold has not yet been developed.

4.8.5 Measure: Common Terns

It was estimated in 1954 that there were 20 000 nesting pairs of Common Terns (*Sterna hirunndo*) in Lake Ontario, Oneida Lake and the upper St. Lawrence River however, today there are only about 2 000 (Andress, 2004). The rising Ring-billed Gull (*Larus deawarensis)* population resulting from increased food sources and nesting sites has been a major contributor to the drastic Common Tern population decline. An example of these population interactions is evident on Ice Island which is a small rocky islet near the SLINP headquarters at Mallorytown Landing.

Chart 7 illustrates changes in the Ice Island Common Tern population as a result of the Ring-billed Gull influx and ecosystem management techniques employed by SLINP and Canadian Wildlife Service staff. In 1997, the exclosure installation was re-established but other factors such as extreme weather conditions, predation and the recent disturbance from Canada Geese (*Branta Canadensis*) have resulted in annual Common Tern failures at Ice Island. There are very few natural nesting sites left and if unmanaged, they will be overtaken by gulls and/or cormorants.

Chart 7: Changes in Common Tern Populations on Ice Island



from: Andress, 2004

There is enough potential to revert Ice Island to a Common Tern nesting colony and Morris et al. (1992) stated that active management of natural islands is required for tern populations to survive and grow. In 2004, 705 nests were counted along the St. Lawrence River; 97% of which were artificial (Andress, 2004). The success rate of natural sites is 0.0 to 1.0 fledglings per nest vs. artificial nesting site success

which is 0.4 to 0.7 fledglings per nest (Andress, 2004). The artificial site rates are less but the numbers of fledglings produced is higher. If this battle is lost, the ecological, social and political problems associated with the hyperabundance of Double-Crested Comorants *(Phalacrocorax auritus)* and Canada Geese in Common Tern habitat would require an intensified ecosystem management approach. Improvements to management techniques at Ice Island are required, to bring the location up to the standard of the American side of the river (navigation cell #180) which in 2004 had 137 nests, while Ice Island had none.

The condition of the common tern population is poor but with adequate management actions can improve over time. No threshold has been developed.

4.8.6 Measure: Other Avifauna

4.8.6.1 Osprey

As a result of intensive human related development within prime nesting habitat, there were only two nesting osprey (*Pandion haliaetus)* pairs observed during the spring of 1992 in the Canadian 1000 Islands (Andress, 2004).

To remedy the issue of insufficient number of nesting spots, five platforms were erected in 1992 in the Thousand Islands and within two years, all platforms were occupied. Each pair produced at least one fledgling. By 2004, there were twenty five nesting pairs located on artificial and natural sites within the Canadian portion of the Thousand Islands alone. Platforms have also been installed at mainland locations throughout the United Counties of Leeds and Grenville to further the nesting success of this species. The Thousand Islands population is expected to continue its growth but without proper management techniques, the osprey population will disappear from this region. The condition of the osprey population is fair and the trend is expected to improve. A threshold has not yet been developed.

4.8.6.2 Peregrine Falcon

The peregrine falcon (*Falco peregrinus antum)* is a COSEWIC designated 'threatened' species. In partnership with other organizations such as the Leeds County Stewardship Council, SLINP is contributing towards their recovery. As a step towards the re-establishment of breeding peregrine falcons in the region, from 2001-2004, 15 chicks were released at Charleston Lake which is located approximately 30 kilometres from SLINP (www.peregrine-foundation.ca/tops/leeds.html). One hacking site was constructed on a high granite bluff at Charleston Lake and it is hoped that natural sites will soon become the choice of this species (Andress, 2004). A similar project initiated in the Bay of Fundy, New Brunswick has been met with success with released birds returning to the area to nest and raise their young (Richer, 2004).

The condition of the peregrine falcon is poor but is expected to improve due to the 15 introduced chicks. Success at the Bay of Fundy extends support to this claim.

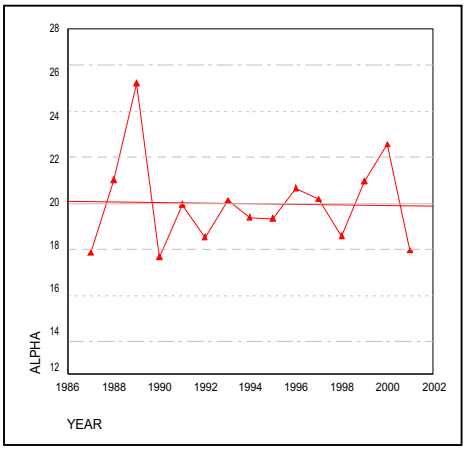
4.8.6.3 Grenadier Island Birds

Since 1983, winter and spring bird counts have been taking place at Grenadier Island to collect data regarding the type and number of bird species which reflect the status of a large selection of birds in the Thousand Islands area.

Six diversity measures were calculated using the data from 1986 to 2002 and the overall condition and trend of species diversity on Grenadier Island was found to be stable (Zorn, 2004). A threshold has yet to be developed. Charts 7 and 8 are two examples of the diversity measures which were calculated for

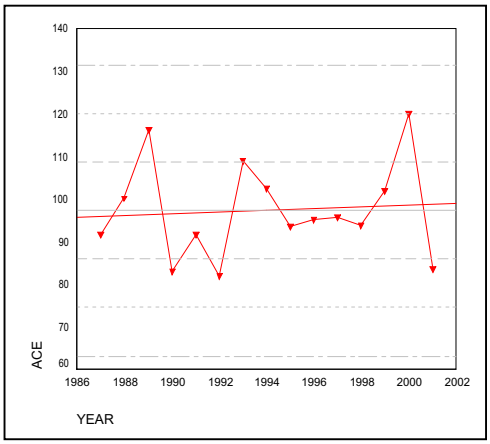
this measure. Between 1987 and 2001, the number of species recorded ranged from 74 to 104. It should be noted that the following COSWEIC designated species; least bittern, red shouldered hawk and cerulean warbler were observed three, four and eight times respectively between the 1986 to 2002 spring bird counts (Robinson, 2001).

Chart 8: ALPHA Diversity Measure; Richness and Number of Individuals



From: Zorn, 2004

Chart 9: ACE Diversity Measure; Species Species Richness sensitive to rare species



From: Zorn, 2004

Below is a summary table that indicates the condition and trend of the various species previously discussed. In general, the trend for reptiles and amphibians is rather bleak while birds are showing a trend of improvement due to very effective management actions.

Table 18: Summary of Species/Species Groups Considered for Assessment and the Associated Conditions and Trends

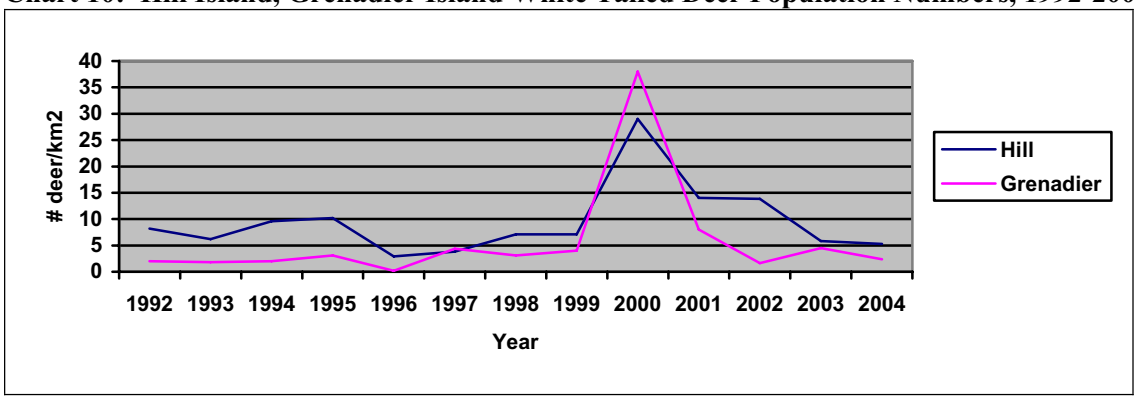
Species/Species Group	Condition	Trend
Herpetiles (excluding turtles)	Moderate	Deteriorating
Turtles	Poor	Deteriorating
Eastern Ratsnake	Poor	Deteriorating
Bull Frogs and Green Frogs	Good	Stable
Bald Eagles	Poor	Improving
Common Terns	Poor	Improving
Osprey	Moderate	Improving
Peregrine Falcon	Poor	Improving
Grenadier Island Birds	Good	Stable

4.8.6.4 Hyperabundant Species

White tailed deer are exerting strong grazing pressure on two of the park's island in particular (Hill Island and Grenadier Island). Deer surveys have been completed since the early 1970's to monitor changes in this species population numbers and their adverse effects on the islands ecosystems. Aerial surveys, browse/vegetation surveys and a limited number of road counts have been integral parts of this effort. White tailed deer are thriving on the islands because of abundant food sources, lack of natural predators and protection from hunters. Two deer per square kilometre is seen as a normal and healthy number and it is clear from the chart below that populations on Hill and Grenadier Island generally

exceed this. Studies have shown that excessive deer browsing has an affect on the overall community structure of forests; under-story vegetation such as woody plants is not able to grow above one or two metres (Patel and Rapport, 2000). Chart 9 illustrates the changes in population numbers between 1992 and 2004 (SLINP, 2004).

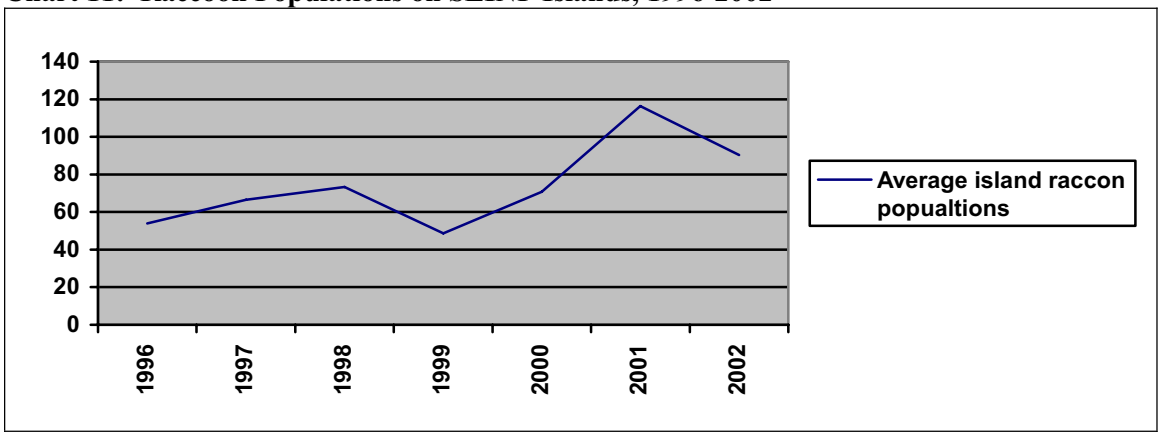
Chart 10: Hill Island, Grenadier Island White Tailed Deer Population Numbers, 1992-2004



from: SLINP, 2004

Raccoons are also a hyber abundant species on the park islands. They are a hazard to the visitors' safety and enjoyment of the islands and present the hazard of rabies to people and other wildlife. Raccoons also predate on turtle eggs which places an ominous threat on turtle hatchling success (Bradford, 2003). Chart 11 illustrates the overall island average between 1996 and 2002; please note that every value far exceeds the county average of 10 raccoons/km^2 .

Chart 11: Raccoon Populations on SLINP Islands, 1996-2002



from: Bradford, 2004

Summary of Condition of Biodiversity Measures

- SLINP is host to an extremely high diversity of herpetile species. Turtles are facing enormous amounts of stress from anthropogenic sources.
- A healthy predator prey relationship exists between the bull frog and green frog populations at SLINP. Both populations have stable numbers.
- Bald eagles, common terns, osprey and peregrine falcons in the TIE have the potential to strengthen their population numbers with adequate management actions. Grenadier Island birds are maintaining their diversity and numbers.
- Raccoon and deer populations on park islands currently exceed regional averages which is causing adverse effects to the natural environment and visitor enjoyment.

- **The condition of biodiversity within SLINP is fair but deteriorating. Species habituating outside of the park are facing larger levels of stress. Thresholds will be developed.**

- **Recommendation: Further development of this indicator and threshold values is required.**

4.9 EI INDICATOR: STEWARDSHIP

4.9.1 Measure: Engaging Canadians, SLINP Messaging

As outlined in the 2001 Engaging Canadians Strategy, informing, influencing and involving Canadians are important steps for Canadian National Parks. These steps will enable Canadians to learn about, appreciate and support the values, issues and challenges associated with their National Parks.

According to the Engaging Canadians document there are three external communication goals for Parks Canada employees.

1. To **raise awareness** of Parks Canada's systems of national parks, historic sites and national marine conservation areas (i.e. inform).
2. To foster **understanding and enjoyment** of individual heritage places, in ways that respect commemorative and ecological integrity (i.e. influence).
3. To strengthen emotional connections to and the **sense of ownership** of heritage places as important, distinguishing symbols of Canada and of our shared citizenship (i.e. involve).

The following sections will evaluate how effectively SLINP is meeting these three goals. Each section will briefly describe the general level of understanding and awareness that various audiences have with regards to Parks Canada, St. Lawrence Islands National Park and Species at Risk. This evaluation focuses on SLINP's communications with the Thousand Islands community, regional residents and park visitors. These audiences have been identified in the park's Social Science Research Strategy as priority markets.

4.9.1.1 Regional Residents Communications

Regional residents are comprised of private households in the area surrounding SLINP as outlined in the *Canadian's Perceptions of Parks Canada National Public Opinion Research 2002 for St. Lawrence Islands National Park.* Historically this group has not been a primary focus for SLINP but there has been a recent shift that has enabled staff to work more intensely with this group. The information that

follows reflects the success that SLINP has generated with regards to educating regional residents about Parks Canada and Species at Risk.

- General Awareness about the Purpose of Parks Canada

The opinions of the regional residents were obtained from the *Canadian's Perceptions of Parks Canada National Public Opinion Research 2002 for St. Lawrence Islands National Park.* The aim of the poll was to identify Canadians current beliefs and opinions of Parks Canada and its mandate.

The poll indicates that regional residents:

- Are unaware of the role of Parks Canada as a protector of National Parks and the environment
- Are concerned with the state of their National Parks and natural environment
- Trusted Parks Canada to give them information regarding National Parks and Historic Sites
- Were generally unaware of threats to National Parks
- Felt that enjoying nature with their friends and family was the primary reason for visiting National Parks
- Support protecting parks as long as it doesn't infringe on their park experience
- Thought that news, media, teachers and schools were the most influential with regards to developing attitudes towards the natural environment.

The information presented above indicates that regional residents have a low level of awareness, understanding and sense of ownership with regard to Parks Canada. They claim to value their National Parks, enjoy nature within the parks and trust the Parks Canada Agency to relay information to them. This indicates an opportunity to strengthen communications with this group and this has been outlined in the SSRS and the Communications Strategy.

- General Awareness about Species at Risk

During the summer of 2003, a SLINP Species at Risk Survey was distributed to random regional residents in the Thousand Islands Ecosystem. The information obtained from the survey enabled SLINP staff to understand the level of awareness residents have about SAR, if they were interested in learning more or becoming involved with the park's efforts and how they would like to be communicated with. This was a first step towards developing co-operative relationships with regional residents regarding SAR protection. The following summarizes the most relevant survey responses for this State of the Park Report.

The survey indicates that:

- 63% of respondents had not heard of the Species at Risk program
- 37% of respondents had heard of the SAR program
- Of the respondents who had heard of the SAR program:
  - 13% had heard a lot about the program
  - 62% claimed to have heard some
  - 25% hadn't heard very much

These survey results indicate that messages regarding Species at Risk are not being effectively communicated to this audience but also showed an excellent opportunity to further communications with regional residents as a large number of respondents indicated an interest in learning more about Species at Risk.

4.9.1.2 Park Visitor Communications

Educating park visitors about key SLINP and Parks Canada messages is an important responsibility of Heritage Presentation, Resource Conservation and Visitor Services staff members. Three surveys (Boater Survey-Summer 1998, Visitor (Mallorytown Landing) Survey-Summer 2000 and Boater Survey-Summer 2002) have provided SLINP staff with information regarding the success of SLINP messaging efforts. The results of the survey are as follows:

Table 19: Levels of Visitor Understanding Regarding SLINP Messages

	Complete Understanding (%)	Partial Understanding (%)	Inappropriate Understanding (%)
1998 Boater Survey[1]	0	16	84
2000 Visitor Survey[1]	2	60	38
2002 Boater Survey[1]	5	71	24

1-complete understanding=6 correct responses, partial understanding=3 to 5 correct responses, inappropriate understanding=<2 correct responses

The results from these three surveys suggest that messaging and education techniques at SLINP need to be enhanced. This is evident from the fact that less than 5% of all respondents from the 1998-2002 surveys, had a complete understanding of park messages. The 2003 Social Science Research Strategy and the 2004 Communications Strategy address this need by defining specific goals, techniques, messages and evaluation processes. These two documents will be discussed in an upcoming section.

Park visitors and regional residents do not have an adequate knowledge level regarding Parks Canada, St. Lawrence Islands National Park, Species at Risk and other ecological issues. Knowledge is key to understanding, appreciating and becoming involved in the protection of ecological integrity therefore, the current lack of knowledge is a threat to ecological integrity in the TIE and SLINP. The condition of communications with regional residents, and park visitors is poor. Communications are improving as a more focussed approach to target audiences and goal oriented communications is becoming more prominent at SLINP.

4.9.1.3 Thousand Islands Community Communications

The Thousand Islands Community is represented by local groups such as the Thousand Islands Association and the Canadian Thousand Islands Heritage Conservancy. Local media, local governments and other stakeholders are also included in this group. Although no method is currently in place to evaluate the effectiveness of the park's communications with this group, there are preliminary plans in place to initiate a recording system for park staff. Currently, SLINP has a wide range of stakeholders that the park communicates with.

4.9.2 Measure: Local Land Use/Public Involvement

The Thousand Islands Ecosystem is a complex patchwork of urban centres, agricultural land, protected area, crown land and privately owned property. Since such a small proportion of the TIE is under formal protection and private landowners have ownership of such a large amount of land, they play a crucial role as stewards in the region. Currently, only 120.4 km^2 (.02%) of land is protected within the 5000 km^2 TIE. Results suggest that the condition of this measure is poor because so little land is under

some form of protection. It can be speculated that this is a threat to the level of ecological integrity within the TIE because a large amount of land is privately owned and regional residents do not have adequate knowledge levels about ecological issues (as reflected in the previously discussed surveys). Community involvement and knowledge levels are predicted to improve over time with the guidance of the park Communications Strategy and Social Science Research Strategy, and the increasing integration of organizations efforts and outreach to private property owners. Thresholds to measure changes in local land use and public involvement will be developed.

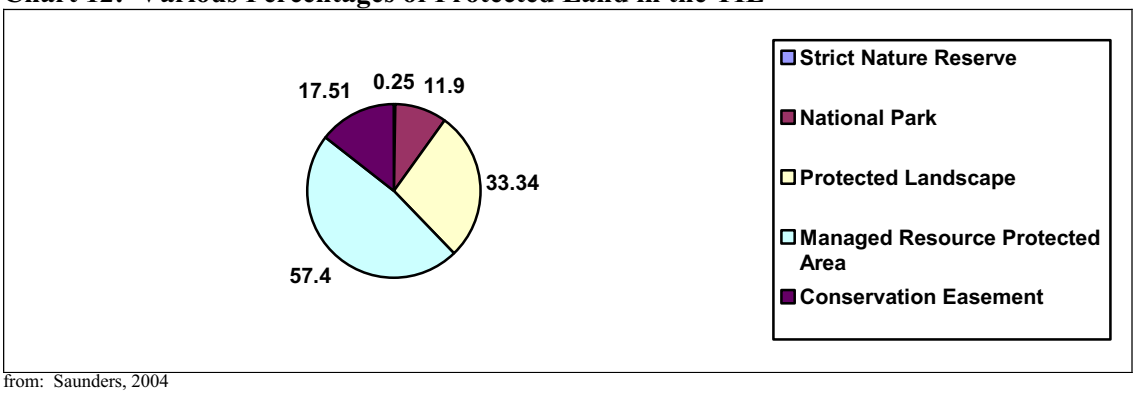
To organize the information relevant to this section, the United Nations Protected Area Management Categories were used. These are internationally recognized categories that deal sufficiently with public land under various levels of protection. Private lands such as those under conservation easement are not included in the UN categories therefore another category has been added to include this type of protection. For definitions of these land management types please see Appendix 3. Table 19 lists the amounts of various land types in the TIE.

Table 20: Protected Land in the TIE

Title	Amount of Land	Specific Properties
Strict Nature Reserve	.25 km^2	Queen's University Biological Station
Wilderness Area	0	N/A
National Park	11.9 km^2	St. Lawrence Islands National Park
Natural Monument	0	N/A
Habitat Species/Management Area	0	N/A
Protected Landscape	33.34 km^2	Charleston Lake Provincial Park, Cataraqui Region Conservation Authority
Managed Resource Protected Area	57.40 km^2	Rideau Canal, St. Lawrence Parks Commission, Thousand Islands Land Trust, Crown Land, Agreement Forest
Private Land Management Agreement/Conservation Easements*	17.51 km^2	Lost Bay Nature Reserve, Rideau Waterway Land Trust, Thousand Islands Land Trust, Canadian Thousand Islands Heritage Conservancy

*this category was added to include private land under various levels of protection. It is not included in the UN Categories.
From: Saunders, 2004

Chart 12: Various Percentages of Protected Land in the TIE[1]



from: Saunders, 2004

[1]The protected land types shown in this chart are the only UN Categories represented in the TIE.

Approximately 15% of the land protected in the TIE is due to the dedicated interests of individual private property owners. Organizations such as the Nature Conservancy of Canada, the Rideau Waterway Land Trust and the Canadian Thousand Islands Heritage Conservancy of Canada enable people to donate or partially manage property that is protected by strict regulations. Regional residents

in the areas adjacent to SLINP have also shown an increased interest in donating property to the park with the confidence that the land will be protected and preserved for future generations to enjoy.

4.9.3 Measure: Park Visitor Satisfaction

At St. Lawrence Islands National Park, services and facilities are offered at both the mainland and island properties. These locations host visitors who expect different experiences and opportunities for experiences therefore surveys are tailored to suit Boaters and Mallorytown Landing visitors. It is a Parks Canada goal that at least 50% of survey respondents be 'very satisfied' (5/5) with the service or facility being provided. The overall satisfaction of visitors can be assessed using four key variables (Joly, 2003). Value for Fee, Learning Experience, Recreational Experience and Communications (Staff Courtesy) are evaluated through the three SLINP surveys *(Boater Survey-Summer 1998, Visitor (Mallorytown Landing) Survey-Summer 200 and Boater Survey Summer 2002)*. The following tables highlight the four required variables and indicate whether SLINP is meeting the Parks Canada requirement of 50% satisfaction level.

a) Value of the Experience for the Fee Paid

	1/5 (least satisfied)	2/5	3/5	4/5	5/5 (most satisfied)	Exceeds 50% standard
1998 Boaters Survey	3	3	16	26	52	✓
2002 Boaters Survey	3	4	14	22	57	✓
2000 Visitors Survey	4	5	18	28	45	✗

b) Satisfaction with the Learning Opportunities Provided

	1/5 (least satisfied)	2/5	3/5	4/5	5/5 (most satisfied)	Exceeds 50% standard
1998 Boaters Survey	2	10	26	33	29	✗
2002 Boaters Survey	2	2	25	35	36	✗
2000 Visitors Survey	1	6	25	35	34	✗

c) Satisfaction with the Recreational Opportunities Provided

	1/5 (least satisfied)	2/5	3/5	4/5	5/5 (most satisfied)	Exceeds 50% standard
1998 Boaters Survey	0	1	7	23	69	✓
2002 Boaters Survey	1	1	8	19	71	✓
2000 Visitors Survey	1	0	4	18	77	✓

d) Communications

Satisfaction with the Level of Staff Courtesy Provided

	1/5 (least satisfied)	2/5	3/5	4/5	5/5 (most satisfied)	Exceeds 50% standard
1998 Boaters Survey	0	1	4	19	76	✓
2002 Boaters Survey	1	1	10	26	69	✓
2000 Visitors Survey	3	5	12	18	63	✓

Satisfaction with the Language of Choice Provided

	1/5 (least satisfied)	2/5	3/5	4/5	5/5 (most satisfied)	Exceeds 50% standard
2000 Visitors[1]	2	5	12	18	63	✓

1-2000 was the only year this data was collected

These tables indicate that the area of concern for SLINP visitor satisfaction is the quantity and/or quality of their learning opportunities. In all surveys, results showed that visitor satisfaction for this variable levels fell below the Parks Canada standard. The overall condition of this measure is stable and exceeds the 50% threshold with the exception of the Learning Opportunities component. The trend of each is expected to increase with the assistance of the Social Science Research Strategy and Communications Strategy.

4.9.4 Official Planning of the Township of Leeds and the Thousand Islands

The Township of Leeds and the Thousand Islands of which SLINP is a part began to review its Official Plan in 2002 and once approved it will be valid until 2023. St. Lawrence Islands National Park has been aggressively involved in the process and has contributed comments as a member of a larger group established by the Biosphere Reserve Network as well as providing independent comments on concerns specific to the park. The park Superintendent has also provided advice as a representative of SLINP. SLINP wants to see a township vision that reflects sustainable economic development and the natural values of the community in addition to an integration of cumulative impact assessment as a key principle of township management. The results of SLINP's involvement in the official plan review process may include the clear reflection of Parks Canada's mandate and values. The park is aiming to create an understanding for the Township that Parks Canada supports sustainable development and fully supports the core natural values of the community with regards to protected areas and quality of life. Table 21 presents information regarding the level of protection required for various natural heritage features in the Township of Leeds and the Thousand Islands. It should be noted that off shield, provincially significant wetlands and the habitat of endangered species are the only land types that are granted 'strict' levels of protection. This is a concern because all categories of land listed in the table are under varying levels of anthropogenic stress and require enhanced levels of protection to remain useable for wildlife and humans.

Table 21: Protection varies among categories of natural areas

Categories of Natural Areas				Protection is required through municipal Official Plans		Protection must be through other means	Authority/Information sources
				Strictly protected	Somewhat protected		
Natural Heritage Features	Wetlands	Provincially Significant	Off Shield	✓			Ontario Ministry of Natural Resources identifies wetlands and determines significance
			On Shield		✓		
		Locally Significant				✓	
	Woodlands	Significant	Off Shield		✓		Municipalities and others must make their own determination. The Eastern Ontario Natural Heritage Working Group report and the Eastern Ontario Model Forest are good sources of information.
			On Shield			✓	
		Not Significant				✓	
	Valleylands	Significant	Off Shield		✓		Municipalities and others must make their own determination.
			On Shield			✓	
		Not Significant				✓	
	Areas of Natural and Scientific Interest	Provincially Significant			✓		MNR identifies Areas of Natural and Scientific Interest and determines significance.
		Regionally Significant				✓	
	Habitat of endangered and threatened species			✓			MNR provides information to authorized users such as municipal planners.
	Fish habitat				✓		MNR and federal Fisheries and Oceans department identify fish habitat.
	Wildlife habitat	Significant			✓		Municipalities and others

		Not significant			✓	must make their own determination. MNR provides guidelines.
Lands adjacent to Significant Natural Heritage Features				✓	✓	Municipalities and others much make their own determination.
Other natural areas (not officially designated as Natural Heritage Features)					✓	Municipalities and others must make their own determination. Non-government conservation organizations are good sources of information.

from: Thousand Island Ecosystem Community Atlas 2004. Canadian Parks and Wilderness Society (CPAWS) Ottawa Valley Chapter.

4.9.5 SLINP Social Science Research Strategy and Communications Strategy

It is recognized that in order to fulfill Agency and park specific goals while working towards ecological integrity, effective relationships with external groups, individuals and agencies are required. The SLINP Social Science Research Strategy and Communications Strategy were developed between 2002 and 2004 to target specific communications goals while delivering relevant messages to target audiences in an effective and efficient manner. Park staff input was integral to the development of each document and the process of compiling each one enabled staff to identify communication based strengths, challenges and suggestions for improvement. The implementation of each document will result in meeting the objectives of the park, the Engaging Canadians Strategy, progressing towards the park vision and Parks Canada mandate.

Summary of Condition of Stewardship Measures

- Communications with park visitors, regional residents and the Thousand Islands Community require additional attention from SLINP staff.
- A very low percentage of land in the TIE is under some form of protection. Many organizations exist to encourage and enable private landowners to place their property under protection.
- Visitor satisfaction levels generally exceed the 50% Parks Canada standard. The exception is the Learning Opportunities variable.
- The park has been actively involved in the local township plan review process and as a result, the plan should reflect the park and communities core natural values.

- **The condition of stewardship is fair and improving as the park increases its profile and activities with its visitors and the community. The presence and work of other stakeholders in the area will also enhance the status of this measure.**

- **Recommendation: Implementation of the park Communication Strategy and Social Science Research Strategy will increase the profile of the parks Heritage Presentation program.**

5.0 EVALUATION OF MANAGEMENT ACTIONS

St. Lawrence Islands National Park is responsible for fulfilling all actions established in the 1998 Park Management Plan. The park has been making an increased effort to base all of its management decisions on sound science and this is resulting in situations that reflect an increased actual or potential level of EI within and beyond park boundaries. The management direction below was summarized from the 1998 Park Management Plan and the 2001 Ecological Integrity Statement.

Table 22: Summary of 1998 Park Management Plan and 2001 EIS Direction, Progress and Recommendations

Initiative: Manage to mitigate effects of fragmented habitat in SLINP and the TIE by recognizing local, regional and international contexts.		
Goal	**Progress**	**Recommendations**
• To strengthen existing partnerships and develop new ones.	• Co-operatively, SLINP and partners established the region under a UNESCO designation. • Various staff members are of Director or Executive status for UNESCO, Algonquin to Adirondack Conservation Association and the Canadian Thousand Islands Heritage Conservancy In addition to these organizations, SLINP has close ties with the Eastern Ontario Model Forest, OMNR, New York Department of Environmental Conservation, United States Fish and Wildlife Service, Department of Fisheries and Oceans, St. Lawrence Parks Commission and the Canadian Wildlife Service among others.	• Development and maintenance of American partnerships.
Initiative: Evaluate the parks ecosystem based on EI functions, structure and representivity.		
Goal	**Progress**	**Recommendations**
• To increase the quantity and quality of natural resource data for the park and TIE.	• SOLRIS partnership with OMNR is resulting in an increased information base.	• Development of conceptual habitat models for the TIE.
Initiative: Protection and restoration of unique landforms.		
Goal	**Progress**	**Recommendations**
• To use ecosystem restoration projects within the park as examples for partners and regional residents.	• Re-introduction of deer berry on Hill Island • Shoreline and wetland restoration at Mallorytown Landing • Red pine plantation management at Hill Island and Mallorytown Landing	• Communicate the methods and results of protection and restoration projects occuring at SLINP to partners and landowners. This will contribute to productive levels of land stewardship. • Increase the area of land with conservation protection.
Initiative: Management of vegetation by reviewing and where necessary, improving existing management plan and vegetation inventories.		
Goal	**Progress**	**Recommendations**
• To use ecosystem restoration projects within the park as examples for partners and regional residents.	• Prescribed burn on Hill Island. • In 2004, an integrated vegetation management plan began. • Fire management fuel and risk management mapping 2004. • Management of Oakworm infestation on Gordon Island was effective because of public awareness initiated by the park.	• Implement priorities upon Vegetation Management Plan approval.

Initiative: Management of wildlife in an effective and efficient manner.		
Goal	**Progress**	**Recommendations**
• Maintaining and increasing the level of native biodiversity in the TIE.	• Management of identified SAR in the park and the TIE. • Participation in two SAR recovery teams and major contributions to recovery plans and actions. • Significant progress has been made with respect to the identification of anthropogenic stresses and associated results on local turtle populations. • A Communications Strategy for land stewardship of SAR habitat has been established. • Recognition of hyoerabundant species and development and implementation of some mitigation techniques.	• Meet the parks SARA commitments to all Species at Risk in the TIE.
Initiative: Establish an Ecological Integrity monitoring program for input into the SOPR and park management decisions.		
Goal	**Progress**	**Recommendations**
• To evaluate the condition of biodiversity and habitat in the TIE.	• Establishment of 8 EI indicators common to all parks in the Greater Lakes Bio-region and associated measures specific to SLINP. • Baseline forest plots were established in 2004. • Development of a stress gradient for Limits of Acceptable Change in the park. • Threshold values for each measure identified in the SOPR are being developed. • A wetland monitoring component for the TIE is being developed.	• Develop index values for each EI indicator based on conceptual models and EI measures. • Re-assessment of the status of ecosystem stressors
Initiative: Monitoring activity impacts within the park and protecting and rehabilitating sensitive resources.		
Goal	**Progress**	**Recommendations**
• To use human access and enjoyment of the park and TIE as a means of protecting EI..	• A reduction of human footprint in the park (Endymion Island, West Grenadier Island and Gordon Island) to protect sensitive resources. • Use of HP communication services to educate park visitors and regional residents/visitors about EI. • Development of a Social Science Research Strategy to identify target markets. • Reduction of the trail grid within the park. • Completion of an island service and facility review and Zoning Audit. • Introduction of environmentally sound technologies such as composting toilets.	• Offer and promote sustainable visitor opportunities that provide an appropriate national park experience.

Summary of Management Actions Evaluation

- Park staff are fulfilling Resource Conservation management actions which is resulting in a more focused approach to protecting the park ecosystem and the TIE. Sound natural and social science is a key component of park infrastructure and visitor services decisions.
- The park is also adopting the role as a leader in conservation within the Thousand Islands Community. Partnerships through research, funding, communications and project development actions are increasing in quality and quantity.
- Communications with the Aboriginal Community is minimal and alternative methods need to be explored.

6.0 Conclusion

This report was the initial attempt by St. Lawrence Islands National Park staff to assess the state of ecological integrity within the park and where possible, the surrounding Thousand Islands Ecosystem. The information used was primarily baseline data and a focus of the park will be to establish thresholds to be used in the 2010 State of the Park Report. Data was obtained from Parks Canada's natural and social science programs and partner organizations also contributed significant amounts of information. St. Lawrence Islands National Park will remain dedicated to strengthening its collection, sharing, interpretation, presentation and evaluation of the data and information it obtains.

An evaluation of 7 ecological integrity indicators and their associated measures show that the condition of the park and the regional ecosystem is fair supporting a future trend of fragile stability. Of particular concern are human impacts including population, building and road densities outside of the park, terrestrial habitat change and the condition of biodiversity in the park and the TIE. A more aggressive approach to ecosystem management, stewardship and education must occur to assist the ecosystem in increasing its stability. Depending on the effectiveness of these approaches and specific actions and private landowners stewardship interests, the draft 2020 vision can be attained.

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APPENDIX A

Herpetile Species Found Within St. Lawrence Islands National Park

Yellow-spotted salamander	*Ambystoma maculatum*
Blue-spotted salamander	*Ambystoma lateerale*
Red-spotted newts/efts	*Notophthalmus*
Red-backed salamander	*Plethodon cinereus*
Four-toed salamander	*Hemidactylium scutatum*
American toad	*Bufu americanus*
Bullfrog	*Rana catesbeiana*
Green Frog	*rana clamitans*
Northern leopard Frog	*Rana pipiens*
Wood Frog	*Rana sylvatica*
Pickerel Frog	*Rana palvstris*
Eastern Grey Treefrog	*Hyla versicolour*
Midland Chorus Frog	*Psuedacris triserianta maculata*
Spring Peeper	*Psuedacris*
Snapping Turtle	*Chelydra serpentina*
Stinkpot Turtle	*Sternotherus odoratus*
Midland Painted Turtle	*Chrysemyspicta*
Northern Map Turtle	*Gratemys geographica*
Blandings Turtle	*Emys blandingii*
Five-lined Skink	*Eumeces fasciatus*
Eastern Garter Snake	*Thamnophis sirtalis*
Northern Ribbon Snake	*Thamnophis sauritus*
Northern Water Snake	*Nerodia sipedon*
Red-bellied Snake	*Storeria occipitomaculata*
Northern Brown Snake	*Storeria dekayi dekayi*
Smooth Green Snake	*Opheodrys vernalis*
Eastern Milk Snake	*Lampropeltis trangulum*
Ring-necked Snake	*Diadophis punctatus*
Black Rat Snake	*Elaphe obsolete*
Mudpuppy	*Necturus maculosus*

APPENDIX B

Definitions of the IUCN Protected Area Management Categories

Category	Description
1a. Strict Nature Reserve	Area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring.
1b. Wilderness Area	Large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.
II. National Park	Natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.
III. Natural Monument	Area containing one, or more, specific natural or natural/cultural feature which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance.
IV. Habitat/Species Management Area	Area of land and/or sea subject to active intervention for management purposed so as to ensure the maintenance of habitats and/or meet the requirements of specific species.
V. Protected Landscape/Seascape	Area of land, with coast and seas as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such as area.
VI. Managed Resource Protected Area	Area containing predominately unmodified natural systems, managed to ensure long-term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.
Conservation easement	Land is protected by restrictions monitored by a conservation group, the land owner continues to manage and own the property.

From: IUCN, 2004

APPENDIX C

Parks Canada Zoning System Summary

Zone Class	Zone Purpose	Public Opportunity
Special Preservation	-special areas or features which deserve special preservation because they contain or support unique, rare or endangered features or the best examples of features.	-usually no internal access, only strictly controlled and non-motorized access. Visitor appreciation and park research programs consistent with resource preservation.
II Wilderness	-extensive areas which are good representations of each of the natural history themes of the park and which will be maintained in a wilderness state	-internal access by non-motorized means. Dispersed activities providing experience consistent with resource preservation, primitive camping areas, primitive roofed accommodation including emergency shelters.
III Natural Environment	-areas that are maintained as natural environments and which can sustain, with a minimum of low-density outdoor activities with a minimum of related facilities	-internal access by non-motorized vehicles and limited motorized means, including in the north, authorized air charter access to river/lakes. Usually dispersed activities, with more concentrated activities associated with limited motorized access. Rustic, small scale permanent fixed roof and accommodation for visitor use and operational use. Camping facilities are to be to the semi-primitive level.
IV Recreational	-limited areas that can accommodate a broad range of education opportunities and related facilities in ways that respect the natural landscape and that are safe and convenient	-outdoor opportunities in natural landscapes or supported by facility development and landscape alteration. Camping facilities will be to the basic service category. Small and decentralized accommodation facilities.
V Park Services	-towns and visitor centres in certain existing national parks which contain a concentration of visitor services and support facilities as well as park administration functions.	-internal access by non-motorized and motorized means. Centralized visitor support services and park administration activities. Facility based opportunites. Major camping areas adjacent to, or, within, a town or visitor centre to the basic serviced category, town or visitor centre.

From: 1998 Park Management Plan