



Annual Report of Research and Monitoring in the Greater Kejimikujik Ecosystem 2010



Parks Canada Parcs Canada

Canada



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Cover photos from top left:

- Floating Red maple leaf by A. Lavers, MTRI
- Out in the canoe by B. Caverhill, MTRI
- Blanding's turtle hatchlings by J. Kinley, MTRI
- American beech trees by J. Kinley, MTRI
- Great black-back gull in flight by J. Kinley, MTRI



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Annual Report of Research and Monitoring in the Greater Kejimikujik Ecosystem 2010

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This is the sixth Annual Report of Research and Monitoring in the Greater Kejimkujik Ecosystem. As with previous editions, this one was inspired by a very similar series piloted by the Parks Canada Western Arctic Field Unit. This report serves as a compilation of the research and monitoring projects that were conducted in the Kejimkujik area. The summaries are all written by the researchers who are listed as contacts for each project but the report as a whole is a collaborative effort between Kejimkujik National Park and National Historic Site of Canada (Kejimkujik) and the Mersey Tobeatic Research Institute (MTRI). Many thanks to all the researchers who took the time to submit the research and monitoring project summaries this year.

This report was produced in fall 2011 and is a compilation of the research and monitoring projects that were conducted in the Kejimkujik area in 2010 by Parks Canada, MTRI, and their partners. The purpose of the report is to make information about these projects available to the public, government agencies, researchers and other stakeholders.

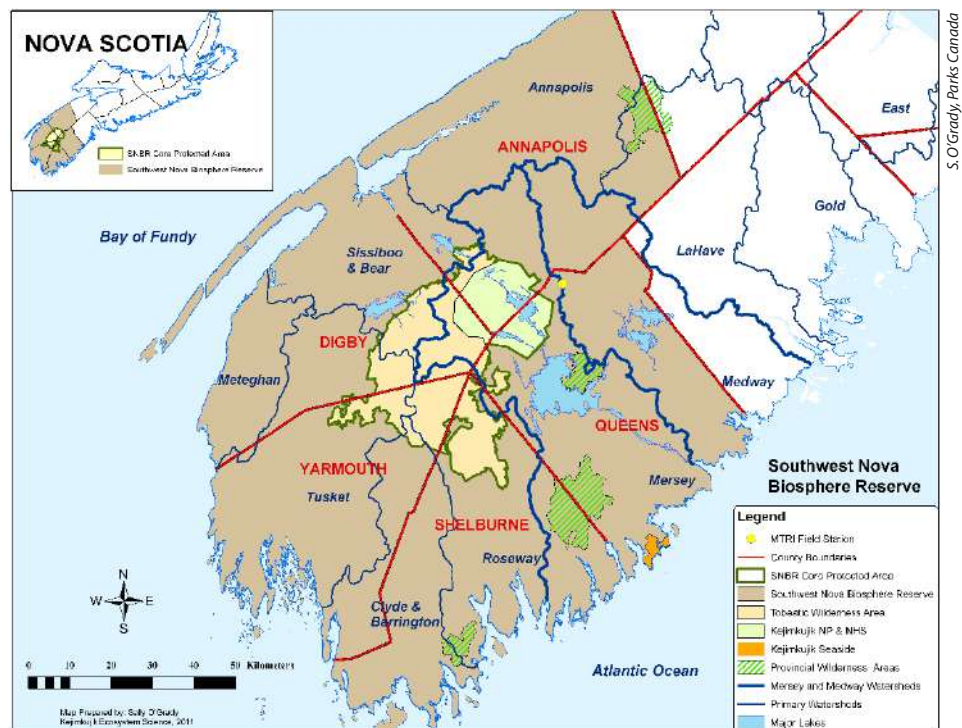
Research and monitoring projects provide the information necessary to make wise management and conservation decisions. The projects in this report are organized in four chapters corresponding to Kejimkujik's Indicator Ecosystems: Coastal, Forest, Wetland, and Freshwater, with an additional chapter highlighting research about the Human Dimensions of sustainable resource use. Projects are categorized as either monitoring or research projects.

The research and monitoring projects detailed in this report are important tools for attaining sustainable management of our natural resources and maintaining ecological integrity of our protected areas. The monitoring projects are conducted to keep track of how the ecological systems around us are changing over time and examine the effectiveness of management actions. The research projects provide a better understanding of the ecology of the area and how it is affected by natural and human-related influences. Overall, they indicate an impressive amount of work that is being undertaken in Kejimikujik and the surrounding area.

Kejimikujik represents the Atlantic Upland Natural Region in Parks Canada's network of protected areas. Kejimikujik consists of 381 km² inland and 22 km² on the coast and, in combination with the Tobeatic, is the core area of the Southwest Nova Biosphere Reserve. Since its establishment, Kejimikujik has been an important centre of science for southwest Nova Scotia. In collaboration with partners, research and monitoring in the park and surrounding landscape has informed decision-makers on a number of management issues at local, regional and national scales. Kejimikujik was declared the first Ecological Monitoring and Assessment Network site in Canada (1993) and was the first in Canada to install a Smithsonian Institution Monitoring and Assessment of Biodiversity plot (1994). Kejimikujik also serves as one of five core Canadian Acid Precipitation Monitoring Network sites that monitor the long-range transport of air pollutants and is a long-term climate monitoring station for Environment Canada. In 1995, Kejimikujik was designated a National Historic Site (the only national park in Canada with this dual designation) highlighting the cultural significance of the area and the importance of aboriginal peoples to understanding and presenting commemorative integrity. Kejimikujik is identified by the Parks Canada Agency as a species at risk priority site where stewardship and recovery are paramount. More information about Kejimikujik can be found at www.pc.gc.ca/pn-np/ns/kejimikujik or at the Friends of Keji Cooperative Association website (www.friendsofkeji.ns.ca).

The Mersey Tobeatic Research Institute (MTRI) is a non-profit co-operative with a mission to advance collaborative research, monitoring, and management that promotes sustainable use of resources and biodiversity conservation in the Southwest Nova Biosphere Reserve. MTRI maintains a field station that provides office workspace, accommodation for researchers, space for public presentations and a site for learning. MTRI provides expertise in the community and coordinates research and monitoring projects to address the goal of sustainable resource management. MTRI also provides an important link from research to the public through an active outreach and education program. More information about the co-operative is available at www.merseytobeatic.ca.

The Southwest Nova Biosphere Reserve (SNBR) comprises a large portion of terrestrial and coastal southwestern Nova Scotia (see map below). The United Nations Educational, Scientific and Cultural Organization (UNESCO) internationally recognizes a biosphere reserve as an area in the world that is deemed to demonstrate a “balanced relationship between humans and the biosphere.” Biosphere reserves around the world fulfill the following three functions: conservation, sustainable development, and capacity building. Collaborative efforts among people in the designated area promote the sustainability of local economies and communities, as well as the conservation of the ecosystems. A biosphere reserve is also a mechanism used for regional planning and multi-sector collaboration. It offers an opportunity for the community to envision sustainability for the region and to work towards achieving it. In 1999, a group of volunteers from Queens and Annapolis counties in Nova Scotia developed a proposal for the establishment of a UNESCO Biosphere Reserve incorporating Kejimikujik and the Tobeatic as the core protected area. This group of volunteers later became incorporated as the Southwest Nova Biosphere Reserve Association (SNBRA). In September 2001, the nomination document received approval and the region of southwest Nova Scotia was designated a biosphere reserve by UNESCO.



Kejimikujik and Tobeatic comprise the core area of the Southwest Nova Biosphere Reserve.

Photos on page 9

Clockwise from top left:

- Piping plover chick by J. Chardine
- Flock of seabirds by J. Kinley, MTRI
- Small green crab on eelgrass by O. Woods
- Clouds reflection in salty sand by J. Kinley, MTRI
- Waves crashing on White Point Beach by B. Caverhill, MTRI



COASTAL



Rationale

Eelgrass is the dominant seagrass species in Atlantic Canada. Eelgrass performs important ecological services in nearshore waters and is often referred to as a 'keystone species' due to its ability to enhance biodiversity and productivity. Eelgrass beds provide nursery habitat for juvenile stages of fish and invertebrates and are important feeding habitat for migrating waterfowl. The primary production of eelgrass beds and their associated epiphytic community exceeds that of many cultivated terrestrial systems. These habitats play an important role as biological filters, sediment stabilizers, exporters of organic matter to subsidize productivity of other coastal ecosystems and as valuable carbon sinks. Declines in eelgrass can precipitate cascading ecosystem effects and a loss of valuable ecological services.



Eelgrass bed at Basin Lake 2007

OBJECTIVES

- To monitor temporal trends in eelgrass extent and condition.
- To assess whether these changes are within the normal range of variation expected for eelgrass beds.
- To provide insight into the causes and ecological consequences of these changes.
- To assess whether the observed changes necessitate a management response.

METHODS

- Suitable eelgrass habitat at St. Catherine's River and Little Port Joli Estuaries are identified annually by canoe to determine the presence of eelgrass beds. The extents of each discrete bed are mapped by a swim survey using a mask and snorkel. The surveyor carries a GPS unit with a track function to record locations for later mapping and area determination.
- The SeagrassNet monitoring protocol is used which is based on population and shoot-based measures of seagrass condition, as well as important ancillary variables such as grazing, epiphyte loading, wasting disease and water quality variables.

RESULTS

- Eelgrass extents at Kejimikujik Seaside continued to decline in 2010. Only 1.3% of the original eelgrass distribution (1987 benchmark) in both estuaries remains. Eelgrass has been absent from St. Catherine's River Estuary since 2001.
- Eelgrass condition assessments indicate serious concerns. Shoot density is declining and wasting disease is present in the remaining bed. Thick growths of the opportunistic filamentous brown algae *Pilayella littoralis* were noted along with dense mats of filamentous green algae *Enteromorpha intestinalis*. Grazing effects were minimal, but shoots with macerated ends or intact roots make up most of the floatsam in Basin Lake in the northern reaches of Little Port Joli Estuary, where the last remaining eelgrass beds at Kejimikujik exist.



O. Woods and M. Symington

Seaslug in eelgrass

Monitoring

EELGRASS COASTAL MONITORING AND RECOVERY

RESULTS

Continued



C. Benoit

Surveyors conducting eelgrass surveys

YEARS OF DATA

High numbers of Green crabs exist in the estuary, consistent with the amount of shredded and uprooted eelgrass shoots. A control program was initiated in 2010 to control numbers to mitigate effects on eelgrass.

- Lagoon water quality analysis indicates that natural nutrient enrichment occurs in some areas of the lagoon. When compared to an index range and optima for eelgrass growth, mean salinity and sediment type both fall within the optima. The minimum salinity measured in Basin Lake (five parts per thousand) falls outside the optima for eelgrass growth, but is still within the range. Mean temperatures for July and August measured at the shallow and deep eelgrass transects exceeded the optimum for eelgrass growth, while maximum temperatures greatly exceeded the optimum but still fell within the range of suitable conditions for eelgrass growth.
- Future monitoring will assess the success of green crab mitigations on eelgrass recovery.

PARTNERS



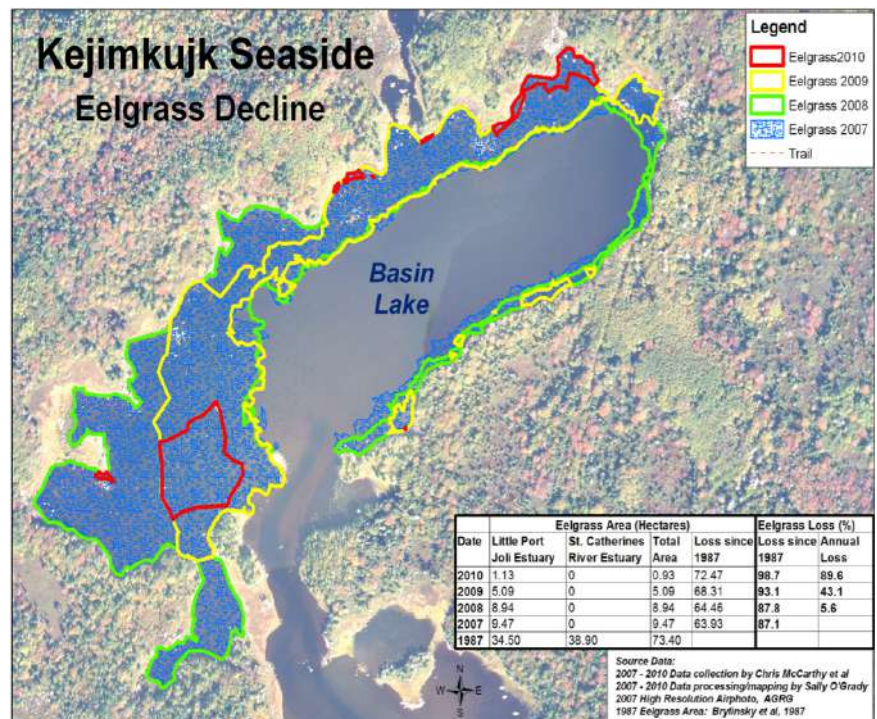
O. Woods

Green crab on eelgrass

- Ongoing since 2007
- Initial survey in 1987
- School for Resource and Environmental Studies, Dalhousie University
- Fisheries and Oceans Canada Gulf Region
- Bedford Institute of Oceanography
- Harrison Lewis Centre

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Remaining eelgrass at Kejimikujik Seaside found at Basin Lake at the northern extreme of Little Port Joli Estuary



Rationale

Coastal marine systems world-wide are threatened by invasions of non-native species. The European green crab is a highly invasive species present along the Nova Scotian coastline. Several studies have shown the green crab to be an 'ecosystem engineer', having significant predation impacts on local species such as soft-shell clams, blue mussels and causing the physical destruction of eelgrass beds. This project is investigating green crab population dynamics, relative influences on native habitats and developing a reduction and monitoring program to help address management and restoration considerations.

Q. Woods and M. Symington



Small green crab on eelgrass

Monitoring

EUROPEAN GREEN CRAB COASTAL MONITORING

OBJECTIVES

- To determine whether physical removal can be effective and sustainable in green crab control at Kejimikujik estuaries.
- To conduct green crab removal operations to prescribed catch per unit effort rates to control impacts on native species.
- In combination with other research and monitoring projects, to assess the ecological consequences of green crab activities in Kejimikujik ecosystems.
- To use this information to assess management effectiveness response in restoring impaired coastal habitats.
- To involve harvesters and the public in restoration activities.
- To determine population structure, distribution and relative density characteristics.

METHODS

- Different sampling techniques and protocols were explored to assess monitoring and removal efficiencies. Trapping was determined to be the most effective method of control and ecological integrity (EI) monitoring. Two types of traps were used: modified eel traps to provide standardized monitoring, and modified shrimp traps developed with local fishing expertise to accomplish larger scale green crab removal.
- Individual (green crab) morphological data is recorded for all individuals captured through EI monitoring. All by-catch and other pertinent data were recorded.
- All crabs captured during removals were sexed and a daily sample of fifty randomly selected crabs was taken to compare sex ratios.

RESULTS

- Trapping results indicated that green crab was more prevalent in soft bottomed channels.
- Monitoring at St. Catherine's and part of Little Port Joli indicated similar densities in both estuaries where removals did not occur.
- In 2010, more than 187,000 green crabs were removed from the upper Little Port Joli Estuary. Size, sex ratios, distribution and trap location efficiencies have been determined. The

K. Duravitch



Green crab fishers comparing catches

RESULTS

Continued



W. Richard, Parks Canada

Laughing gull in a crate of culled green crabs

YEARS OF DATA

PARTNERS



O. Woods and M. Symington

European green crab

proportion of larger males declined in areas where the greatest number of removals occurred. El monitoring at Basin Lake, in the upper reaches of Little Port Joli Estuary indicates reduction efforts were effective in reducing numbers to prescribed catch rates to allow for ecosystem recovery.

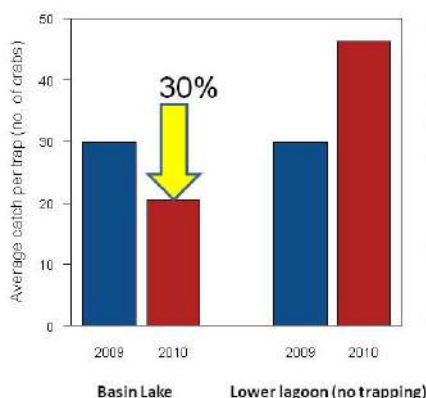
- Average catch per unit effort in Basin Lake was decreased by 30%, and biomass was decreased by 43%.
- General knowledge was gained on more effective fishing techniques including amounts of bait to use, fishing hotspots and how often to pull traps to gain maximum efficiencies.
- A good correlation ($r = .89$) was obtained between percentages of males in sample 50 counts and total daily counts. This will save time in that not all captured crabs will need to be sexed in future removal operations.
- Options for positive use of culled invasives were investigated including use as lobster bait, fertilizer and composting.

- On going since 2008

- Dalhousie University
- Fisheries and Oceans Canada Gulf Region
- Bedford Institute of Oceanography

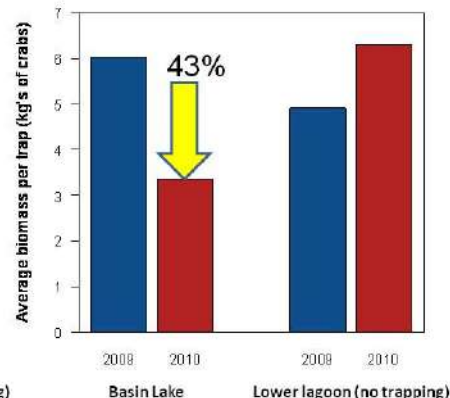
Change in Average Catch per Trap

Little Port Joli Estuary Removals database



Change in Average Biomass

Little Port Joli Estuary Removals database



C. McCarthy, Parks Canada

Green crab reduction at Basin Lake compared to the rest of the Little Port Joli estuary (no intensive removal fishing)

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Rationale

The Piping plover is a small shorebird that has been listed as an Endangered species by the Committee on the Status of Endangered Species in Canada since 1985. Piping plovers nest on white sandy beaches including St. Catherine's River Beach at the Kejimikujik Seaside. In recent years, the number of nesting pairs of Piping plovers in the province has decreased significantly due to habitat disturbance, loss and fragmentation, predation, and development of over-wintering grounds. The Piping plover is often referred to as a management dependent species, as sustained management actions are needed to maintain and increase population levels. Park staff have monitored plover adults and chicks within the park since 1985 to assess Piping plover population levels at the Kejimikujik Seaside (and southwest Nova) and to implement a suite of management strategies focused on protecting and sustaining plover numbers.

M. Crowley, Parks Canada



Piping plover

Monitoring

PIPING PLOVER MONITORING PROGRAM

OBJECTIVES

- To monitor the number of breeding pairs of Piping plover and their productivity (number of chicks fledged per pair).
- To monitor the extent of suitable nesting habitat for Piping plovers in Kejimikujik and restore a portion of nesting habitat on St. Catherine's River Beach.
- To take part in a multi-park remote camera project by examining predation and abandonment of nests through deployment of a digital video recorders.
- To note predators or signs of predators on St. Catherine's River Beach.

METHODS

- Park staff and volunteers monitored St. Catherine's River Beach frequently during Piping plover nesting season. This was done at a distance with binoculars and spotting scopes. Other birds and animals, particularly predators, were also noted.
- Park staff worked beyond boundary with the Bird Studies Canada team to assist in monitoring at Ragged Harbour and other beaches.
- Nest, chick and habitat observations were recorded. Nests were located by observing territorial birds and individuals exhibiting nesting behaviours.
- After a minimum of three eggs were laid (of four in a full clutch) nests were numbered and georeferenced.
- A remote camera was deployed on nests with four eggs to monitor potential predation and reasons for nest abandonment.
- Plover habitat was restored on one section of St. Catherine's River Beach, through removal of marram grass by hand.

RESULTS

- Three pairs of Piping plovers were observed at St. Catherine's River Beach. Two of these pairs nested successfully, fledging three and four chicks respectively.
- The third pair had two nest attempts; predation was suspected for the first nest and confirmed for the second by an American crow (captured on the remote camera).
- No exclosures were used on the nests this year and cameras were deployed on all three nests. In addition to capturing the



D. Smith, Parks Canada

Piping plover monitoring

RESULTS

Continued

YEARS OF DATA

PARTNERS

predation event, there is also footage of the two nests hatching (view at www.pipingplover.landandwater.ca).

- Volunteers assisted with habitat restoration at the main restoration site at the tip of St. Catherine's River Beach. Additionally, baseline data was set up to enable monitoring of suitable habitat over time.
- More than 50 volunteers contributed 300 hours to Piping plover recovery and stewardship efforts including monitoring, beach clean-up and habitat restoration efforts.
- Weekly interpretation programs provided a glimpse into the life of Piping plovers and an invitation to help with monitoring. Outreach education was done regularly through partnership with White Point Beach Resort.

- Ongoing project since 1985

- Parks Canada
- Piping Plover Recovery Team (Eastern Canada)
- Bird Studies Canada
- Environment Canada
- Province of Nova Scotia



M. Crowley, Parks Canada

St. Catherine's River Beach



M. Crowley, Parks Canada

A remote camera filming a plover nest



Parks Canada

Predation of a plover nest by an American crow was captured on one of the remote cameras

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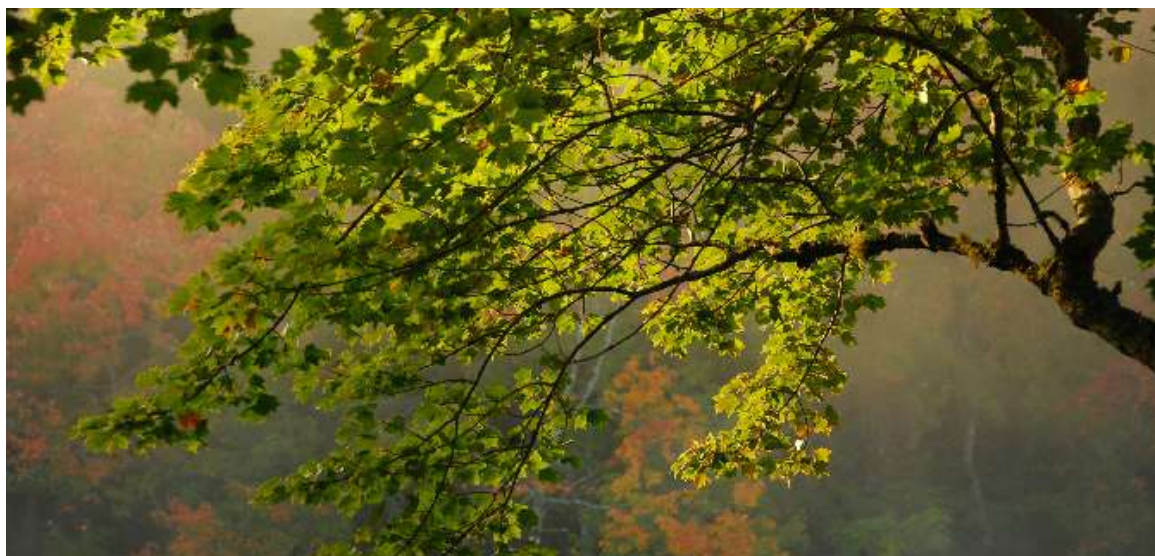


D. Smith, Parks Canada

Volunteers helping with habitat restoration

Photos on page 17 Clockwise from top left:

- Sugar maple by B. Caverhill, MTRI
- Cinnamon fern by A. Lavers, MTRI
- Eastern hemlock by A. Belliveau, MTRI
- Mushrooms growing out of a dead Balsam fir by J. Kinley, MTRI



FOREST



Rationale

Red oak trees play a significant role in the Acadian Forest, providing both food and shelter for a diversity of wildlife. Monitoring Red oak at study plots in Kejimikujik over the past few years have shown poor levels of regeneration. Some of the contributing factors to the disturbance of Red oak in the Acadian forest may include past forestry practices and suppression of forest fires. Other contributing factors that may have altered Red oak regeneration and distribution also include browsing by White-tailed deer, acorn predation and stress from defoliators. The purpose of this work is to assess the health of mixedwood stands with Red oak and to determine appropriate sites for Red oak regeneration experiments both inside and outside Kejimikujik. These proposed experiments will help build a better understanding of management techniques to be used in Kejimikujik and other parts of the Acadian forest.



Freshly fallen Red oak acorns

Research

RED OAK REGENERATION IN MIXEDWOOD STANDS

OBJECTIVES

- To collect data to determine appropriate sites for Red oak regeneration experiments inside and outside Kejimikujik.
- To set up White-tailed deer exclosures to protect Red oak seedlings and saplings from browsing.
- To monitor Red oak regeneration over a 10-year period within the deer exclosures and determine the impact of White-tailed deer on Red oak regeneration.
- To assess the damage inflicted on mature Red oak by the Oak leaf shredder and Oak leaf roller.
- To monitor previously determined areas by completing Red oak transects and Forest Ecosystem Classification (FEC) plots.

METHODS

- Trained researchers completed FEC vegetation and soil plots. This involved digging soil pits, completing species inventories for 10 x 10 m transects and estimating canopy cover by each tree species.
- Trained researchers completed transect surveys using a belt transect of 150 x 2 m covering 300 m² to quantify Red oak regeneration.
- Red oak defoliation was estimated visually.
- Three deer exclosures measuring 2 m x 2 m were erected in the centre of randomly selected quadrats within each site.

RESULTS

- Eighteen White-tailed deer exclosures were erected at four different sites; two inside Kejimikujik (Big Dam and Loon Lake), and two outside (Grassy Lake and Rossignol Lake).
- Fifteen FEC plots were measured, four outside Kejimikujik and eleven inside (including one conducted at the prescribed burn site at Big Dam). For all sites, vegetation and soil classes were determined.
- There was a significant decrease in White pine, Red spruce, and Witch hazel at the study plots in 2010 after the prescribed burn.
- Mature Red oak experienced an average of 39% defoliation at study sites.

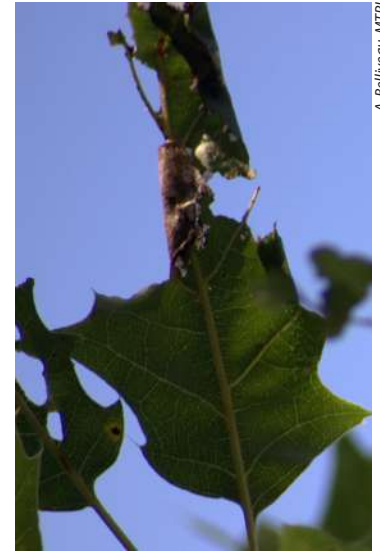
YEARS OF DATA

PARTNERS

- Year 5 of an ongoing project
- Mersey Tobeatic Research Institute
- Parks Canada
- Nova Scotia Community College
- Nova Scotia Department of Natural Resources
- Nova Scotia Department of Economic Development
- Service Canada



Oak leaf shredder damage to a Red oak



Oak leaf roller damage to a Red oak



Paul Hebert and Alicia Pray-Leslie erecting a deer enclosure

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Rationale

According to the Forest Stewardship Council's (FSC) ninth principle, an assessment to determine the presence of the high conservation value forests must be completed. After obtaining the FSC certification in early 2010, Bowater Mersey Paper Company contracted MTRI to locate and score old growth forests in their Medway District. This information will be used for the purpose of certification, for preserving such conservation value forests, and for use in future management operations in this Medway District.

Research

OLD FORESTS IN MEDWAY DISTRICT



Wild lily-of-the-valley in stair step moss near McVickers Lake



Yellow birch near George's Lake

OBJECTIVES

- Assess as many potential old growth stands as possible using Nova Scotia Department of Natural Resources (NSDNR) old growth scoring methodology, with guidance from previous maps and past timber cruising groundwork conducted by Bowater.
- Collect information pertinent to high conservation value forests such as tree species and age, wildlife and rare species.
- Gather basic information for sites of other unstudied old growth forests observed on the ground and reported by community members.
- Analyze data to determine typical old growth forest attributes for this district.

METHODS

- Locations of previously examined potential old growth stands in the Medway District were provided by Bowater.
- At each site, sample points were selected where tree species, age, height and coarse woody debris volumes were measured using NSDNR's Old Forest Score sheet.
- The NSDNR forest score ranks age by measuring three trees per site, or plot, and averaging nine trees per stand. All trees are tallied with a prism sweep, divided into three groups according to diameter size, and the smallest tree among the trees in the largest third was chosen.
- All data were analysed using NSDNR's Old Forest scoring system to determine a score out of 100 which can be compared to other old forest sites measured using the same protocol.

RESULTS

- Sixty-eight sites were scored representing 22 old forest stands totaling 216 hectares.
- Twenty-one stands were hemlock dominated, one was black spruce dominated.
- Average score for all sites was 81%, the lowest component

RESULTS

Continued

YEARS OF DATA

PARTNERS

score being deadwood which averaged 5.75 of a possible 15 for the 22 sites.

- Average age for all sites was 215 years.
- Approximately 40% of all stands had Tessellated rattlesnake plantain, a plant indicating thin-soiled coniferous forests; these plants were often nestled in a thick moss cover.
- Eight sites remain unverified, with approximately 12 new sites identified for further research.

- Single year project

- Mersey Tobeatic Research Institute
- Bowater Mersey Paper Company Ltd
- Nova Scotia Department of Natural Resources



A. Belliveau, MTRI

Fungi growing out of a Eastern hemlock near Birch Lake

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www.merseytobeatic.ca



A. Belliveau, MTRI

Researcher taking a core sample of a Eastern hemlock tree near McVickers Lake



A. Belliveau, MTRI

Tolerant hardwood stand near George's Lake

Rationale

One of the roles of the Forest Health Group within Nova Scotia Department of Natural Resources (NSDNR) is to monitor, assess, and record the damage caused by forest insects and diseases to the forest resource. In 2004, aerial surveys detected defoliation and mortality caused by the native Jack pine budworm in mature stands of White pine throughout the Southwest Nova Biosphere Reserve. The damage generated concern among forest managers because this was the first record of this pest causing damage to the forest of Nova Scotia. In Nova Scotia, the Jack pine budworm is unique in that it is feeding specifically on mature White pine rather than its usual host, Jack pine, which is its preferred host in other regions of Canada and the United States.



Jack pine budworm larva exposed in feeding chamber



Overwintering larvae extraction procedure

Research

JACK PINE BUDWORM POPULATION ASSESSMENT

OBJECTIVES

- To detect locations of defoliation, determine the size of the outbreak, and record the severity of the damage using aerial surveys.
- To assess the effectiveness of pheromone traps to collect male moths and to detect building populations.
- To determine overwintering larval (L2) population levels.
- To develop and test different lure formulas which may be more efficient than the one available now.

METHODS

- Two observers flew flight lines 10 km apart at an altitude of approximately 500 m. Locations with defoliation were mapped into polygons using ArcPad software. The extent of the damage was also recorded for each polygon using a severity rating of light, moderate or severe.
- Pheromone traps were hung in June and July to capture male moths to provide an indication of a build-up of moths in a particular area, to predict a possible outbreak in the future.
- In late fall we collected three branch samples from different trees, each 60 cm long, from select locations where the pheromone traps were located. These were washed in a 1% solution of sodium hydroxide for two hours then filtered to extract the overwintering larvae. These larvae were counted to assess population levels at each of the sample points.
- To test lure effectiveness, six traps were set, each containing a different lure, and one control trap containing no lure, at three different locations where Jack pine budworm had been causing defoliation in 2009.



Pheromone trap

NSDNR

RESULTS

- No new defoliation or recently dead trees were detected this year, the first time since 2004.
- Fifty pheromone traps were placed in mature White pine stands in June and July and 45 were returned. Sixteen were positive; catches ranged from one to five moths per trap.
- Fifteen samples were collected to determine the presence of overwintering larvae (L2) and were processed in the lab with no larvae found.

YEARS OF DATA

- Ongoing project since 2004.

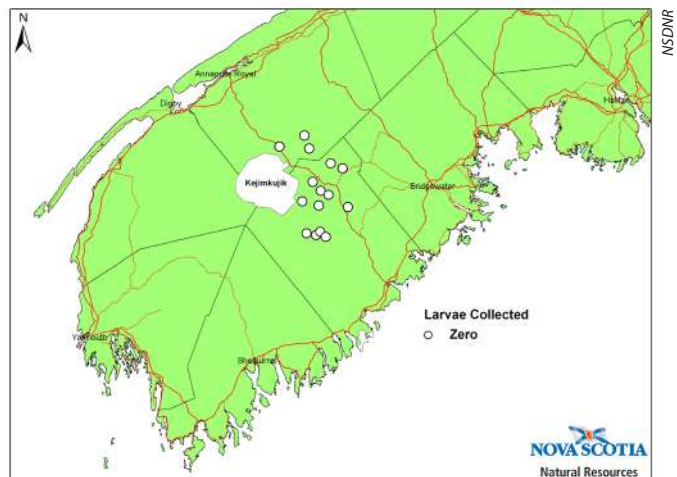
PARTNERS

- Nova Scotia Department of Natural Resources
- Canadian Forest Service - Atlantic



MTRI

Pine Lake mortality and damage in 2006



NSDNR

Jack pine budworm trap catches in 2010

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Rationale

Since the important decline of the moose in mainland Nova Scotia, the White-tailed deer, a naturalized species, became one of the major herbivore affecting Kejimikujik forest ecosystems. Through its selective browsing on certain species of wildflowers, shrubs and trees, it can have extensive influence on the forest community composition and structure. Significant increases in deer populations may result in increased pressure through over browsing. Alternatively, a decrease in local White-tailed deer abundance could also result in ecosystem change since deer are important prey for top predators such as coyote and bobcat. White-tailed deer is also a game species and changes in deer population may provide information about hunting pressure outside the park and the effectiveness of enforcement at Kejimikujik.



Young buck browsing along park roadside

OBJECTIVES

- To monitor and assess changes in the population of White-tailed deer at Kejimikujik.
- To determine if the mean number of White-tailed deer observed per day at Kejimikujik (as assessed by the roadside population) is within the range of natural variation (*i.e.* between 1.39-5.89, as determined through analysis of data between 1987-2007) and if it has increased or decreased over time.

METHODS

- White-tailed deer have been monitored at Kejimikujik since 1976 through an annual roadside count, which was conducted each day in October along the Main Parkway and portions of Jeremys Bay Campground. The number, age class, and sex of observed deer were recorded.
- The sampling framework for this project represents only the roadside population of White-tailed deer at Kejimikujik.
- White-tailed deer roadside count data between 1987 and 2010 were analyzed to detect trends over time. A linear model was used to assess whether the slope of the temporal variable was significantly different from zero. The period from 1987 to present is presumed to reflect a stable population level for this region in the current conditions and was used for the assessment period for trend analysis.
- The status of White-tailed deer at Kejimikujik was also examined by comparing recent data to established thresholds. Thresholds for White-tailed deer abundance at Kejimikujik were developed based on statistical variability in the annual mean of deer counted per day in the roadside survey at Kejimikujik between 1987 and 2007. To assess status, the linear model from the trend assessment was used to generate a point estimate (with associated error) of the measure for the most recent year, which was then compared to the established thresholds.



Rick Brunt, conducting a deer survey

Monitoring

WHITE-TAILED DEER ABUNDANCE

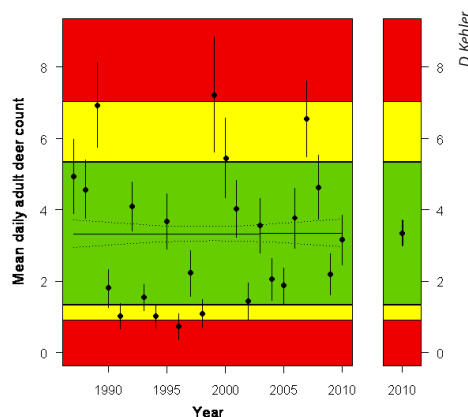
RESULTS

- The current status of White-tailed deer at Kejimikujik was found to be good and the trend stable, meaning that White-tailed deer abundance is at a level that is considered to be within the suitable range of abundance, low enough to not significantly impact forest ecosystem structure, but high enough to support top-predator populations in the region.
- Detailed research, however, is needed to better understand the carrying capacity of White-tailed deer at Kejimikujik, to improve monitoring thresholds and inform future management needs.
- When looking at the proportion of adult female, adult male and fawn from the total number of deer counted during the survey between 1987 and 2010, it seems that the three categories remained stable over time. None of the simple regressions done on untransformed data between time (year) and the % of adult female, male and fawn were significant. The stable trend observed over time is not the result of one group taking more importance than another group, over the last 23 years.

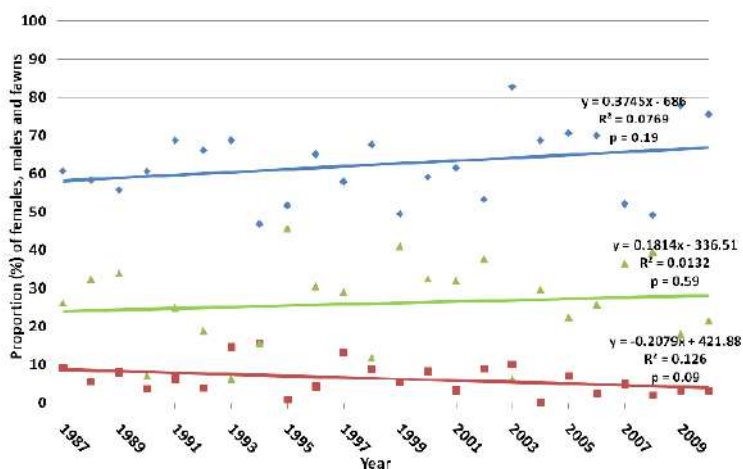
YEARS OF DATA

PARTNERS

- Ongoing since 1976
- Parks Canada
- Nova Scotia Department of Natural Resources



Status and trend of the roadside deer population in Kejimikujik (Note: Green zone represents good condition, yellow represents fair condition and red zone represents poor condition)



Proportion of adult females, males and fawns from the total number of White-tailed deer counted during the survey in function of the year, from 1987 to 2010. Blue: females, Red: males and Green: fawns

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Rationale

Nocturnal owls are surveyed across Canada as indicators of forest ecosystem health. As top predators in the food chain, they are vulnerable to habitat disturbance. Barred owls have specialized habitat requirements that link them to large hardwood trees for cavity nesting. Additionally, they are sensitive to forest cover and composition changes associated with forest management activities. Owls are not easy to monitor due to their secretive, nocturnal activities. They roost for much of the day and attempts to conduct visual surveys are challenging. Bird Studies Canada coordinates surveys in all three Maritime provinces. Locally, two official routes have been conducted annually since 2002 while a third, unofficial route, was established in 2005. These surveys document relative owl counts and note changes over time within landscapes being changed by forest harvesting and human developments.



Barred owl



Baby Barred owl

Monitoring

NOCTURNAL OWL SURVEY

OBJECTIVES

- To carry out an annual survey of nocturnal owl populations on established routes.
- To compare local populations within Nova Scotia, within the Maritimes and within Canada.

METHODS

- At night, volunteer surveyors drove their designated route and stopped every 1.6 kilometers. At each stop they broadcast recordings of owl calls prepared by Bird Studies Canada and recorded the number and species of owls heard or seen.
- Route 40 was surveyed by Peter Hope. This route began on highway Route 8, eight kilometers north of Mersey River Bridge in Maitland Bridge and continued north to South Milford.
- With the aid of 18 volunteers, route 41 was surveyed by Donna Crossland. This route began at the Kejimikujik entrance and ended near the Gold Mines trailhead.
- One unofficial route, using the same protocol, began at the entrance of the Devonshire/ Rossignol Road and continued towards the Mersey River. This route was surveyed by Peter Hope.

RESULTS

- In spring 2010, Barred, Saw-whet and Long-eared owls were reported. In other years Great horned owls have also been detected.
- The Route 41 survey (within the park) detected 16 Barred owls and one Saw-whet owl on April 23, 2010.
- The Devonshire / Rossignol survey detected two Long eared owls and two Saw-whet owls on April 25, 2010.

YEARS OF DATA

- Ongoing project since 2002

PARTNERS

- Parks Canada
- Bird Studies Canada
- Mersey Tobetic Research Institute



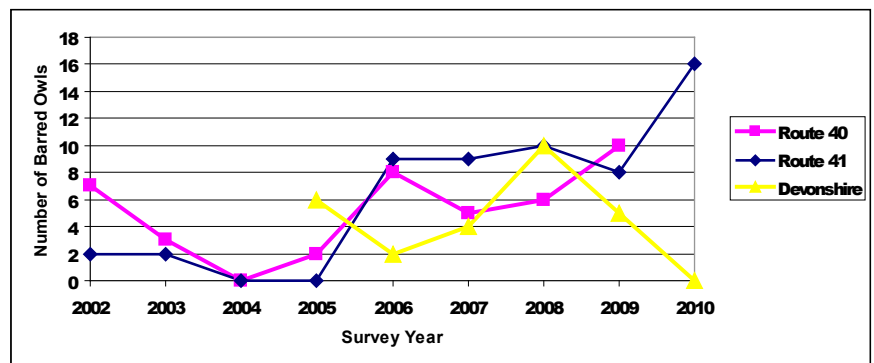
A. Belliveau, MTRI

Owl survey routes are indicated in red



M. Elderkin

Saw-whet owl



MTRI

Number of Barred owls detected on three survey routes. The Highway 8 (Route 40) and Kejimikujik (Route 41) routes have been surveyed since 2002 and the Devonshire/Rossignol route has been surveyed since 2005

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Rationale

Glossy buckthorn is an invasive alien species introduced to North America from Europe. It is now strongly established in the Southwest Nova Biosphere Reserve and Kejimikujik. It is listed as a Category 1 priority invasive plant in the park due to its ability to exclude all other species and dominate a site indefinitely. Since the presence of invasive plants are indicators of disturbance, pollution, climate change and other ecological stressors, monitoring the presence, abundance and distribution of this plant is in accordance with Parks Canada's mandate to maintain ecological integrity.



Mature Glossy buckthorn plants



J. Neigh removing berries of mature plants in the field and marking cut stumps with tagging tape

Monitoring

GLOSSY BUCKTHORN ERADICATION AND MANAGEMENT

OBJECTIVES

- To reduce the footprint of Glossy buckthorn within the park by 25% by 2011, 50% by 2012 and 100% by 2013.
- To educate the public and increase awareness of the impacts of the plant and ways to eradicate it.

METHODS

- Areas in the park with Glossy buckthorn were surveyed and tracked with a GPS.
- Three plots were assigned to evaluate the effectiveness of girdling plants of various sizes.
- Areas of high plant concentration were tracked to direct future removal and monitoring efforts.
- Mature plants were either cut using a hand saw or chainsaw, pulled by hand or with the weed wrench Extractagator™.
- Mature plants with berries were cut and disposed in garbage bags or, due to time constraints, were cut and left in the field.
- Stumps of cut trees, and areas where trees had been pulled were recorded using a GPS and marked with flagging tape (where stumps existed).
- Educational events were given to park visitors on the identification and impact of Glossy buckthorn.
- An identification and information guide was created for the top six priority invasive plants.

RESULTS

- A total of 276 mature berry-bearing plants were removed during the 2010 field season.
- Assessment of girdling treatments needs to be conducted over the next years.
- Two educational hands on demonstrations were given to a total of 23 people.

RESULTS

Continued

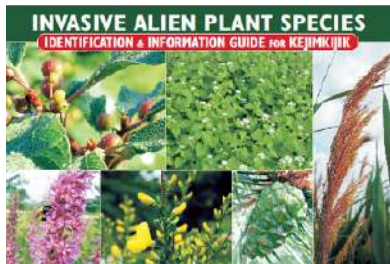
YEARS OF DATA

PARTNERS

- A presentation on the invasive plants monitoring program and top six priority plants in Kejimikujik was delivered at MTRI on August, 2010.
- An identification and information guide on the top six priority plants in Kejimikujik was created and will be available in both official languages.

- Year 2 of a 5 year project

- Parks Canada



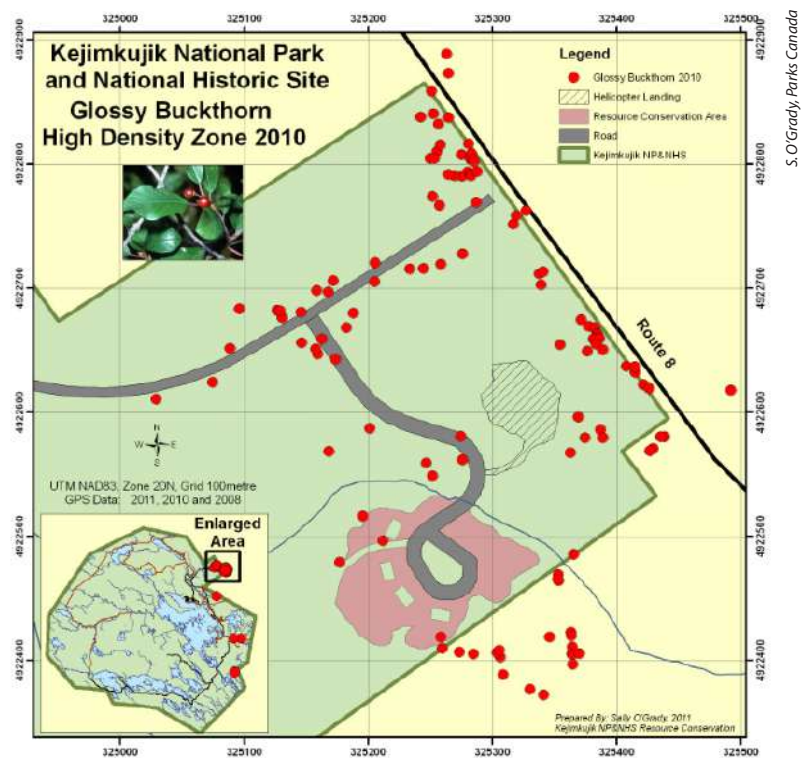
Parks Canada

Cover of an identification and information guide on the top six priority plants in Kejimikujik was created and will be available in both official languages



D. Ure, Parks Canada

A group of volunteers after Glossy buckthorn educational "on site" demonstration



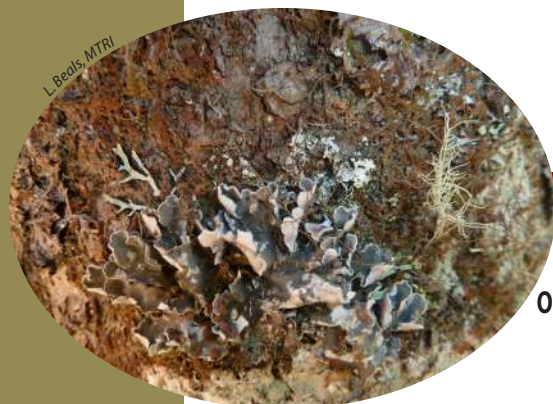
S. O'Grady, Parks Canada

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Rationale

Boreal felt lichen and other rare lichens of the coastal forest community are threatened by forestry practices and air pollution. The threat posed by forestry is largely due to lack of ability to detect the presence of rare lichens and to predict where these lichens will occur. Little is known about which sources of air pollution pose the greatest threats and at what levels. Some progress from the forestry threat has been made in the last five years with the use of the GIS habitat algorithm to identify likely habitat. Since the GIS algorithm was developed in 2005, 22 new Boreal felt lichen locations were found and protected. This project focused on finding new rare lichen sites; getting a better understanding of health of the population, habitat and level of threat; increasing awareness of rare lichens in Nova Scotia and protecting existing Boreal felt lichen sites.



Boreal felt lichen

Monitoring

BOREAL FELT LICHEN MONITORING

OBJECTIVES

- To improve the predictive ability of a GIS habitat algorithm to increase likelihood of finding Boreal felt lichen.
- To increase knowledge of habitat characteristics and severity of threats at Boreal felt lichen sites over time.
- To raise the profile of Nova Scotia's rare lichens.
- To find and protect Boreal felt lichen and other at risk lichen sites through reporting to the provincial government.

METHODS

- In both forested and non-forested areas, those sites that were predicted as likely habitat and surrounding areas were searched for Boreal felt lichen and other rare lichens.
- All currently known sites of Boreal felt lichen were permanently marked for long-term monitoring.
- Data were collected on habitat parameters including trees species, tree heights, tree diameters, tree ages, crown cover, slope, aspect, soil drainage, ground cover and other parameters.
- When Boreal felt lichen sites were found the provincial government and relevant stakeholders were informed under a new reporting procedure. Any losses or habitat destruction were also reported.
- Two one day lichen Identification workshops were held in Boreal Felt Lichen habitat. One was open to the public and one was for government employees).

RESULTS

- Boreal felt lichen was found at nine new sites in 2010. Thirty three thalli were found on 15 trees (three sites in Halifax County, one in Guysborough County, four in Richmond County and one in Shelburne County).
- Habitat parameters and monitoring data were collected at those 19. An additional 15 blocks outside of the harvest area were searched for rare lichens.
- All but one of the extant sites were visited to confirm the survival of Boreal felt lichen and measure their growth.
- A secure access database was developed, error checked,



T. Neilly searching for lichens on Bennetts Lake

RESULTS

Continued

populated and shared with the recovery team. All digital data were backed up to paper copies.

- Nineteen harvest blocks were surveyed for Newpage prior to of their harvest schedule.
- Thirteen people participated in the public workshop on the eastern shore and eleven government employees (NSDNR and EC) participated in a second workshop. Three new trees with Boreal felt lichen were found during workshops at a site already known to have Boreal felt lichen.
- Sand Pond National Wildlife Area and McNutts Island, which are federally owned pieces of land were searched for Boreal felt lichen.
- No Boreal felt lichen was found on federal land.

YEARS OF DATA

- Ongoing project since 2007

PARTNERS

- New Page Corporation
- Nova Scotia Department of Natural Resources
- Nova Scotia Department of Environment
- Environment Canada



Map showing the areas where the computer generated algorithm predicts Boreal felt lichen habitat to occur

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Boreal felt lichen habitat

Rationale

In 2010 the Nature Conservancy of Canada (NCC) contracted MTRI to conduct biotic inventories of five large properties within the Southwest Nova Biosphere Reserve.



Plymouth gentian

Research

BIOTIC INVENTORY OF FIVE NCC PROPERTIES

OBJECTIVES

- To create species list for four taxa: vascular plants, non-vascular plants, lichens and birds.
- To note, photograph and map a list of improvements and threats/human impacts to the properties.
- To conduct Forest Ecosystem Classification assessments of each property according to provincial protocols.

METHODS

- During the month of June each site was visited to conduct inventories of birds during the dawn chorus. A variety of habitats were visited to capture the highest diversity of species possible.
- Forest and ecosystem types were mapped. Vascular and non-vascular plant surveys targeted a wide variety of habitats but focused on wetlands where there is a higher biodiversity.
- Wetland and riparian habitats were surveyed for epiphytic macro lichens. A diversity of forest types were visited to maximize the number of species observed.
- Extensive searches were made to map human impacts, including threats or improvements.

RESULTS

- Many rare (S1, S2, or S3 ranking) species were found on each property.
- Significant finds included: Boreal felt lichen and Canada warbler at Bennets Lake, *Sphagnum cyclophyllum* and Longs bulrush at Quinns Meadows, Plymouth gentian and *Fuscopannaria ahlneri* at Pearl Lake, Canada warbler and at Third Lake and Greenish-white sedge and *Lebtogium subtile*, at Lac De l'Ecole.
- Many other rare species were found and mapped.



Ruth Newell conducting grass and graminoid surveys

YEARS OF DATA

PARTNERS

- Single year project
- Nature Conservancy of Canada
- Atlantic Canada Conservation Data Center
- Dalhousie University
- Acadia University



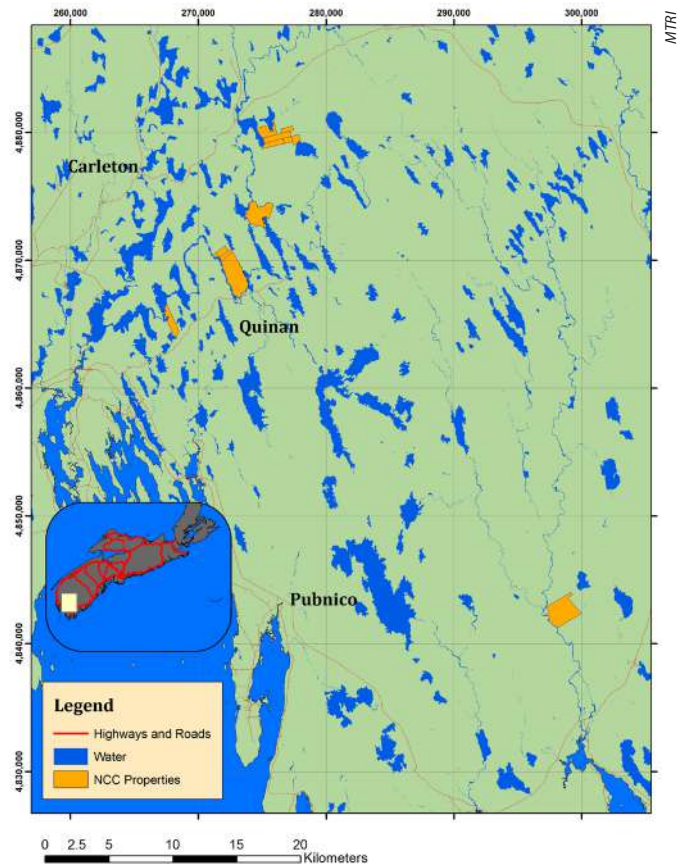
Skunk cabbage

A. Belliveau, MTRI



Tusket River shoreline survey for mosses and lichens

B. Toms, MTRI



Map of the five NCC properties

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Rationale

Flying squirrels may be sensitive to fragmentation and good indicators of landscape connectivity because they need mature trees to climb for gliding and to sleep in during the day. To understand the connectivity requirements of flying squirrels in Nova Scotia, local life history data are required to determine how long they live, how many young they have and how they disperse. With this project, live-trapping, passive integrated transponder (PIT) tags and nest boxes were used to collect life history data for flying squirrels. PIT tags are small glass microchips that are inserted under an animal's skin and that provide the time, date and unique code for the animal when they pass through a circular antenna.



Southern flying squirrel to be released after being weighed and measured

Monitoring

MONITORING FLYING SQUIRREL SURVIVORSHIP

OBJECTIVES

- To determine survivorship of flying squirrels.
- To determine fecundity (ability to produce young) of flying squirrels.

METHODS

- Study grids were installed at six sites in the Mersey and Medway watersheds with wooden brackets placed on the south side of trees at chest height.
- Live traps were placed on the brackets and baited with peanut butter and apples.
- Captured flying squirrels were measured, implanted with PIT tags and released where they were caught.
- PIT tag receiving stations were placed within the grid to monitor survivorship.



Paul Hebert checking a Tomahawk live trap

RESULTS

- In the month of April, 2011, 18 captures of 12 individual flying squirrels (four southern and eight northern) were made near Donnellan Lake, Grafton Lake, and Kempt Provincial Park Reserve.
- Half of the flying squirrels were recaptured from previous years. Four of these had been PIT tagged the previous year, and two had been tagged two years ago.

YEARS OF DATA

- Ongoing project since 2005

PARTNERS

- Mersey Tobeatic Research Institute
- Nova Scotia Habitat Conservation Fund
- Parks Canada
- Acadia University



J. Saroli, MTRI

Measuring the hind foot of a Southern flying squirrel



K. Bourassa, MTRI

Jesse Saroli and Rachel Thibodeau checking a Tomahawk live trap



J. Saroli, MTRI

Volunteer replacing the battery in a PIT tag reader at Donnellan Lake

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Rationale

The species composition of vegetation in forest ecosystems is an important measure of forest ecological integrity. Forest species diversity is assessed from repeated sampling of forest vegetation in plots located in selected forest ecosystems. In addition to changes in native species richness, monitoring forest composition will also provide information on the colonization of forest plots by invasive species. Forest species diversity data also provide valuable information related to shifts in ecological processes and succession associated with local, regional and global factors.



Kejimikujik Seaside barrens



Yellow screwstem

Monitoring

PORT MOUTON VEGETATION MONITORING STUDY

OBJECTIVES

- To sample and compare long-term forest monitoring plots in Kejimikujik Seaside with to 2007 baseline data on vascular plant and ground moss species composition and cover.
- To collect additional semi-quantitative data on species composition and occurrence for the ecosystems in which the plots are located.

METHODS

- Vegetation plots were assessed using the Canadian National Vegetation Classification protocol. Ground species with their percent cover in each of seven possible layers on 20 x 20 m plots are recorded.
- A Local Ecosystem Floristic List was developed for each plot. All ground species that can be found in a homogenous stand of vegetation during an hour survey by a botanist were recorded.

RESULTS

- Plant lists were developed of late summer vascular plant species within the 17 forest monitoring plots representing three different ecosystems in a combined 7225 m² area.
- The plot lists resulted in 86 different species: one lichen, one liverwort, 11 mosses and 73 vascular plant species.
- All data were added to the 2007 database, and a final analysis will occur in 2013.

YEARS OF DATA

- 2007 and 2010
- Re-measurement every 3 years

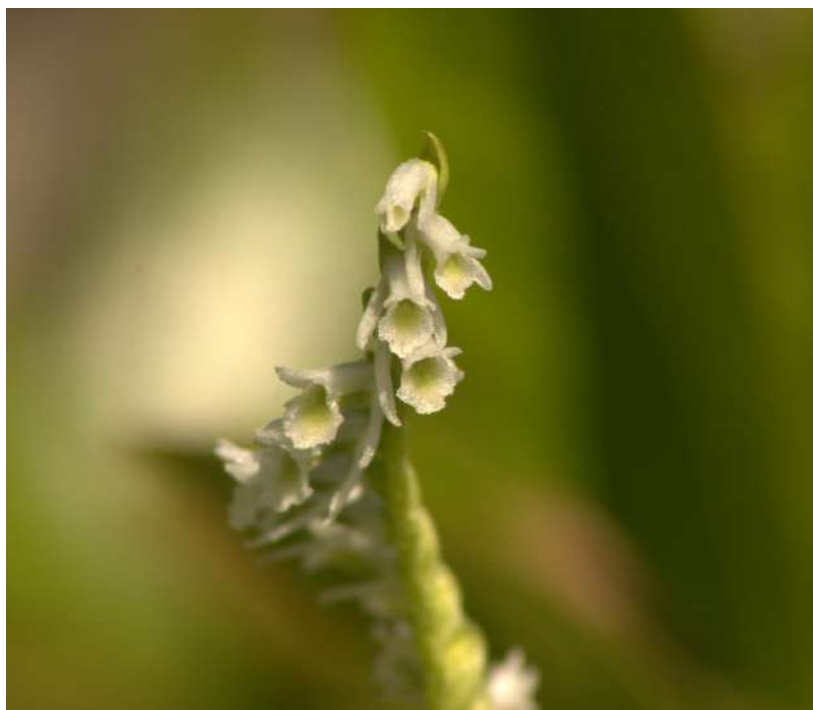
PARTNERS

- Mersey Tobeatic Research Institute
- Parks Canada
- Nova Scotia Department of Natural Resources
- Nature Serve Canada



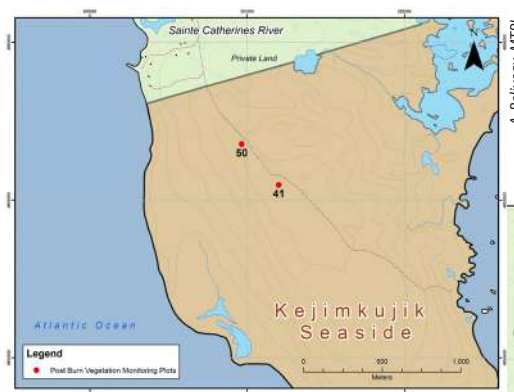
A. Belliveau, MTRI

White fringed orchid with Monarch butterfly



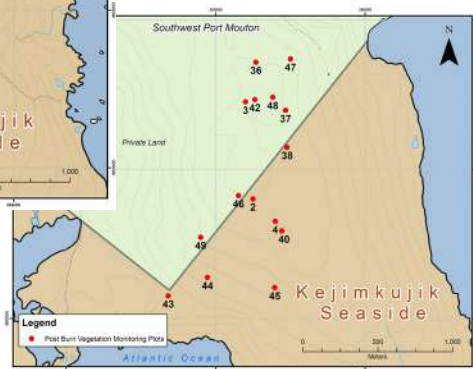
A. Belliveau, MTRI

Slender ladies' tresses



A. Belliveau, MTRI

Maps of vegetaions plots



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Rationale

Chimney swifts are an important part of the ecosystem; they eat up to 1000 insects each day. This unique species is unable to land on a branch or the ground like other birds because its legs are not structurally built to hold up its body; instead it grips the side of a rough surface (such as a hollow tree or chimney) and it uses stiff tail feathers to support its weight. Chimney swifts can remain in the air all day, catching insects and skimming the surface of lakes or rivers for water; some have even been reported to spend multiple days flying without any rest. Chimney swifts are listed as Threatened in Canada and Endangered in Nova Scotia. Their decrease in numbers is likely the result of pesticides used to kill insects and the decline of hollow trees, which are both their nesting and roosting sites. As a result chimney swifts have adapted to using chimneys to roost and nest in; however, the decline in suitable chimneys (due to new building regulations and insurance regulations) may also be impacting the population.



Chimney swift roosting site

Monitoring

CHIMNEY SWIFT ROOST MONITORING

OBJECTIVES

- To monitor the Chimney swift population at the McGowan Lake Fish Hatchery Roost and to encourage others to monitor and report sightings at other roosts.
- To assist in the development of standardized monitoring methods to be used during Chimney swift counts throughout the region.
- To obtain data during each Chimney swift count that will contribute to existing data for the region.
- To confirm and monitor reported nesting sites in the greater Kejimikujik ecosystem.
- To increase awareness of Chimney swifts in the south west Nova Scotia Kejimikujik ecosystem.

METHODS

- A data sheet was developed and used to obtain comparable information for each Chimney swift count.
- Chimney swift counts were completed throughout the summer to monitor the population at the McGowan Lake roost.
- Potential nesting sites were visited and photographed to determine if they were active.
- A website was created to enable others to learn about Chimney swifts and report any sightings.
- A regional meeting was held by Bird Studies Canada to create the Maritime Swift Watch.
- Information on weather, arrival and departure times, a total count of Chimney swifts was collected for each area.
- Counts were conducted until it was assumed that the Chimney swifts had migrated.

RESULTS

- Comparable information was obtained for seven counts between June 21 and August. 16, 2010. Numbers of swifts ranged from 40-90; however, the last night had a count of zero chimney swifts likely due to an early southward migration.
- No active nesting sites were discovered.



Alicia Pray-Leslie recording Chimney swift counts

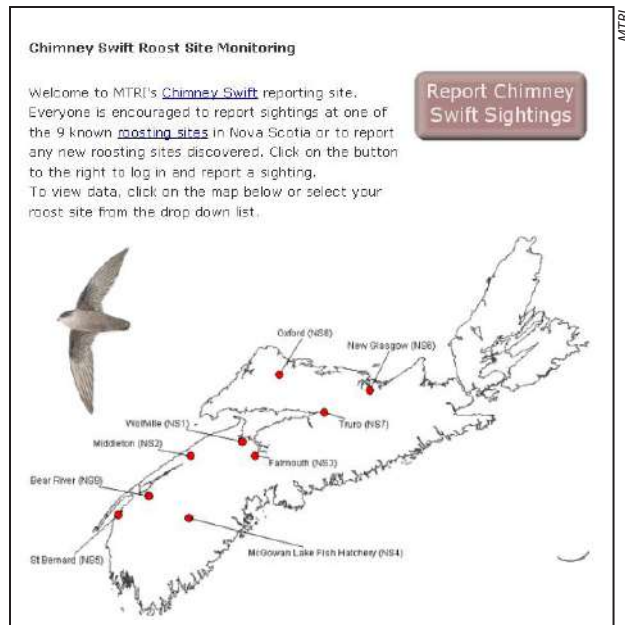
P. Hebert, MTRI

YEARS OF DATA

- Year 2 of a 2 year project

PARTNERS

- Mersey Tobeatic Research Institute
- Environment Canada
- Bird Studies Canada
- Blomidon Naturalists Society
- Nova Scotia Power
- McGowan Lake Fish Hatchery



Website to report Chimney swift sightings in Southwest Nova Scotia

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Two Chimney swifts circling the McGowan Lake roost at dusk

Rationale

The provincial Forest Ecosystem Classification (FEC) can be thought of as a catalogue of forest and woodland ecosystems in Nova Scotia. The FEC provides information about the site, soil moisture, soil nutrients and tree and understory plant species. Classifying forest ecosystems based on vegetation, soil and site characteristics allows forestry professionals, woodlot owners and researchers to recognize similar forest ecosystem units on the ground and to develop a common understanding of these units. Best management practices which address hazards and operational limitations associated with different ecosystems can then be developed. Forest ecosystem classifications also provide a means through which ecosystem-based management principles can be applied operationally at the stand level, and a framework from which to communicate the success or failure of different management treatments. Most forest resource values can be evaluated within the classification.



A. Belliveau, MTRI

Upper Shelburn River Red pine

Research

FOREST ECOSYSTEM CLASSIFICATION

OBJECTIVES

- To develop a comprehensive forest ecosystem classification system for Nova Scotia.
- To identify and describe recurring vegetation communities and soil types associated with Nova Scotia forests.
- To provide an ecological framework from which to communicate and promote ecosystem-based management at the stand level.
- To provide an ecological framework from which best management practices can be developed and applied to promote sustainable forest management in the province.

METHODS

- A stratified sampling approach was taken to divide the province's forest landscapes into 47 different sampling units (based on earlier biophysical and ecological land classification).
- Cover type maps, soil series map and surficial geology maps were also used to narrow down potential sampling areas.
- Arc View 9 and Google Earth were used to create navigational tools to get to each site as well as to display each FEC plot that was completed.
- At each sample location, detailed vegetation, soil and site data were collected from representative plots. Data included an inventory of above ground plants (bryophytes, lichens, herbs, shrubs and trees) and a full soil profile description. Where applicable, sequential plots were also established along major slopes.
- Similar plant communities and soils were grouped into recurring vegetation types and soil types based on statistical analysis and expert opinion.
- Ecosites were also delineated which represent general productivity units as reflected by changes in soil moisture and nutrient regimes.



P. Neilly, NSDNR

Puffball fungus growing on the forest floor

RESULTS



Hobblebush in brilliant autumn colour

P. Neily, NSDNR

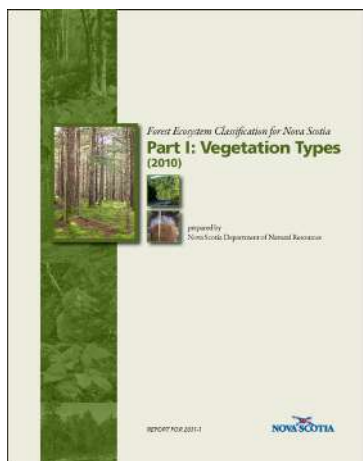
- This project was initiated as a pilot from 2000-2003, and as a full scale provincial project from 2004 onward. Approximately 1500 plots have been measured across the province, with about 367 located in western Nova Scotia. Of the latter, 63 plots were established in 2009, 25 completed by NSDNR and 48 plots completed by MTRI.
- The Forest Ecosystem Classification for Nova Scotia's Western Ecoregion - Interim Report was published in 2006 and contains fact sheets for 39 vegetation types, descriptions for 16 soil types (plus 3 phases), keys for identifying vegetation types and soil types and information on provincial ecotypes found in western Nova Scotia (available from NSDNR).
- Results from 10 years of FEC project work were synthesized to produce a comprehensive provincial FEC guide which is presented in three documents: Forest Ecosystem Classification for Nova Scotia: Part I Vegetation Types; Part II Soil Types; and Part III Ecosites. This three-part guide builds upon, but also supersedes, all earlier interim FEC publications. (Part II available June 2011).
- Forest soil types of identification and interpretation manual is available online at www.gov.ns.ca/natr/publications/forpubs.htm. This document contains keys to determine soil type and soil texture as well as photographs of the soil types and distinguishing features.
- A Field Manual for Forest Ecosystem Classification, NSDNR Manual FOT 2007-1 is available online at www.gov.ns.ca/natr/publications/forpubs.htm. This report provides the methodology used to establish sample plots for forest ecosystem sampling.

YEARS OF DATA

- Ongoing project since 2000

PARTNERS

- Nova Scotia Department of Natural Resources
- Parks Canada
- Nova Scotia Department of Environment
- Mersey Tobeatic Research Institute



Cover of Part 1 of Nova Scotia FEC;
Vegetation Types

P. Neily, NSDNR

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A wet deciduous vegetation type at Sand Beach Lake in Digby
County

P. Neily, NSDNR

Photos on page 43

Clockwise from top left:

- Reeds by A. Belliveau, MTRI
- Canoe on McGowan Lake by J. Kinley, MTRI
- A Yellow pond lily by J. Saroli, MTRI
- Snow covered Nancy Lake by A. Lavers, MTRI
- Loon by B. Caverhill, MTRI



FRESHWATER



Rationale

The Brook trout is the most popular sportfish in Nova Scotia and the main fish species sought after by anglers in Kejimikujik. Most fishing effort occurs annually during the period from April 1 (season opening) until end of June. The park is mandated to properly manage harvested fish populations but to monitor the health of the fresh water aquatic ecosystem. Brook trout are sensitive to environmental stressors such as habitat degradation, increased water temperature, competition and over exploitation, thereby making it a good indicator species.



Brook trout being measured using the Corbett-Baird Trout Measuring Device

Monitoring

BROOK TROUT MONITORING PROGRAM - CREEL CENSUS

OBJECTIVES

- To determine if the mean relative abundance catch per unit effort (CPUE) for mature Brook trout (greater than 25 cm in length) is in good condition (greater than 0.078) in both Mersey and Peskowsk watersheds and if it decreased since the last creel census.
- To determine if the mean condition index (relative weight) for Brook trout (*i.e.* greater than 19 cm in length) in the Mersey and Peskowsk watersheds is in good condition (greater than 101.4) and if it decreased since the last census.

METHODS

- A creel census program, designed to monitor Brook trout, was being carried out by an organized group of more than 25 experienced volunteer fly fishermen and park staff under an established protocol, between April 1 and June 30. The creel census was carried out for three year periods on a five year interval. There was a census carried out in 2002 - 2004 and the current program runs from 2009 - 2011.
- The Catch per Unit Effort or CPUE (number of trout caught during one hour of angling) was used as an estimate of relative abundance. Condition was determined by combining trout length (cm) and weight (g) data into a single condition index.
- Two partial watersheds were defined. The "Mersey" was delineated, from the southern end of Kejimikujik Lake to the park boundary (just above Lake Rossignol) and "Peskowsk", from Lake Peskawa to the southern boundary of the park.
- Data concerning fish abundance and condition were gathered by employing 100 hrs of fishing per watershed. In addition, at least 50 Brook trout from each area were weighed and length was measured. Trout were measured using a plexi glass holding device developed by Gary Corbett and Reg Baird.



Creel Census volunteer Roy Barteaux processing a trout by measuring the length and weight of a Brook trout prior to release

METHODS

Continued

RESULTS

YEARS OF DATA

PARTNERS

- Thresholds for the relative abundance measure were developed using the monthly catch and effort data from the Eel Weir at Kejimikujik from 1994-1996, as the population was judged to be in good condition at that time.

- In 2009, the number of fishing hours completed in each watershed was lower than the targeted 100. Moreover, mistakes due to misunderstanding of the research protocol led to the discard of more some data. In 2010, volunteers and staff were able to put more effort into the program and reached the objective of 100 hours in each watershed. The data discarded was minimal. As in 2009, the number of trout caught in 2010 has greatly exceeded the objective of fifty (50) trout for each area.
- Preliminary analysis of the results from the two first years suggests that the Brook trout status is good and stable over time. Complete analysis will be done once the Creel Census is completed in 2011.

- Current creel census program running from 2009-2011
- Ongoing projects and programs since the 1970's

- Trout Nova Scotia
- Parks Canada

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R. Brunt, Parks Canada

Creel Census volunteer fly fishermen at Peskowsk Brook, Spring, 2010 - (left to right) Ray Sanford, George Kregling and Reg Baird



D. Pouliot, Parks Canada

Volunteer fly fisherman Ryan Potter fishing at the Loon Lake Run in May 2010

Rationale

Monitoring benthic invertebrate communities has proven to be an accurate means of assessing aquatic health. These “bottom- living” organisms reflect the state of an aquatic ecosystem in a more comprehensive fashion than more traditional, one dimensional monitoring techniques. Benthic invertebrates are excellent biological indicators because they are abundant, relatively sedentary, long-lived (one to three years) and sensitive to a variety of stressors. These characteristics allow them to mirror the conditions of their specific habitat and exhibit any environmental impacts that have occurred in the preceding weeks, months and even years. Although Kejimikujik can control events within its own boundaries, aquatic ecosystems are still vulnerable to transboundary impacts from adjacent land use, long range transportation of air pollutants and climate change. To this effect, benthic invertebrate monitoring serves as an early warning system to detect ecological distress and alert park management.



Riffle habitat for kicknet sampling
Minard Brook, Kejimikujik



K. Rowter inspecting a
kicknet sample from the
Mersey River

Monitoring

BENTHIC INVERTEBRATE MONITORING

OBJECTIVES

- To assess aquatic health in 22 representative streams at Kejimikujik.
- To determine how aquatic health of stream ecosystems is changing over time, as represented by the benthic macroinvertebrate communities.
- To contribute to Environment Canada's Canadian Aquatic Biomonitoring Network (CABIN) database.

METHODS

- Standard CABIN protocols were used which include: site characterization, water chemistry analysis, reach characteristics, channel measurements, substrate characteristics and benthic invertebrate collection based on a standardized 3-minute-kick-net sample.
- Benthic invertebrate identification to the lowest level possible by a qualified taxonomist.
- Data were entered into the national CABIN database.
- Data were analyzed and compared to results observed in 2005 from identical sample locations to determine the current status and trends in stream ecosystems at Kejimikujik.

RESULTS

- Benthic invertebrates were sampled in 22 streams at Kejimikujik in 2010, with sampling locations matching those from the 2005 effort.
- Benthic invertebrate communities at Little River had the highest species richness with 32 different taxa identified. Benthic invertebrate communities at Lucifree Brook had the lowest species richness with 16 taxa identified.
- Mayflies, Stoneflies and Caddisflies (together called EPT due to their taxonomic names) are sensitive to disturbance. As a result, samples with a high proportion of these taxa may represent streams with higher levels of aquatic health. Benthic invertebrate communities at Inness Brook had the highest proportion of mayflies, stoneflies and caddisflies (EPT = 66%). Benthic invertebrate communities at Rogers Brook had the lowest proportion of these taxa (EPT = 30%).

RESULTS

Continued

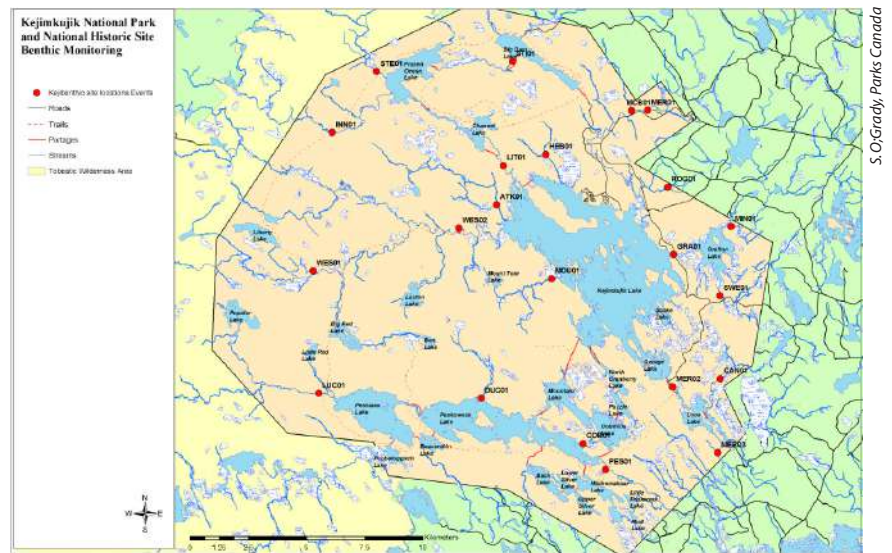
- Analysis was conducted on the 2010 data for species richness showing that there has been no change in species richness from the benchmark 2005; therefore status of this measure is good.
- Analysis with the percentage of EPT data shows a slight decrease but within one standard deviation of the benchmark data of 2005; therefore the status of this measure is good.

YEARS OF DATA

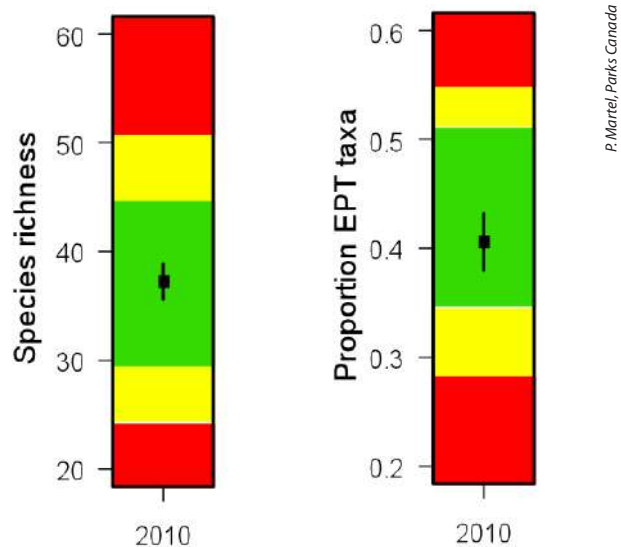
- Ongoing project since 2005
- The sampling frequency for this project is every 5 years

PARTNERS

- Parks Canada
- Environment Canada



Benthic invertebrate sampling sites at Kejimikujik in 2010



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Rationale

Atlantic Coastal Plain Flora (ACPF) are a unique group of plants that exist in the relatively flat stretch of land from Florida to Nova Scotia. In Nova Scotia, ACPF fare disjunct from other ACPF populations. In 2010 MTRI, in partnership with the ACPF Recovery Team and Parks Canada initiated a project to create baseline data and increase stewardship opportunities for landowners who live with ACPF. This project will be the first to conduct a complete census of ACPF in Nova Scotia on 36 high priority lakes.



Golden crest, an ACPF species in flower

Monitoring

ATLANTIC COASTAL PLAIN FLORA STEWARDSHIP AND MONITORING

OBJECTIVES

- To monitor populations of endangered, threatened and special concern ACPF on 36 high priority lakes identified in the recovery strategy.
- To implement a community-based, volunteer-driven water quality monitoring program to detect threats to the low nutrient environment of ACPF (see other section page 48).
- To engage and involve landowners on 32 high priority lakes.
- To collect habitat information on lakes where botanical surveys are conducted.

METHODS

- Count and geo-reference populations of all red and yellow ranked ACPF species (NS General Status ranks) by expert botanists, researchers and volunteers along the 36 lakeshores where 11 species occur, which are listed in Canada's Species at Risk Act.
- Directly involve volunteers and landowners in all field work activities so they can learn about the species with which they share their land.
- Document shoreline habitat using geo-referenced photos and habitat parameter data.
- Engage landowners through door to door visits and public events.

RESULTS

- Over 140 km of shoreline was surveyed and 19 of the 36 lakes were visited for one or more project activities. High quality maps documenting the distribution of ACPF along these lakeshores can be viewed at www.speciesatrisk.ca.
- Surveys were completed for seven lakes including: Barrington, Pleasant, Salmon, Sloans, Hog, First Christopher, and Little Ponthook Lakes. Partial surveys took place on Molega, Ponthook and Great Pubnico Lakes. These lakes were too large to complete in a single year and will be completed over several years.



S. Blaney, a botanist, recording the species of ACPF present on the Ponthook Lake shoreline

B. Toms, MTRI

RESULTS

Continued

- Shoreline habitat was documented on six lakes.
- New locations of Golden crest and Redroot were discovered, as well as new populations of Long's bulrush.
- Landowners were contacted around six lakes and a Social event was held in August for ACPF participants.
- Over 20 volunteers contributed over 700 hours to this project and were recognized at two volunteer appreciation events (one for each region)
- A field guide to ACPF species was produced and will be distributed in the coming years.

YEARS OF DATA

- Year 1 of a 5 year project.

PARTNERS

- Parks Canada
- Nova Scotia Crown Share Land Legacy Trust
- Atlantic Canada Conservation Data Center
- Environment Canada
- Dalhousie University
- Nova Scotia Department of Natural Resources
- Nova Scotia Department of the Environment
- Nova Scotia Nature Trust
- Tuskent River Environmental Protection Association
- TD Friends of the Environment Foundation
- Sage Environment Fund



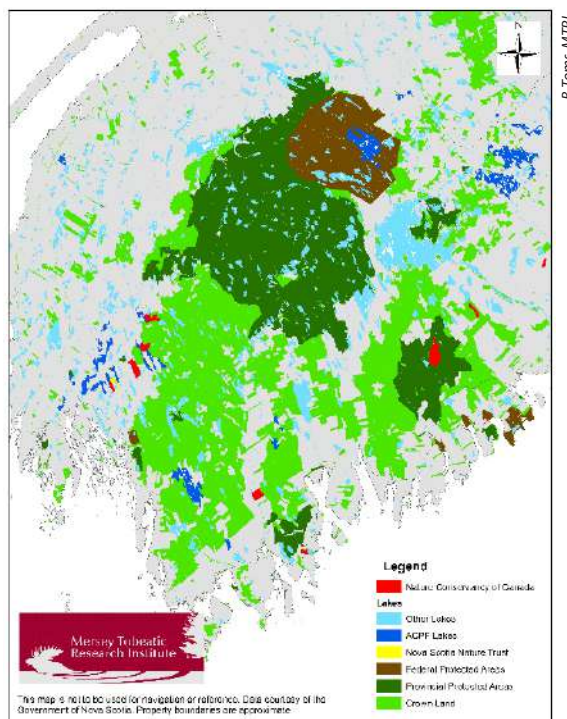
Cover of the field guide created for distribution to stewards and volunteers



A flowering Pink coreopsis, an ACPF species

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The study area, showing the high priority lakes containing Atlantic Coastal Plain Flora species that are at risk in Mersey and Tuskent watersheds

Rationale

Atlantic Coastal Plain Flora (ACPF) is a group of plants found along the low lying land of the Atlantic coastal plain. These plants are typically poor competitors against other plants and therefore they often thrive in the areas where other plants are not able to grow quickly. These are typically along lake shorelines with a high degree of winter ice scour, where flooding is common, and in areas with low aquatic nutrient levels (oligotrophic). Although ACPF can be found near water with moderate (mesotrophic) or even high (eutrophic) nutrient levels, increased lake nutrient levels have been identified as a significant threat to ACPF species.



A. Belliveau, MTRI

Purple Bladderwort flowers

Monitoring

WATER QUALITY IN ATLANTIC COASTAL PLAIN FLORA HABITAT

OBJECTIVES

- To sample water quality from a representative subset of the high priority lakes identified in the ACPF recovery strategy.
- To involve and recruit volunteers to monitor lake water quality in future years of the project.
- To contribute to existing water quality data sets from high priority ACPF lakes.
- To present results to community members and raise awareness about the importance of lake water quality and ACPF.

METHODS

- Water samples and in-situ measurements of water quality data were collected at the deepest point of the lake four times annually (May, July, August, and October).
- Water quality sampling training workshops were held for interested community members and volunteers in locations near both watersheds.
- A community information session was held in late fall to update interested people on the results of the first year of the project.

RESULTS

- Two water quality sampling training workshops were held, one in the Tusket area (Carleton) and one in the Medway area (Kempt).
- Three times each (July, August, October) a total of ten high priority lakes were sampled (seven in Tusket and three in Medway).
- One lake was found to be oligotrophic, six lakes were found to be mesotrophic and three lakes were found to be eutrophic.
- An information session was held in Carleton and all data and results were presented.



L. Beaulieu, MTRI

Volunteers collecting and recording water quality data on Little Ponhook Lake

YEARS OF DATA

PARTNERS

- Year 1 of a 5 year project
- Atlantic Coastal Plain Flora Recovery Team
- Mersey Tobeatic Research Institute
- Parks Canada
- Tusket River Environmental Protection Agency
- Acadia University
- TD Friends of the Environment Foundation
- Sage Environment Fund



L. Beals, MTTRI

Randy Cleveland collecting a water sample on Bennetts Lake

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Lake	Carlsons Trophic Status Index	Trophic Status
Wilsons	20.1	Oligotrophic
Bennetts	40.6	Mesotrophic
Hog	41.0	Mesotrophic
Kegeshook	44.9	Mesotrophic
Little Ponhook	40.7	Mesotrophic
Salmon	49.8	Mesotrophic
Sloans	43.6	Mesotrophic
Cameron	50.8	Eutrophic
Fanning	57.6	Eutrophic
Raynards	52.9	Eutrophic

L. Beals, MTTRI



M. Crowley, Parks Canada

Volunteers learning various water sampling techniques at a training workshop

Rationale

Acid deposition has impacted freshwater ecosystems in eastern Canadian provinces for many decades. Legislation in Canada and the U.S.A. has reduced emissions that contribute to acid deposition, so we expect some degree of chemical and biological recovery of these acidified lakes and wetlands. In order to verify these expectations, Environment Canada is monitoring aquatic macroinvertebrate, amphibian, and minnow species composition in small acid sensitive lakes across Ontario, Quebec, and Kejimikujik in Nova Scotia. Although assessing water quality in acid-sensitive lakes is vital, sampling fish and invertebrates is also important because these organisms represent the food base for breeding loons and waterfowl. Sampling fish and invertebrates is therefore essential to measuring and understanding the recovery, or lack of recovery, in the ability of these acid sensitive habitats to support waterbirds. Identification of certain acid-sensitive fish and invertebrate species, as well as shifts in communities to more acid-sensitive compositions, indicates the chemical and biological recovery of degraded ecosystems. This monitoring also allows Environment Canada to assess the effectiveness of current air pollution regulations in Canada and the U.S.A., and determine if changes to regulations are required to further protect acid sensitive habitats from the impacts of acid deposition.

Monitoring

ACID RAIN BIOMONITORING

OBJECTIVES

- To establish the current composition and abundance of aquatic invertebrate, amphibian, and minnow species (waterbird prey) within acid sensitive lakes of Kejimikujik.
- To determine whether species assemblages are changing in response to changing lake chemistries.
- To provide data on fish and invertebrate communities present in Kejimikujik, which can then be related to results obtained across south eastern Canada.

METHODS

- Food web sampling was conducted on a total of 20 lakes in Kejimikujik and the surrounding area in June 2009 and June 2010.
- Sampling was completed in the same manner that Canadian Wildlife Service (CWS) food chain monitoring is conducted in Ontario and Quebec Regions, to ensure comparability of current and historic data.
- Minnows and amphibian tadpoles were captured in baited minnow traps and aquatic invertebrates were collected using sweeps and benthic drags.
- Benthic samples were preserved in the field and collected invertebrates were later sorted in a laboratory using dissecting scopes.
- All specimens were sent to a taxonomist for identification to species level.



Rocky outcrop on Peskowesk Lake, Kejimikujik



Christina Nussbaumer sampling zooplankton on Peskowesk Lake

RESULTS

- A total of 209 aquatic macroinvertebrate taxa were identified from a total of 20 lakes.
- A significant positive trend ($p=0.005$) was detected of fewer invertebrate taxa in more acidic lakes.
- Due to the acidic nature of many Kejimikujik lakes, acid sensitive taxa such as snails, clams, mayflies, caddisflies, and leeches were generally rare in acidic lakes. In contrast, acid tolerant species such as sowbugs, beetles and worms were more common in acidic lakes.
- These are the first monitoring results for aquatic biodiversity in lakes in Kejimikujik in recent years, and the data provide an excellent baseline for assessing recovery of aquatic biodiversity following past and future reductions in acid deposition.

YEARS OF DATA

- Year 2 of a 2 year project

PARTNERS

- Environment Canada
- Parks Canada
- Mersey Tobeatic Research Institute



Environment Canada

Kick and sweep sample for benthic invertebrates

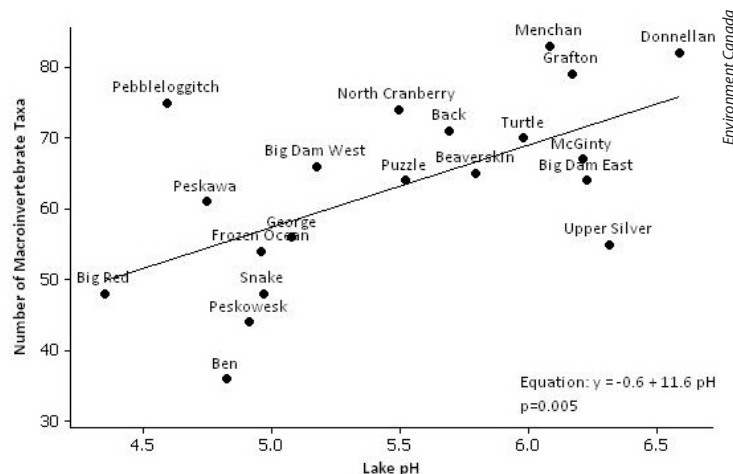


Environment Canada

Adam Martens and Miriam Morgan performing a sweep sample for aquatic invertebrates in the water column

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Environment Canada

Total number of aquatic invertebrate taxa in relation to pH of 20 Kejimikujik lakes sampled in 2009 and 2010. Regression analysis shows a significant trend of fewer invertebrate taxa in more acidic lakes ($p=0.005$, $r^2=0.36$)

Rationale

Aquatic connectivity within and between watersheds has been identified as critically important for the survival of Brook trout and other fish species populations. Barriers to fish passage, such as dams, badly designed culverts or modifications to the natural stream bed, can significantly reduce the ability of fish to migrate within the watershed. Such obstacles to movement can limit accessibility to suitable spawning, feeding, overwintering and summer habitats. Limited access to essential habitats greatly reduces the ability of a stream network to support healthy and abundant fish populations. Fragmentation is therefore considered to be a significant threat to the integrity of freshwater ecosystems. Aquatic habitat fragmentation could be responsible for the extirpation of species, such as the Atlantic salmon in the Mersey watershed. To help restore connectivity for Brook trout in the Mersey watershed, crossings on fish bearing streams have been localized in and around Kejimikujik and prioritized for remediation actions. Restoration work has begun and will continue over the next year.



Culvert found in Kejimikujik with insufficient water for fish passage

Monitoring

AQUATIC CONNECTIVITY

OBJECTIVES

- To survey stream crossings within Kejimikujik.
- To prioritize crossings in need of remediation based on potential improvement scores provided by the aquatic connectivity index.
- Within the park boundary, improve the aquatic connectivity index score by at least 20 in the watersheds identified as priorities for restoration.
- Restore problematic crossings following the best available knowledge on stream bed alteration.

METHODS

- Culverts and other types of stream crossings were localized in 2008 and 2009 within the park boundary and four catchments extending beyond park's boundaries.
- Crossings on fish bearing streams were assessed for fish passability using abiotic factors: culvert diameter, slope, embedment, roughness coefficient and flow. Passability scores were obtained using FishXing software. Passability scores have been used to calculate the impact of a given barrier on habitat availability for fish and ranked using a Dendritic Connectivity Index (DCI).
- In partnership with Fisheries and Oceans, restoration work was planned for identified priority sites. An environmental assessment was written and certified contractors were hired to complete the work. The efficiency of the mitigation measures used to reduce the impact of the actual work was monitored.

RESULTS

- A total of 176 crossings were localized within Kejimikujik boundaries: 134 culverts, 38 bridges, three boardwalks and one decommissioned road. Of those, 46 were located on fish bearing streams.
- The first passability assessment of crossings on fish bearing streams, classified 31 (67%) as fully passable, 12 (26%) as partial barrier and three (7%) crossings as impassable.
- Three sites were restored in September 2010.



Allan Tufts and Aaron Theriau removing the old culvert at Square Camp Brook

RESULTS

Continued

- A fish ladder made of rock boulders were set up in the Rogers Brook culvert, passing under the main park road. The fish ladder should assist fish travel through the culvert during high velocity events.
- The diameter of the old Square Camp Brook culvert was too small. The flow in the culvert was too strong for fish to pass so it was replaced by a culvert of proper diameter.
- The culverts at Flowing Waters Trail were rotten, falling apart and filled with rocks and mud making fish passage impossible. The restoration work involved using coffer dams to keep the working area dry and pumping the water around to maintain normal flow downstream. Many tadpoles and few small Brook trout were carefully removed from the work area. The culverts were removed and a small pedestrian bridge was erected.

YEARS OF DATA

PARTNERS

- Ongoing project since 2008

- Parks Canada
- Fisheries and Oceans Canada
- Saint Mary's University
- Mersey Tobeatic Research Institute
- Trout Nova Scotia
- Clean Annapolis River Project
- Education and Water Monitoring Action Group
- Nova Scotia Salmon Association: Adopt-A-Stream Program
- Bluenose Coastal Action Foundation



O. Woods, Parks Canada

Daniel Pouliot, pulling a large rock into Rogers Brook's culvert to build up a fish ladder on September 1, 2010



D. Pouliot, Parks Canada

Trout Nova Scotia representative, Reg Baird, taking pictures of the small Brook trout that summer student employee Oliver Woods is carefully moving out of the work area

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D. Pouliot, Parks Canada

The restoration crew, a mix of park employees and certified local contractors, posed proudly after completion of the pedestrian bridge at Flowing Waters trail

Rationale

The Common loon is a highly visible water bird inhabiting many of the lakes within the Southwest Nova Biosphere Reserve. It is an icon of wilderness and people are captivated by its beauty and haunting call. Concerns have been raised about the health of loons after a study by the Canadian Wildlife Service (CWS) found very high blood mercury concentrations in Kejimikujik loons. These levels have been associated with impaired reproduction and altered breeding behavior in some areas. LoonWatch began on 16 lakes within Kejimikujik in 1996. In 2006, the program was expanded to the greater landscape through MTRI, where volunteers are trained to observe and record loon activity and breeding success on their assigned lake throughout the summer using a national protocol developed by Bird Studies Canada. These two program components will provide a picture of how well loon populations are doing in the region.



Adult loon concealing its nesting location

Monitoring

KEJIMKUJIK-MERSEY LOONWATCH PROGRAM

OBJECTIVES

- To observe Common loon abundance and breeding success on lakes within Kejimikujik and in the Southwest Nova Biosphere Reserve with a focus on the Mersey and Medway watersheds.
- To determine status and trends in loon abundance, lake use and reproductive potential of resident birds.
- To monitor water quality on lakes being observed by LoonWatchers outside Kejimikujik.

METHODS

Outside Kejimikujik:

- Lakeside dwellers and cottagers with an interest in loons were recruited and provided with information about loons and the monitoring protocol.
- Trained volunteers were used to survey lakes in June for loon pairs, in July for newly hatched chicks and in August for surviving young.
- MTRI staff visited many of these lakes, canoed to the deepest part and measured water quality at one meter intervals, recording temperature, conductivity, dissolved oxygen and pH.
- Volunteer data were collected and compiled, then shared with Bird Studies Canada.

Inside Kejimikujik:

- LoonWatch uses trained volunteers in a coordinated effort to simultaneously survey study lakes within a three hour observation period, in early June and during the third week of August.
- Loon monitoring combined data gathered from intensive LoonWatch days involving many volunteers, plus public observations and repeated surveys by Kejimikujik staff.
- MTRI and Environment Canada are also doing more intensive work to better understand population dynamics and relative mercury levels in loons in the region (See page 58-59 and 60-61).



Volunteer Ben Wentzel observing loons on Minard Lake

D. Pernet, MTRI

RESULTS



L. Beals, MTRI

Menchan Lake nest with one egg

YEARS OF DATA

- In 2010, the two LoonWatch programs had over 60 volunteers monitoring loons on at least 55 lakes in the Southwest Nova Biosphere Reserve and about the same number monitoring loons on 16 lakes inside Kejimikujik.
- Nine loon chicks were recorded by LoonWatchers outside Kejimikujik. Four of these chicks were observed as large chicks that had a good chance of survival on First Christopher, Tupper, Donnellan and Russell lakes.
- The surface pH of volunteer lakes ranged from 4.85-7.31.
- The June Kejimikujik LoonWatch reported seven territorial pairs and a total of 15 adult loons, and four small chicks. The August Kejimikujik LoonWatch reported 12 territorial pairs, 32 adult loons and eight chicks.
- Eight large loon chicks were recorded by LoonWatchers in Kejimikujik at the large chick stage on Beaverskin, Big Dam East, Cobrielle, Grafton, Kejimikujik, Loon, and Peskawa lakes.

PARTNERS

- 2006 was the first year for the Mersey LoonWatch Program
- 1996 was the first year for the Kejimikujik program
- Monitoring will continue on an annual basis
- Parks Canada
- Mersey Tobeatic Research Institute
- Bird Studies Canada
- Environment Canada



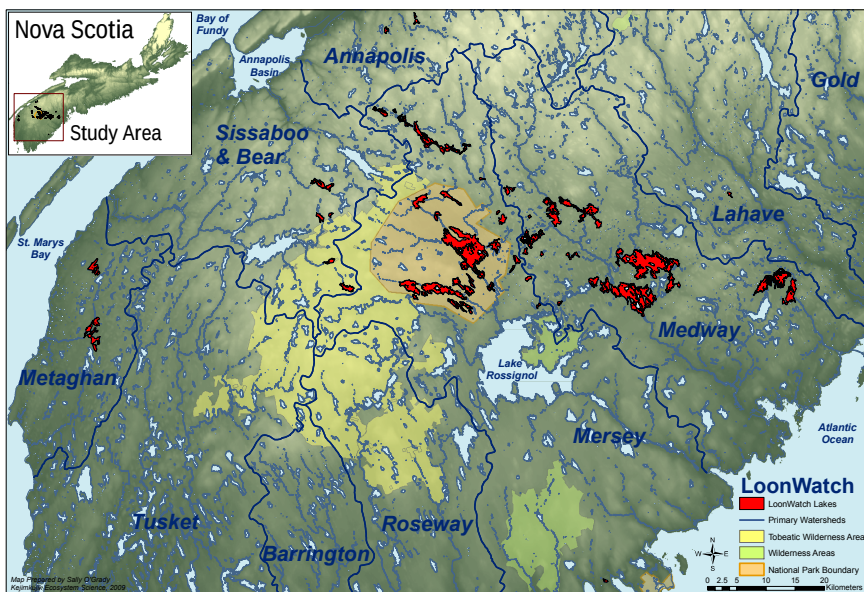
A. Lavers, MTRI

Three adult Common loons on Mountain Lake

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S. O'Grady, Parks Canada

Map showing locations of LoonWatchers in the Southwest Nova Biosphere Reserve with Kejimikujik shaded in brown and Tobeatic in yellow

Rationale

The Common loon is widely used as an indicator of the health of lake ecosystems. The number of chicks that each territorial pair is able to raise is monitored on 35 study lakes within Kejimikujik and the surrounding region; this is a measure of the loon's reproductive success or productivity. Loon productivity is adversely affected by such factors as acid rain, structural and recreational development of lake shorelines, disturbance by boaters, water-level fluctuations, predators and mercury pollution. Environment Canada monitored loon productivity in Kejimikujik from 1988 until 1997 on 25 lakes in Kejimikujik. Loon productivity was found to be correlated with mercury levels in the loons and the fish they eat. Environment Canada resumed monitoring of fish mercury levels in 2006 and Common loon productivity in 2007 and partnered with MTRI to conduct fieldwork, which was expanded to include ten additional lakes outside the park.



Common loon on nest at Annis Lake

Monitoring

MONITORING COMMON LOON PRODUCTIVITY

OBJECTIVES

- To monitor the number of territorial Common loon pairs on 35 study lakes.
- To monitor the number of loon chicks produced by these territorial pairs.
- To provide data on loon productivity for each study lake, which can then be related to environmental factors, human disturbance and mercury pollution.
- To determine if temperature gradient, water level rise, or circannual rhythm cause emergence from hibernation in this species.

METHODS

- Twenty-four lakes within Kejimikujik and 11 lakes outside of the park, but in the surrounding area were surveyed for Common loons and Common mergansers at least three times from early June until September 2010 by trained researchers.
- Surveys included observations of adult loons, nests, eggs and chicks and Common mergansers and their chicks.
- When loons were located the time, date, weather, a GPS location of where the loon was first seen and its behaviour were recorded. Maps were made of the GPS sightings and territorial areas for each loon.
- Survey results were summarised in a database and productivity was calculated for each territorial loon pair.

RESULTS

- Forty-one pairs of loons were observed, 30 of which were breeding pairs (nesting or with chick).
- Common mergansers were observed on 15 of the 35 study lakes.
- Of the nests located for the 30 breeding territories, 24% of eggs were suspected to have been predated at the egg or downy chick stage, 21% were suspected to have been abandoned or unfertilized (found rotten), and 15% were suspected to have been flooded.



Benna Keoghoe and Lindsey Beals surveying Frozen Ocean Lake

RESULTS

Continued

- A total of 29 loons chicks were observed on 22 of the 30 breeding territories, seven of which were observed as large chicks in August or September and likely fledged.
- According to these observations, Common loon productivity for 2010 was higher than in previous years at 0.17 chicks per territorial pair.

YEARS OF DATA

- Year 4 of a 5 year project

PARTNERS

- Parks Canada
- Mersey Tobeatic Research Institute
- Environment Canada
- TD Friends of the Environment Foundation
- Mountain Equipment Co-op
- Canada Summer Jobs, Service Canada

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A well hidden Common loon nest on Grafton Lake



A downy Common loon chick taking cover from the wind

Rationale

Common loons face multiple stressors in their environment that affect their health, reproduction, and survival. These stressors include loss of nesting habitat to human development, loss of eggs to flooding and predation, human disturbance and pollution sources like acid rain, lead fishing sinkers and mercury. Our past research at Kejimikujik found that acidic lakes with high mercury levels in fish and loons produce fewer loon chicks on average. As part of a national study of mercury levels in Common loons, adult loons and their chicks were captured on lakes in Kejimikujik and nearby. This project aims to monitor mercury levels in Common loons at selected sites across Canada, and track any trends in those mercury levels over time. Mercury levels in the loons will be linked with mercury levels measured in Yellow perch (which loons eat) in the same lakes by research partners from the University of New Brunswick, and with loon productivity as measured by MTRI. The findings of this study will help a Canadian assessment of the risks of mercury pollution to fish and wildlife, being carried out by Environment Canada.



Banded loon after release

OBJECTIVES

- To monitor the mercury levels in Common loon adults and their chicks in the Kejimikujik area.
- To monitor any changes in those mercury levels over time.
- To track mercury levels in loons along with any changes in loon reproductive success, fish mercury levels and deposition of mercury air pollution.

METHODS

- Common loon adults and chicks were captured at night in July 2010 on lakes in Kejimikujik and the surrounding area.
- Captured loons were banded with a unique combination of coloured legbands, measured, blood and feather samples were taken for mercury analysis and then the birds were released unharmed.
- Blood and feather samples were sent to the National Wildlife Research Centre in Ottawa, along with other loon samples from across Canada, for mercury analysis.



Researchers with an adult banded loon



Flock of loons

Monitoring

MONITORING MERCURY IN COMMON LOONS

RESULTS

- With excellent production of loon chicks in 2010, we were able to capture 16 adult loons and 14 chicks. All the adults and eight of the chicks were large enough for leg bands.
- The loon blood and feather samples are currently being analysed for mercury at the National Wildlife Research Centre. Results will be shared later in 2011.

YEARS OF DATA

- Year 2 of a 2 year project

PARTNERS

- Environment Canada
- BioDiversity Research Institute (Maine, USA)
- Mersey Tobeatic Research Institute
- Parks Canada



N. Burgess, Environment Canada

Downy loon chick



N. Burgess, Environment Canada

Researchers releasing an adult loon

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Rationale

Mercury is known to affect the nervous system and reproduction of humans and wildlife if exposure from fish consumption is high. Kejimikujik has no direct anthropogenic mercury sources, yet fish and loon tissues contain concentrations that are among the highest in North America. In an earlier study in 2006 and 2007, we found that mercury levels in Yellow perch had increased in 10 of 16 lakes in Kejimikujik and likely pose a greater risk to loons, and perhaps to the fish themselves, than a decade before. Although we know that mercury can affect wildlife, little is known about how the health of wild fish with high levels of mercury can be affected. We also do not know why fish from some lakes in Kejimikujik have increased mercury levels even though emissions of this pollutant to the atmosphere from human activities have decreased in North America.



M. Clayden

The shoreline of Big Dam West Lake where some of the fish and aquatic insects were collected for this study

Research

EFFECTS OF MERCURY IN FRESHWATER FOOD WEBS

OBJECTIVES

- To understand whether high mercury concentrations in Kejimikujik are affecting the ability of Yellow perch to grow and reproduce.
- To understand how mercury gets transferred up the food web into perch in low-pH lakes.

METHODS

Yellow perch health:

- In September of 2009 and 2010, adult Yellow perch were collected from 12 lakes within the park. These lakes are known to have perch with a wide range in mercury concentrations.
- For each fish, its length and weight were measured and scales were taken to determine age and assess growth. Muscle tissue was collected to measure mercury. Ovaries or testes were sampled to understand whether egg or sperm cell development was delayed and if there was any damage to livers, kidneys or spleens from exposure to mercury.

Food web study:

- In June-September 2009 and 2010 lake sediments, zooplankton, aquatic insects and fish were collected from seven lakes in Kejimikujik.
- Insects and other fish that the perch may be eating were collected to understand how much mercury is in the diet of the perch, how it compares from one lake to another and how it is biomagnifying to reach high concentrations in fish such as Yellow perch.

RESULTS

- Field work for the first year of this two year study was completed in September 2009. All of the Yellow perch have been analyzed for mercury and the levels in their muscles were similar to the results from earlier studies.
- Differences have been observed between lakes in how well the fish grow and in how large their ovaries or testes are but these do not seem to be related to mercury levels. However, there is some evidence that mercury is damaging the liver and kidney tissues in fish with the highest levels.



L. Jonart

Meredith Clayden using a dip net to look for aquatic insects along the shoreline of Peskowsk Lake

RESULTS

Continued

- Mercury was measured in several different types of insects from these lakes and levels were found to vary from one type of insect to another and from one lake to another.
- Results will be used to understand whether perch mercury is highest in lakes where insect mercury is highest. The lab analyses for both projects are ongoing and other field work is being planned for 2010 to expand the number of lakes in these two projects.

YEARS OF DATA

- Year 2 of a 2 year project

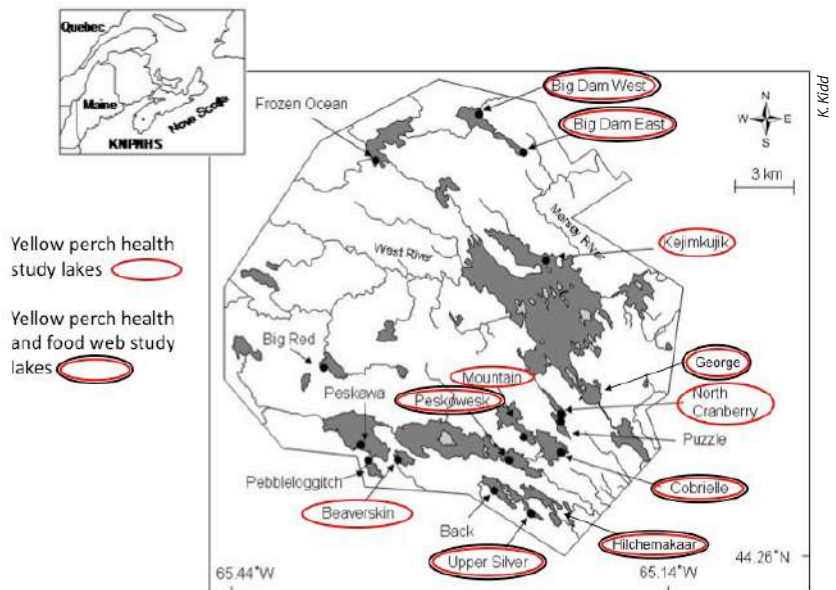
PARTNERS

- Parks Canada
- Environment Canada
- Natural Sciences and Engineering Research Council



N. Gottselig

Katharina Batchelar dissecting a Yellow perch which has been caught at Grafton Lake



K. Kidd

Lakes in Kejimikujik that were sampled in 2009 and 2010 for sediments, zooplankton, aquatic insects, or fish in this study

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M. Gauthreau

A Yellow perch from Kejimikujik on a length board to determine fork length of the fish

Rationale

Common loons in Kejimikujik are accumulating neurotoxic concentrations of methylmercury (MeHg) due to biomagnification from organisms lower in the food web. Predatory aquatic insects such as dragonflies have been found to accumulate high MeHg concentrations (similar to fish) and are potentially transporting it in both terrestrial and aquatic ecosystems. Information concerning MeHg bioaccumulation in lower trophic organisms is currently very limited. Bird and fish exposure to MeHg will vary depending on the type of prey consumed as well as the life stage and body parts they select. The dragonfly's role in mercury biomagnification can be better understood by measuring the amount of different types of mercury in the dragonfly throughout its life cycle.



Big Dam East Lake, near where the study took place



Amy Buckland-Nicks sampling dragonflies on the shore of Big Dam East Lake

Research

MERCURY IN DRAGONFLIES FROM KEJIMKUJIK LAKES

OBJECTIVES

- To determine if there is a significant difference in dragonfly mercury concentrations sampled from Big Dam East and Big Dam West lakes. Big Dam West Lake has higher mercury in its surface water and in fish.
- To determine if there is a significant difference in mercury concentrations and the percentage that is MeHg between the dragonfly naiad, adult, and exuviae (post-emergence casings).
- To determine if there is a significant difference in mercury species concentrations between the head, thorax and abdomen of the dragonfly naiad and adult.
- To determine if there is a relationship between naiad age and weight with mercury species concentrations.

METHODS

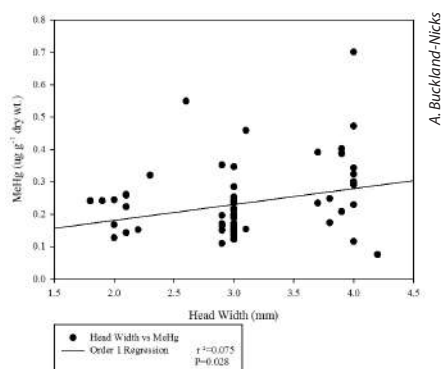
- Freshwater samples were collected from 10 lakes in Kejimikujik spanning a range of dissolved organic carbon (DOC) concentrations (DOC ranging from 2.6 to 15.4 mg/L).
- In May and June 2010, dragonfly naiads, adults, and exuviae were sampled from the shores and near shore areas of Big Dam East and Big Dam West lakes. Ten representative, evenly dispersed sites (~100 m apart) were chosen for each lake.
- Samples were frozen and homogenized, then analyzed for different types of mercury using alkaline digestion, ethylation, and gas chromatography - atomic fluorescence spectrometry. Concentrations were recorded for both dry weight and wet weight. Eight naiads and eight adults were allotted for body section analysis.
- General linear models were used to analyze significant differences between lake samples and life stages and one-way analyses of variance were used for body section comparisons. Linear regressions were used to determine relationships between naiad growth and mercury concentrations.

RESULTS

- Dragonfly naiads had MeHg concentrations ranging from 76 to 715 ng g⁻¹ (dry weight), and are high compared to studies of mercury in dragonflies from other natural lakes. High

RESULTS

Continued



Linear relationship between naiaid age (head width) and MeHg ($\mu\text{g g}^{-1}$ dry wt.)

YEARS OF DATA

PARTNERS

percentages of MeHg (79% to 97%) indicates the dragonfly's high trophic level.

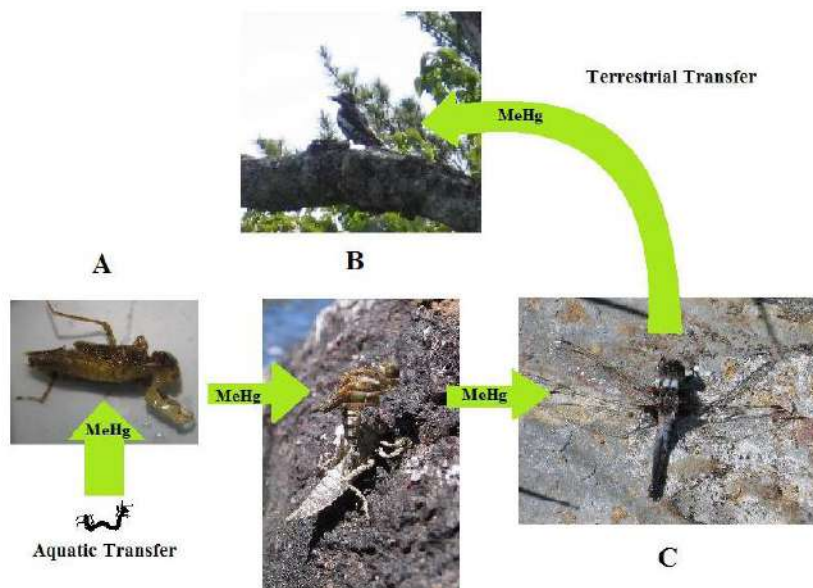
- Dragonfly samples from Big Dam West, with higher mercury levels, had higher body concentrations of mercury, possibly indicating their potential as mercury biomonitors.
- MeHg concentrations were similar between adults and naiads, as well as between mature flying adults and emerging adults, indicating either the low impact of the adult's terrestrial diet or MeHg detoxifying mechanisms.
- Exuviae had fifty-fold lower MeHg than naiads and adults and likely have little impact on dragonfly MeHg concentrations.
- Emerging dragonflies had two to three-fold higher Hg(II) than naiads and mature adults (low %MeHg) indicating either the possible effects of weight loss or MeHg detoxification mechanisms with emergence.
- MeHg was homogenously distributed in the body sections of naiads and adults, indicating equal exposure for predators feeding on different parts.
- MeHg concentrations are positively related to naiaid age and weight; however the relationship is weak due to high variation in the oldest naiads.

- Single year project

- Natural Sciences and Engineering Research Council of Canada
- Ducks Unlimited
- Acadia University

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The terrestrial transfer of MeHg from aquatic food sources to dragonfly A) naiads, B) emerging adults, and C) mature adults to birds

Rationale

Transfer of mercury from aquatic to terrestrial ecosystems occurs primarily via consumption of invertebrates by birds and fish. As intermediate predators, dragonfly and damselfly nymphs (Order Odonata) are important invertebrates in littoral zones and wetlands. The impact of many environmental pollutants such as MeHg on aquatic invertebrate predators has received minimal research attention. Investigating the effects of methylmercury-cysteine on aquatic invertebrate predators may increase knowledge of methylmercury bioaccumulation. The role of invertebrates in the food chain, and how they respond to environmental contaminations are the major gaps in research addressed.



Examining damselflies in the field

Research

MERCURY EFFECTS ON DAMSELFY NAIADS

OBJECTIVES

- To determine the effects of MeHg injections on foraging behaviour and escape response of damselfly naiads.

METHODS

- Changes in foraging behaviour, responses to a predatory stimulus, and neuroanatomy of damselfly naiads as a result of mercury bioaccumulation were tested in the lab.
- Damselfly naiads were collected from Big Dam East and Big Dam West lakes of Kejimikujik.
- Injections of methylmercury cysteine were administered into the abdominal thoracic articulations of naiads.
- Foraging and predatory response tests were completed at 24 hours and one-week intervals.
- Trials were performed on naiads that had been injected with one of five dilutions of methylmercury (100 ng, 500 ng, 1000 ng, 2500 ng or 5000 ng of MeHg) or a saline cysteine solution.

RESULTS

- Results suggest that MeHg has no biologically significant effect on foraging behaviour.
- Reduction of MeHg in damselfly bodies at 24 hrs and one-week was not significant.
- However, a decrease in concentrations of MeHg was observed.
- MeHg injections lead to a significant increase in velocity.
- MeHg injections did not have a significant effect on angular movement in this experiment.

YEARS OF DATA

- Single year project

PARTNERS

- Acadia University



A. Larkin

Researchers recording data in the field



A. Larkin

Researchers collecting invertebrates

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Photos on page 71

Clockwise from top left:

- Water-pennywort by M. Crowley
- Blanding's turtle hatchling running for water by J. Kinley, MTRI
- Wetland from the air by A. Lavers, MTRI
- Green frog by J. Kinley, MTRI
- Pink *Calopogon* orchid by B. Caverhill, MTRI



WETLANDS



Rationale

Transitions between plant communities on the landscape have become a focus of ecological research due to their relatively high diversity and sensitivity to global climate change. However, little is known about how vegetation changes across natural landscape boundaries such as the forested edges of wetlands and lakes. Boundary structure affects flows of energy, material and organisms across such transition. An understanding of this structure would help delineate wetland boundaries and how these boundaries contribute to valuable wetland functions such as providing carbon sinks, supplying clean water and enhancing soil nutrition. Determination of the effective width of these transitions will contribute towards mapping the extent of transition zones on the landscape. These transitions have greater biodiversity and different habitat features that are important for wildlife conservation.



Looking from a bog into the forest along one of the study transects

Research

VEGETATION AT WETLAND FOREST EDGES

OBJECTIVES

- To estimate the distance of edge influence (edge width) for forest structure, understory composition and bryophyte composition at bog and lakeshore forest edges.
- To compare patterns of changes in vegetation structure and individual species across bog and lakeshore forest edges.
- To determine if understory, bryophyte and structural diversity are greater at the edge compared to the adjacent forest and bog communities.

METHODS

- Transects were set up across four bogs and four lakeshore forest edges in spruce forests in southwest Nova Scotia with sampling points at 5, 15, 25, 40, 60, 100, 140 and 180 m from either side of the edge.
- At each sampling point, forest structure characteristics were measured including canopy cover, live and dead tree density, and moss and soil samples for subsequent determination of soil moisture and pH were collected.
- Contiguous 1 m x 1 m quadrats -60 to +60 m and across 5 m spans at 100, 140, and 180 m were used to estimate cover of saplings, understory and bryophyte species.
- Analysis focused on comparing data at each edge distance with the reference data (100, 140, and 180 m) using randomization tests. Later, spatial pattern analysis will be used to compare patterns across the transitions.

RESULTS

- Structure of the forest side of the edge was not significantly different from interior forest at either bog or lakeshore forest edges. There was also little difference in understory composition at the forest side of bog edges.
- Distance of edge influence was 40 m into the bog for increased tree density, greater canopy cover and greater abundance of some understory species compared to further into the bog; and 5 m into the forest for peat moss, an indicator species for bogs.
- Patterns of individual species abundances varied considerably across the transition zones.



Wendy Wilson, Kaitlyn O'Handley and Ana. Pérez collecting data along a lakeshore forest edge

RESULTS

Continued

YEARS OF DATA

PARTNERS

- Both transition zones exhibited some different habitat features compared to the adjacent communities such as greater canopy cover and tree density at bog edges and lower total moss cover at both edge types.
- At bog edges, bryophyte species richness was higher and tree structural diversity was either higher or lower. Shrub species richness decreased from the bog to the forest as herb richness increased.
- Single year project
- Natural Sciences and Engineering Research Council of Canada
- Parks Canada
- Mersey Tobeatic Research Institute



Wendy Wilson measuring the diameter of a log at the study site

K. O'Handley

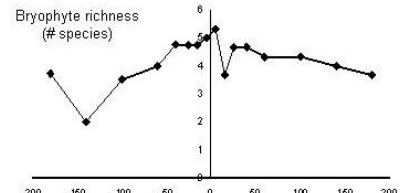
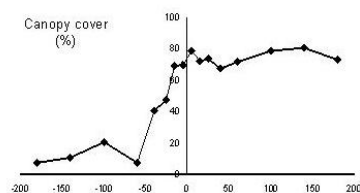
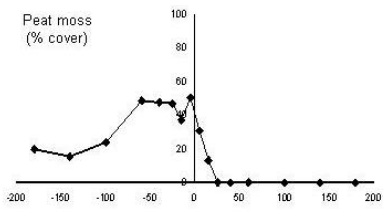
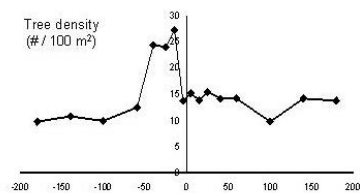


W. Wilson

A lakeshore forest edge five meters into the forest

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Bog Distance from edge (m) Forest

Average tree density and canopy cover across the bog-forest transition

Bog Distance from edge (m) Forest

Average peat moss cover and bryophyte species richness across the bog-forest transition

K. Harper

Rationale

Atlantic coastal plain flora (ACPF) are a unique group of unrelated plants that are mainly found along lake and rivershores, wetlands and saltmarshes in southwest Nova Scotia. Almost half of these species are listed as 'at risk' or 'sensitive' by the NS General Status Ranks and some are globally rare. There are over 90 species of ACPF in Nova Scotia, including the species Water-pennywort. Water-pennywort is a small plant with rounded, lobed green leaves. The leaves float like a lily pad in deep water and stand erect in shallow water or above the water line. This special plant is only found on few lakes in all of Canada. It is listed as Threatened by the Species at Risk Act and Endangered by the NS Endangered Species Act. The population in Kejimikujik is monitored annually by park staff and volunteers to assess its distribution and abundance.

M. Crowley, Parks Canada



Water-pennywort can float on top of the water like a lily pad

OBJECTIVES

- Monitor Water-pennywort population abundance and density on Kejimikujik Lake.
- Assess water levels, stem height and percent damage within Water-pennywort stands.
- Survey Kejimikujik Lake to look for the establishment of new Water-pennywort stands.

METHODS

- Water-pennywort surveys are conducted annually on Kejimikujik and George lakes within Kejimikujik. Surveys are conducted on known populations in both shoreline and aquatic habitats.
- Extensive surveys are conducted every few years to search for new stands.
- Population abundance, density, stem height, water depth and percent damage of individual Water-pennywort stands are assessed by systematic transect surveys in early August. Stand surface area is also measured. Survey results are compared to historic data in order to determine population size fluctuations.

RESULTS

- Park staff and volunteers monitored Water-pennywort at six sites in Kejimikujik on August 12-13, 2010.
- Water levels were high on Kejimikujik Lake in August 2009 and 2010. Consequently the majority of the pennywort observed was floating on the top of the water (like a lily pad) and no flowering was observed. In 2008 lake water levels were lower and erect stems and flowers were observed at multiple sites. In 2008 the number of ramets/stand was also lower. Further investigation is required to determine how water levels affect stand density and size.

M. Crowley, Parks Canada



In low water years Water-pennywort also grows erect out of the water

Monitoring

WATER-PENNYWORT MONITORING

RESULTS

Continued

YEARS OF DATA

PARTNERS



M. Crowley, Parks Canada

Monitoring Water-pennywort on Kejimikujik Lake



M. Crowley, Parks Canada

Volunteers assisting with monitoring

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- Stand area and the density of ramets per stand fluctuate between years; however the Kejimikujik population appears to be stable.
- A portion of Kejimikujik Lake will be intensively surveyed for Atlantic coastal plain flora in 2011, including searching for new stands of Water-pennywort.

- Ongoing project since 1999
- Initial population estimates for Water-pennywort were conducted in 1983

- ACPF Recovery Team
- Parks Canada

Table 1. Estimated aerial extent (m²) of Water-pennywort stands at Kejimikujik

Stand Name	2007	2008	2009	2010
Merrymakedge Beach	1677	1360	1275	2710
Meadow Beach	466	606	434	555
Jim Charles	254	544	313	414
Jeremy's Bay (Indian Point)	3161	3590	3282	3573
George Lake	145	159	32	247
Petroglyphs	851	1334	796	1700



M. Crowley, Parks Canada

Flowers are produced in low water years

Rationale

The Nova Scotia Nature Trust's Rare Plant Monitoring program engages volunteers in collecting field data on the habitat for Atlantic coastal plain plants found along lakeshores and bogs in southwestern Nova Scotia. Volunteers are trained to identify and count these rare plants and monitor changes in populations at the same sites every year. Monitoring helps to determine how the plant populations behave over time. Are they migrating along the shoreline? Are they staying in one established location? Are the numbers of plants increasing or decreasing? This information improves the ability to protect these exceptional plants and their habitat. The Atlantic coastal plain flora is one of the most endangered plant groups in Canada; 11 of the 90 species are considered Endangered, Threatened, or Special Concern by the Committee on the Status of Endangered Wildlife in Canada. Five species are considered to be globally at risk of extinction and 25 are listed as 'at risk' or 'sensitive' by the Nova Scotia provincial government. Rare Plant Monitors play a key role in aiding their recovery both as "citizen scientists" and as communicators of how interesting species at risk recovery can be.



Plymouth gentian, a nationally Endangered Atlantic coastal plain flora species

Monitoring

RARE PLANT MONITORING

OBJECTIVES

- To involve local landowners, recreational land users and other interested individuals in the conservation and recovery of Atlantic coastal plain flora in southwestern Nova Scotia.
- To collect information on the geographic distribution of Atlantic coastal plain flora on private lands in southwest Nova Scotia.
- To track changes in and assess threats to Atlantic coastal plain flora populations and habitat in southwest Nova Scotia.

METHODS

- Outreach and education initiatives were conducted with landowners in Lunenburg, Queens, Shelburne, Yarmouth, Digby and Annapolis counties about the importance of protecting coastal plain plants and habitat on their property.
- Volunteers were recruited for the Rare Plant Monitoring program. These recruits included landowners in southwest Nova Scotia as well as conservation minded individuals throughout the province.
- New and existing volunteers were trained to identify Atlantic coastal plain flora species, measure population density, gauge habitat threats, and record this information on Nature Trust data sheets.
- Volunteers visited selected coastal plain sites on private lands one or more times each year to count plant populations, photograph the sites and record observations of habitat.
- These data sheets were submitted to the Nova Scotia Nature Trust to aid in species conservation.

RESULTS

- Seven new volunteer monitors were trained in 2010.
- Nature Trust volunteers monitored Atlantic coastal plain flora habitat on nine lakes (Ponhook, Molega, Fancy, Moody, Snare, Gillfillan, Hog, Barrington, Little Halfway) and along the Medway River, contributing to long-term data records of habitat characteristics and species occurrences on these lakes.



Volunteer monitors treading carefully along a lakeshore during a training session

RESULTS

Continued

YEARS OF DATA

PARTNERS

- Atlantic coastal plain flora species monitored included: Pink coreopsis, Thread-leaved sundew, Plymouth gentian, Golden crest, Redroot, Tubercled spike-rush, Long's bulrush, Buttonbush, Virginian meadow-beauty, Goldenrod, Goldenpert, Marsh St. John's wort, Lance-leaved violet, Swamp rose, Button sedge, Yellow-eyed grass and Purple bladderwort.

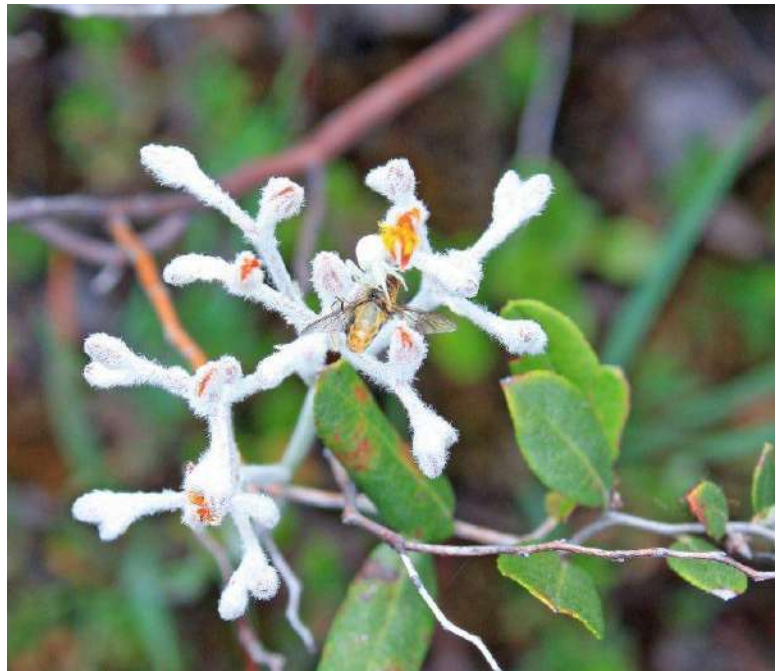
- Ongoing project since 1999

- Nova Scotia Nature Trust
- Atlantic Coastal Plain Flora Recovery Team
- Nova Scotia Department of Environment
- Nova Scotia Department of Natural Resources
- Government of Canada Habitat Stewardship Program for Species at Risk
- Nova Scotia Habitat Conservation Fund
- Nova Scotia Species at Risk Conservation Fund
- Municipality of the District of Shelburne
- Canadian Wildlife Federation
- Aveda International



B. Holden, NSNT

Virginian meadow-beauty found by two volunteer monitors during a site visit



J. Kenefick, NSNT

Golden crest, a nationally threatened Atlantic coastal plain flora species, with a pollinator, found by a volunteer monitor along Fancy Lake

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Rationale

Blanding's turtles in Nova Scotia exist in three small populations on the Mersey and Medway watersheds and have been listed as Endangered under both the federal *Species at Risk Act* and the *Nova Scotia Endangered Species Act*. One of the concerns for this long lived (80+ years), slow maturing (20+ years) species is the lack of young adults in the population. This is of particular concern in the population at Kejimikujik where only five young females have been recorded during the last decade. Rates of predation of unprotected nests are variable but can reach 100%. Raccoons are the primary nest predators and their populations may be unusually high in human inhabited areas (*i.e.*, campgrounds and communities). An annual volunteer-based nest protection program was established in Kejimikujik and later expanded to populations outside the park to engage the public in helping to protect and care for turtle nests.

Monitoring

BLANDING'S TURTLE NEST MONITORING

OBJECTIVES

- To protect Blanding's turtle nests from predation in order to improve recruitment into the populations.
- To collect eggs for incubation and rearing (from Kejimikujik nests).
- To provide an opportunity for volunteers to engage in species at risk recovery.
- To collect long-term data on female survivorship, clutch size, hatching success and site fidelity.

METHODS

Nest Protection (June)

- Known nesting sites were monitored on a nightly basis during nesting season.
- Individual turtles were radio tracked to locate new nesting sites.
- Starting at 7:30 pm, volunteers and researchers walked each site watching for turtles. Observers watched females go through the nesting process and recorded data related to behaviour and movements, weather, timing of activities and clutch size.
- Once a nest was completed and the female had left the site, volunteers covered the nest with a wire mesh cage and secured it with large rocks to protect the nest from predation.
- Eggs from selected nests in Kejimikujik were collected and transported to Oaklawn Farm Zoo for incubation.

Nest Monitoring (September – October)

- Nests were monitored periodically until the first hatchlings emerged and then were monitored daily by volunteers and researchers who marked, measured, weighed and released hatchling turtles at the nest site.



A hatchling Blanding's turtle taking its first steps



Checking the temperature of the protected nests at McGowan Lake

R. Thibodeau, MTRI



N. D'Entremont, Parks Canada

Measuring the weight of a hatchling Blanding's turtle

RESULTS

Nest Protection (June)

- In 2010, volunteers in Kejimikujik located and protected a record 27 Blanding's turtle nests. Of these, eggs from 12 nests were collected for incubation.
- Thirteen nests were protected at McGowan Lake and six at Pleasant River, thanks to efforts from volunteers, researchers and community members.

Nest Monitoring (September – October)

- One-hundred-eighty-three hatchlings emerged in total in 2010 from the nests that were not collected for incubation.
- A total of 76 hatchlings emerged from the 15 nests in Kejimikujik. Volunteers also helped to excavate eggs from nests that were overdue.
- At McGowan Lake, 67 hatchlings emerged from the protected nests.
- In Pleasant River, 40 hatchlings emerged from volunteer-monitored protected nests monitored by local volunteers.

YEARS OF DATA

- Ongoing project since 1989 in Kejimikujik
- Ongoing project since 2000 at McGowan Lake
- Ongoing project since 2002 at Pleasant River

PARTNERS

- Parks Canada
- Blanding's Turtle Recovery Team
- Acadia University
- Friends of Keji Cooperating Association
- Mersey Tobeatic Research Institute
- Government of Canada Habitat Stewardship Program for Species at Risk
- Oaklawn Farm Zoo

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J. Saroli, MTRI

A group of herpetologists learning about Blanding's turtle nesting

Rationale

Blanding's turtles in Nova Scotia are listed as Endangered under both the provincial Endangered Species Act and the federal Species at Risk Act. The listing is in part due to their small population size and limited distribution in the province. Since 1969, only 300 individual adults have been identified, most within the three currently known populations. Unconfirmed sighting reports suggest that additional populations may exist elsewhere in the southwest region of the province. Searching for new populations is a labour intensive undertaking, requiring the help of many volunteers.



A Blanding's turtle peeks out of its shell

Monitoring

BLANDING'S TURTLE DISTRIBUTION SURVEYS

OBJECTIVES

- To search for additional populations of Blanding's turtles in several areas around southwest Nova Scotia.
- To continue monitoring the Blanding's turtles in the three known populations in southwest Nova Scotia.

METHODS

- Live trapping was conducted using hoop traps baited with sardines. Traps were set for two to five days and were checked daily by trained staff and volunteers.
- Visual surveys were conducted by slowly searching the area by canoe or on foot.
- All new turtles captured were given a unique notch code so that they can be individually identified on subsequent captures. Turtles were handled by trained personnel in accordance with the standard procedures developed by the Blanding's Turtle Recovery Team.
- Search areas were selected based on proximity of sighting reports and presence of appropriate looking habitat identified from air photographs or ground surveys.

RESULTS

- Thirty individual trapping sessions were conducted on four watersheds for a total of 787 trapping nights on provincial and private land.
- Nineteen volunteers were involved in trapping, putting in over 550 hrs of effort. Volunteers were involved in 23 of the 30 trapping sessions. Eighteen of the trapping sessions were conducted entirely by volunteers.
- Blanding's turtles were only trapped from two of the three known populations, and none of the trapping sessions in new areas yielded any Blanding's turtle captures.



Blanding's turtle wetland habitat

YEARS OF DATA

PARTNERS



J. McNeil, MTRI

A young turtle's age can be measured by counting rings on the scutes on its underside

- Ongoing project since 1989
- Acadia University
- Mersey Tobeatic Research Institute
- Parks Canada
- Nova Scotia Power Incorporated
- Nova Scotia Department of Natural Resources
- Friends of Keji Cooperating Association
- Government of Canada Habitat Stewardship Program for Species at Risk



J. McNeil, MTRI

After being processed, this turtle returned back to the water where it was trapped

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Rationale

The Nova Scotia population of Blanding's turtles is listed as Endangered by the federal *Species at Risk Act* and *Nova Scotia Endangered Species Act*. This small population is geographically isolated from the species main range and low juvenile recruitment has been observed. Three distinct populations are known to exist in Nova Scotia. Viability analysis conducted on one of these populations, Kejimikujik, suggests that without intervention, the population faces significant risk of extinction. Headstarting is a conservation tool that aims to boost recruitment by rearing hatchlings in captivity for the first two years of their life and releasing them back into their natural habitats. This allows turtles to avoid high mortality rates associated with early life stages and to grow under optimal conditions. Incubating eggs under optimal laboratory conditions can potentially provide an additional boost to recruitment by producing larger numbers and healthier hatchlings than variable conditions in the wild.



Hatchling emerging

Research

BLANDING'S TURTLE HEADSTART INCUBATION

OBJECTIVES

- To boost recruitment into the Kejimikujik population of Blanding's turtles
- To determine the optimal incubation temperatures and conditions that produce healthy male and female Blanding's turtles

METHODS

- During nesting season in June, eggs from 12 nests in Kejimikujik were collected and transported to the incubation facilities at Oaklawn Farm Zoo. Eggs were incubated at one of two temperatures, 26.5 °C or 30.5 °C (one degree higher and lower than in 2009).
- Hatchlings emerged from the incubated eggs from mid-July to mid-August. In mid-September these hatchlings were transported to the Toronto Zoo to be reared under the care of experienced zoo personnel until spring 2012.
- Hatchlings from the 2009 cohort continued to be reared at Acadia University following established rearing protocols. Turtles were transported to Oaklawn Farm Zoo for an overwintering period from December to February. Turtle growth was monitored on a weekly basis prior to the first overwintering period and is now monitored on a biweekly basis.

RESULTS

- Fifty-eight hatchlings emerged from the 142 eggs collected in 2010 (40.8%). Hatching success was considerably lower than the previous year (81%).
- At emergence, hatchlings from the low temperature incubators weighed an average of 9.1 g (range 7.1 g-11.1 g, n= 34) and hatchlings from high temperature incubators weighed an average of 7.8 g (range 5.5 g - 9.1 g, n= 24).
- Hatchlings started feeding and growing shortly after emergence and have continued growing since their arrival at the Toronto Zoo.

YEARS OF DATA

PARTNERS



J. McNeil, MTRI

An incubated Blanding's turtle emerging

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- The 103 surviving hatchlings from the 2009 clutch have continued to grow. As of September 29, 2010 carapace length ranged from 49 to 71 mm and mass ranged from 25.6 to 66.7 g.
- Hatchlings from the 2009 clutch will be released back into their natural habitats in spring 2011.
- Year 2 of a 4 year project
- Acadia University
- Parks Canada
- Oaklawn Farm Zoo
- Toronto Zoo
- Friends of Keji Cooperating Association
- Mersey Tobeatic Research Institute



J. McNeil, MTRI

Hatchling incubators



J. McNeil, MTRI

Blanding's turtle eggs in incubator

Rationale

The chemistry of the water in a peatland system is determined by two principal factors: the quality and quantity of the water coming into the system and the chemical transformation within the system itself. As a result, the quality and quantity of water in a wetland can be strongly influenced by many stressors, including land use change and forestry practices, infrastructure and road development, hydrological modification, acid deposition and long-range transport of air pollutants and climate change. This project monitors water quality and quantity in peatlands (bogs) at Kejimikujik. The specific measures that are reported on are a water quality index, developed based on the status of key wetland water quality parameters (*i.e.*, pH, conductivity, salinity, phosphorous, nitrogen, potassium, and calcium) and mean monthly water level. These water quality and quantity parameters affect the growth of plants and peatland communities, so changes in these parameters are indicative of significant changes in peatland communities.

D. Pouliot, Parks Canada



Heber Meadow

Monitoring

WETLANDS WATER QUALITY AND QUANTITY

OBJECTIVES

- To determine if mean monthly water levels are within the range of natural variation for bogs at Kejimikujik and whether they have increased or decreased over the past five years.
- To determine if key water quality parameters (*i.e.*, pH, conductivity, salinity, Ca, N, K, P) are within the range of natural variation for bogs at Kejimikujik and whether they have increased or decreased over the past five years.

METHODS

- Ten medium-large bogs (*i.e.*, greater than or equal to 15 ha in surface area) were sampled for water quality and level at Kejimikujik.
- Wetland water quality and level were sampled in piezometers or small diameter observation wells, that were installed at each site.
- Water quality measurements were done in May and October using in-situ probes and through laboratory analysis of collected water samples.
- Water levels were measured manually in May and October as well as automatically through the use of Onset HOBO data loggers that record water level every 12 hrs.
- The sampling frequency for this project is once annually for water quality and continuously for water level. Each site is visited twice annually to replace the data logger.

RESULTS

- More years of data are needed to assess status and trend of this measure.
- Preliminary results of average pH, water temperature, dissolved oxygen, conductivity and turbidity are presented in attached table. The high variability in conductivity reading (X: 66; SD: 60) in the spring 2010 can be explained by an outlier reading at site ID_354 Southwest Branch (conductivity = 233 $\mu\text{S}/\text{cm}^3$). Other variables that showed similar outlying condition at the same site at the same time are pH (5.87) and turbidity (0.150 TDS g/L). The unconfirmed but potential death of insects that got trapped in the well could be an explanation for such readings.

M. Bokarski, Parks Canada



Piezometer well, with its cap removed for a water sample, being used to measure water quality and quantity

YEARS OF DATA

PARTNERS

- Ongoing project since 2008
- Parks Canada
- Mersey Tobeatic Research Institute
- Heather Stewart, Wapusk National Park



D. Pouliot, Parks Canada

M. Bojarski collecting water sample from the piezometer well at Heber Meadow



M. Bojarski

D. Pouliot, keeping his cool despite voracious black flies repeated attacks

Year	2008		2009		2010	
Season	Spring	Fall	Spring	Fall	Spring	Fall
pH minimum	3.69 (0.24)	3.95 (1.12)	3.78 (0.10)	3.77 (0.17)	3.76 (0.62)	2.65 (0.47)
pH maximum	4.62 (0.24)	4.29 (0.12)	4.03 (0.10)	4.40 (0.17)	5.87 (0.62)	4.46 (0.47)
Water temperature (T°C)	8.96 (2.13)	9.71 (1.17)	10.11 (0.90)	8.15 (1.03)	9.08 (0.79)	10.18 (1.43)
Oxygen (mg/L)	2.90 (1.10)	4.29 (1.26)	3.19 (1.38)	3.45 (1.66)	2.69 (2.42)	2.02 (0.59)
Oxygen (% saturation)	25.2 (9.5)	37.4 (11.2)	27.6 (11.5)	29.2 (13.6)	19.2 (14.9)	18.0 (5.3)
Conductivity (µs/cm ³)	46 (8)	60 (6)	42 (2)	55 (5)	66 (60)	58 (20)
Turbidity (TDS g/L)	0.030 (0.005)	0.039 (0.004)	0.027 (0.001)	0.035 (0.003)	0.043 (0.038)	0.040 (0.008)

K. Rowter, Parks Canada

Average wetland water variables by year and season with standard deviation for the 10 sites sampled at Kejimikujik (n= 10 except for Fall 2008 where n:9)

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Rationale

The Eastern ribbonsnake is listed as Threatened by the federal Species at Risk Act and the Nova Scotia Endangered Species Act. Although they have been found at over 40 sites in southwest Nova Scotia, the majority of these sites have less than five sightings and little is known about the long term population trends or specific habitat requirements of the species. Grafton Lake, in Kejimikujik, is one of the few known places in the province where ribbonsnakes occur in high densities. Ribbonsnakes are typically found in wetlands and along lake shorelines during summer. However, little is known about how much they rely on terrestrial habitats that surround these wetlands and how far they will travel into these terrestrial habitats, particularly for overwintering.



An Eastern ribbonsnake in early spring near the suspected overwintering site



N.D'Entremont, Parks Canada

Camera mounted to record activity around the suspected overwintering site

Research

EASTERN RIBBONSNAKE TERRESTRIAL HABITAT

OBJECTIVES

- To monitor long-term population trends in ribbonsnake abundance and distribution
- To locate overwintering sites and determine their habitat characteristics
- To determine how far snakes move away from wetlands

METHODS

- Sites were surveyed on foot by a team of 1-14 people (average of three). People systematically surveyed each site, attempting to cover the entire search area. Data on search effort, temperature and weather conditions was recorded.
- Sites were surveyed throughout the active season. In spring and fall, surveys focused on both wetlands and surrounding terrestrial areas. When possible, surveys occurred each warm and sunny day. Throughout the summer, surveys occurred periodically and were focused primarily on the wetlands.
- Surveys were often aided by trained conservation canines.
- An effort was made to hand capture each ribbonsnake observed. Snakes were marked individually by ventral scale clipping, which last approximately one year. Snakes were measured, weighed, examined for distinguishing characteristics and were then released at the capture site. Information on snake location, behaviour and habitat characteristics was recorded.
- Two constantly recording video cameras were set up in suspected overwintering areas from October 21 to November 4 in an attempt to record snakes returning to their overwintering sites.

RESULTS

- The first known terrestrial overwintering site for ribbonsnakes in Nova Scotia was discovered in fall 2009 and verified in spring 2010. In March a total of 11 ribbonsnakes were found at this wooded location, 150 m from the nearest wetland. In fall 2010, despite intensive surveys only 1 live and 3 dead ribbonsnakes were found at this site. The dead snakes were believed to have been killed by freezing weather conditions. No snakes were observed on video camera recordings.

RESULTS

Continued

- Ribbonsnake mating activity was observed for the first time in Nova Scotia. Mating activity took place at the overwintering site, shortly after emergence.
- A total of 97 observations were recorded and 46 individual snakes were identified (37 first capture, 22 recaptures, 38 escapes)
- Over 80 people participated in 375 hrs of survey effort, which included students from field classes at Dalhousie University, North Queens Regional School and Nova Scotia Community College.

YEARS OF DATA

- Ongoing project since 2004

PARTNERS

- Acadia University
- Eastern Ribbonsnake Recovery Team
- Dalhousie University
- Parks Canada
- Mersey Tobeatic Research Institute



A terrestrial survey for Eastern ribbonsnake at Grafton Lake

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Three snakes mating on the forest floor in early spring

Rationale

The Eastern ribbonsnake, a subspecies of the Northern ribbonsnake, is considered threatened in Canada. Its range in Nova Scotia is known as the greater Kejimikujik ecosystem in Queens, Annapolis and Lunenburg counties. The structure of the population is currently being investigated through the ongoing collection of sightings and captures. Within the current range extent there are large areas without any sightings or captures. Recently, there have been confirmed sightings far from what was formerly considered to be the range limit.



Eastern Ribbonsnake sunning itself

Research

EASTERN RIBBONSNAKE RANGE

OBJECTIVES

- To gain a better understanding of the range and population structure of the Eastern ribbonsnake by searching priority areas outlined in the recovery strategy as well as other areas that may contain ribbonsnakes.
- To determine the level of Passive Internal Transponder (PIT) tag retention of individuals tagged the previous year.

METHODS

- Visual searches for ribbonsnakes were conducted with two or more trained people until it was felt that the area had been searched thoroughly.
- When captured, snakes were processed for standard body measurements. Location, habitat and climatic variables were also collected.
- PIT tags were inserted just below the skin of sufficiently large ribbonsnakes in an effort to permanently mark for future identification.

RESULTS

- Ribbonsnakes were found for the first time at four sites (Cannon Lake, Pierce's Lake, Flinn Lake and Little Ponhook Lake). All of these areas were between sites where snakes were previously captured.
- Ribbonsnakes continue to be found in new areas within their known range, which lends credibility to the idea that their distribution is less scattered and more contiguous than previously thought.
- Ribbonsnakes previously PIT-tagged were recaptured and positively identified at Keddy Cove on Molega Lake. The success with the PIT-tagging shows one more way of marking and identifying this species, which is notoriously difficult to study.

YEARS OF DATA

- Ongoing project since 2004



Wetland habitat of the Eastern ribbonsnake

PARTNERS

- Government of Canada Habitat Stewardship Program for Species at Risk
- Acadia University
- Eastern Ribbonsnake Recovery Team
- Dalhousie University
- Mersey Tobeatic Research Institute
- Nova Scotia Power Incorporated
- Parks Canada



R. Thibodeau

Researchers conducting a visual survey for Ribbonsnakes



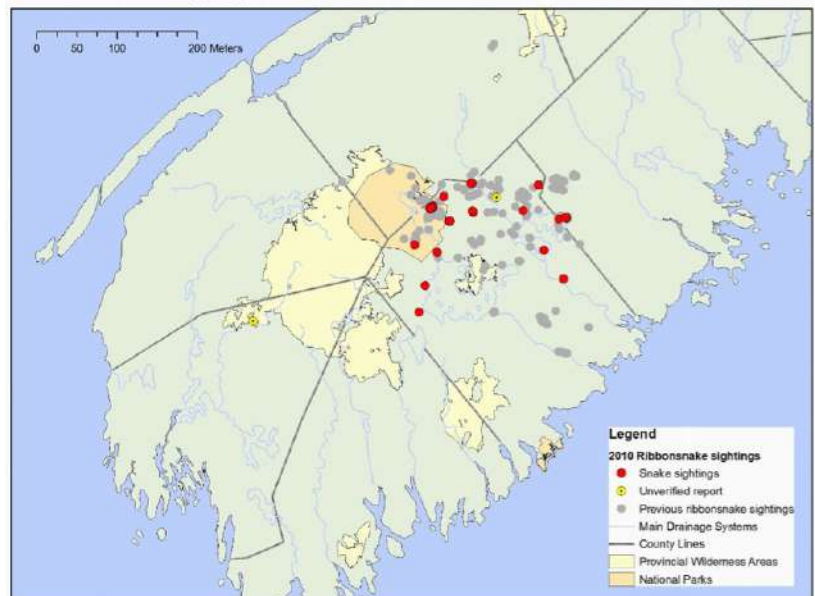
A. Tanner

Eastern ribbonsnake basking in the sun near Minamkeak Lake

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Eastern ribbonsnake sightings in Nova Scotia in 2010



J. MacNeil, MTRI

Map data provided by the Province of Nova Scotia, Geomatics Canada and the Eastern Ribbonsnake Recovery Team.

Prepared by: Jeffie MacNeil, 17 Jan 2010

Eastern Ribbonsnake sightings (red) and reports (yellow) during 2010

Rationale

Recently, several birds that breed in forested landscapes in Nova Scotia have been designated as species at risk by the Committee On the Status of Endangered Wildlife In Canada. Breeding Bird Surveys (BBS) across Canada, Nova Scotia, and Kejimikujik have documented a decline in these species since the surveys began in the late 1960s. Past observations and surveys in Kejimikujik suggested that three of these species – the Canada warbler, Olive-sided flycatcher, and Rusty blackbird – typically breed in a range of treed wetlands, such as treed bogs, swamps, and riparian forest. However, no quantitative studies had been done on their habitats. Furthermore, few data were available for these birds in the managed forest landscape. This project was a first attempt to fill gaps in information needed before a monitoring program and conservation plan for these species can be developed for the greater Kejimikujik ecosystem.



Canada warbler habitat with scattered trees emerging above tall shrubs and Cinnamon fern, and Sphagnum moss-covered ground



Nat Harper records habitat data for Rusty blackbirds along the banks of the Mersey River

Research

BIRD SPECIES AT RISK IN TREED WETLANDS

OBJECTIVES

- To re-survey sites in Kejimikujik with past records of these species.
- To conduct a broad survey of Abitibi-Bowater lands in the Medway District.
- To compare habitat features of occupied and unoccupied sites in the two areas.

METHODS

- In Kejimikujik, historical locations and other sites with similar habitat were surveyed from June 1 to July 7, 2010.
- In the Medway, treed wetlands were identified using GIS and accessible sites across the area were surveyed, from June 22 to July 5, 2010.
- Playback of recorded songs and calls was used to increase the chance of detecting the target species. All three species responded vigorously to playback, often by approaching and vocalizing.
- Habitat was quantified by amount of deciduous and coniferous cover in different vegetation layers, abundance of snags, and various ground features, including wetness.

RESULTS

- The accompanying map shows where the three species were found among the sites surveyed. Birds were at least, if not more, abundant in the Medway than in Kejimikujik. Abundance could not be compared directly because Medway samples covered a larger area.
- All three of the species were absent in most of their historical locations in Kejimikujik. This result confirms declining trends reported through the BBS.
- The habitat where birds were found did not differ from the habitat where target birds were not found, suggesting that not all suitable habitat was occupied. This finding is consistent with the notion that the species are declining for reasons other than breeding habitat loss.
- Canada warblers occurred in similar habitats in the two areas, typically wet forest with a well-developed shrub layer two meters or higher, scattered emergent trees and snags, and

RESULTS

Continued

- shaded ground covered with Cinnamon ferns and Sphagnum moss.
- Olive-sided flycatchers inhabited coniferous treed bogs in both areas. However, in the Medway District, half of the birds were found in cutovers, which were drier and had less tree cover, but retained some large trees or snags needed for perches and nests.
- Rusty blackbirds were found at low abundance and were greatly outnumbered by Common grackles, which appear to have taken over their niche in Nova Scotia. All Rusty blackbirds in Kejimikujik were found along the Mersey River, in open red maple floodplain or denser mixed-wood forest. They were found in different habitats in the Medway. Water and exposed mud was an important feature of occupied habitat in both areas.

YEARS OF DATA

- Single year project

PARTNERS

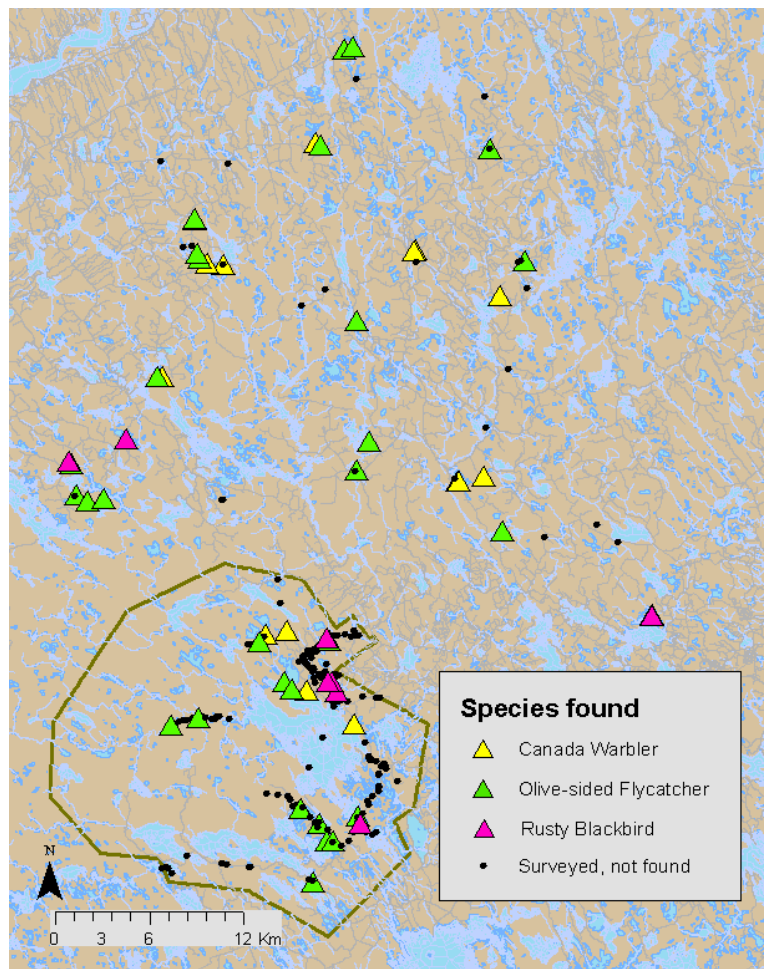
- Abitibi-Bowater
- Dalhousie University
- Parks Canada
- Mersey Tobeatic Research Institute



Jess Fargher uses a loudspeaker to playback the 'pip-three-beers' song of a male Olive-sided flycatcher

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Map of the sites surveyed in Kejimikujik and Abitibi-Bowater's Medway district north of the park. A triangle indicates that a site had one or more individuals of the target species

Photos on page 93

Clockwise from top left:

- Tolerant hardwoods research near the Medway River, A. Belliveau, MTRI
- John Kinley paddling on McGowan Lake by J. Kinley, MTRI
- Group of outreach participants by B. Caverhill, MTRI
- Thomas Raddall cabin by J. Kinley, MTRI
- Inuksuk by A. Belliveau, MTRI



HUMAN DIMENSIONS



Rationale

Since May 2009, in support of the designation of Kejimikujik as a Dark Sky Preserve (DSP), members of the Royal Astronomical Society of Canada (RASC) have been making measurements of dark sky quality and have created panoramic night time photographs of the near-horizon sky to detect and document light pollution created by unshielded electric lighting within the Park and in surrounding communities. RASC members also advise Parks Canada regarding the location, brightness, and shielding of lights within the Park (to reduce sky glow, glare, and light trespass) to maintain DSP status.



D. Chapman

A bright moon blocking out the stars



RASC

The Royal Astronomical Society of Canada's logo to signify a Dark Sky Preserve

Research

DARK SKY QUALITY ASSESSMENT

OBJECTIVES

- Measure and record dark sky quality.
- Create photographic night-time skyline panoramas to record light pollution.
- Identify lighting that does not comply with RASC Guidelines for DSPs.

METHODS

- Using Sky Quality Meters (SQMs) supplied by the Canadian firm Unihedron (www.unihedron.com), RASC members made measurements in May and August 2009 and March 2010, between the end of dusk and the start of dawn, in the absence of moonlight. Locations included the Primary Observing Site next to Jorehys Bay Campground parking lot P2 (Site 1), Merrymakedge Beach near parking lot P2 (Site 2), the Eel Weir, Kedge Beach, and the storage area near the turnoff to Big Dam Lake.
- On March 5, 2010, RASC members took night-time exposures of natural and artificial sky glow in dark skies at Site 1 and Site 2. A full 360-degree panorama was completed at Site 1 but tree cover and high water limited the vista at Site 2 to less than 180 degrees.
- On several occasions RASC members visited illuminated outdoor areas within Keji and identified non-compliant lighting to Parks Canada staff.

RESULTS

- SQM measurements varied between 21.5 and 21.9 magnitudes per square arcsecond in all locations in dark skies away from artificial lighting. On a given night, the measurements were consistent between sites, but results varied from night to night, depending on atmospheric conditions. (Higher SQM readings denote darker skies: light polluted suburban Halifax skies register at about 18.6; a measurement at Dollar Lake Provincial Park—from which the sky glow from Halifax is unmistakable—gave the value 21.2; and a typical measurement from Grasslands National Park (SK)—Canada's newest DSP—is 21.7.) (For a full explanation of units, see <http://www.stjarnhimlen.se/comp/radfaq.html>).
- The skyline panorama at Site 1 showed only natural skyglow

RESULTS

Continued

from Zodiacal Light (prominent in the western sky just after dusk in spring); however, the treeline blocks the sky there up to 10 or 15 degrees above the horizon, so any low-elevation sky glow would be masked. At Site 2—although the vista is limited—the sky is seen to within a few degrees of the horizon and sky glow is evident in the direction of Yarmouth and Digby (see photos).

- Parks Canada has given priority to making the lighting within the proposed DSP core area compliant with the RASC Guidelines for Outdoor Lighting in DSPs.
- On July 3, 2010, the National Council of the RASC officially declared Kejimikujik the first Dark Sky Preserve in Nova Scotia.

YEARS OF DATA

- Ongoing project since 2009

PARTNERS

- Royal Astronomical Society of Canada
- Parks Canada

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D. Chapman

Enhanced portion of night-time skyline at Site 2 showing artificial sky glow (Yarmouth, N.S.) at horizon against a dark sky



D. Chapman

Enhanced portion of night-time skyline at Site 1 showing natural sky glow (Zodiacal Light) at lower left against a dark sky

Rationale

We live in a special place! The Southwest Nova Biosphere Reserve is one of Canada's "Biodiversity Hotspots". There are over 40 species at risk in the province and southwest Nova Scotia is home to over 80% of these plants and animals. Species at Risk Stewardship Biologists from Kejimikujik have partnered with MTRI, Acadia University and other organizations such as First Nations, schools, community groups, industry, and all levels of government to help recover the species at risk that live in this unique and special region. This work is to learn about species at risk in the SNBR, share their knowledge with the public, and engage and empower interested families and communities in hands-on recovery actions for these species and the habitat requirements.



Kaleigh teaches her classmates about the Blanding's turtle

Research

SPECIES AT RISK STEWARDSHIP IN SNBR

OBJECTIVES

- To promote environmental stewardship actions and advocacy and to create ambassadors for species at risk.
- To increase awareness and understanding within the general public about species at risk in the SNBR and generate sighting reports.
- To engage and involve Canadians in hands-on recovery actions that help recover key species at risk including Blanding's turtle (endangered), Eastern ribbonsnake (threatened), Monarch butterfly (special concern), Piping plover (endangered), Water-pennywort (threatened) and other Atlantic coastal plain flora.

METHODS

- Species at risk stewardship volunteer opportunities in the SNBR include: Blanding's turtle nesting monitoring, trapping, radio-tracking and visual surveys, Eastern ribbonsnake surveys, Piping plover monitoring and habitat restoration, Atlantic coastal plain flora monitoring and water quality sampling, rare lichen surveys and more.
- Partnerships continue to be established with individuals and organizations that work with species at risk in Nova Scotia to enhance communication and collaboration and ultimately the recovery of species at risk in the SNBR.
- Outreach strategies are developed to link science and stewardship to achieve awareness and appreciation for species at risk.

RESULTS

- In 2010, for the fourth year in a row, over 300 volunteers contributed more than 10,000 hours of their time toward environmental conservation in the SNBR. This is more than 50,000 hours since 2006! To the best of our knowledge this effort is one of the largest volunteer contributions to conservation in Canada.
- A Walk of Honour Celebration and BBQ was held in August to honour the volunteers inducted into the walk at the 2009 volunteer banquet. The Walk of Honour is behind the Kejimikujik Visitor Center and recognizes the volunteers that have contributed over 250 (bronze), 1000 (gold) or 2000 (platinum) hours. Eleven volunteers were added to the Walk of Honour and four moved up to gold and platinum.



Reg and Barbara Baird with their grandson at the volunteer banquet. Reg was presented with an award in recognition of his 10,000th Brook trout caught and released for research and recovery projects

M. Crowley, Parks Canada



M. Crowley, Parks Canada

Volunteers standing on their stones at the Walk of Honour. The names of volunteers are carved into the granite stones along the walkway to celebrate and honour their contributions

YEARS OF DATA

PARTNERS

- Over 100 volunteers and stewards attended the fifth annual volunteer banquet in December to celebrate their amazing and inspiring achievements. Eight stewards were inducted into the Walk of Honour this year. The fifth Volunteer Newsletter was also created and handed out.
- Four volunteer training guides were created to provide an easy, informative and visually appealing way to become trained on protocols and methodologies. Three focused on the Blanding's turtle (nesting- tracking, trapping and visual surveys – hatchling emergence) and one on the Eastern ribbonsnake (visual and coverboard surveys).
- Volunteer researcher hats were created to recognize the efforts of volunteers for Blanding's turtle, Atlantic coastal plain flora, Piping plover, Friends of Keji, Brook trout and LoonWatch.
- Ongoing project since 2006
- Parks Canada
- Friends of Keji
- Acadia University
- Bear River First Nation
- Mersey Tobeatic Research Institute
- Southwest Nova Biosphere Reserve Association
- Bird Studies Canada
- Government of Canada Habitat Stewardship Program



Pleasant River Hall

Attendees at the 2010 volunteer banquet celebration

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M. Crowley, Parks Canada

Alain and Martin with their new Atlantic coastal plain flora volunteer researcher hats

Rationale

Situated about one kilometre east of the Port Royal Habitation, the Melanson Settlement National Historic Site was designated for its outstanding archaeological resources and is considered a prime example of a pre-deportation Acadian family settlement (c. 1664-1755). From 1984 to 1986, archaeologists from Parks Canada completely excavated one house cellar and tested two other cellars, uncovering almost 100 000 artefacts and faunal remains. In October 2010 a team of archaeologists from Université Laval and Parks Canada surveyed the site for new archaeological features, and tested around the house cellars for midden deposits rich in artefacts and animal bone and shell remains. This fieldwork research was the first phase of an ongoing archaeology doctoral project which focuses on 17th and 18th century Acadian foodways and animal husbandry practices. More intensive excavations are planned for May-June 2011.



Test unit next to Alexandre Robichaud's and Anne Melanson's house cellar (c. 1700-1755)

Research

ARCHAEOLOGY AT THE MELANSON SETTLEMENT

OBJECTIVES

- To re-locate the 18 known archaeological features and record their GPS coordinates.
- To record and map all newly identified features.
- To test the efficiency of a hand-held soil corer for locating midden deposits.
- To undertake archaeological testing in the yard of at least three houses, in order to find deposits rich in faunal remains.

METHODS

- A walking survey was completed in order to re-locate the 18 known features and to identify new features. All features were recorded with a GPS.
- Areas around the house cellars were tested using a non-intrusive hand-held soil core sampler (one inch wide).
- Collected soil cores guided where further testing would be undertaken. Shovel test pits, measuring 50 x 50 cm, were excavated in high potential areas around the house cellars.

RESULTS

- Three new features were recorded, and were subsequently tested.
- The first new feature (#19) was a small circular mound, about 3 metres in diameter. A test pit next to this feature yielded an impressive amount of bousillage fragments (clay mixed with hay used for walls).
- The second feature (#20) was a roughly oval mound. A fair amount of bousillage and the remains of charred planks were found.
- The third feature (#21) had a shallow depression on the east half and a slight raise on the west half. Not many artefacts were found: only two tiny bits of bousillage, a calcined bone and a pipe bowl fragment.
- In at least two occasions, midden deposits could be clearly located using the soil core sampler. The midden soils were composed of a very dark brown organic loam with lots of small seashell, charcoal and bousillage fragments.



Stéphane Noël and Rob Ferguson preparing for the survey

A.-M. Faucher

RESULTS

Continued

- Four middens were identified near house cellars. They all contained large amounts of shells (mostly clams and mussels), animal bones, French and English ceramics, bottle glass, pipe stems and bowls, etc. The presence of a large quantity of shells probably contributed to neutralize the pH of the acidic soil, which permitted the preservation of faunal remains.
- Two of those four middens will be excavated during the second phase of fieldwork at the site, in May-June 2011.

YEARS OF DATA

- Year 1 of a 2 year project

PARTNERS

- Parks Canada
- Laval University
- Social Sciences and Humanities Research Council



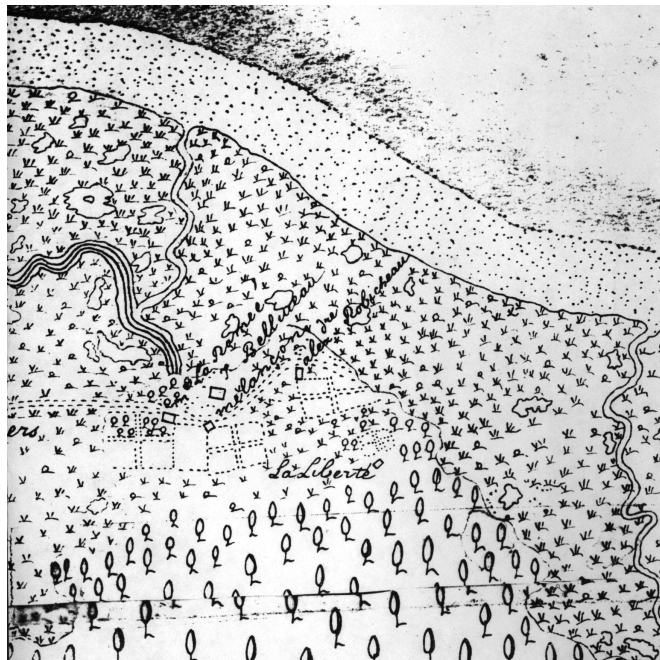
R. Ferguson, Parks Canada

An overgrown house cellar feature



M. Lynch

Cathy Leblanc and a Mi'kmaw interpreter out in the field and the encampment site



Library and Archives Canada

Historical map from 1708, showing the family inhabiting certain households

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Rationale

Forest Stewardship Council (FSC) forest certification has been developing since the early 1990's, as a response to public concern about unsustainable forestry systems around the world. It is a voluntary, market-based concept developed to certify forest management practices to a set of globally recognized environmental, social and economic standards. In November 2009 MTRI received confirmation from the Nova Scotia Department of Natural Resources for funding from the Community Development Trust Fund to promote FSC certification of small woodland owners in Nova Scotia. The goal of the project is to work closely and collaboratively with smallholders, woodlot owner groups, and other partners throughout Nova Scotia to provide services to improve forest management practices on small private woodlands through forest certification. This will also help smallholders prepare to meet the increasing global demand for certified forest products and demonstrate a commitment to promoting sustainable forestry practices in the region. Part of this fund was to conduct research on group certification models around the world, and to look at the feasibility of organisations such as MTRI becoming an FSC group entity, holding a certificate on behalf of a group of local landowners.

Research

FOREST CERTIFICATION FOR SMALL WOODLOT OWNERS

OBJECTIVES

- To study working national and international models of group certification and assess the "best fit" approach for owners of small woodlands in the Nova Scotia.
- To conduct a landowner survey to assess their values, perception and expectations of forest certification, including benefits and deterrents.
- To assess MTRI's readiness to act as a group entity for landowners in the Southwest Nova Biosphere Reserve.

METHODS

- National and international FSC groups were researched and contacted where applicable to compare group size, characteristics, management structure, membership distribution and funding models. More detailed profiles were made of existing FSC groups in Nova Scotia.
- The feasibility analysis was guided by a working group including representatives from the following organizations: Federation of Nova Scotia Woodland Owners, Nova Scotia Woodland Owners and Operators Association, Nova Scotia Landowners and Forest Fibre Producers Association, Nova Forest Alliance, Ecology Action Centre, Nova Scotia Department of Natural Resources, Lunenburg Queens Regional Development Agency, Harry Freeman & Son Ltd, NewPage Corporation, AbitibiBowater Inc., Freya Forestry, CR Trees, Windhorse Farm.
- Gap analyses as well as strengths, weaknesses, opportunities and threats analyses were carried out with regard to MTRI's position and location in the context of pursuing FSC group entity status.
- Anticipated costs were modelled and a financial projection was formulated.
- Landowners were surveyed to assess their woodland association values and experiences, and perceived benefits and deterrents to becoming certified.



Balsam fir



Old Stumps with butt rot

RESULTS

- Six models for FSC group types were identified globally. A detailed feasibility report was written, including recommendations for MTRI implementing FSC certification for woodlot owners, a detailed cost analysis (see MTRI: FSC Forest Certification for Small Woodland Owner Feasibility Report, October 2010).
- Landowner surveys demonstrated that there is a genuine concern for the future of Nova Scotia's woodland amongst small woodland owners, with their value as a family legacy ranked as the most important by 70% of landowners surveyed.
- Seventy-six percent of landowners surveyed currently carry out their own woodland management. Of those that used contractors in the past, half were dissatisfied with the results.
- Half of the landowners ranked "personal assurance of sustainable management" as being the most important benefit of certification.
- Cost of management plans/group membership fees, additional bureaucracy, and a perceived loss of control were ranked as the three greatest deterrents to becoming certified.

YEARS OF DATA

- Single year project

PARTNERS

- Mersey Tobeatic Research Institute
- Nova Scotia Department of Natural Resources
- Nova Forest Alliance



Lumber at Windhorse Farms

A. Belliveau, MTRI



Old growth Yellow birch near Maitland Bridge

A. Belliveau, MTRI

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Rationale

The Monarch butterfly is a charismatic species that captivates a wide audience due to its amazing life history and long distance migration. It is designated as a species of special concern under the Species at Risk Act, which means it is at risk of becoming endangered if the threats to its population are not reversed. The Monarch is impacted by habitat loss, chemical and pesticide use, and storms throughout its range. The milkweed plant is key habitat for the Monarch because the females only lay their eggs on milkweed and caterpillars only eat their leaves (no milkweed = no Monarchs). The education, motivation and empowerment of individuals and communities to help this species are key to the recovery process.



Monarch butterfly with a tag



Monarch butterfly display at Kejimikujik's Visitor Center

Research

MONARCH BUTTERFLY STEWARDSHIP IN SNBR

OBJECTIVES

- To bring awareness of the Monarch butterfly to park visitors and residents of the SNBR and promote the butterfly club, which encourage landowners to create butterfly habitat by planting chemical-free butterfly gardens.
- To partner with communities to help plant butterfly gardens in the SNBR.
- To provide educational opportunities and first-hand experiences to witness the transformations of this species through an interactive display at the Kejimikujik Visitor Center.
- To bring educational and teaching opportunities to the Maritimes.

METHODS

- A Canadian Wildlife Federation grant was obtained by the Friends of Keji Coopertive Association to plant butterfly gardens through the biosphere through partnership with Parks Canada and MTRI.
- Parks Canada partnered with the Monarch Teacher Network to bring the first Teaching and Learning with Monarch Butterflies workshop to the Maritimes (two day workshop held on Aug 26-27).
- Summer staff at MTRI attended farmer's markets across Nova Scotia with Butterfly Club kits.
- A weekly "Monarch Magic" interpretive program was delivered in Kejimkjuik to engage visitors and promote the Butterfly Club. Club kits were also sold at the By the Mersey Gift Shop.
- Over 30 caterpillars were reared at the display in the Kejimkujik Visitor Center to the amazement and excitement of onlookers. Butterflies released in the fall were tagged in partnership with Monarch Watch to learn more about migration routes.
- Butterfly and caterpillar costumes and life stage models helped to facilitate learning experiences.

RESULTS



M. Crowley, Parks Canada

Releasing Monarch butterfly in Kejimikujik

- Six community butterfly gardens were planted with the help of community members, school kids, nature camps and seniors. Gardens were located at Barrington Historical Gardens, North Queens Community School, Bridgetown Jubilee Park, Acadian First Nation, North Queens Nursing Home and Kejimikujik. Two signs were designed to highlight educational messaging and placed beside each garden with a bench.
- Smaller signs were also created promoting chemical free butterfly habitat.
- Two butterfly tea socials were held to celebrate in the community; one at the North Queens Nursing Home and the other in Acadia First Nation.
- Experts from New Jersey and Ontario came to help teach the Monarch butterfly workshop. It was well attended by teachers and educators and will be held in New Brunswick in 2011. Participants were taught about ecology, conservation and rearing. They left with the knowledge, materials and passion to produce their own outstanding learning experiences.
- The gardens at Kejimikujik and MTRI were designated as official Monarch waystations by Monarch Watch.

YEARS OF DATA

- Ongoing project since 2008

PARTNERS

- Parks Canada
- Friends of Keji
- Monarch Teacher Network Canada
- Canadian Wildlife Federation
- Southwest Nova Biosphere Reserve
- Mersey Tobeatic Research Institute



J. Todd

Chemical Free Butterfly sign created as part of the Friends of Keji butterfly proposal

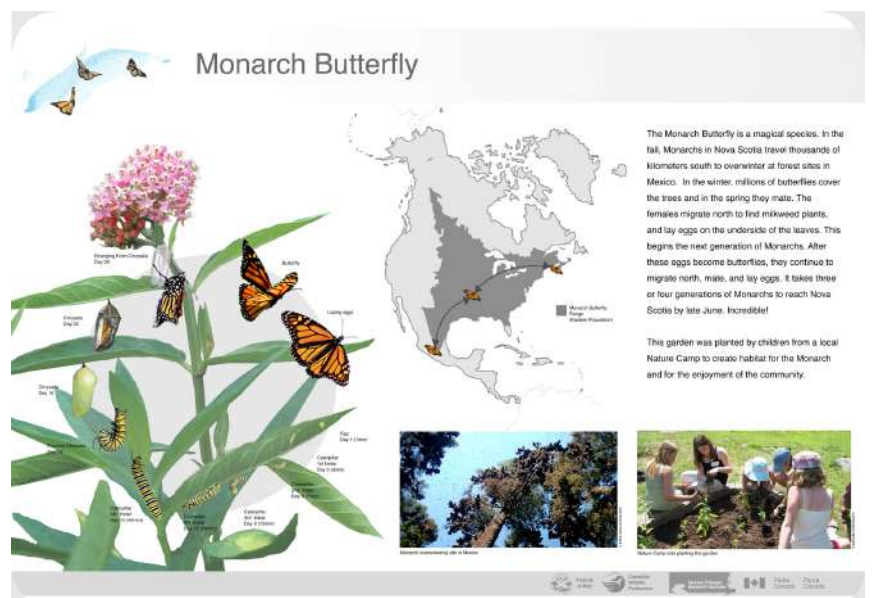


M. Crowley, Parks Canada

Butterfly garden planted in Barrington

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M. Griffin-Allwood

One of the two interpretive signs created for the six butterfly gardens planted in SNBR

Rationale

The Aquatic Connectivity project offers many opportunities to engage park visitors, students, volunteers, and local stewards in restoration and monitoring initiatives. Through their involvement in these activities, participants learn about the work that Parks Canada is doing to restore, monitor, and protect the aquatic health of Kejimikujik's waterways.



Park visitors help monitor water quality



Examining and identifying benthic macroinvertebrates

Research

PUBLIC INVOLVEMENT IN AQUATIC CONNECTIVITY

OBJECTIVES

- To provide opportunities for park visitors, volunteers, and local school groups to learn about the importance of aquatic connectivity and restoration initiatives in freshwater ecosystems.
- To involve park visitors, volunteers, and local school groups in meaningful experiences through restoration and monitoring activities related to the Aquatic Connectivity project.

METHODS

- Prior to the culvert removal and bridge construction on the Flowing Waters Trail, park visitors and volunteers were invited to assist Resource Conservation staff with the following activities: characterizing the aquatic habitats, monitoring water quality and flow rates at the site, taking pre-restoration photos of the site, and conducting fish surveys.
- A workshop entitled "Best Practices in Watercourse Alteration and Water Quality Monitoring" was offered to the public and local NGOs.
- A guided walk showcasing research and monitoring in Kejimikujik was presented weekly on the Flowing Waters Trail. Given that this trail passes one of the sites selected for remediation work, the Aquatic Connectivity project was discussed in detail.
- Local high school classes were invited to help monitor the aquatic health of local waterways as part of the Kejimikujik Adopt-a-River school program.
- Heritage Presentation and Resource Conservation staff visited l'École secondaire de Clare to present several benthic macroinvertebrate workshops as part of their Environmental Science program.

RESULTS

- Twenty-four park visitors spent a total of 48 hours assisting Resource Conservation staff during two "Meet a Researcher" events. An additional nine volunteers contributed a total of 45 hours helping with various monitoring and restoration activities.

RESULTS

Continued

- Thirty-three people attended various portions of the Best Practices workshop for a total of 45 hours of education/involvement.
- During the summer of 2010, 91 visitors participated in seven guided walks on the Flowing Waters Trail.
- Three classes participated in the school program: the Grade 10 class at North Queens Rural High School, the Envirothon Team at Digby Regional High School (Grades 10-12), and the Grade 11/12 Environmental Science class at l'École secondaire de Clare. Working as volunteers for the park, students conducted physicochemical and bacteriological analyses and inventoried the benthic macroinvertebrate communities at various study sites. A total of 56 students devoted 182.5 volunteer hours to this program.
- Park staff presented four 45 minute workshops to a total of 105 Grade 6, 7, and 8 students. An additional 25 students from the Environmental Science class assisted with these workshops.
- To summarize, 122 volunteers spent a total of 320.5 hrs helping resource conservation staff with hands-on activities. An additional 221 individuals participated in either the guided walk or the workshops in Clare.

YEARS OF DATA

PARTNERS

- Year 1 of a 2 year project
- Parks Canada
- Education and Water Monitoring Action Group
- Mersey Tobeatic Research Institute



G. Turner

Students collecting benthic macroinvertebrates



D. Pouliot, Parks Canada

A student tests the dissolved oxygen at one of the study sites

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APPENDIX 1

PROJECTS IN KEJIMKUJIK AND THE GREATER KEJIMKUJIK ECOSYSTEM IN 2010

	Kejimkujik	Greater Kejimkujik Ecosystem	Monitoring	Research
Coastal				
Eelgrass Coastal Monitoring	X		X	
European Green Crab Coastal Monitoring	X		X	
Piping Plover Monitoring Program	X		X	
<i>Projects not included in this report:</i>				
Salt Marsh Vegetation Monitoring	X		X	
Estuary Water Quality Monitoring	X		X	
Green Crab Control (Estuary Recovery)	X		X	
Forest				
Red Oak Regeneration in Mixed Wood Stands	X	X		X
Old Forests in Medway District		X		X
Jack Pine Budworm Population Assessment	X			X
White-tailed Deer Abundance	X		X	
Nocturnal Owl Survey	X	X	X	
Glossy Buckthorn Eradication and Management	X		X	
Boreal Felt Lichen Monitoring		X	X	
Biotoc Inventory of Five NCC Properties		X	X	
Monitoring Flying Squirrel Survivorship	X	X	X	
Port Mouton Vegetation Monitoring Study	X		X	
Chimney Swift Roost Monitoring		X	X	
Forest Ecosystem Classification		X		X
<i>Projects not included in this report:</i>				
Forest Trees Monitoring	X		X	
Salamanders Monitoring	X		X	
Decay Rate Monitoring	X		X	
Forest Birds Monitoring	X		X	

	Kejimikujik	Greater Kejimikujik Ecosystem	Monitoring	Research
Invasive Plants; Trail Monitoring	X		X	
Caledonia Christmas Bird Count	X	X	X	
Freshwater				
Brook Trout Monitoring Program- Creel Census	X		X	
Benthic Invertebrate Monitoring	X		X	
Atlantic Coastal Plain Flora Stewardship and Monitoring	X	X	X	
Water Quality in Atlantic Coastal Plain Flora Habitat		X	X	
Acid Rain Biomonitoring	X		X	
Aquatic Connectivity	X	X	X	
Monitoring Common Loon Productivity	X	X	X	
Kejimikujik-Mersey LoonWatch Program	X	X	X	
Monitoring Mercury in Common Loons	X	X	X	
Effects of Mercury in Freshwater Food Webs	X			X
Mercury in Dragonflies from Kejimikujik Lakes	X			X
Mercury Effects on Damselfly Naiads	X			X
Projects not included in this report:				
Lake Cold-Water Habitat		X	X	
Mercury Concentrations in Fish	X			X
Lake Water Quality Monitoring	X		X	
Lake Primary Productivity Monitoring	X		X	
Stream Flow Monitoring	X		X	
Wetland				
Vegetation at Wetland Forest Edges		X		X
Water-Pennywort Monitoring	X		X	
Rare Plant Monitoring		X	X	
Blanding's Turtle Nest Monitoring	X	X	X	
Blanding's Turtle Distribution Surveys	X	X	X	
Blanding's Turtle Headstart Incubation	X	X		X
Wetlands Water Quality and Quantity	X		X	
Eastern Ribbonsnake Terrestrial Habitat	X	X		X
Eastern Ribbonsnake Range	X	X		X
Bird Species at Risk in Treed Wetlands	X	X		X
Projects not included in this report:				
Wetland Vegetation Monitoring			X	
Barren Meadow Blanding's Turtle Population	X			X
Human Dimensions				
Dark Sky Quality Assessment	X			X
Species at Risk Stewardship in SNBR	X	X		X
Archaeology at the Melanson Settlement		X		X
Forest Certification for Small Woodlot Owners		X		X
Monarch Butterfly Stewardship in SNBR	X	X		X
Public Involvement in Aquatic Connectivity	X	X		X

APPENDIX 2

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