Annual Report of Research and Monitoring in the Greater Kejimkujik Ecosystem 2014

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Mersey Tobeatic Research Institute

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Cover Photos, clockwise from top left:
- *Mersey River in the fall,* by J. Reid
- *Meadow at Roger's Brook, Kejimkujik,* by W. Pitts
- *Paddling in the Tobeatic,* by C. Gray
- *Kejimkujik Seaside,* by W. Pitts
- *Forest along Portage E in Kejimkujik,* by J. Reid

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Annual Report of Research and Monitoring in the Greater Kejimkujik Ecosystem 2014

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J. Reid

INTRODUCTION

This is the tenth Annual Report of Research and Monitoring in the Greater Kejimkujik Ecosystem. 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.

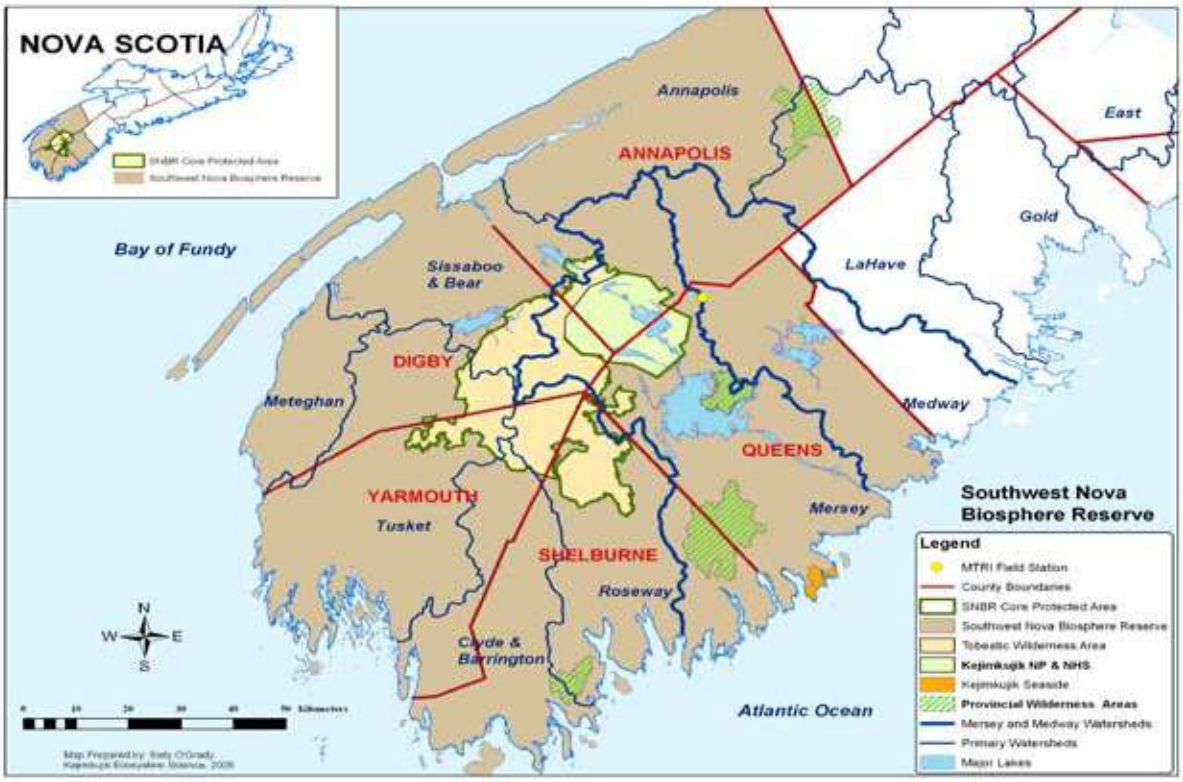
This report was produced in winter 2015 and is a compilation of the research and monitoring projects that were conducted in the Kejimkujik area in 2014 by Parks Canada, MTRI and their partners. The purpose of the report is to make information about these projects available to the public, government agencies, 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 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, how it is affected by natural and human-related influences and how to affect restoration. Overall, they indicate an impressive amount of work that is being undertaken in Kejimkujik and the surrounding area.

Kejimkujik represents the Atlantic Upland Natural Region in Parks Canada's network of protected areas. Kejimkujik consists of 381 km^2 inland and 22 km^2 on the coast and, in combination with the Tobeatic Wilderness Area, is the core area of the Southwest Nova Biosphere Reserve. Since its establishment, Kejimkujik 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. Kejimkujik was declared the first Ecological Monitoring and Assessment Network site in Canada (1993) and was the first in Canada to install Smithsonian Institution Monitoring and Assessment of Biodiversity plots (1994). Kejimkujik 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, Kejimkujik 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. Kejimkujik is identified by the Parks Canada Agency as an important species at risk site where stewardship and recovery are paramount. In 2010, Kejimkujik was designated "Dark Sky Preserve" by the Royal Astronomical Society of Canada. More information about Kejimkujik can be found at www.pc.gc.ca/pn-np/ns/kejimkujik 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 promote sustainable use of natural resources and biodiversity conservation in the Southwest Nova Biosphere Reserve and beyond through research, education and the operation of a field station. MTRI's field station is located between Kejimkujik and Caledonia in Kempt, Queens County where it provides office work space, accommodation for researchers, space for public presentations and a site for learning. The field station has taken great efforts to reduce its carbon footprint by employing five green technologies for heating, cooling and power generation. It has been awarded Gold by LEED for Homes and reduced its power consumption by more than 50% through renovations and energy conservation. 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 charitable co-operative is available at www.merseytobeatic.ca.



S. O'Grady, Parks Canada

Kejimkujik and Tobeatic comprise the core area of the Southwest Nova Biosphere Reserve

The Southwest Nova Biosphere Reserve (SNBR) comprises a large portion of terrestrial and coastal southwestern Nova Scotia (see map above). 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 Kejimkujik 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.

Photos on page 9, clockwise from top left:
- *Piping plover,* by M. Crowley, Parks Canada
- *European Green crabs,* by K. Rowter, Parks Canada
- *Sieving for young Soft-shell clams at Kejimkujik Seaside,* by J. Reid
- *Little Port Joli Estuary,* by J. Reid
- *Eelgrass transplants,* by J. Reid

Coastal sidebar photo: J. Reid

COASTAL

Rationale

The Piping plover is a small shorebird that has been listed as an Endangered species by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) since 1985. Piping plovers nest on white sandy beaches including St. Catherine's River Beach at Kejimkujik 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 distant over-wintering grounds. The Piping plover is often referred to as a management dependent species, as sustained management actions are sometimes 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 Kejimkujik Seaside and to implement a suite of management strategies focused on protecting and sustaining plover numbers.

M. Crowley, Parks Canada

Piping plover chick

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 Kejimkujik Seaside and restore a portion of nesting habitat on St. Catherine's River Beach.
- To note predators or signs of predators on St. Catherine's River Beach.

METHODS

- Park staff and volunteers monitored St. Catherine's River Beach and Little Port Joli Beach during Piping plover nesting season. This was done at a distance with binoculars and other observations including predators, garbage and stewardship and threat indicators were noted.
- 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.
- Plover habitat was enhancement and restoration efforts were maintained and continued.

M. Crowley, Parks Canada

Volunteers J. Bent and M. Beal, assisiting with plover monitoring

RESULTS

- In 2014, St. Catherine's River Beach and Little Port Joli Beach continued to be surveyed at the Kejimkujik Seaside from May to August.
- At St. Catherine's River Beach, three Piping plover pairs, four nests (one re-nest), eight chicks and six fledglings were observed.
- At Little Port Joli, one pair, two nests (one re-nest) and two chicks were observed. The last successful nesting activity at Little Port Joli was 25 years ago in 1989. One of the two hatched chicks was last observed at 14 days old, but was not confirmed fledged (>20d).
- Kejimkujik is part of a broad volunteer program where park visitors and community members are encouraged to get involved with hands-on recovery actions. Throughout the season, volunteers assisted with Piping Plover monitoring and with habitat restoration efforts.

RESULTS
Continued

- Off-leash dogs are a threat to nesting birds. For the second year, Piping plover treat bags and thank you stickers were handed out to dog owners observed with their dogs on leash in an effort to make positive strides towards the encouragement of this behaviour.
- In the fall of 2014, the plover habitat restoration zone was enhanced with the goal to increase the area by 20%. For further information refer to the "Piping Plover Habitat Management" report (page 12).

YEARS OF DATA

- Ongoing project since 1985

PARTNERS

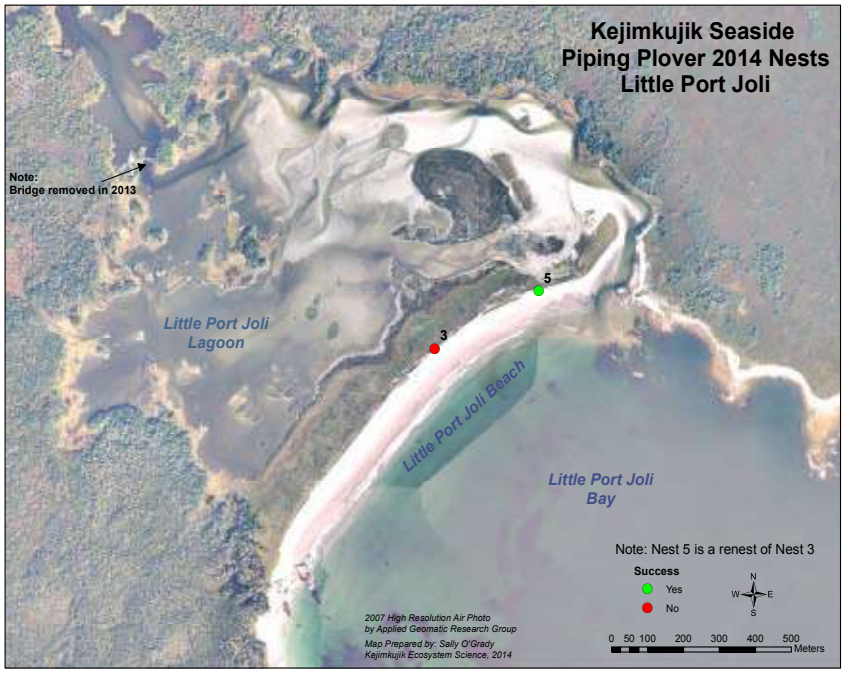
- Parks Canada
- Piping Plover Recovery Team (Eastern Canada)
- Bird Studies Canada
- Environment Canada
- Province of Nova Scotia

R. Mayhew

First nest at Little Port Joli Beach in 25 years

M. Crowley, Parks Canada

Visitors receiving a thank you for having their dogs on leash



Parks Canada

Piping plover nests at Little Port Joli Beach in 2014

CONTACT

Megan Crowley
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-2185
Fx. (902) 682-3367
megan.crowley@pc.gc.ca
www.pc.gc.ca

Rationale

Piping plovers nest on sparsely vegetated sandy beaches, a dynamic habitat influenced by weather events that can impact sand dune formation and destruction. St. Catherine's River Beach has experienced a widespread reduction of Piping plover nesting habitat through the increased establishment of Marram grass over the last 35 years. Active management efforts were undertaken starting in the fall of 2002 to restore approximately one hectare of nesting habitat through the mechanical removal of Marram grass behind the St. Catherine's River Beach dune. This was done as an experimental treatment to recreate and restore former Piping plover nesting habitat and was the first time this technique was utilized in eastern Canada. In the nesting season of 2003, Piping plovers and scrapes were observed in the management zone and annual nesting attempts have occurred in the management zone since 2004. Efforts are undertaken to maintain nesting habitat using mechanical and/or non-mechanical means.


W. Pitts

Plover nest in the management zone

Monitoring

PIPING PLOVER HABITAT MANAGEMENT

OBJECTIVES

- To increase the amount of nesting habitat for Piping plovers at St. Catherine's River Beach by maintaining and expanding the established plover management zone.
- To assess the effectiveness of the management zone on Piping plover nesting and fledgling success.

METHODS

- Nesting habitat is created through the removal of Marram grass and other vegetation (Beach pea, woody shrubs) by plowing and raking the vegetation off the site. The use of tools and hand-pulling is also used for maintenance efforts.
- The zone is delineated using a Global Positioning System (GPS). each year to determine changes in the amount of suitable habitat and to determine maintenance requirements.

RESULTS

- In 2014, one nest was observed in the north-east section of the management zone on May 21st, containing four eggs. This nest was unsuccessful and the pair was suspected to have re-nested on the main beach near the tip.
- In August after the Piping plover chicks had fledged, the Dalhousie Field School lent a hand for the second year with habitat restoration efforts by assisting with hand pulling of Marram grass.
- This fall, the plover habitat restoration zone was expanded using mechanical means with the goal to increase the current nesting habitat area by 20%. Mechanical Marram grass removal methods had not been employed for a couple years and sections of the zone were beginning to fill back in. The runway to the lagoon was widened and Marram grass was removed from areas that had grown in.
- The zone was delineated with a GPS before and after habitat enhancement efforts and will be analyzed this winter.
- Commencing in 2014, trees near the management zone were removed to reduce the number of nearby predator perches.


W. Pitts

Dalhousie Field Class beside their pile of Marram grass pulled to assist with habitat enhancement efforts

YEARS OF DATA

- Ongoing project since 2002

PARTNERS

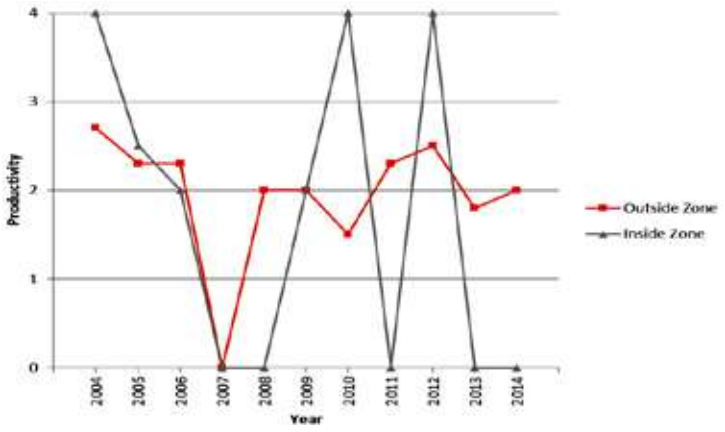
- Parks Canada
- Piping Plover Recovery Team (Eastern Canada)

S. Walsh, Parks Canada

Parks staff enhancing the management zone by removing Marram grass in the late fall

Parks Canada

Nesting habitat has significantly decreased at St. Catherine's River Beach since 1976



Parks Canada

Piping plover productivity (number of chicks fledged per pair) inside and outside the management zone from 2004-2014

Year	Total Nesting Pairs	Total Nests	Management Zone nests	Hatched nests (mgmt. zone)	Productivity outside zone (# fledged/ # pairs)	Productivity inside zone (# fledged/ # pairs)	Productivity (overall)
2004	4	4	1	1	2.7 (8/3)	4.0 (4/1)	3.0 (12/4)
2005	5	5	2	2	2.3 (7/3)	2.5 (5/2)	2.4 (12/5)
2006	5	7	3	2*	2.3 (7/3)	2.0 (4/2)	2.2 (11/5)
2007	4	9	4	0	0	0	0
2008	3	2	1	0	2.0 (4/2)	0	1.3 (4/3)
2009	3	4	1	1	2.0 (4/2)	2.0 (2/1)	2.0 (6/3)
2010	3	4	1	1	1.5 (3/2)	4.0 (4/1)	2.3 (7/3)
2011	4	3	0**	0	2.3 (7/3)	0	1.8 (7/4)
2012	3	5	2	1	2.5 (5/2)	4.0 (4/1)	3.0 (9/3)
2013	5	7	1	0*	1.8 (9/5)	0	1.8 (9/5)
2014	3	4	1	0*	2.0 (6/3)	0	2.0 (6/3)+
Average	**3.9**	**5.1**	**1.5**	**0.7**	**1.9**	**1.62**	**1.8**

Parks Canada

Comparison of Piping plover nesting pairs, nests, and productivity inside and outside of the plover management zone at St. Catherine's River Beach from 2004-2014. Productivity refers to the number of chicks fledged per pair (recovery team target = 1.65)

* pair nested unsuccessfully in mgmt. zone and moved to main beach to re-nest

** the fourth pair observed in 2011 established a territory in the management zone. Before nesting occurred, one adult was found dead in the zone and sent to UPEI for a necropsy. The results suggested pneumonia as a potential cause of death.

+ With the Little Port Joli pair, productivity is 1.5 (6/4)

CONTACT

Megan Crowley
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-2185
Fx. (902) 682-3367
megan.crowley@pc.gc.ca
www.pc.gc.ca

Rationale

The Nova Scotia Piping Plover Conservation Program is coordinated by Bird Studies Canada (BSC), a non-profit organization. The program's goal is to recover Endangered Piping plovers and conserve beach habitat in Nova Scotia. Atlantic Coast beaches, including Lunenburg, Queens and Shelburne counties, support the southern Nova Scotia sub-population which is believed to be reproductively isolated from other plovers in Eastern Canada. Since 1991, over 30% breeding pairs and over 25% of beach breeding sites have been lost in southern Nova Scotia. Bird Studies Canada staff coordinate dozens of volunteers and partners in plover monitoring, breeding habitat protection and stewardship on beaches outside of Parks Canada's Kejimkujik Seaside.

R. d'Entremont

This juvenile Piping plover, banded with flag "E0", was among the 33 chicks and 29 adults banded on southwest Nova Scotia beaches by Enviornment Canada in 2014

Monitoring

NOVA SCOTIA PIPING PLOVER CONSERVATION PROGRAM

OBJECTIVES

- To protect beach habitat and reduce threats for plovers.
- To increase understanding and awareness among beachgoers and coastal communities about plovers and the ecological value of beaches.
- To build community support and engagement for recovery and conservation efforts.
- To strengthen partnership for conservation and recovery within Nova Scotia, regionally and internationally.

METHODS

- Staff, volunteers and partners conducted beach surveys April to August throughout southern Nova Scotia to establish presence of plovers, assess threats and protect breeding habitat.
- Beachgoer education, signs and rope fencing were used to reduce threats to plovers from human activities. Plover population, breeding success, recreational activities and potential predators were monitored. Threats were identified to breeding plovers, which informed habitat protection and stewardship activities.

RESULTS

- Including Kejimkujik Seaside, a total of 46 pairs of Piping plover were found on 28 beaches across Nova Scotia in 2014. There were 32 breeding pairs in southern Nova Scotia, three less than 2013. Of these pairs, four were in Lunenburg County, eight in Queens County (including four in Kejimkujik Seaside) and 20 in Shelburne County.
- Despite lower population numbers, plovers had a more successful breeding season than the past two years. Excluding Kejimkujik Seaside (refer to the two previous reports for Kejimkujik Seaside results), 29 monitored pairs produced 49 fledged young on 18 beaches in southern Nova Scotia, resulting in a productivity rate (1.7 fledglings per pair) that exceeded the established 1.65 annual target. Of the 37 nests with known fates, 62% hatched, which is higher than the past eight-year annual mean for Nova Scotia (50%). Chick survival was 61%, which is slightly lower than nine-year mean (66%). For the first year on record, a pair of plovers nested at a small beach at the end of Durham Lane in Port Joli Bay. The

C. Curry

Environment Canada biologists and volunteer, A. Nagy-MacArthur, releasing chicks after banding at Louis Head beach

RESULTS
Continued

pair fledged three young thanks to support from cottagers and beach visitors.

- In 2014, Environment Canada (EC) initiated a five-year research study to understand Piping plover population declines in eastern Canada by assessing survival of adults and juveniles and identifying key wintering areas. EC banded upper legs of adults and chicks with a uniquely coded flag and silver band. BSC followed and reported banded plovers.
- As in past years, the vast majority of walkers on beaches in southwest Nova Scotia supported habitat protection on beaches. A total of 92% of 223 walkers stayed outside of sensitive nesting areas marked with signs (assessed during 249 surveys), which represents a slight increase over 2013 (89%). Support from dog walkers, however, decreased compared to 2013. Of the 87 dogs observed in 2014, only 40% were on-leash (assessed during 351 surveys). Illegal motorized vehicle use on beaches increased two-fold compared to 2013. Mean sum of vehicles and vehicle tracks per survey was 0.2 (n=351 surveys) compared to 0.1 (n=367 surveys) in 2013. Cape Sable Island beaches of Stoney Island, Daniel's Head and The Hawk had the highest level of vehicle use. One nest was lost due to disturbance from a motorized vehicle at Crow Neck, Shelburne County.

C. Curry

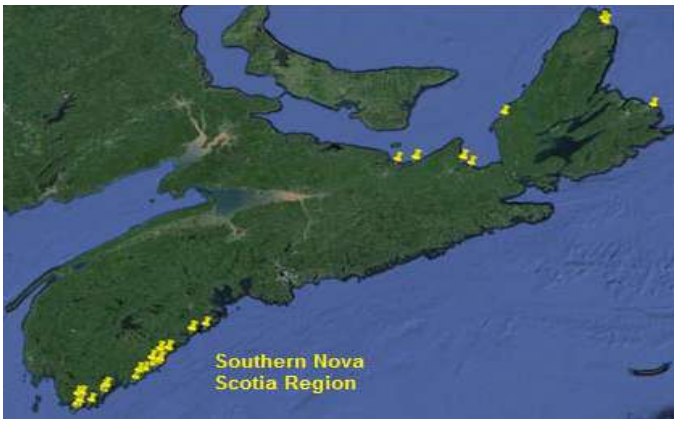
Volunteer team at Johnstons Pond, Shelburne County

YEARS OF DATA

- Ongoing project since 2006
- Bird Studies Canada initiated a multi-year recovery effort for plovers in Nova Scotia in 2006. Before 2006, monitoring and recovery efforts were coordinated by various partners, including Nova Scotia Department of Natural Resources.

PARTNERS

- Parks Canada
- Environment Canada's Canadian Wildlife Service
- Nova Scotia Department of Natural Resources
- Friends of Keji Cooperating Association
- Nova Scotia Nature Trust
- Government of Canada through the federal Department of the Environment: Habitat Stewardship Program for Species at Risk
- Municipalities of the District of Shelburne and Barrington
- Town of Shelburne
- Sage Environmental Program
- TD Friends of the Environment Foundation
- Town of Shelburne
- White Point Beach Resort



S. Abbott, BSC

Location of 2014 Piping plover breeding sites in Nova Scotia

CONTACT

Sue Abbott
Bird Studies Canada
Ph. (902) 426-4055
sabbott@bsc-eoc.org
www.birdscanada.org/volunteer/nsplover
Facebook: "Piping Plover Conservation in Nova Scotia"

Rationale

Coastal marine systems world-wide are threatened by invasions of non-native species. The European green crab, familiarly known as the cockroach of the sea, is a pan-global invasive species occuring in estuaries from New England to Newfoundland. Several studies have shown the European green crab to be an 'ecosystem engineer', with significant predation impacts on local species such as Soft-shell clams and Blue mussels and causing the physical destruction of eelgrass beds. A more recent introduction of a clade from Iceland may be causing amplified impacts due to cold tolerance, its aggressive nature and its ability to adapt to new foraging opportunities. This project is investigating European green crab population dynamics, relative influences on native habitats and developing a reduction and monitoring program to help address management and restoration considerations.

O. Woods

European green crab

Monitoring

INVASIVE GREEN CRAB RESTORATION PROGRAM

OBJECTIVES

- To determine whether physical removal can be effective and sustainable in European green crab control at Kejimkujik Seaside estuaries.
- To conduct European 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, assess the ecological consequences of European green crab activities in Kejimkujik Seaside ecosystems.
- To work with local interests, industry and other government departments to develop a positive use for harvested European green crabs.
- To assess management effectiveness in restoring impaired coastal habitats such as eelgrass beds.
- To involve harvesters and the public in restoration activities.

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 to conduct ecological integrity monitoring. Two types of traps were used: modified eel traps to provide standardized monitoring and modified shrimp (Russell) traps developed by local fishing expertise to enhance larger scale European green crab removal.
- Morphological data were recorded for all individuals captured through monitoring. All by-catch and other pertinent data were recorded throughout all sampling investigations to determine population structure, distribution and relative density characteristics.
- All European green crabs captured during monitoring were counted and measured to determine catch per unit effort and biomass of the crab population.

C. McCarthy, Parks Canada

Atlantic blue crab caught while monitoring eelgrass beds

RESULTS

- Through standardized monitoring since 2009, the total catch per year has decreased by 82%.
- Approximately two million European green crabs have been removed from Little Port Joli Estuary and sold or composted. Size, sex ratios, distribution and trap location efficiencies have been determined.

RESULTS
Continued

J. Garber, Parks Canada

Park staff preparing for a day of European green crab fishing

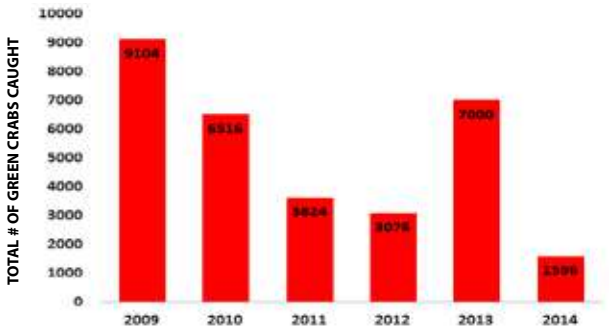
- Catch per unit effort has decreased over time except for last year. There was a large number of small crabs caught in 2013 but the smallest number of crabs caught to date was in 2014. This is indicative of a strong year class moving through the population.
- The majority of larger crabs have been removed from the Little Port Joli population through trapping, thus shifting the biomass of individual crabs to a smaller size. As a result of high reproduction rates in European green crabs, combined with our fishing pressure, a biomass level that is stabilizing may have been reached.
- Eelgrass biomass has increased over the past number of years (see eelgrass report on page 18) and European green crab removal efforts will continue as required to ensure a steady eelgrass increase in the future.
- Native species are still being caught as by-catch. A new species, the Atlantic blue crab, has established a small population in the estuary through a natural range expansion and will be monitored closely for its ecological impacts.
- Results from this project have also enabled other ecosystem restoration projects (*i.e.* eelgrass transplanting) to enhance native species and habitats.

YEARS OF DATA

- Ongoing project since 2008

PARTNERS

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



Parks Canada

Total annual European green crab catch with the standardized monitoring traps in the Little Port Joli Estuary, 2009 - 2014

Parks Canada

Annual biomass average of individual European green crabs in the Little Port Joli Estuary, 2009 - 2014

CONTACTS

Nathaniel Feindel and Chris McCarthy
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-7651 or 682-4100
Fx. (902) 682-3367
nathaniel.feindel@pc.gc.ca
chris.mccarthy@pc.gc.ca
www.pc.gc.ca

Rationale

Eelgrass is the dominant seagrass species of marine ecosystems in Atlantic Canada. Eelgrass habitats perform important ecological services in nearshore waters, 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 important feeding habitat for migrating waterfowl. The primary production of eelgrass beds and their associated epiphytic community exceeds that of many cultivated terrestrial systems, playing 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. By 2010, eelgrass at Kejimkujik Seaside had declined to less than 2% of its 1987 distribution.

K. Rowter, Parks Canada

Eelgrass shoots at St. Catherine's River Estuary, Kejimkujik Seaside

Monitoring

EELGRASS COASTAL MONITORING AND RECOVERY

OBJECTIVES

- To detect long-term change in eelgrass extent.
- To detect long-term change in eelgrass condition measures that signal a decline or improvement in environmental quality.
- To assess whether management response is effective in reversing eelgrass loss.

METHODS

- Suitable eelgrass habitats at St. Catherine's River and Little Port Joli Estuaries were examined by canoe to determine the presence of eelgrass beds.
- The extents of each discrete bed were mapped by a swim survey using mask and snorkel. The surveyor carried a Global Positioning System (GPS) unit with a track function to record locations for later mapping and area determinations.
- The SeagrassNet monitoring protocol was used to measure conditions along transects established within eelgrass beds including morphology, grazing, epiphyte load, wasting disease and water quality variables.
- Eelgrass transplant plots were monitored at Little Port Joli Estuary for general condition and survival.

RESULTS

- After reaching less than 2% of its 1987 distribution by 2010, eelgrass decline has been reversed coincident with effective control of European green crabs at Little Port Joli Estuary in 2011. Since then, a continuous restoration rate of 10% has been observed at Little Port Joli Estuary. As a result of this success, European green crab control activities are planned to commence at St. Catherine's River Estuary in 2015.
- Using donor plugs from within the estuary, volunteers continued to assist with the first eelgrass transplant trials on this coast. Three of the four trial plots showed excellent results with a greater than 50% survivorship in 2014. The fourth trial plot (#12, in yellow, on the graph) was located near high densities of European green crab resulting in a 60% loss of eelgrass transplants within 2 months, showing the importance of European green crab control before taking recovery actions.

K. Rowter, Parks Canada

Eelgrass condition monitoring by canoe

RESULTS
Continued

- Future monitoring will continue to assess the success of European green crab mitigations on eelgrass recovery.

YEARS OF DATA

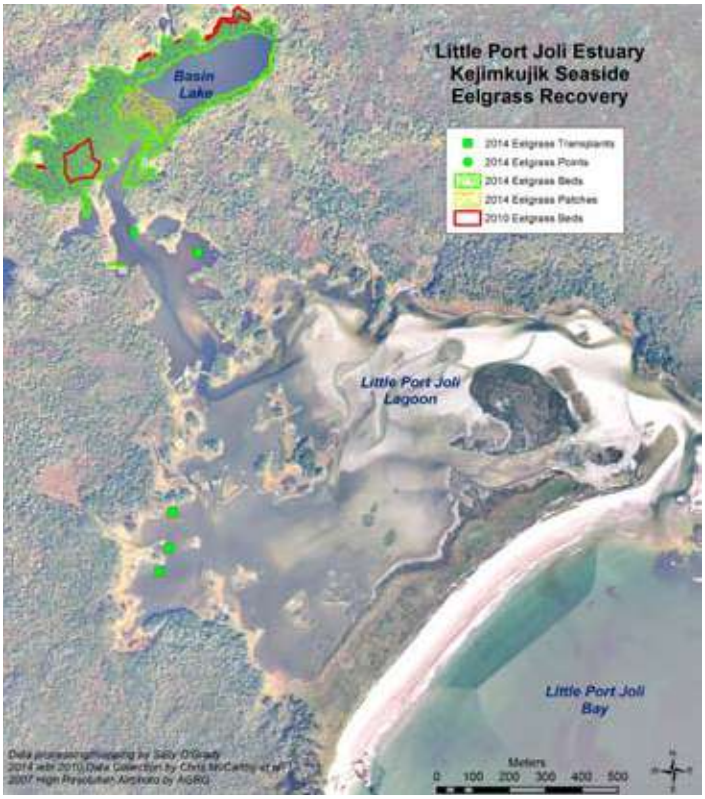
- Ongoing project since 1987

PARTNERS

- Parks Canada
- School for Resource and Environmental Studies, Dalhousie University
- Fisheries and Oceans Canada Gulf Region
- Fisheries and Oceans Canada Bedford Institute of Oceanography
- Harrison Lewis Marine Centre

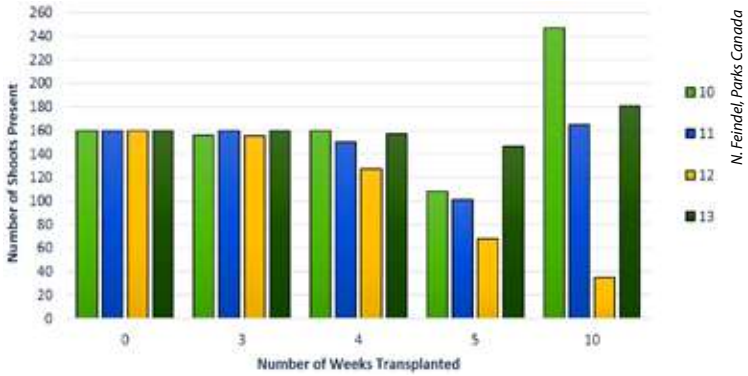
C. McCarthy, Parks Canada

Volunteers helping out with eelgrass transplants at Little Port Joli Estuary



S. O'Grady, Parks Canada

Comparison of 2010 and 2014 eelgrass extents at Little Port Joli Estuary



N. Feindel, Parks Canada

Survival of eelgrass transplants in trial plots 10, 11, 12 and 13 at Little Port Joli Estuary in 2014

CONTACTS

Gabrielle Beaulieu and Chris McCarthy
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-4001
Fx. (902) 682-3367
gabrielle.beaulieu@pc.gc.ca
chris.mccarthy@pc.gc.ca
www.pc.gc.ca

Rationale

Nutrient enrichment of the coastal zone as a result of anthropogenic inputs of nitrogen and phosphorus is becoming a pressing issue in many regions of the world. In shallow waters, nutrient enrichment can cause blooms of fast growing algae which may eliminate slower growing submerged aquatic vegetation such as seagrasses, which provide important nursery habitat in coastal waters for many fish and invertebrate species. Harmful algal blooms and anoxia or hypoxia in bottom waters are also symptoms of nutrient enrichment and can precipitate the collapse of shellfish and fish stocks and changes in benthic species composition. Kejimkujik has identified high water quality as critical to the ecological integrity of its lagoon ecosystems including eelgrass beds, salt marsh, benthic invertebrate communities and the diverse wildlife that depend on these habitats.

K. Rowter, Parks Canada

Breaking ice to sample Basin Lake at Little Port Joli in 2014

Monitoring

ESTUARINE WATER QUALITY MONITORING

OBJECTIVES

- To determine if the Estuarine Water Quality Index (EWQI) for Little Port Joli Estuary at Kejimkujik Seaside is in good condition (*i.e.* >0.66) and if it has changed over the last five years.
- To identify through visual surveys if common symptoms of eutrophication are present in Little Port Joli Estuary, such as nuisance macroalgae blooms and epiphyte abundance.

METHODS

- Monitoring is conducted annually, generally in November, at low tide.
- A visual survey was conducted to identify any common symptoms of eutrophication.
- Four locations within the Little Port Joli Estuary were sampled for temperature, salinity, turbidity, dissolved oxygen and pH.
- The Estuarine Water Quality Index is composed of three sub-measures: dissolved inorganic nitrogen (DIN), dissolved phosphorus (P) and dissolved oxygen (DO).
- Mean sample concentrations of DIN, P, and DO are compared to the thresholds using a one sample t-test (a=0.20) and assigned a sub-measure score (0 or 1) based on whether they exceed the threshold.
- Threshold score was determined by averaging the three sub-measure scores.

K. Rowter, Parks Canada

D. Reid out on a cold day conducting water quality monitoring at Little Port Joli

RESULTS

- The salinity at Basin Lake in December 2014 was unexpectedly higher in relation to the other sampling sites, likely in relation to the presence of surface ice which would have increased the salinity directly underneath the ice as salt crystals were excluded from the ice formation process.
- With the exception of the Basin Lake, the sampling sites within the Little Port Joli Estuary had salinity, turbidity and oxygen readings that were similar to previous years.
- The 2014 Estuarine Water Quality Index value will be determined when lab results become available.

YEARS OF DATA

- Ongoing project since 2008

PARTNERS

- Parks Canada
- Environment Canada
- Dalhousie University

	Temp °C	TDS (g/l)	Salinity	O_2, %	pH
Basin Lake	7.60	29.15	28.66	75.00	7.76
West Lagoon	4.00	28.43	28.05	86.00	n.d.
Lagoon Mouth	5.10	27.81	27.00	96.00	n.d.
Open Ocean	5.10	27.87	27.09	96.00	n.d.

Parks Canada

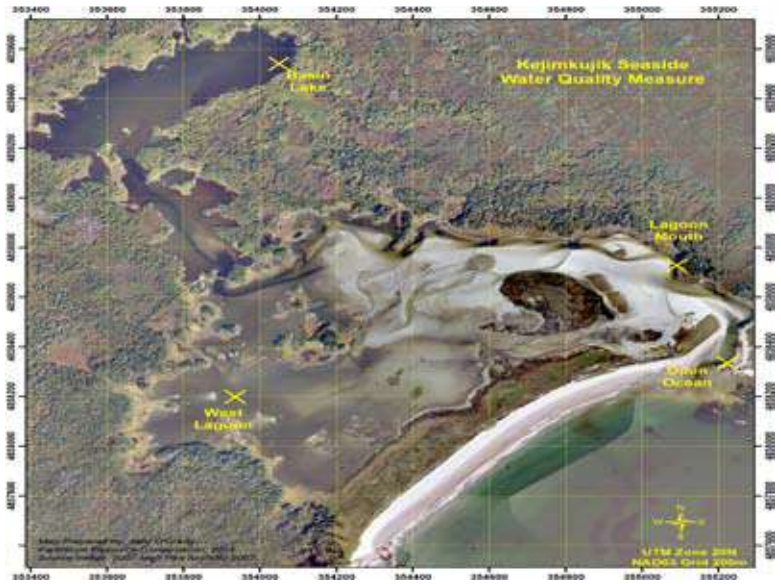
Sampling location descriptions and results for estuarine water quality at Kejimkujik Seaside, 2014

Sub Measures			
Measure	Question	0	1
Dissolved Inorganic Nitrogen (DIN)	Is the mean estuary DIN concentration ≥0.020mg/L?	Yes	No
Dissolved Phosphorous (DP)	Is the mean estuary DP concentration ≥0.015mg/L?	Yes	No
Dissolved Oxygen (DO)	Is the mean estuary DO concentration ≤7.8mg/L?	Yes	No

Thresholds			
Measure	Poor	Fair	Good
Estuarine Water Quality Index (EWQI)	<0.33	0.33-0.66	>0.66

Parks Canada

Estuarine Water Quality Index (EWQI) sub-measures and thresholds



S. O'Grady, Parks Canada

Map of Little Port Joli indicating water quality sampling locations

CONTACTS

Kyle Rowter and Chris McCarthy
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-4001
Fx. (902) 682-3367
kyle.rowter@pc.gc.ca
chris.mccarthy@pc.gc.ca
www.pc.gc.ca

Rationale

With the potential for bivalves to accumulate bio-available contaminants such as heavy metals and inorganic or organic contaminants from both the water and sediments, bivalves can serve as bioindicators of contaminant levels in marine ecosystems. The Québec-Atlantic Coastal Bioregional Working Group identified filter-feeding bivalves as an important measure of coastal ecological integrity. At Kejimkujik Seaside the Soft-shelled clam is the most abundant bivalve in the two estuarine basins. Changes to Soft-shell clam abundance could have major consequences for biodiversity at the Seaside since they are a major food source for gulls, ducks, shorebirds, crabs, gastropods and marine worms. Furthermore, they provide a valuable ecosystem service through the removal of excess nutrients from the water column and may be responsible, in part, for preventing anoxia in coastal water bodies within and outside of Kejimkujik Seaside's boundaries.

K. Rowter, Parks Canada

Soft-shell clams on a sieve at Little Port Joli Estuary, Kejimkujik Seaside

Monitoring

SOFT-SHELL CLAM MONITORING

OBJECTIVES

- To detect long-term changes in Soft-shell clam abundance outside the normal range of variation for Kejimkujik Seaside.
- To monitor population structure of Soft-shell clams in Little Port Joli Estuary.

METHODS

- A systematic survey of the Little Port Joli Basin clam flat was conducted using a 50 x 50 m grid.
- Circular quadrats of 0.34 m diameter were positioned at plot locations identified by Global Positioning System (GPS). A second plot was identified and dug 2 m to the east of the initial location and another plot dug 2 m to the west.
- The surface of each plot was excavated to approximately 10 cm and sieved through a 0.5 mm screen to isolate young Soft-shell clams for measurement.
- When the surface sample was processed, the entire plot was carefully excavated by hand to a depth of approximately 30 cm, any clams were gently removed from the substrate and set aside.
- The length of each clam was then measured and each individual was carefully replanted in the plot from which it was excavated with its siphon pointing up.

C. McCarthy, Parks Canada

Nova Scotia Community College's Natural Resource and Environmental Technology class learning about the clam monitoring protocol

RESULTS

- In 2014, 116 survey stations were visited, with three replicate plots dug at each station for a total of 348 sample plots.
- Size-class frequency of young clams of 1 mm up to 14 mm in length has increased between 7 and 19% when compared to previous monitoring years.
- These data suggest that the restoration work at Little Port Joli Estuary may be having positive impacts on recruitment of young Soft-shell clams into the population.

YEARS OF DATA

- Ongoing project since 2008 (pilot year); monitoring frequency is every three years

PARTNERS

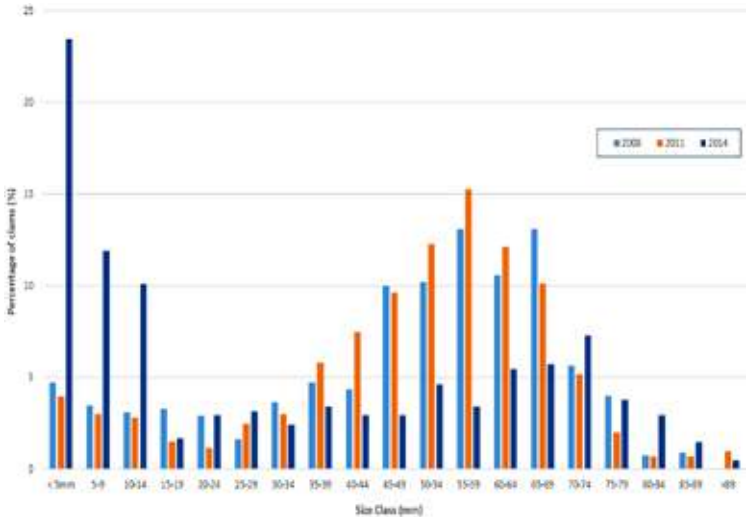
- Parks Canada
- Dalhousie University
- Department of Fisheries and Oceans
- Kouchibouguac National Park

S. Walsh, Parks Canada

Clamming in October at Little Port Joli

S. Walsh, Parks Canada

A volunteer excavating a plot with a Parks Canada staff member



G. Beaulieu, Parks Canada

Size-class frequency of Soft-shell clams for three years of monitoring at Little Port Joli Estuary, Kejimkujik Seaside

S. O'Grady, Parks Canada

Aerial map of 50 m x 50 m grid sampled at Little Port Joli Estuary

CONTACT

Gabrielle Beaulieu
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-4001
Fx. (902) 682-3367
gabrielle.beaulieu@pc.gc.ca
www.pc.gc.ca

Photos on page 9, clockwise from top left:
- *White-tailed deer,* by J. Reid
- *Salamander monitoring,* by D. Reid, Parks Canada
- *Saw-whet owl,* by D. Crossland
- *Kejimkujik forest,* by J. Reid
- *White-tailed deer exclosure,* by J. Barker, MTRI

Forest sidebar photo: J. Reid

FOREST

Rationale

Landbird species that have declined sharply in recent decades include the Common nighthawk, Chimney swift, Eastern wood-pewee, Olive-sided flycatcher, Canada warbler and Rusty blackbird. These six landbird species at risk (SAR), their declines and threats to their persistence are largely unfamiliar to the general public. Education through outreach can help conserve these species, and public engagement in monitoring can yield important information about populations and habitats. With data from research and public surveys, models can be built to map habitat distribution for each species across the landscape. Conservation activities can target areas identified as important and guide conservation activities on managed landscapes.

C. Ferrari

A male Rusty blackbird singing from a snag on land owned by the Nature Conservancy of Canada in Weymouth, Nova Scotia

Monitoring

LANDBIRDS AT RISK IN FORESTED LANDSCAPES

OBJECTIVES

- To conduct field surveys for six landbird species at risk and their habitat.
- To build species distribution models for each species in southwest Nova Scotia.
- To raise public awareness about these species and engage community members in landbird monitoring.

METHODS

- Landbird SAR were surveyed April - June 2014 at 70 sites, using playbacks of conspecific vocalisations.
- Habitat surveys were conducted June - July 2014 at 48 sites, by estimating deciduous, coniferous, shrub, herbaceous cover, abundance of snags and various ground features.
- Habitat for each species was modeled using MaxEnt. First generation models were developed by Alana Westwood, Jen Randall, Meagan Kindree and Siobhan Darlington-Moore, October 2013 - April 2014. Second generation models were completed by intern Clara Ferrari, September 2014.
- 'Species at risk in forested landscapes' public workshops were held in Kempt, Halifax, Annapolis Royal, Tusket Falls, Liverpool, Saulnierville and Kejimkujik, from February - September 2014.
- Workshop participants were encouraged to report SAR detections. Further requests were made through social media, newspapers, posters, brochures and word of mouth.
- A pilot citizen science Common nighthawk survey was organized and run in June 2014.

L. Achenbach

Field technician C. Ferrari completing a habitat survey while timing a point count survey in the Kejimkujik backcountry

RESULTS

- From April - August 2014, the following were reported: 1325 Common nighthawks (14 by Landbirds Project, 1509 by the public; most were in migrating groups, including one of approximately 1000 birds); 14 Chimney swifts (seven by Landbirds Project, seven by the public); 40 Eastern wood-pewees (28 by Landbirds Project, 12 by the public); 20

RESULTS
Continued

Olive-sided flycatchers (17 by Landbirds Project, three by the public); five Canada warblers (two by Landbirds Project, three by the public); and 20 Rusty blackbirds (seven by Landbirds Project, 13 by the public).

- Thirteen people participated in the Common nighthawk pilot survey, completing 25 surveys and detecting 35 nighthawks.
- Workshops, social media and other outreach activities led to public reports of 64 SAR locations, 60 of which were new.
- Species distribution models were created for each species. Models used location data since 2006 from research surveys, the Maritime Breeding Bird Atlas, the Breeding Bird Survey and other public reports.

YEARS OF DATA

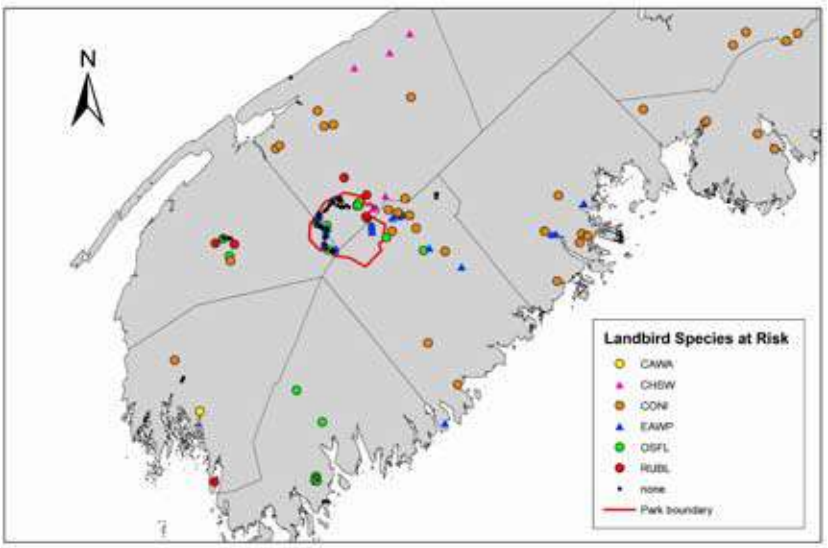
- Ongoing project since 2010; the project will continue each spring and summer, funding-dependent

PARTNERS

- Dalhousie University
- Mersey Tobeatic Research Institute
- Parks Canada
- Nova Scotia Endangered Species Recovery Fund
- Nova Scotia Habitat Conservation Fund
- Government of Canada through the federal Department of the Environment: Habitat Stewardship Program for Species at Risk
- Environment Canada Science Horizons Internship Program
- Nature Conservancy of Canada
- Nova Scotia Bird Society
- Nova Scotia Nature Trust

C. Ferrari

A male Olive-sided flycatcher singing from the top of a snag on land owned by the Nature Conservancy of Canada in Weymouth, Nova Scotia



L. Achenbach

Known locations and sites surveyed for the presence of landbird SAR in southwest Nova Scotia in 2014 (CAWA – Canada warbler; CHSW – Chimney swift; CONI – Common nighthawk; EAWP – Eastern wood-pewee; OSFL – Olive-sided flycatcher; RUBL – Rusty blackbird)

CONTACT

Cindy Staicer
Department of Biology
Dalhousie University
PO Box 15000
Halifax, NS B3H 4R2
Ph. (902) 818-6062
Fx. (902) 494-3736
cindy.staicer@dal.ca
http://biology.dal.ca/People/faculty/staicer/staicer.htm

Rationale

Christmas Bird Counts have been carried out annually for over a century. They have been conducted at several locations in Nova Scotia over the last 50 years and in Caledonia since 1991. Currently, within Nova Scotia, approximately 35 Christmas Bird Counts are conducted every year. The counts occur on one day between mid-December and early January (hence the name Christmas Bird Count) within the same set area. The bird counts document early winter birds and can be compared from year-to-year and area-to-area. The Nova Scotia Bird Society and Audubon Society maintain a master record of all counts within the province and annually report the counts with notes on the unique results of that year.


J. Reid

Downy woodpecker feeding on suet at a feeder

Monitoring

CALEDONIA CHRISTMAS BIRD COUNT

OBJECTIVES

- To document early winter birds during an ongoing annual survey.
- To record sufficient data so that the results may be compared from year-to-year and count-to-count.
- To engage interested volunteer members of the public to complete the annual count.
- To publicize the results to inform and interest the local public in the bird communities of the Caledonia area.

METHODS

- Annually, a one day Christmas Bird Count has been held between specific dates determined by the Audubon Society between mid-December and early January.
- This count has consistently been held in the same area: a circle of 24 km diameter centered where a brook flows northward out of Donnellan Lake in West Caledonia.
- The coordinator organized volunteers to cover different areas so the maximum number of habitats could be searched and the most species located while preventing repeated counting of the same birds in the same areas.
- The bird species and their numbers were recorded.
- The time spent in the woods and at bird feeders, distances traveled, methods of travel and numbers of people involved were recorded to compare the effort by observers.


J. Reid

Volunteer D. Reid observing birds during the count

RESULTS

- The 2014 Caledonia Bird Count occurred on December 14 when 29 species and 819 individual birds were observed. There were 19 hours spent observing feeders and a total of 53 hours volunteered.
- There were 31 observers who participated this year, up from 25 last year.
- The total number of kilometres walked was 48 and driven was 61.

RESULTS
Continued

- Rare birds sighted included the following: Northern cardinal, Pintail duck, Common loon, Sharp-shinned hawk and White-throated sparrow.
- Species not observed that are usually included in the Caledonia Bird Count include Canada goose, Song sparrow and Purple finch.

YEARS OF DATA

- Ongoing project since 1991

PARTNERS

- Nova Scotia Bird Society
- Mersey Tobeatic Research Institute

M. Crowley

A. Levesque participating in the 2014 Christmas Bird Count

A. Lavers

Volunteers making the Christmas Bird Count a part of their family holiday traditions

J. Reid

American goldfinch

CONTACT

Amanda Lavers
Mersey Tobeatic Research Institute
9 Mount Merritt Road
PO Box 215
Kempt, NS B0T 1B0
Ph. (902) 682-2371
Fx. (902) 682-2760
amanda.lavers@merseytobeatic.ca
www.merseytobeatic.ca

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 require large hardwood trees which have cavities suitable for their nests. Additionally, they are sensitive to forest cover and composition changes associated with forest harvesting and human developments. Owls are not easy to monitor due to their secretive, nocturnal activities. Bird Studies Canada coordinates nocturnal 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.

D. Crossland

Barred owl spotted during the day

Monitoring

NOCTURNAL OWL SURVEY

OBJECTIVES

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

METHODS

- At night, volunteer surveyors drove a designated route making ten stops each at least 1.6 km apart. At each stop recorded owl calls prepared by Bird Studies Canada were broadcasted and the number and species of owls heard or seen were recorded.
- Route 40 begins 8 km north of the Mersey River Bridge on Highway 8 in Maitland Bridge and continues northward to South Milford.
- Route 41 begins at the entrance to Kejimkujik and ends near the Gold Mines trail.
- The Devonshire/Rossignol Route follows these roads starting where Devonshire Road intersects West Caledonia Road towards the Mersey River.

C. McCarthy, Parks Canada

Volunteers R. Bower and R. Reeves, recording survey data

RESULTS

- Over the years, Barred, Saw-whet, Great horned and Long-eared owls have been detected.
- Route 40 was surveyed by Brad Toms on April 18 2014. Two Barred owls and one Great horned owl were detected.
- Route 41 was surveyed by Chris McCarthy and local 4H contributors on April 25 2014. They detected nine Barred owls and one Great horned owl.
- The Devonshire/Rossignol Route was not surveyed in 2014 due to poor road conditions.

YEARS OF DATA

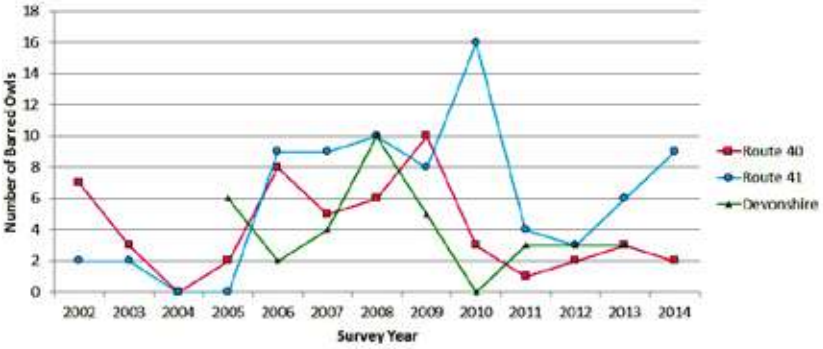
- Ongoing project since 2002

PARTNERS

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

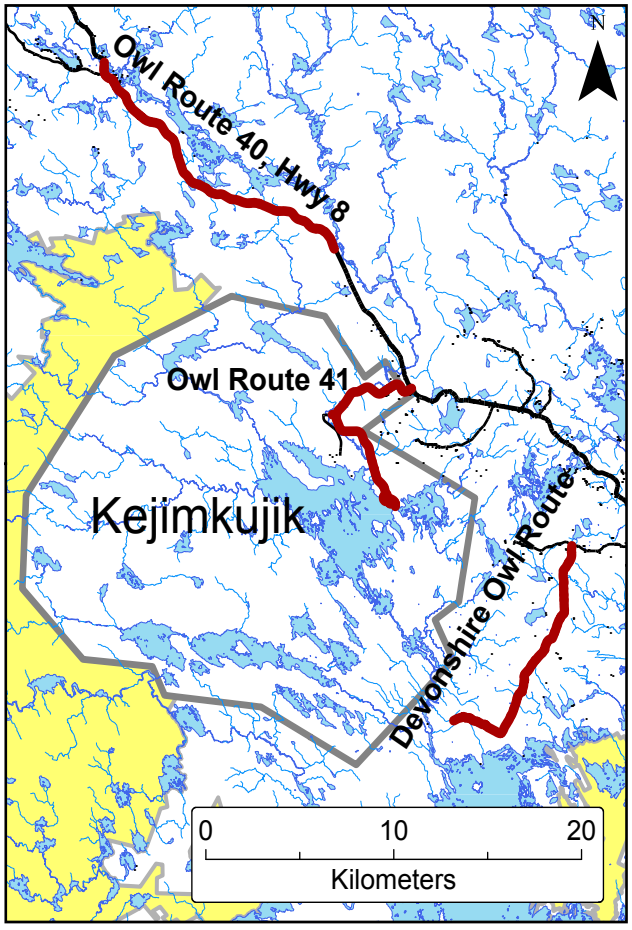
J. McNeil

Barred owl perched on a fence at night



D. Reid, Parks Canada

Number of Barred owls detected on three survey routes. The Highway 8 (Route 40) and Kejimkujik (Route 41) routes have been surveyed since 2002. The Devonshire/Rossignol Route has been surveyed since 2005, but it was not surveyed in 2014.



A. Belliveau, MTRI

Owl survey routes are indicated in red

CONTACTS

Brad Toms
Mersey Tobeatic Research Institute
9 Mount Merritt Road
PO Box 215
Kempt, NS B0T 1B0
Ph. (902) 682-2371
Fx. (902) 682-2760
brad.toms@merseytobeatic.ca
www.merseytobeatic.ca

Chris McCarthy
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-4100
Fx. (902) 682-3367
chris.mccarthy@pc.gc.ca
www.pc.gc.ca

Rationale

Aerial insectivorous bird populations have been in sharp decline for several decades in North America. The Chimney swift was listed as Threatened in 2007 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and under the federal Species at Risk Act (SARA) in 2008. In Nova Scotia, several well known roost sites have been informally monitored for many years by a number of dedicated volunteers. In 2010, multiple stakeholders came together, along with experts from Quebec, Ontario and Manitoba, to identify gaps and needs for Chimney swift recovery in the Maritime Provinces and to bring current monitoring in line with other Canadian programs. The result was the Maritime Swiftwatch program initiated by Bird Studies Canada. This project aims to systematically monitor population levels at known roost sites, to learn more about nesting ecology of Chimney swifts and increase awareness of Chimney swifts.

M.F. Elderkin

Chimney swift adult on barn wall showing the stiff feather tip 'spikes' that help balance against surfaces

Monitoring

MCGOWAN LAKE CHIMNEY SWIFT MONITORING

OBJECTIVES

- To conduct counts at the McGowan Lake roost site on standardized dates and other dates during migration and nesting seasons.
- To introduce new volunteers to Chimney swift monitoring to expand the base of available volunteers.
- To analyze automated counter data to get a better understanding of arrival and departure rates as well as seasonal fluctuations.

METHODS

- Chimney swifts were counted as they entered the roost site at dusk using visual and video counts. Weather conditions were also noted along with any other aerial insectivores. Counts took place on standardized dates as well as casually on other dates.
- An Eco-Visio data logger was deployed in July 2013 and collected in November 2013.

RESULTS

- Eight counts took place from May through August, including four counts on standardized dates. The highest count was 137 and the lowest was two birds. Two of the counts took place in August after the roost was no longer in use by a large group and had one and two birds counted.
- A data logger deployed in 2013 and collected in fall 2013 showed that while the logger consistently underestimated the number of birds it proved to be a great tool to observe usage patterns at a Chimney swift roost. The last large group to use the roost was on August 13 2013 and sparse readings after that date cannot reliably be identified as Chimney swifts using the roost (<6 birds).
- The data logger was not deployed in 2014.

YEARS OF DATA

- Ongoing project since 2011

PARTNERS

- Bird Studies Canada
- Blomidon Naturalist Society
- Ecology Action Center
- Mersey Tobeatic Research Institute
- Nova Scotia Power

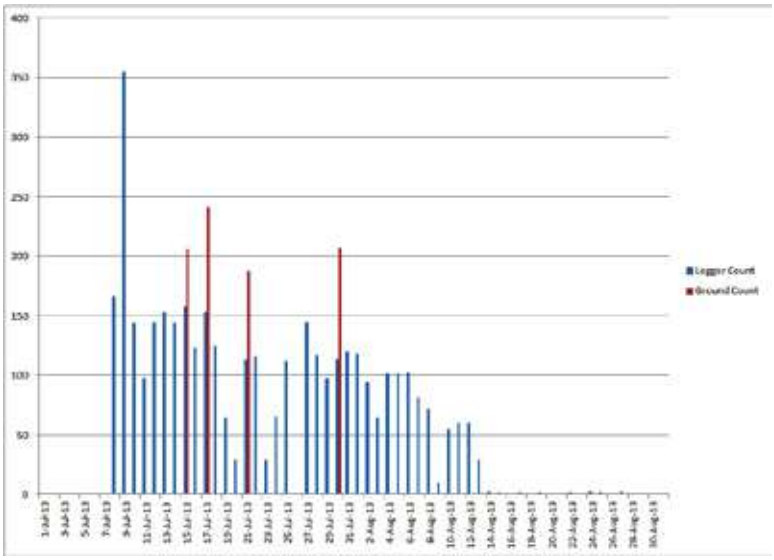
M.F. Elderkin

McGowan Lake Chimney swift roost site

Year	Minimum Count	Maximum Count	Average (n)
2011	14	162	80 (12)
2012	9	98	56 (10)
2013	4	241	132 (14)
2014	2	137	70 (8)*

B. Toms, MTRI

Count data from McGowan Chimney swift roost 2011-2014 (*Two counts, with only 1 bird and 2 birds, took place in August likely after the roost was no longer in use)



B. Toms, MTRI

Comparison of ground counts and automated counts using the Eco-visio data logger from July 9 2013 to August 31 2013

M.F. Elderkin

Chimney swift nest on barn wall showing 'spit halo'

CONTACT

Brad Toms
Mersey Tobeatic Research Institute
9 Mount Merritt Road
PO Box 215
Kempt, NS B0T 1B0
Ph. (902) 682-2371
Fx. (902) 682-2760
brad.toms@merseytobeatic.ca
www.merseytobeatic.ca

Rationale

The Forest Health Group within the Forest Protection Division of the Department of Natural Resources monitors and assesses insect and disease populations and damage, and provides technical advice and management options to forest stakeholders. In 2004, an aerial damage survey detected defoliation and mortality caused by the Jack pine budworm, a native insect of Jack pine stands, in mature and old growth stands of White pine throughout the Southwest Nova Biosphere Reserve. Because this was the first record of this defoliating pest causing damage to the forests of Nova Scotia, it generated concern among forest managers. The reason for the concern is that in Nova Scotia the Jack pine budworm is feeding specifically on White pine rather than its usual host, Jack pine, which is its preferred host in other regions of Canada and the United States.

Forest Health NSDNR

Jackpine budworm larvae

Monitoring

JACK PINE BUDWORM POPULATION AND DAMAGE ASSESSMENTS

OBJECTIVES

Aerial Surveys:

- To observe and record locations of defoliation, determine the size (ha) of the outbreak and the severity of the damage.

Ground Surveys:

- To place pheromone traps baited with lures in mature and old growth stands of White pine to collect male moths to detect building populations.
- To collect branch samples to determine overwintering larval (L2 second instar larval stage) population levels.

METHODS

Aerial Surveys:

- Using one helicopter, two observers flew the entire province at an altitude of 600 m (approximate) along flight lines spaced 10 km apart.
- Locations of defoliation or mortality were delineated using a digitizing tablet and/or a personal computer using ArcPad software.
- Damage severity was also recorded for each polygon using a severity rating of light, moderate or severe defoliation or mortality.

Ground Surveys:

- Using ArcGIS software, forest stands containing a major component of mature to old growth White pine were selected that provided the habitat required to support an outbreak population of Jack pine budworm.
- At each of these sites one Multi-Pher® pheromone trap containing a lure to attract the male moths were placed during late June or early July, just before the peak period of moth emergence and flight activity.
- One 60 cm mid-upper crown branch section was collected from each of three trees at the sample location and brought to the Nova Scotia Department of Natural Resources lab for further processing. Each branch section was processed through a 1% sodium hydroxide wash to remove the second instar larvae from their hibernaculum and then identified and counted.

Forest Health, NSDNR

Conducting a damage assessment survey

RESULTS

Forest Health, NSDNR

Multi-Pher® pheromone trap

Aerial Surveys:

- No new defoliation or dead trees were detected in 2014 while conducting the annual survey for this defoliating insect.

Ground Surveys:

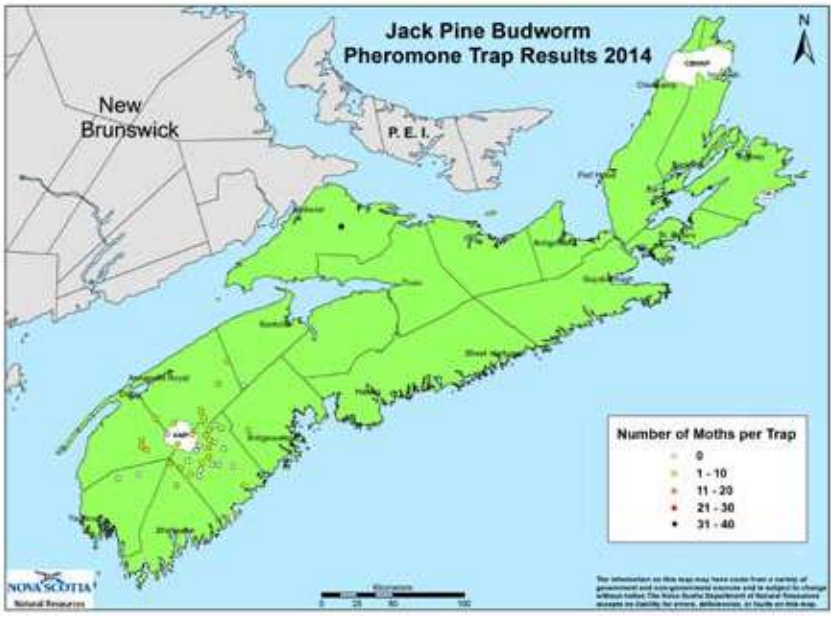
- Trapping: Forty-nine Multi-Pher® pheromone traps baited with lures to attract male moths were placed in mature and old growth White pine stands during June 2014 and were picked up in late fall and winter. Fifteen traps contained no moths; twenty-four traps contained 1 - 10 moths; and one trap at Black River, Cumberland County contained 39 moths. Two traps were missing and seven were on the ground.
- Overwintering L2 larvae: Three locations were assessed in 2014, all from Cumberland County. Thomson Station had seven larvae per sq. meter of bark surface; Black River had none; and Springhill Junction had none. This is the first time we have collected any L2 larvae from Jack pine in Nova Scotia. Previously, all L2 were collected from White pine.

YEARS OF DATA

- Ongoing project since 2004

PARTNERS

- Nova Scotia Department of Natural Resources



Forest Protection, Forest Health Group, NSDNR

Phermone trap catch results

CONTACTS

Justin Smith and Mike LeBlanc
Nova Scotia Department of
Natural Resources
Shubenacadie, NS
Ph. (902) 758-7099 or 758-7213
Fx. (902) 758-3210
Justin.Smith@novascotia.ca
Michael.A.LeBlanc@novascotia.ca
www.gov.ns.ca/natr/forestprotection/
foresthealth

Rationale

Boreal felt lichen (BFL) and other rare lichens that inhabit coastal forests in Nova Scotia are at risk because of air pollution and forestry. Boreal felt lichen and other rare cyanolichens are difficult to detect and as a result the knowledge of their ranges and distributions is incomplete. Little is known about which sources of air pollution pose the greatest threats and at what levels. A Geographic Information System (GIS) habitat algorithm was developed by the Nova Scotia government and has allowed the forest industry to use precaution when harvesting in potentially sensitive areas. This project has fostered partnership with industry to search for Boreal felt lichen. Since the algorithm was developed, knowledge of Boreal felt lichen populations has increased greatly. The continuation of this long term data set will be crucial to conserving Nova Scotian populations of Boreal felt lichen.

T. Power

Dry Boreal felt lichen, Richmond County

Monitoring

BOREAL FELT LICHEN MONITORING IN NOVA SCOTIA

OBJECTIVES

- To improve predictive ability of a GIS habitat algorithm to increase the 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 rare lichens in Nova Scotia.
- To find and protect Boreal felt lichen and other at risk lichen sites in Nova Scotia.

METHODS

- In forested areas, sites predicted by GIS as likely habitat were searched for Boreal felt lichen.
- Known sites were permanently marked for long term monitoring.
- When new Boreal felt lichen sites were found the provincial government and relevant stakeholders were notified. Any losses or habitat destruction were also reported.
- Temperature and humidity loggers (ibuttons) were deployed and collected at Boreal felt lichen sites on Cape Breton Island.

B. Toms, MTRI

C. Pepper looking for Frosted glass-whiskers in a scarred maple

RESULTS

- From 2005 to 2014, 337 trees with Boreal felt lichen were discovered through this project. During that same time, 61 of those trees no longer contained Boreal felt lichen.
- In 2014, 65 new trees containing Boreal felt lichen were discovered and monitoring of survivorship occured at 30 sites.
- In 2014, MTRI researchers found at least 12 trees with Blue felt lichen (Special Concern), 26 trees containing Vole ears (Endangered) and at least six trees containing Frosted glass whiskers (Special Concern).
- Forest industry employees and Nova Scotia Department of Natural Resources staff visited a Boreal felt lichen site with MTRI staff and accompanied searches for Boreal felt lichen to learn about the habitat.
- A temperature and humidity study of habitat was continued using automated data loggers at Boreal felt lichen sites on Cape Breton Island and results are expected in 2015.

YEARS OF DATA

- Ongoing project since 2007

PARTNERS

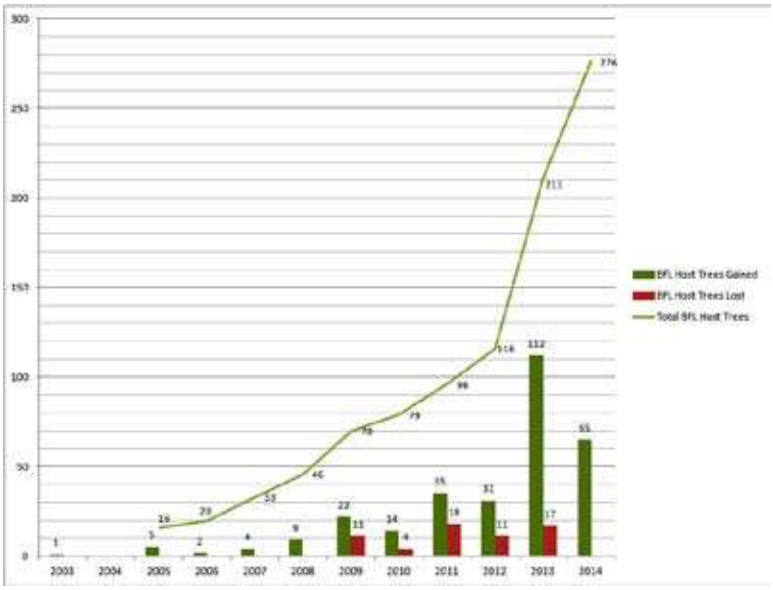
- Government of Canada through the federal Department of the Environment: Habitat Stewardship Program for Species at Risk
- New Page Corporation
- Northern Pulp
- Nova Scotia Environment
- Nova Scotia Department of Natural Resources
- Mersey Tobeatic Research Institute
- Mountain Equipment Co-op

B. Toms, MTRI

Blue felt lichen

B. Toms, MTRI

Lichen researchers T. Neily and C. Pepper doing a survey on a rainy day



B. Toms, MTRI

Number of BFL - host trees gained (green bar), BFL - host trees lost (red bar) and total number of BFL - host trees (green line)

B. Toms, MTRI

Boreal felt lichen (left) and Vole ears lichen (right)

CONTACT

Brad Toms
Mersey Tobeatic Research Institute
9 Mount Merritt Road
PO Box 215
Kempt, NS B0T 1B0
Ph. (902) 682-2371
Fx. (902) 682-2760
brad.toms@merseytobeatic.ca
www.merseytobeatic.ca

Rationale

Since the decline of the Mainland moose in the province, the White-tailed deer, a naturalized species, became one of the major herbivores affecting Kejimkujik forest ecosystems. Selective browsing of deer on certain species of herbaceous plants, shrubs and trees can exert extensive influences on forest community composition and structure. Significant increases in deer populations may result in a reduction of some forest plant components (*e.g.* Sugar maple and Yellow birch) through over-browsing. Alternatively, a decrease in local White-tailed deer abundance could result in changes in the predator trophic structure 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 populations can provide information about hunting pressure outside the park and the effectiveness of enforcement at Kejimkujik.

J. Reid

White-tailed deer observed during the October roadside census

Monitoring

RELATIVE ABUNDANCE OF WHITE-TAILED DEER

OBJECTIVES

- To monitor and assess changes in the population of White-tailed deer at Kejimkujik.
- To determine if the mean number of White-tailed deer observed per day at Kejimkujik (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 Kejimkujik since 1976 through an annual roadside count, which was conducted each day in October along the Main Parkway and locations within Jeremy's 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 Kejimkujik.
- White-tailed deer roadside count data between 1987 and 2012 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 Kejimkujik was also examined by comparing recent data to established thresholds. Thresholds for White-tailed deer abundance at Kejimkujik were developed based on statistical variability in the yearly mean of deer counted per day in the roadside survey at Kejimkujik 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.

J. Reid

White-tailed deer grazing along the roadside within Kejimkujik

RESULTS

- The average number of White-tailed deer observed each day in 2014 at Kejimkujik was lower than last year (3.7 deer obs/day vs 7.8 in 2013). It is thought that the 2013 numbers were high, while in 2014 they returned to a more average number. There

RESULTS
Continued

may be a cyclical nature to relative deer abundance within Kejimkujik.

- The high 2013 number is outside the range of acceptable abundance according to established Kejimkujik thresholds. High deer numbers are known to cause detrimental effects to hardwood recruitment as they browse on the young trees and hinder their growth and establishment. There is however the possibility that as the forests within Kejimkujik mature, deer cannot find suitable browsing material and migrate toward the roadsides where new growth is more abundant, potentially elevating the roadside deer count.
- The 2014 lower numbers returned to a more normal situation in Kejimkujik, within the established thresholds.
- Detailed research into the carrying capacity of White-tailed deer at Kejimkujik would improve monitoring thresholds, help determine the effect deer populations have on forest growth and regeneration and help improve future management decisions.

YEARS OF DATA

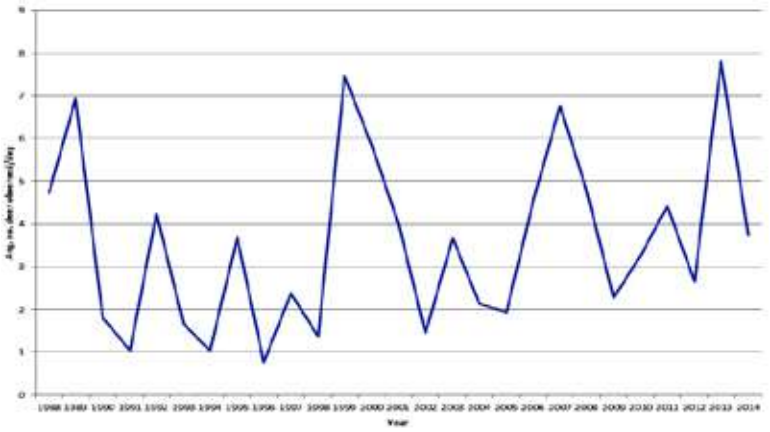
- Ongoing project since 1976

PARTNERS

- Parks Canada
- Nova Scotia Department of Natural Resources

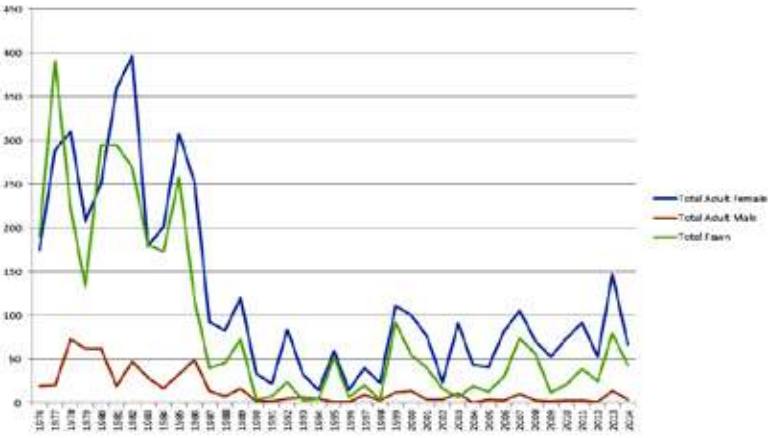
D. Reid, Parks Canada

White-tailed deer are a common sight along the roadsides of Kejimkujik



S. Walsh, Parks Canada

Average October daily White-tailed deer observations at Kejimkujik from 1988 to 2014



S. Walsh, Parks Canada

White-tailed deer demographic change (total numbers) from1976 to 2014

CONTACT

Steph Walsh
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-7017
Fx. (902) 682-3367
stephanie.walsh@pc.gc.ca
www.pc.gc.ca

Rationale

Invasive plant species are a significant threat to the ecological integrity of Kejimkujik. These species can outcompete and displace native plants. Invasive plants at Kejimkujik were inventoried in 2004, and the list of invasive plants was divided into several categories based on their capacity to invade and sustain new populations in natural areas. Kejimkujik has been monitoring invasive plants along park trails since 2008 in order to track invasive plant distributions and spread. Glossy buckthorn is an aggressive non-native shrub that currently poses a threat to vegetation communities. Dense colonies are reducing native biodiversity, particularly in riparian habitat. Its seeds are dispersed by birds, thereby enabling it to invade remote areas far away from parent populations. Park management has identified Glossy buckthorn as a priority for control efforts. Several techniques have been used with minimal success to control Glossy buckthorn, including hand-pulling, girdling and cutting. Herbicide trials were completed in 2014.

K. Rowter, Parks Canada

Glossy buckthorn at Cannon Brook, Kejimkujik

Monitoring

INVASIVE PLANT MONITORING AND RESTORATION

OBJECTIVES

Invasive Plants:

- To track the presence and distribution of existing invasive plant species in Kejimkujik.
- To identify priority invasive species and areas of concern.
- To determine if the Invasive Plant Index is within acceptable range for trails within Kejimkujik and has it changed over the last five years.

Glossy buckthorn:

- To effectively eradicate all mature, seed producing Glossy buckthorn plants from all locations as they become known.
- To monitor areas of Glossy buckthorn eradication to ensure eradication of new germinants from the seed bank.

METHODS

Invasive Plants:

- Twenty-three park trails were surveyed by walking slowly and searching for presence and abundance of the priority invasive species, with approximately half of these trails surveyed each year on a rotating schedule (11 trails one year, 12 trails the next year).
- Trails were surveyed during August or early autumn. Surveys included vegetation along the trail footprint and within 1 m of the trail edge, with either the full trail surveyed or a standard length of 3 km for long trails.

Glossy buckthorn:

- Young Glossy buckthorn are hand-pulled wherever they are detected and their Global Positioning System (GPS) locations are recorded in a database. This database allows park staff to log new occurrences, track eradication treatments and to conduct follow-up monitoring.
- Large Glossy buckthorn will be removed by cutting all stems and treating the cut stump with herbicide. Staff have been trained and certified for safe application of herbicides. Management effectiveness monitoring at each location will proceed during 7 - 10 years to ensure that all new germinant plants are eradicated.

K. Rowter, Parks Canada

Young Glossy buckthorn along the Mersey River

RESULTS

Invasive Plants:

- No new occurrences of invasive plants were identified on park trails monitored in 2014.

Glossy buckthorn:

- Results of Glossy buckthorn monitoring efforts since 2008, indicate that control efforts for this species will require ongoing management actions.
- More than 950 individual stems of Glossy buckthorn have been documented on lands within Kejimkujik, in addition to occasional dense colonies of Glossy buckthorn, occupying a minimum of 4034 m². More colonies, not yet fully assessed, have been reported along the Mersey River riparian zone at the park's eastern end near the Orde Stillwater.
- Six new occurrences of Glossy buckthorn within the park were recorded in the invasive plant database in 2014. Of the six new occurrences, three were young plants and were hand-pulled. Branches were broken off two of the mature plants to prevent fruit production, but all three mature plants will require herbicide in order to thoroughly eradicate them.
- Final results of herbicide trials have been evaluated and a proposal to park management on long-term integrated control strategies for Glossy buckthorn is being finalized.

D. Crossland, Parks Canada

Glossy buckthorn in November 2010 still holding some leaves and fruit

YEARS OF DATA

- Ongoing since 2008

PARTNERS

- Parks Canada

D. Crossland, Parks Canada

Severed, herbicide-treated stumps of Glossy buckthorn one year after treatment

CONTACT

Donna Crossland
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-2293
Fx. (902) 682-3367
donna.crossland@pc.gc.ca
www.pc.gc.ca

Rationale

Plethodontid salamanders lack lungs and breathe through their glandular skin and the roof of their mouth, which must remain moist for respiration; they are vulnerable to desiccation and soil contaminants. Plethodontids can reach high densities in many forest habitats and play an important role in ecosystem food webs and detrital dynamics. They are useful indicator species of forest ecosystems due to their life history traits. They are completely terrestrial and occupy a small home range. They generally have long life spans (ten plus years), high annual rates of survivorship and low birth rates, resulting in stable population sizes under normal conditions. Thus a change in population is more likely to be an indication of some stress to a forest ecosystem rather than simply due to shifts in home range. In Nova Scotia there are only two native plethodontid salamanders: the Four-toed salamander (rare) and the Eastern red-backed salamander (common). Salamanders are monitored as one component of the integrated forest plots designed to assess and monitor the state of forest ecosystems at Kejimkujik and detect changes over time.

K. Rowter, Parks Canada

Red-backed salamanders

Monitoring

PLETHODONTID SALAMANDER MONITORING

OBJECTIVES

- To monitor plethodontid salamander abundance in the mixed Red maple/Red oak/White pine forest ecosystems and Eastern hemlock forest ecosystems of Kejimkujik.

METHODS

- Salamander abundance was assessed in 12 long-term integrated forest plots that were established in 2003 in mixed and hemlock forest ecosystems using a stratified random sampling design.
- Within these plots, salamander abundance was assessed once per week for four weeks in mid-September to mid-October each year.
- At each plot, the number of salamanders observed under 40 thick wooden boards (artificial cover boards) was counted and recorded. Though the monitoring focus was placed on Eastern red-backed salamanders, all other salamander species were recorded when present.
- Colour phase of the salamanders are also recorded. Red-backed salamanders have three phases; the "red-back" which is black with a red stripe running down the back, the "lead-back" which is all black and "erythristic" which is all red but very uncommon.

S. Walsh, Parks Canada

Artificial cover board with identifying tag, approximately 1 square foot and made from 2 inch thick pine board

RESULTS

- Since monitoring of Eastern red-backed salamanders began in 2003, the salamander population has remained stable in both the hemlock and mixed hardwood forest ecotypes.
- This relatively long term stability (12 years) in salamander abundance indicates that during this time period stressors such as climate change, acid rain and land use change have had no significant effect on salamander abundance in Kejimkujik forests.
- In 2014, 16 volunteers contributed 95 hours to salamander monitoring.

YEARS OF DATA

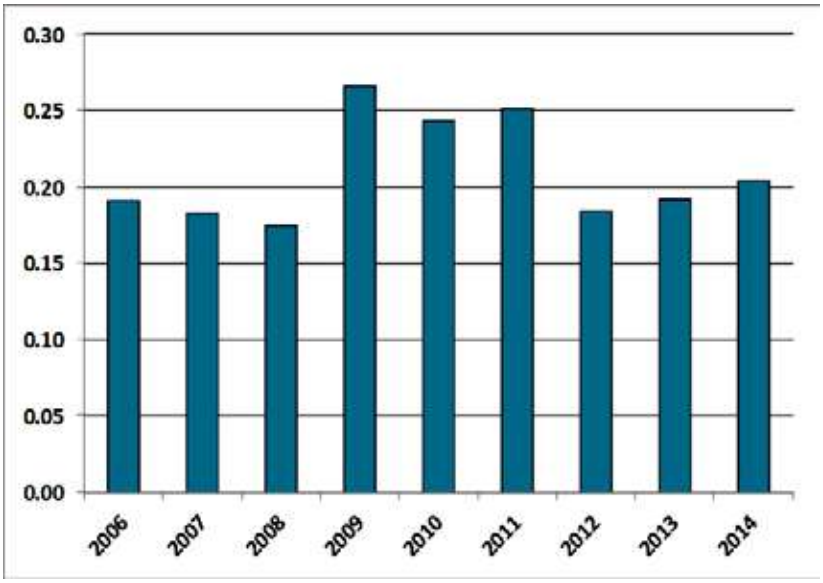
- Ongoing project since 2003

PARTNERS

- Parks Canada

K.Rowter, Parks Canada

Red-backed salamander in the lead-back colour phase found next to slug eggs



K.Rowter, Parks Canada

Average number of Red-backed salamanders per artificial cover board across all sites

M. Crowley, Parks Canada

Volunteer E. Whynot checking cover boards in a hemlock forest

CONTACT

Kyle Rowter
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-4001
Fx. (902) 682-3367
kyle.rowter@pc.gc.ca
www.pc.gc.ca

Rationale

Kejimkujik is situated in the Acadian Forest region, a transition zone between more temperate tree species (*e.g.* Red spruce, Red oak and Eastern hemlock), and more boreal associated species (*e.g.* White spruce, Black spruce and Balsam fir). The Acadian forest characteristically perpetuates itself through the process of gap dynamics – small openings in the forest created by insect infestations, windthrow, disease or senescence of individual trees. Depending on the gap sizes created following disturbance, trees may recolonize from the surrounding late-successional, more shade tolerant forest community, or in situations of larger, open gaps, with early successional, light dependent species. The assessment of trees and shrubs in permanently marked forest plots provides important information about the structure, composition and growth rate of a forest and how it is changing over time.

S. Walsh, Parks Canada

Hemlocks in Big Dam forest plot, Kejimkujik

Monitoring

FOREST HEALTH - TREES

OBJECTIVES

- To monitor tree growth, sapling regeneration and forest succession in hemlock and mixedwood stands of maple-oak-birch-pine at Kejimkujik.
- To determine if the Forest Tree Index (calculated from measurements of tree growth, sapling regeneration and forest succession) is within the range of natural variation historically observed in forest plots across western Nova Scotia.

METHODS

S. Walsh, Parks Canada

Volunteer E. Albert in the Big Dam forest plot

- Tree growth, mortality and recruitment were assessed at twelve 20 x 20m long-term integrated forest plots that were established in 2004 in mixed and hemlock forests using a stratified random sampling design.
- Every five years, trees within these plots are re-located and assessed for tree growth by measuring Diameter at Breast Height (DBH). New trees are identified, enumerated and measured.
- Two submeasures were examined:
  - o productivity - growth rate of mature trees
  - o forest succession - the change in dominance (basal area) of trees
- Each submeasure was scored as poor, fair or good by comparing data to thresholds developed using historical data from forest plots across western Nova Scotia. The overall Forest Tree Index was calculated by combining the scores for each of these submeasures.

RESULTS

- Overall the status of the Forest Tree Index at Kejimkujik is currently good since productivity, forest succession and tree regeneration are all in the expected range. Evaluation of trends over time will require additional data.
- Red spruce dominance continues to decline; possible reasons for this decrease in dominance are unknown.

RESULTS
Continued

- Eastern hemlock is declining in the identified hemlock stands, mainly as a result of former Pale-winged grey moth infestations in 2002. Eastern hemlock appears to be increasing in the hardwood stands along with Red maple.
- White pine and Red maple have increased in forest plots, likely in response to canopy openings caused by recent disturbances.

YEARS OF DATA

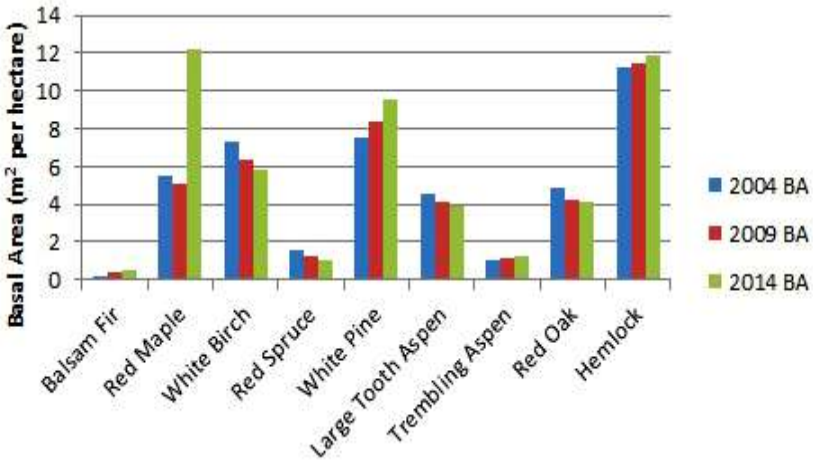
- Ongoing project since 2004; monitoring frequency is every five years

PARTNERS

- Parks Canada

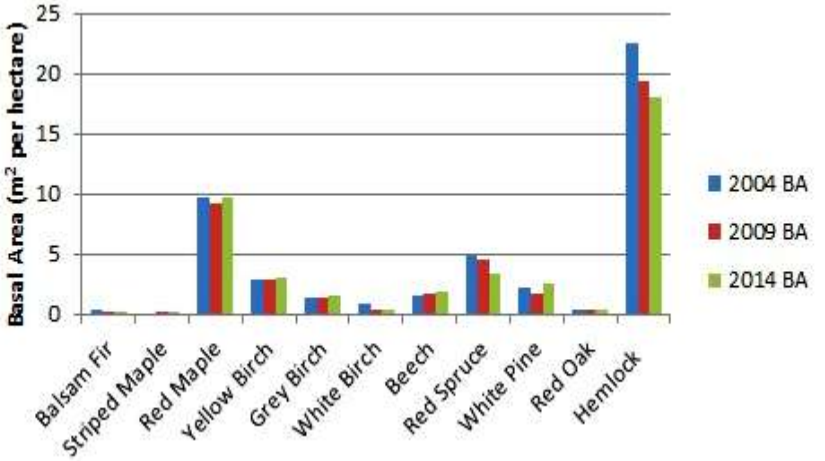
S. Walsh, Parks Canada

Volunteer G. Turner measuring trees during forest plot surveys at Channel Lake Trail, Kejimkujik



Parks Canada

Basal area comparison of hardwood forest plots



Parks Canada

Basal area comparison of hemlock stand forest plots

CONTACTS

Steph Walsh and Donna Crossland
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-7017
Fx. (902) 682-3367
stephanie.walsh@pc.gc.ca
donna.crossland@pc.gc.ca
www.pc.gc.ca

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 plots in Kejimkujik over the past few years has shown poor levels of regeneration. Some of the contributing factors to the disturbance of Red oaks in the Acadian Forest likely include past forestry practices, natural stand succession 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 mixed-wood stands containing Red oak and to determine appropriate sites for Red oak regeneration experiments both inside and outside Kejimkujik. These proposed experiments will help build a better understanding of management techniques to be used in Kejimkujik and other parts of the Acadian Forest region.

J. Barker, MTRI

Red oak sapling in the fall

Research

RED OAK REGENERATION IN MIXEDWOOD STANDS

OBJECTIVES

- To monitor hardwood, especially Red oak, regeneration over a 10-year period within permanently marked transects and determine the impact White-tailed deer have on Red oak regeneration.
- To monitor Red oak and other hardwood species that are within White-tailed deer exclosures which protect hardwood seedlings and saplings from browsing by large herbivores.
- To assess defoliation damage inflicted on mature Red oaks by the Oak leaf shredder and Oak leaf roller.
- To assess changes in Cancer root (parasitic on Red oak) populations within control and prescribed burn sites.

METHODS

- Tree species regeneration was estimated along belt transects of 150 x 2 m by counting tree species in various height classes both in control sites and treatment (prescribed burn) sites in five locations within the park.
- Data was collected at the beginning and at each 50 m interval along the transect by estimating standing living volume with a prism sweep, estimating canopy cover, noting ground vegetation and taking photos of north, east, south and west aspects.
- Red oak defoliation was estimated visually in the canopy of mature oaks within the belt transects.
- Trees species, their height classes and any browsing were noted within 42 deer exclosures in seven locations, with both control and treatment sites, within and outside of Kejimkujik.
- Cancer root clumps were noted and counted where present along transects and within exclosures.

A. Belliveau, MTRI

Cancer root, a rare vascular plant of Red oak forests

RESULTS

- Preliminary analysis of pre- and post-burn data has demonstrated the prescribed burn area is succeeding toward a Red maple and Witch hazel uplands forest and that White pine seedlings and saplings are significantly reduced.
- Data from transects showed that Red oaks experienced on average about 39% defoliation in years prior to 2012, but only

RESULTS
Continued

about 9% in 2012 - 2014 suggesting a recession in recent Oak leaf roller and Oak leaf skeletonizer outbreaks.

- Transect data to date showed a significant decline (down to 12%) in browsed Red oak saplings in 2014 compared with the last two years, which peaked at over 75% in 2012. This corresponds with the recent spike and fall, in 2013 and 2014 respectively, in the number of deer observed within Kejimkujik (see White-tailed deer report on page 38).
- Exclosure data dating back to 2011 did not show any significant changes or increases in Red oak seedlings, which is likely an indication of the importance of the long-term nature of this research initiative and the many factors (*e.g.* Red oak acorn bumper crop frequency, insect defoliation stress) in play.
- The number of Cancer root clumps showed a slight increase in both the prescribed burn and control transects at the McGinty Lake Road site and showed a slight decrease on both transects at the Eel Weir Road site. However, due to fluctuations in the number of plants to date and other variables, it is not yet possible to establish a link between forest surface fires and the persistence of this rare parasitic plant species.

J. Barker, MTRI

Red oak transect canopy

YEARS OF DATA

- Year 9 of an ongoing project

PARTNERS

- Mersey Tobeatic Research Institute
- Parks Canada
- Service Canada

J. Barker, MTRI

Regeneration at the Eel Weir bridge prescribed burn site in Kejimkujik

J. Barker, MTRI

A deer exclosure near the Eel Weir bridge, Kejimkujik

CONTACTS

Jane Barker
Mersey Tobeatic Research Institute
9 Mount Merritt Road
PO Box 215
Kempt, NS B0T 1B0
Ph. (902) 682-2371
Fx. (902) 682-2760
info@merseytobeatic.ca
www.merseytobeatic.ca

Pierre Martel
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-2798
Fx. (902) 682-3367
pierre.martel@pc.gc.ca
www.pc.gc.ca

Rationale

The use of DNA barcoding has greatly improved large-scale biodiversity assessments by overcoming the limits of traditional species identification. This technique differentiates species by variations in a short gene sequence. Malaise traps are tent-like structures that are effective at capturing insects from various groups and are easily deployed and cost-effective. In 2012, the Biodiversity Institute of Ontario (BIO) and Parks Canada initiated the Canadian National Parks (CNP) Malaise Program where 14 national parks in central and western Canada participated. In 2013, 14 national parks in eastern Canada were involved in the program, Kejimkujik included. In addition, eight of the 14 parks were visited by four BIO staff on the BIObus (BIO's RV field vehicle) to conduct the Standardized Sampling Program. Various trapping techniques were used to obtain a more representative list of arthropod species within the park. All samples were brought to BIO by October 2013 to start processing. Complete park reports were prepared and ready in fall 2014.

A. Pawlowski

A Luna moth attracted to the UV night sheet in Kejimkujik

Research

ARTHROPOD DIVERSITY AND DNA BARCODING

OBJECTIVES

- Large-scale trapping of arthropods in Canadian National Parks to obtain tissue material and subsequently determine Canadian species diversity using DNA barcoding.
- Over the long term, creation of a complete DNA barcode library for all eukaryote species that occur in Canada.

METHODS

- General collecting (aquatic sampling, night sheet, bucket and bottle trap, hand collecting) occurred at various sites throughout the park.
- All associated collection data and sequences will be uploaded to the online Barcode of Life Datasystems (BOLD). Barcodes will be assigned a Barcode Index Number (BIN), which represents a unique species and can be compared to the DNA barcode reference library.

CNP Malaise Program:

- Two Malaise traps (15 m apart) were deployed by BIO staff in Jeremy's Bay Campground, near the ampitheatre, near the campfire circle.
- Traps collected specimens for 20 weeks; Kejimkujik staff changed the sample bottles every week.

Standardized Sampling Program:

- Four BIObus staff visited Kejimkujik once in May and once in August. They conducted standardized sampling at Eel Weir Road and the Big Dam Lake area (north in proximity to the Hemlock & Hardwoods Trail and south to the Channel Lake Trail).
- Two Malaise traps, ten pan traps, ten pitfall traps, one soil core, one intercept trap and one Burlese funnel deployed at each site for one week per visit. Each staff also performed sweep netting for five minutes at each site on three separate days (12 sweep netting events).

Analytical Protocol:

- DNA will be extracted from each specimen, and every individual will gain a DNA barcode sequence which enables the assignment of more detailed taxonomic information in the future.

A. Pawlowski

Setting up a Malaise trap at one of the standardized sampling sites

RESULTS

- Collected a total of 21,708 specimens from 18 weeks of Malaise trapping in Kejimkujik.
- A total of 18,151 DNA barcodes were generated (83.6% success rate).
- To date, 2,899 BINs have been determined.
- Twenty BINs with more than 100 individuals (758 individuals of one species of fly); 1,436 singletons.

YEARS OF DATA

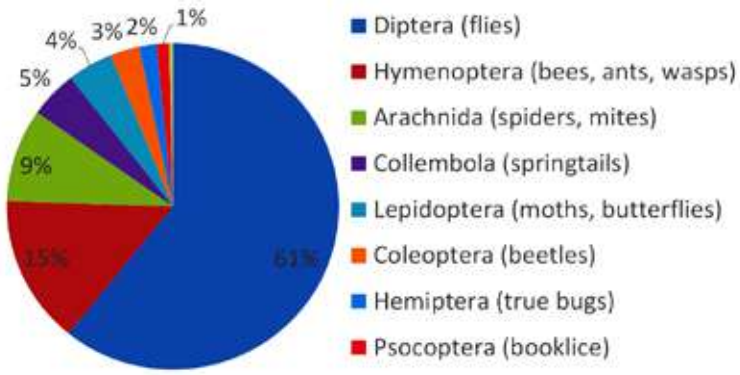
- Year 3 of a 4 year project

PARTNERS

- Biodiversity Institute of Ontario
- University of Guelph
- Canadian Centre for DNA Barcoding
- Parks Canada
- Genome Canada: Ontario Genomics Institute
- Canadian Foundation for Innovation
- Ontario Ministry of Research and Innovation
- Ann McCain Evans and Chris Evans

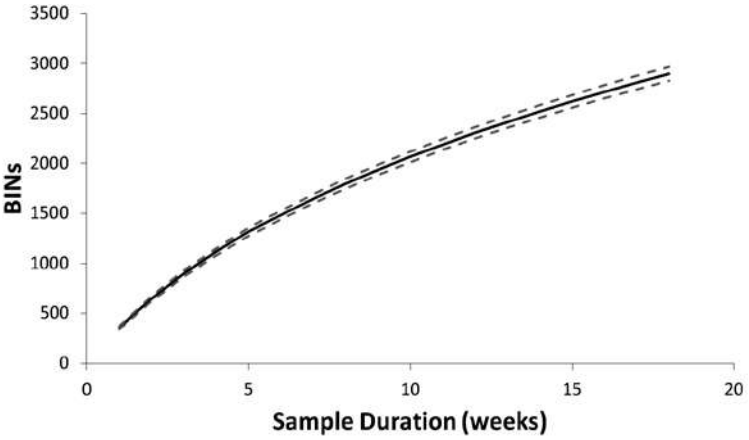
A. Pawlowski

The BIObus student crew: G. Ansell, M. Zlatkin and K. Lutes



K. Perez

Percentage relative abundance of taxonomic orders collected at Kejimkujik in 2013



K. Perez

Species accumulation curve for the 18 Malaise trap samples collected in Kejimkujik analyzed to date

CONTACT

Paul D.N. Hebert
Biodiversity Institute of Ontario
50 Stone Road East
Guelph, ON N1G 2W1
Ph. (519) 824-4120 ext. 56520
phebert@uoguelph.ca
http://www.biodiversity.ca

Photos on page 51, clockwise from top left:
- *Mersey River, Kejimkujik,* by J. Reid
- *Grafton Brook, Kejimkujik,* by J. Reid
- *Adult and juvenile loons,* by W. Pitts
- *Big Dam Lake, Kejimkujik,* by J. Reid
- *Turtle-safe fyke net,* by D. Reid, Parks Canada

Freshwater sidebar photo: J. Reid

FRESHWATER

Rationale

In 2011, Nova Scotia Nature Trust (NSNT), MTRI and Kejimkujik came together to create a combined Atlantic Coastal Plain Flora (ACPF) Volunteer Plant Monitoring Program, building on the program established by the Nature Trust in 2000. The collaborative plant monitoring program was designed to involve interested, conservation-minded individuals and groups in community-based science to collect information on the populations and habitats of particular species of ACPF on an annual basis. In 2014, the program was consolidated with the Nature Trust's Property Guardian program, with more of a focus on threat monitoring within existing conservation lands. Data collected by monitors will contribute to the growing understanding of ACPF in Nova Scotia and will contribute to the stewardship of the Nature Trust's protected properties in southwest Nova Scotia..


NSNT

Thread-leaved sundew

Monitoring

ACPF VOLUNTEER PLANT MONITORING

OBJECTIVES

- To document threats to high priority ACPF along the shorelines of lakes.
- To contribute to the body of knowledge about ACPF including locations of habitats and current threats.
- To engage volunteers in a meaningful monitoring program that contributes directly to the conservation of ACPF species.
- To inform management of Nature Trust Conservation properties that host ACPF species.

METHODS

- Volunteers were paired with Nature Trust Conservation properties with ACPF species of interest. Volunteers visited a selected site one or more times in the summer and collected observations of habitat quality, noting occurrences of disturbance (evidence of ATV use, shoreline alterations, *etc.*) or other potential impacts (*e.g.* invasive species).
- Observations were reported in a standardized form, and sent to the Nature Trust.
- Data was compiled by Nature Trust staff, and all rare ACPF sighting were reported to the Atlantic Canada Conservation Data Centre.


NSNT

Volunteer R. McKay surveying Long's bulrush on the Medway River

RESULTS

- Thirteen volunteers worked to monitor ACPF habitats in southwest Nova Scotia covering eight sites: Cameron Lake, Gillfillan Lake, Wilsons Lake, Bennetts Lake, Molega Lake, Pleasant River, Medway River and Fancy Lake.
- Nature Trust staff trained new volunteers as Property Guardians with ACPF threat monitoring protocol.
- Additionally some volunteers collected data over and above the threat monitoring protocol between July and September 2014. These data included: Plant species abundance of ACPF at certain sites; Water level in order to determine the area of exposed shoreline habitat.
- Threats or changes at these sites included: increased in grass species abundance on Molega Lake's shoreline as well as new cottage developments and increased boating activity;

RESULTS
Continued

dense deer tracks and grazing were observed within a patch of Redroot on Cameron Lake; Fancy Lake had a decline in Goldencrest from previous years. Fancy Lake had drier than usual conditions this year; ATV use occurred along a portion of Wilsons Lake.

- ATV use, clear-cutting of adjacent forest, garbage dumps and other anthropogenic disturbances were noted nearby ACPF lakes but not on the sensitive shoreline habitat.
- Seven additional volunteers are entering the program this fall and will be trained as Property Guardians or in ACPF sampling methodologies. Additional training and mentorship is needed to support the growing volunteer base. The Nature Trust is seeking support from experienced volunteers and botanists to help train and mentor surveyors for the 2015 season.

YEARS OF DATA

- Ongoing project since 2011

PARTNERS

- Nova Scotia Nature Trust
- Mersey Tobeatic Research Institute
- Parks Canada
- Atlantic Coastal Plain Flora Recovery Team
- Nova Scotia Environment
- Nova Scotia Department of Natural Resources
- Atlantic Canada Conservation Data Centre
- Nature Conservancy of Canada
- Government of Canada through the federal Department of the Environment: Habitat Stewardship Program for Species at Riskk
- Nova Scotia Habitat Conservation Fund
- Nova Scotia Species at Risk Conservation Fund
- Davis Foundation
- Municipality of the District of Shelburne
- Municipality of the District of Lunenburg

NSNT

Recording survey data

NSNT

NSNT Endangered Species Coordinator K. McKendry surveying Cameron Lake

CONTACT

Alice Morgan
Nova Scotia Nature Trust
2085 Maitland St
Halifax, NS B3K 2Z8
Ph. (902) 425-5263
Fx. (902) 429-5263
alice@nsnt.ca
www.nsnt.ca

Rationale

The Atlantic Coastal Plain Flora (ACPF) is a group of plants that exist mainly on lakeshores and wetland habitats in Nova Scotia. Their populations are largely disjunct from other ACPF populations in Canada and several species have been listed under the Species At Risk Act (SARA). In 2010 MTRI, in partnership with the ACPF Recovery Team, Nova Scotia Nature Trust and Parks Canada, initiated a project to collect baseline data for the Species At Risk Act listed ACPF populations in southwest Nova Scotia, establish monitoring protocols and increase stewardship opportunities for landowners who live with ACPF.

B. Toms, MTRI

G. Smith learning about ACPF plants from botanist A. Belliveau on Bennetts Lake

Monitoring

ACPF STEWARDS IN COTTAGE COUNTRY

OBJECTIVES

- To monitor populations of Endangered, Threatened and Special Concern ACPF on 36 high priority lakes identified in the ACPF recovery strategy.
- To engage landowners on the 36 high priority lakes.
- To collect habitat information on lakes where botanical surveys are conducted.

METHODS

- Populations of SARA listed ACPF species were counted by botanists and georeferenced along lake shores.
- Shoreline habitat was documented through georeferenced photos and habitat parameter data collected by researchers and volunteers.
- Landowners were directly involved in a variety of recovery activities.

A. Belliveau

A. Belliveau and L. Keating at the last meter of ACPF shoreline surveyed for rare plants

RESULTS

- Complete surveys took place on three lakes (Pearl, Kegeshook and Bennetts).
- Partial surveys took place on four lakes (Molega, Ponhook, Great Pubnico and Gilfillan.) These lakes were too large to complete in a single year.
- From 2010 to 2014, the entire shoreline of 35 of the high priority lakes has been completely surveyed for rare ACPF plants (~530km). Habitat and threat surveys still need to be completed on some lakes.

YEARS OF DATA

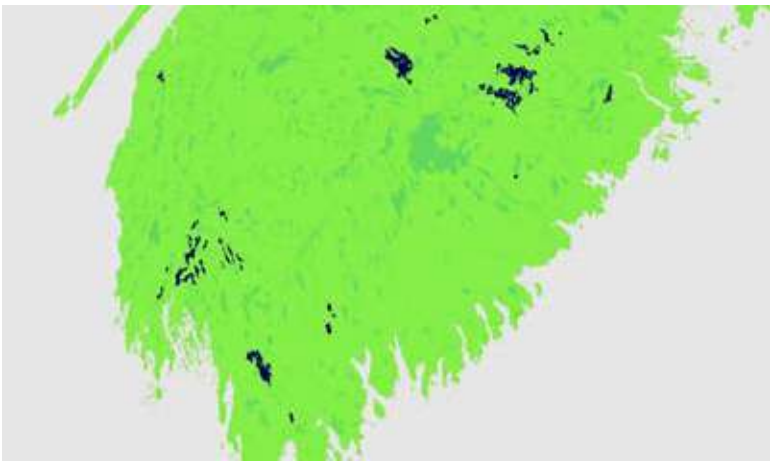
- Year 4 of a 5 year project

PARTNERS

- Mersey Tobeatic Research Institute
- Government of Canada through the federal Department of the Environment: Habitat Stewardship Program for Species at Risk
- Parks Canada
- Atlantic Canada Conservation Data Centre
- Environment Canada
- Dalhousie University
- Nova Scotia Environment
- Sage Environmental Program
- Nova Scotia Nature Trust
- Tusket River Environmental Protections Association
- Fern Hill Institute for Plant Conservation

B. Toms, MTRI

Pink coreopsis found at Bennetts Lake



B. Toms, MTRI

The 36 high priority lakes (dark blue) containing at risk Atlantic Coastal Plain Flora

B. Toms, MTRI

Plymouth gentian flower and rosettes

CONTACT

Brad Toms
Mersey Tobeatic Research Institute
9 Mount Merritt Road
PO Box 215
Kempt, NS B0T 1B0
Ph. (902) 682-2371
Fx. (902) 682-2760
brad.toms@merseytobeatic.ca
www.merseytobeatic.ca
www.batconservation.ca

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 water 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.

Tubercled spike-rush along the shore of Great Publico Lake

Monitoring

WATER QUALITY IN ACPF HABITAT

OBJECTIVES

- To sample water quality from a representative subset of 15 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 to raise awareness about the importance of lake water quality and ACPF.

METHODS

A secchi disk being lowered into the water

- Water samples and on-site measurements of water quality data were collected at the deepest point of the lake four times annually (May, July, August and October).
- The Carlsons trophic status index (TSI) was calculated for each sampling site.
- Field parameters (temperature, dissolved oxygen, turbidity, pH and salinity) were collected using a YSI Sonde.
- Phosphorus, nitrogen and chlorophyll measurements were obtained by independent laboratory measurements. True colour and alkalinity obtained in the fall through laboratory measurements.
- Community members aided in water quality sample collection.

RESULTS

- Twelve high priority lakes with a total of 15 sites were sampled (Tusket: seven, Medway: five), four times each (May, July, August and October).
- With data averaged over all four sampling periods in 2014, six sites were found to be oligotrophic, five mesotrophic and two eutrophic (both on the Carleton River) based on the Carlsons TSI value.
- On average all sites show decreased water quality when compared to baseline data collected in 2002.

YEARS OF DATA

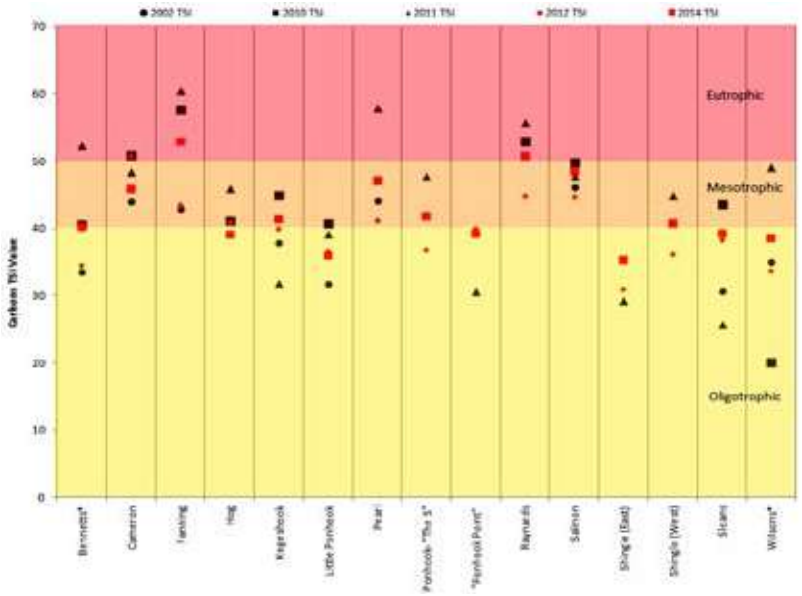
- Year 4 of a 5 year project

PARTNERS

- Government of Canada Habitat Stewardship Program for Species at Risk
- Parks Canada
- Mersey Tobeatic Research Institute
- Atlantic Coastal Plain Flora Recovery Team
- Tusket River Environmental Protection Agency
- Acadia University
- St. Mary's University
- Sage Environmental Program

MTRI

Collecting water quality data



B. Toms, MTRI

Comparison of 2002, 2010, 2011, 2012 and 2014 Carlsons TSI values for sample sites where colour bars denote oligotrophic status ranging from 0-39 (yellow), mesotrophic status from 40-49 (orange) and eutrophic status from 50-69 (pink)

C. Gray, MTRI

C. Tedesco assissting with water quality monitoring field work

CONTACT

Brad Toms
Mersey Tobeatic Research Institute
9 Mount Merritt Road
PO Box 215
Kempt, NS B0T 1B0
Ph. (902) 682-2371
Fx. (902) 682-2760
brad.toms@merseytobeatic.ca
www.merseytobeatic.ca
www.batconservation.ca

Rationale

The Tusket River Environmental Protection Association (TREPA) was established in April 1986 in response to a blowout from the Rio Algom Tin Mine in East Kemptville, which polluted the Tusket River. TREPA rapidly evolved to deal with any environmental issues of concern to southwest Nova Scotia, particularly those affecting Yarmouth County and the Tusket catchment. The Atlantic Coastal Plain Flora (ACPF) is a relict assemblage of plant species found in many parts of southwest Nova Scotia. Typically, they inhabit marginal environments where competition from other species is limited. Many are species at risk and occur on the shores of lakes and rivers in the region. In recent years, eutrophication in the Carleton system has become a concern. Increases in nutrient levels may affect littoral species at risk. Therefore monitoring of water quality is part of a program of monitoring the status of ACPF and can help point to issues which need to be addressed.


TREPA

J. Sollows taking a GPS reading while monitoring

Monitoring

WATER QUALITY IN THE TUSKET CATCHMENT

OBJECTIVES

- To establish and maintain a water quality database to complement monitoring of ACPF.
- To monitor changes in water quality over time.

METHODS

- Eight lakes were monitored from a canoe in early May and July and late August and October. Lakes monitored include Fanning, Sloans, and Raynards (Carleton catchment), Salmon (Annis catchment), Pearl, Wilsons, and Bennetts (on the main Tusket) and Kegeshook (on the Cold Stream).
- Data collected on the spot included Secchi depth, water temperature, conductivity, total dissolved solids and pH at depths of 25 cm, twice Secchi depth and 1 m above the bottom. Composite samples were taken from depths of 25 cm and twice Secchi depth, and sent to a laboratory to assess concentrations of nitrate, nitrite, total phosphorus, colour and alkalinity. Data were typically collected at or near the deepest spot in the lake. Samples for chlorophyll-*a* analysis were also taken with a 1 m long vertical bailer; these samples were filtered, frozen, and sent to Dalhousie University for analysis.
- Similar data are collected from additional lakes, under other funding, in order to complement this database.
- Data are stored in an Excel file and an online database.


J. Sollows, TREPA

Past secretary of TREPA, C. Jacquard, preparing to head out on the water

RESULTS

- Nutrient levels in the Carleton River tend to be higher upstream.
- Nutrient levels in the Tusket River are sometimes comparable with those in the lower Carleton River, but high colour levels in the Tusket may prevent blooms.

YEARS OF DATA

- Ongoing project since 2010

PARTNERS

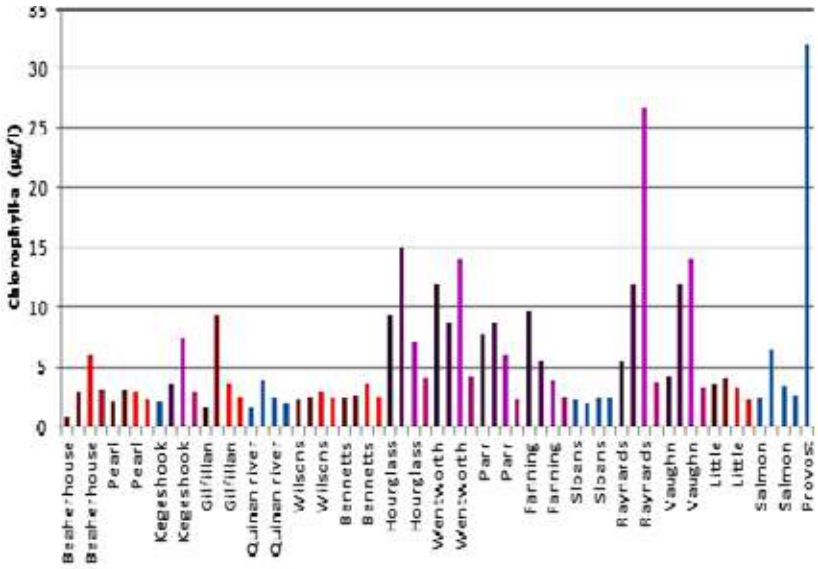
- Tusket River Environmental Protection Association

J. Sollow, TREPA

C. Shepherd lowering a sonde into Bennetts Lake

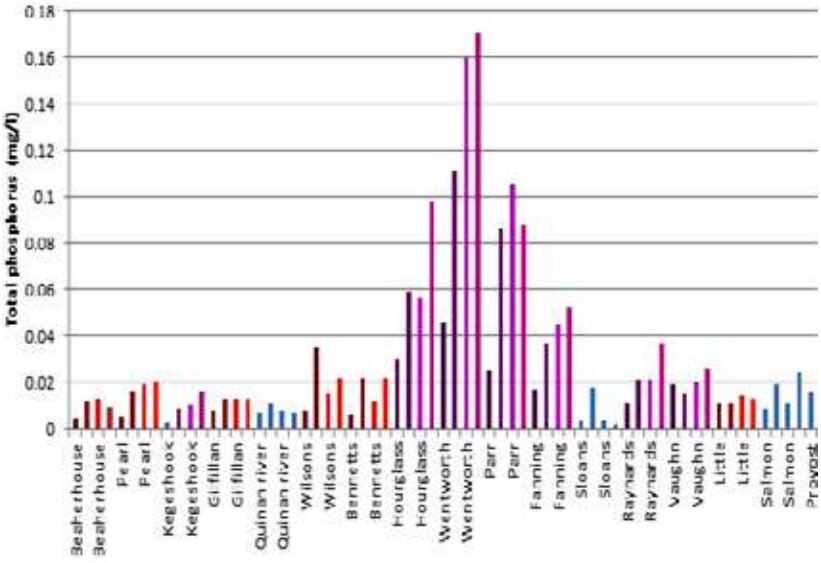
J. Sollow, TREPA

S. Sollows loading the canoe with monitoring equipment at Sloans Lake



J. Sollows, TREPA

Chlorophyll-a concentrations in the four samples, taken in May, July, August, and October 2013 (only one reading was taken from Provost, in August)



J. Sollows, TREPA

Total phosphorus in the four samples, taken in May, July, August, and October 2013 (only one reading was taken from Provost, in August)

CONTACT

John Sollows
Tusket River Environmental Protection Association
399 Wyman Rd
Sand Beach, NS B5A 5G4
Ph. (902) 742-2802
nhungjohn@eastlink.ca
www.trepa.com

Rationale

The Community-Based Environmental Monitoring Network (CBEMN) is a non-governmental organization housed in the Geography Department of Saint Mary's University (SMU), and has been operating for over a decade. Its primary objective is to increase community capacity for environmental monitoring by providing equipment, information and training to stewardship organizations across the Atlantic provinces. The CBEMN facilitates networking between stewardship organizations and conducts training and educational outreach activities with community organizations and the general public. The CBEMN is currently leading a major project called Community-University Research Alliance (CURA) H2O that aims to build capacity for non-governmental water quality monitoring through a standardized training program and an accompanying set of monitoring equipment (Wet-Pro). This work is being conducted with a large network of mixed stakeholders to work towards integrated watershed management in Nova Scotia. CURA H2O has project components in all the Atlantic provinces, Alberta, British Columbia and internationally, and has built a central database to house and integrate regional water quality data.

Preparing to take water quailty samples

Monitoring

CURA H2O - COMMUNITY BASED MONITORING

OBJECTIVES

- To increase community capacity for water monitoring and management in the Atlantic provinces and abroad.
- To standardize the way in which stewardship organizations conduct water quality monitoring.
- To leverage thousands of volunteer hours that are already dedicated to water quality monitoring.
- To establish a stewardship driven water quality database to promote networking/data sharing between organizations.

METHODS

- CURA H2O established an online training course and accompanying toolkit (Wet-Pro).
- Equipment and training was delivered to stewardship organizations across the Atlantic provinces.
- Central database was developed to house community data.
- Mobile application was developed to facilitate data uploads (from the field).

RESULTS

- CURA H2O has provided 35 stewardship organizations with standardized training and equipment (Wet-Pro).
- There are currently more than 30 stewardship organizations (five in southwest Nova Scotia) actively uploading water quality data into the data management infrastructure. There have been 568 monitoring locations established (96 in southwest Nova Scotia), totaling over 6000 individual water quality observations (2500 from southwest Nova Scotia).

YEARS OF DATA

- Year 4 of a 5 year project; the CBEMN has been operating for over a decade and is currently leading the 5 year CURA H2O project

PARTNERS

- Social Sciences and Humanities Research Council
- Environment Canada
- Nova Scotia Environment
- World Wildlife Fund
- Community Based Environmental Monitoring Network
- Clean Annapolis River Project
- Mersey Tobeatic Research Institute
- Clean Nova Scotia
- Bluenose Coastal Action Foundation
- Parks Canada
- Tusket River Environmental Protection Association
- Nature Conservancy Canada
- Ecology Action Centre
- A full list of partners and funders can be found at www.curah2o.com

O. Woods, CURA H2O

A. Weston, of the Nova Scotia Salmon Association, and staff from the Bluenose Coastal Action Foundation discussing stream restoration and establishing water quality monitoring sites

O. Woods, CURA H2O

ACAP Humber Arm staff collecting baseline water quality data

www.curah2o.com

A screenshot of a MTRI monitoring location in the CURA H2O database

CONTACTS

Cathy Conrad and Oliver Woods
CURA H2O
Geography Department, Saint Mary's University
923 Robie Street
Halifax, NS B3H 3C3
Ph. (902) 420-5686
cconrad@smu.ca
oliver.woods@smu.ca
www.curah2o.com
www.cbemn.ca
www.wet-pro.ca

Rationale

Water quality is a globally accepted and widely used measure for assessing and monitoring the condition of freshwater ecosystems. The physical and chemical characteristics of water have a strong influence on aquatic biota and freshwater ecosystem processes. Additionally, many of the primary stressors to freshwater processes are reflected in changes to water quality (*e.g.* acidification, eutrophication and deforestation). As a result, changes in water quality may provide an early warning of environmental stress to aquatic ecosystems. Atlantic Canada is particularly sensitive to acidification because its soils and bedrock generally have poor acid-buffering capabilities. Primary productivity (the rate at which light is converted to biomass through photosynthesis) is another key measure used to determine information about food availability and lake trophic status (nutrient level), and is commonly determined by measuring the photosynthesizing pigment, chlorophyll *a*. In Kejimkujik, 18 lakes have been monitored twice per year since 2008 to provide insights to the freshwater ecosystem health of the region.


M. Crowley, Parks Canada

A secchi disk being used to measure water clarity

Monitoring

LAKE WATER QUALITY MONITORING IN KEJIMKUJIK

OBJECTIVES

- To monitor the status and trends in water quality in freshwater lakes in Kejimkujik by assessing a core suite of water quality parameters that are critical to aquatic ecosystem health and that may be impaired by primary stressors in the bioregion.
- To monitor the status and trends in primary productivity (chlorophyll *a*) in freshwater lakes in Kejimkujik.
- To determine if the results correlate with the range of natural variation for lakes in Kejimkujik or if there are observed changes over time and to compare with levels on lakes throughout the Greater Kejimkujik Ecosystem.

METHODS

- Water quality and primary productivity were selected as a monitoring measure for Kejimkujik's Freshwater Ecological Integrity Indicator, as part of Parks Canada's State of the Park reporting.
- Eighteen brown and clear water lakes are sampled annually in June and August. These sites represent all brown and clear lakes >20 ha that are accessible and part of Environment Canada's Acid Rain Lake Monitoring Network.
- To obtain data for the nine parameters selected, water quality was assessed *in-situ* using an YSI Sonde and through water samples sent to Environment Canada's analytical lab in Moncton for processing and analysis. Chlorophyll *a* samples were filtered, frozen and sent to the Water Lab at Dalhousie University.
- Following the guidelines and formulas develop by the Canadian Council of Ministers of the Environment (CCME), a Water Quality Index (WQI) value was produced for all sites combined for the water quality measure.
- The WQI is a tool used to summarize complex water chemistry data into a single index to simplify and standardize water quality assessment and reporting across the country. The WQI is broadly used by Environment Canada and other organizations to communicate the status and trends in water quality.


M. Crowley, Parks Canada

Volunteer E. Albert participating in the water quality monitoring program

METHODS
Continued

- For primary productivity measure, concentrations of chlorophyll *a* were compared to thresholds based on established trophic level limits and trend over time.
- Full protocol documents are available upon request.

RESULTS

- The WQI was last analyzed in 2010 and considered to be in fair condition and stable.
- Now that seven years of data are available, a more in-depth analysis is planned.
- Commencing in 2013, water quality samples were obtained by volunteers assisting park staff.
- Of the 18 lakes sampled, Big Red Lake was the most acidic with the lowest recorded pH of 4.4 and Grafton Lake was the least acidic with the highest recorded pH of 6.5. The average pH for all lakes was 5.4.

YEARS OF DATA

- Ongoing project since 2008

PARTNERS

- Parks Canada
- Environment Canada
- Dalhousie University

M. Crowley, Parks Canada

Volunteer G. Turner collecting a water quality sample on Mountain Lake

Stressor	Parameter	Oligotrophic threshold (low nutrient lakes)	Mesotrophic threshold (moderate nutrient lakes)	Eutrophic threshold (high nutrient lakes)
Eutrophication	Total phosphorous	<10 ug/L	10-30 ug/L	30-100 ug/L
	Total nitrogen	<350 ug/L	350-650 ug/L	>650 ug/L
	Dissolved oxygen	>5 mg/L (summer)	5 mg/L (summer)	5 mg/L (summer)
Acidification	pH	>5.0 (brown)	>5.0 (brown)	>5.0 (brown)
		>5.9 (clear)	>5.9 (clear)	>5.9 (clear)
	Calcium	>0.64mg/L (brown)	>0.64mg/L (brown)	>0.64mg/L (brown)
		>0.74mg/L (clear)	>0.74mg/L (clear)	>0.74mg/L (clear)
	Aluminum	<0.16mg/L (brown)	<0.16mg/L (brown)	<0.16mg/L (brown)
		<0.046mg/L (clear)	<0.046mg/L (clear)	<0.046mg/L (clear)
Land use change	Turbidity	<1.3FTU	<1.3FTU	<1.3FTU
	Nitrate	<2.9 mg/L	<2.9 mg/L	<2.9 mg/L
	Dissolved organic carbon	<10.8mg/L (brown)	<10.8mg/L (brown)	<10.8mg/L (brown)
		<4.68mg/L (clear)	<4.68mg/L (clear)	<4.68mg/L (clear)

K. Rowter, Parks Canada

Thresholds of the nine parameters used to calculate the Water Quality Index

CONTACT

Megan Crowley and Kyle Rowter
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-2185
Fx. (902) 682-3367
megan.crowley@pc.gc.ca
kyle.rowter@pc.gc.ca
www.pc.gc.ca

Rationale

Mercury contamination is an ongoing global issue and is still poorly understood in many remote regions including southwest Nova Scotia. Methylmercury is the toxic form of mercury that can be bioaccumulated and biomagnified through the aquatic food web and can lead to behavioural changes in piscivores. The role of dissolved organic carbon (DOC) in the persistence or degradation of methylmercury to non-toxic mercury species still remains unclear. In year 1, our research focused on the photoreactivity of DOC from a set of six lakes ranging in DOC concentration. This research in year 2, addressed the impact of DOC on the photodegradation of methylmercury within lake waters but in a controlled laboratory environment.

View of North Cranberry Lake, Kejimkujik

Research

RELATIONSHIPS BETWEEN CARBON AND MERCURY

OBJECTIVES

- To continue to monitor lake quality parameters over the ice-free season.
- To determine how DOC presence and therefore photoreactivity of water impacts the rate at which methylmercury photodegrades.
- To repeat experimental protocols with seasonal variation in natural water samples.

METHODS

- Six lakes, paired by location (Big Dam East & Big Dam West, Puzzle & North Cranberry and Peskawa & Pebbleloggitch), were sampled repeatedly for DOC concentration, absorbance, mercury and dissolved ions.
- Water was collected from one high carbon lake (Big Dam West) for laboratory experiments.
- Collected water was filtered and manipulated to remove some of the photoreactive characteristics prior to experimentation.
- Samples were then exposed to continuous UV-A radiation for up to 48 hours (equivalent to approximately one week in field during summer) and absorbance, DOC concentration and methylmercury concentration were measured.
- Experiments were repeated three times over 2014 at the same intervals as the experiments in 2013.

RESULTS

- Seasonal variation in DOC concentration from 2014 matched 2013's trends with increasing DOC from June through to the fall. DOC concentrations ranged from 3 - 23 mgC/L across lakes and sampling periods.
- Initial experiments revealed that the rate of methylmercury photodegradation could be linked to the photoreactivity of the other dissolved constituents within the lake water, such as DOC.
- The DOC concentration naturally varied between sampling periods but the photoreactivity of the experimental water samples was also significantly adjusted allowing for a better understanding of these processes.

RESULTS
Continued

- Although experiments have been completed we are still analyzing the samples and are looking forward to seeing results from our repeated experiments.

YEARS OF DATA

- Year 2 of a 3 year project

PARTNERS

- Parks Canada
- Environment Canada
- Natural Science and Engineering Research Council (NSERC) of Canada
- NSERC-CREATE Training Program in Climate Science
- Canada Research Chairs Program
- Acadia University
- St. Francis Xavier University
- Memorial University of Newfoundland

S. Klapstein

J. Egan helping measure solar radiation in the water column of Peskawa Lake, Kejimkujik

L. Graham

S. Klapstein setting up the computer program to measure solar radiation in lake water columns

J. Egan

S. Klapstein paddling on Peskawa Lake, Kejimkujik in October

CONTACTS

Sara Klapstein
Memorial University of Newfoundland
sklapstein@mun.ca

Nelson O'Driscoll
Acadia University
Wolfville, NS B4P 2R6
Ph. (902) 585-1679
Fx. (902) 585-1034
nelson.odriscoll@acadiau.ca

Rationale

Mercury (Hg) is emitted to and transported via the atmosphere; however, current atmospheric mercury levels cannot be assumed to be representative of fish mercury concentrations or subsequent mercury exposure of fish-consuming humans and wildlife. The Freshwater Inventory and Surveillance of Mercury (FISHg) program is part of Canada's Clean Air Regulatory Agenda Mercury Science Program, which defines the state of the Canadian environment with respect to mercury in order to inform the development and track the effectiveness of policy measures. The FISHg network monitoring program identifies the spatial and temporal trends in fish mercury concentrations at six lakes across Canada.

Fishing at Jake's Landing, Kejimkujik

Research

FRESHWATER INVENTORY AND SURVEILLANCE OF MERCURY

OBJECTIVES

- To establish a monitoring program for spatial and temporal mercury trends in fish, at six lakes across Canada, including Kejimkujik Lake.
- To provide data on mercury levels in fish across Canada in a single database.
- To identify the effectiveness of of Canada's Clean Air Regulatory Agenda on reducing fish mercury levels across Canada by establishing baseline fish mercury concentrations.

METHODS

- Water, sediment and fish (ten trout and ten perch) were collected in Kejimkujik Lake in the fall of 2012, 2013 and 2014.
- Ancillary information was collected annually from each lake in the FISHg project (fish trophic position, water concentrations of mercury and other metals, DOC, major nutrients, pH and other water quality parameters of site specific concern).

RESULTS

- Water quality results are available for Kejimkujik Site 1 for the 2014 samples. Overall most parameters had similar concentrations as in prior years (2012 - 2013). Only chlorophyll was higher in 2014, up from 0.7 to 3.3 µg/L.
- Mercury, methyl mercury and other metal concentrations are still pending for all three sites in 2014.
- Fish concentrations of mercury are still pending.

YEARS OF DATA

- Ongoing project since 2012

PARTNERS

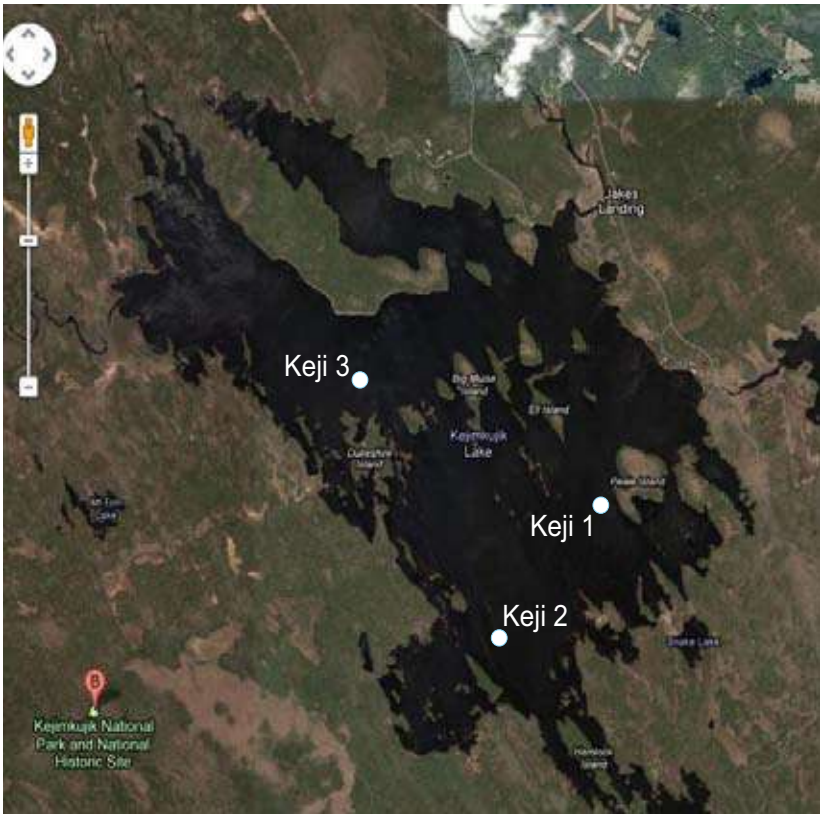
- Environment Canada

T. Smith, Environment Canada

Brook trout caught and sampled

T. Smith, Environment Canada

Working on Kejimkujik Lake



B. Lalonde, Environment Canada

Sampling locations in Kejimkujik Lake

CONTACTS

Christine Garron and Benoit Lalonde
Environment Canada
45 Alderney Drive
Dartmouth, NS B2Y 2N6
christine.garron@ec.gc.ca
benoit.lalonde@ec.gc.ca
www.ec.gc.ca

Rationale

Kejimkujik has been identified as a mercury hotspot because of the high concentrations of this pollutant in fish and fish-eating birds. These animals have high amounts of mercury in their diets due to accumulation through lake food webs. In earlier studies, mercury in aquatic insects and fish were found to vary from one lake to another for reasons that are not well understood. Mercury concentrations were also found to correlate with histological alterations, such as macrophage aggregates (MAs), in the liver and kidney of Yellow perch. However, it is unknown if this is true of other species in the lakes (Golden shiner, Banded killifish, and Brown bullhead).

J. Thera

S. Graves and A. Müller collecting various tissues from fish for mercury analysis and health effects near Puzzle Lake, Kejimkujik

Research

MERCURY IN FRESHWATER FOOD WEBS

OBJECTIVES

- To understand the variability of mercury in aquatic insects and fish among the different lake food webs.
- To understand the health effects in fish species in response to high mercury concentrations.
- To further investigate whether the liver of Yellow perch showed structural alterations related to mercury.

METHODS

Food web study:

- Insects were collected in June, July, and August in 2013 and July 2014 from six lakes within the park that varied in mercury and environmental conditions.
- Fish (Yellow perch, Golden shiner, Banded killifish) were collected from the same six lakes in September 2013. For each fish, its length and weight were measured and muscle was taken.
- Samples were frozen until analysis of mercury and amino acids, especially cysteine (an amino acid found in proteins that is known to bind mercury in fish muscle).

Fish health study:

- Three fish species (Golden shiner, Banded killifish, Brown bullhead) were collected in either September 2013 or October 2014 in the same six lakes as the above study.
- Muscle tissue was collected for mercury analysis. Liver, kidney, and spleen were removed to assess tissue damage (macrophage aggregates).

Yellow perch liver study:

- Five lakes were sampled in September 2013. The ultrastructure and the distribution of mercury within the liver were analyzed by transmission electron microscopy and electron energy loss spectrometry.

G. Lapalus

J. Thera collecting aquatic insects along the shoreline of Hilchemakaar Lake, Kejimkujik

RESULTS

Food web and fish health studies:

- Field work for this two year study was completed in October 2014. Aquatic insects were sorted and identified. All fish muscle samples from the first year have been analyzed for mercury and are similar to results from earlier studies.

RESULTS
Continued

- Male and female Brown bullhead with higher mercury concentrations had more tissue damage in the liver and spleen. Male killifish with higher mercury concentrations had more tissue damage in the spleen.
- Lab analyses for these projects are still ongoing.

Yellow perch liver study:

- The liver of higher mercury Yellow perch showed enlarged lysosomes and mercury was localized within the hepatic lysosomes and MAs. The results are suggestive of detoxification via mercury sequestration in the liver of Yellow perch.
- A positive relationship between muscle total mercury and relative area of MAs in the liver was observed. The hepatocytes of higher mercury fish showed enlarged lysosomes and mercury was localized within the hepatic lysosomes as well as the MAs. The increased size of hepatic lysosomes, the increased frequency of liver MAs in fish with high mercury concentrations, and the localization of mercury within the MAs and lysosomes are suggestive of detoxification via mercury sequestration in the liver of Yellow perch.

YEARS OF DATA

- Year 2 of a 2 year project

PARTNERS

- Environment Canada
- Parks Canada
- Natural Sciences and Engineering Research Council of Canada
- Institute for Environmental Research, RWTH-Aachen University
- Centre for Fish and Wildlife Health, Vetsuisse Faculty, University of Bern

J.Thera

Aquatic insects and fish were collected at North Cranberry Lake, Kejimkujik

J.Thera

Researchers sorting through lake vegetation for aquatic insects

CONTACT

Karen Kidd
University of New Brunswick and Canadian Rivers Institute
100 Tucker Park Road
Saint John, New Brunswick E2L 4L5
Ph. (506) 648-5809
Fx. (506) 648-5811
kiddk@unb.ca
www.unb.ca/saintjohn/sase/research/kiddlab/

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 research conducted by the Canadian Wildlife Service found that our Nova Scotia loons have the highest blood mercury concentrations of any loon population in North America. These levels have been associated with impaired reproduction and altered breeding behavior in some areas. Besides the bio-accumulation of mercury, loons are sensitive to lake water acidification, water level fluctuations and human disturbance. LoonWatch surveys began on park lakes within Kejimkujik 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 an 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.

V.F.Smith

A family of loons observed on Cameron Lake by a LoonWatch volunteer

Monitoring

THE KEJIMKUJIK-MERSEY LOONWATCH PROGRAM

OBJECTIVES

- To observe loon abundance and breeding success on lakes within Kejimkujik 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 contribute to the monitoring of lake water quality.

METHODS

Inside Kejimkujik:

- LoonWatch used trained volunteers to simultaneously survey study lakes within a three hour observation period in late May and again in late August.
- LoonWatch observations in May focused primarily on observing the number of adult loons (territorial pairs and individuals) residing on each lake. The August LoonWatch focused on the importance of assessing the number of surviving juvenile loons. Nests were not specifically sought after during LoonWatch in an effort to minimize disturbance.

Outside Kejimkujik:

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

E. Le Bel, Parks Canada

Parks Canada staff and volunteers planning the survey within Kejimkujik

RESULTS

Inside Kejimkujik:

- LoonWatch detected only four loon chicks in 2014 that were believed to survive to full fledging. Reproductive success was not high, considering that a total of 15 active nests were detected earlier in the year by the ongoing research efforts of the Canadian Wildlife Service and MTRI. Lakes that supported

RESULTS
Continued

C. Gray, MTRI

Juvenile loon observed near Peter's Point, Kejimkujik Lake

juvenile loons were Big Dam, Cobrielle, Frozen Ocean and Kejimkujik.

- During 2014, the largest simultaneous count of adult loons on Kejimkujik lakes reached 44 individuals, counted on August 24th.
- The numbers of volunteers continued to hold steady for the Kejimkujik LoonWatch program, with some new volunteer recruitments joining forces with other seasoned, long-term dedicated LoonWatchers.

Outside Kejimkujik:

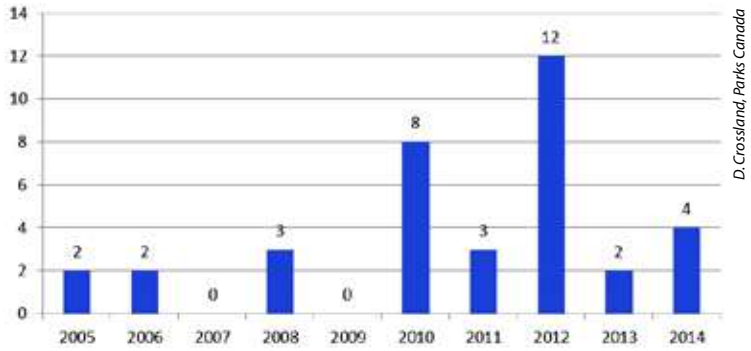
- In 2014, the Mersey LoonWatch program had 20 volunteers monitoring loons on 20 lakes in the Southwest Nova Biosphere Reserve.
- Seventeen loon chicks were recorded on nine lakes outside Kejimkujik. Five of these chicks were observed as large chicks that had a good chance of survival.
- The surface pH of the volunteer lakes ranged from 3.89 to 6.64 in 2014.
- May's total rainfall was slight at 44.3 mm (Environment Canada's National Climate Data and Information Archive), which may account for nest failure on several lakes due to stranding. In June, the total rainfall increased significantly which resulted in nest flooding on two lakes.

YEARS OF DATA

- Ongoing project since 1996 (Kejimkujik) and 2006 (Mersey)

PARTNERS

- Parks Canada
- Mersey Tobeatic Research Institute
- Bird Studies Canada
- Environment Canada - Canadian Wildlife Service



D. Crossland, Parks Canada

Total number of juvenile loons observed in Kejimkujik

D. Crossland, Parks Canada

August 2014 Kejimkujik LoonWatch volunteers and park staff

CONTACTS

Colin Gray
Mersey Tobeatic Research Institute
9 Mount Merritt Road
PO Box 215
Kempt, NS B0T 1B0
Ph. (902) 682-2371
colin.gray@merseytobeatic.ca
www.merseytobeatic.ca

Donna Crossland
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-2293
Fx. (902) 682-3367
donna.crossland@pc.gc.ca
www.pc.gc.ca

Rationale

As an indicator of aquatic health, the Common loon has been a focus of research and monitoring at Kejimkujik and MTRI. Studies have shown that loons in the Kejimkujik area have high concentrations of mercury as a result of bioaccumulation, and that this may negatively affect the survival and reproduction in the long term. A total of 58 Common loons have been banded by Environment Canada. Seventeen loons were banded in the first banding period between the years 1995-1997, three juveniles and 14 adults. In the 2009-2012 banding period, 12 juveniles and 29 adults were banded. Loons were captured at night and banded with a unique combination of colored leg bands in addition to a numbered Canadian Wildlife Service metal band. Loons were measured, sampled and then released. Loon research for the 2014 field season included productivity, survivorship surveys and water quality testing. As in 2013, the focus again in 2014 was on adult survivorship through re-sighting of loons that were banded by the Canadian Wildlife Service and the Biodiversity Research Institute.

C. Gray, MTRI

Common loon on Grafton Lake, Kejimkujik

Research

ADULT SURVIVORSHIP OF COMMON LOONS

OBJECTIVES

- To observe banded Common loons to enable researchers to identify information about individuals such as territory, mate fidelity, site fidelity and productivity.
- To develop and improve methodology for future study of adult survivorship through band re-sighting.

METHODS

- Between April 28 - August 12 2014, researchers from MTRI surveyed 26 lakes in and around Kejimkujik. Twenty three of those lakes had previously banded loons.
- Loons were observed from lake shorelines and by canoe, using spotting scopes with tripods and binoculars, with favorable weather conditions playing a key role.
- Researchers entered loon observations on a Global Positioning System (GPS) and recorded lake name, territorial divide if established, date, presence or absence of bands, colours and position of bands, and year banded. On a separate data sheet, researchers recorded lake site information, weather conditions, UTM location and time of observation, behavioral information, nest site information and individual characteristics, such as age (adult or chick).

RESULTS

- Researchers observed banded loons on 15 of the 26 lakes surveyed. Twenty individuals were observed with all four bands, each band having a unique color combination. Five individuals were observed with only partial bands.
- There was reasonably high site fidelity again in 2014. All but three loons were observed on lakes where they were originally banded. These three loons are all female, and all banded in 2010. A Grafton Lake female banded in 2010 is now part of a nesting pair on Peskawa Lake approximately 15 km away. A Peskowesk female banded in 2010 was observed with a juvenile near Peter's Point on Kejimkujik Lake approximately 9 km away. The third, a female banded in 2010 on Big Dam Lake was observed in Jeremys Bay also on Kejimkujik Lake approximately 5 km away.
- In 2014, it was noted that the banded female on Donnellan Lake and banded male on Mary Lake did not return. The male on Donnellan has paired up with a loon without bands and the pair that was observed on Mary Lake has been banded.

C. Gray, MTRI

Banded adult female observed on Channel Lake, Kejimkujik

RESULTS
Continued

- There were 19 adults out of 20 confirmed observations. One loon, a former juvenile with one silver band on the left leg was observed on North Cranberry Lake. Four of the banded adults were from 2009, ten from 2010 and five from 2012.
- Only 26 out of the 35 study lakes were surveyed this year for productivity. There were 15 territories on 13 lakes with evidence of breeding; 16 nests were located. Six nesting sites successfully hatched chicks of which four survived. Five nests were suspected to have been flooded, two of which had been second attempts. Two nests addled by stranding, and 7 nests suspected to have been predated. Because this work again in 2014 focused on resighting banded birds, some chicks and nests likely went undetected.

YEARS OF DATA

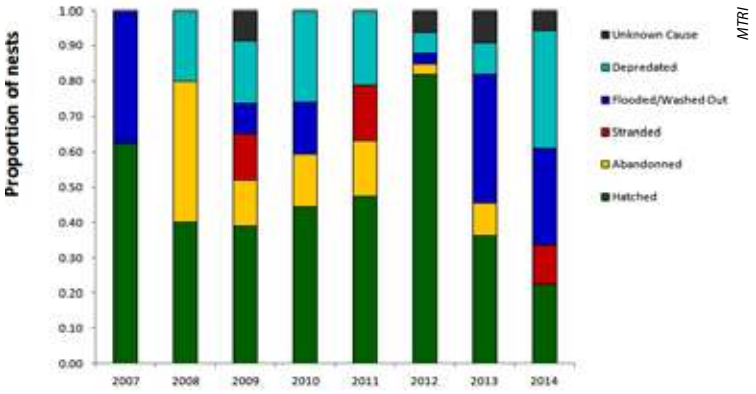
- Ongoing project since 2007

PARTNERS

- Environment Canada
- Parks Canada
- Mersey Tobeatic Research Institute
- Nova Scotia Economic Development
- TD Friends of the Environment Foundation

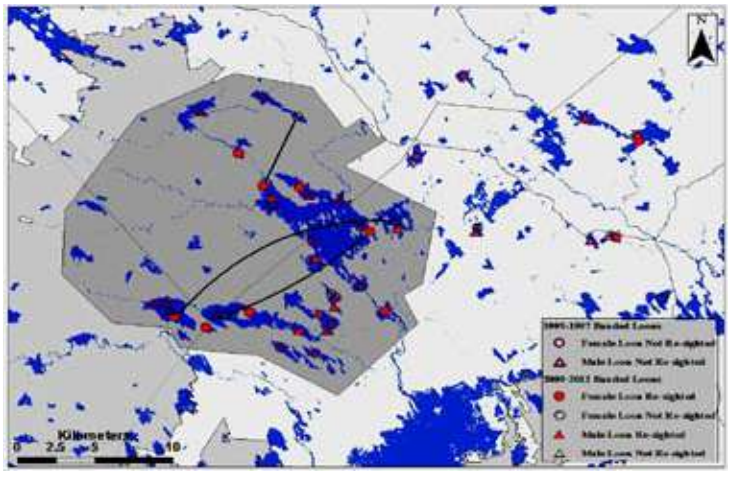
C. Gray, MTRI

MTRI staff finding a spot to set up the scope



MTRI

Fate of nests observed on 35 study lakes in 2007 - 2014 (n=144)



A. Pray-Leslie, MTRI

Locations of banded loon sightings

CONTACTS

Colin Gray and Amanda Lavers
Mersey Tobeatic Research Institute
9 Mount Merritt Road
PO Box 215
Kempt, NS B0T 1B0
Ph. (902) 682-2371
Fx. (902) 682-2760
info@merseytobeatic.ca
www.merseytobeatic.ca

Rationale

Kejimkujik's freshwater ecosystem is under immediate threat from two highly invasive predatory fish species; Smallmouth bass and Chain pickerel. Smallmouth bass are located in Cannon Lake, only 2 km upstream from the park boundary, flowing into Loon Lake. Chain pickerel are below Lake Rossignol, approximately 30 km downstream of the park. Preventing the entry of these invasive species into Kejimkujik is paramount. Should either species become established in Kejimkujik, there would be significant negative impacts to the freshwater ecosystem, including direct and indirect effects on Brook trout and Blanding's turtle populations as well as overall changes to aquatic species abundance and composition. Our focus this year was to monitor all watersheds within the park for any evidence of invasive fish within Kejimkujik. Using minnow traps, angling and a novel monitoring tool, the 'Turtle-safe fyke net', there was no evidence of Smallmouth bass or Chain pickerel within the park. Assisting our partners at Nova Scotia Inland Fisheries, a mark-recapture study was conducted to estimate both population size and age-class distribution of Smallmouth bass in Cannon Lake, which was followed up with targeted removals.

D. Reid, Parks Canada

The Turtle-safe fyke net deployed at Loon Lake, Kejimkujik

Monitoring

PROTECTING KEJIMKUJIK'S TROUT FISHING LEGACY

OBJECTIVES

- To monitor all watersheds within the park for invasive fish and to assess each watershed's risks for invasive fish introduction.
- To assess the population of Smallmouth bass in Cannon Lake and begin targeted removals.
- To investigate methods to prevent the introduction of invasive fish from entering Kejimkujik waters, including temporary and permanent barriers, as well as behavioural, physical, hydrological and natural enhancement options.
- To begin to systematically identify critical habitat for Brook trout within the park, including cold water refugia and spawning grounds.
- To establish an emergency response protocol for each watershed in the park should invasive fish be detected, with efforts focused in watersheds deemed to be at a higher risk of invasion.

METHODS

- Monitoring within each watershed included minnow trapping, angling, fyke nets and outreach with anglers in the park.
- One of our new monitoring tools is a large fyke net that was modified to be turtle-safe. This included floating the tail section, adding breathing vents in each section and limiting the set depth to 1.2 m.
- Smallmouth bass were caught, tagged and released with gill tags or floy tags in Cannon Lake.
- Removals of Smallmouth bass from Cannon Lake began late in the season via angling, and the Nova Scotia Department of Inland Fisheries used an electrofishing boat and made three passes over a 36 hour period.

C. Weisner, Parks Canada

A Blandings turtle that was caught in the Turtle-safe fyke net being held in a recovery tub before measurements and radio tagging

RESULTS

- Every watershed within the park was monitored and no evidence of invasive fish within the park was found.
- The Turtle-safe fyke net proved to be a powerful monitoring tool catching between 40 and 150 fish per night, with a CPUE (fish caught/hour) of between 0.01 (Brook trout) to 2.8 (White perch), depending on lake and seasonality shoreline use by certain species.
- Seven Painted turtles and one Blanding's turtle were caught,

RESULTS
Continued

alive and well, in the Turtle-safe fyke net.

- Preliminary data and observations indicate that the Smallmouth bass population in Cannon Lake has been there for more than eight years, however there was still prey fish species (*i.e.* Golden shiner) and abundant prey sized fish, suggesting that the bass have not met carrying capacity within the lake.
- Electrofishing removed 60 Smallmouth bass, however none were marked. Technical difficulties with the boat limited its time fishing, however the experience allowed us to modify our method for maximum efficiency in the future.
- Out of the 46 tagged Smallmouth bass in Cannon Lake, only two were re-caught (via angling) preventing an actual estimate of population size at this point.

YEARS OF DATA

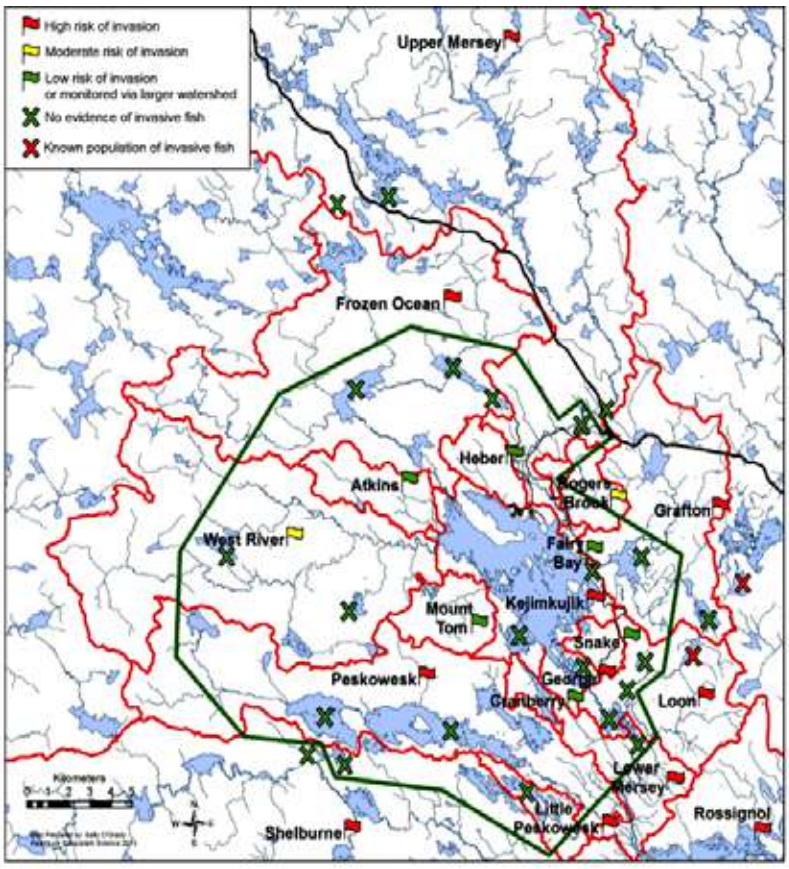
- Year 1 of a 4 year project

PARTNERS

- Parks Canada
- Nova Scotia Department of Inland Fisheries
- Kejimkujik's Trout Fishing Volunteers
- Mersey Tobeatic Research Institute
- Department of Fisheries and Oceans Canada
- Acadia University

E. Barrett, Parks Canada

A young of the year Smallmouth bass caught in Cannon Lake



S. O'Grady and D. Reid, Parks Canada

Watershed map of Kejimkujik indicating estimated level of risk for invasive fish entry and locations of monitoring effort

CONTACT

Darrin Reid
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-4003
Fx. (902) 682-3367
darrin.reid@pc.gc.ca
www.pc.gc.ca

Rationale

The hydrological regime of a stream plays a critical role in determining the biodiversity and ecological processes of aquatic, wetland and riparian ecosystems. Stressors such as roads, dams, water diversions, deforestation, municipal development and climate change affect and alter hydrological processes. As a result, hydrological characteristics provide important information on the integrity of freshwater systems and how they may be changing over time. Critical parameters of hydrologic condition are assessed in five watersheds and used to monitor and report on the status and trends in stream flow at Kejimkujik.

S. Walsh, Parks Canada

Stream flow monitoring site at West River

Monitoring

STREAM FLOW MONITORING

OBJECTIVES

- To monitor the status and trends in stream flow in major transboundary watersheds at Kejimkujik.
- To determine if the Stream Flow Index is within the range of natural variation for major transboundary watersheds at Kejimkujik and if it is changing over time.

METHODS

- Stream flow was monitored at one site in each of the following five major transboundary watersheds at Kejimkujik: Mersey River, Little River, West River, Grafton Brook and Peskowesk Brook. The Mersey River site has been monitored by the Water Survey of Canada since 1968 and Parks Canada has been monitoring the other sites since 2008.
- A permanent stream gauging station was installed at each site, using an automated data logger to record a continuous record of water level.
- Measurements of water depth and stream flow were taken of a cross section of each stream periodically throughout the year to determine total discharge. Discharge measurements were done at a range of different water levels to define a rating curve for the relationship between water level and discharge for a given site.
- A time series of discharge data was generated from the measured water level data using the defined rating curve for each site.
- Historic discharge data from the Mersey River site were used to calculate five parameters, selected to represent the critical characteristics of hydrologic processes.
- Thresholds for each parameter were established based on statistical variability in historical data from each site between 1968 and 1988 (i.e. the condition is good if it is within one standard deviation from the historic mean; the condition is poor if it is more than two standard deviations from the historic mean). Using the thresholds, each parameter was given a score for each year and the scores were averaged to obtain a Stream Flow Index value for the Mersey River for each year between 1989 and 2006.

S. Walsh, Parks Canada

HOBO water level logger removed from its protective PVC housing

RESULTS

- Precipitation events and the resulting effect on water level is clearly evident in the water level graph. High water episodes occurred in January and April of 2014 while the lowest water levels were observed in August 2013 and June 2014.
- West River experienced the highest fluctuation in seasonal water levels, displaying substantial dips and spikes representing periods of drought and precipitation respectively. The relatively extreme variability of West River to precipitation inputs is likely due to the small size and structure of its headwater reservoir, limiting its ability to regulate stream flow following precipitation events. Peskowesk Brook by contrast, has the most stable water level and the the largest headwater of the streams sampled.
- Currently, a long-term dataset only exists for the Mersey River watershed. Monitoring of the remaining four sites was initiated in 2008 and is ongoing. Site specific thresholds for these watersheds are still in development and require further analysis before long-term trends and conditions can be assessed.

YEARS OF DATA

- Ongoing project since 2006

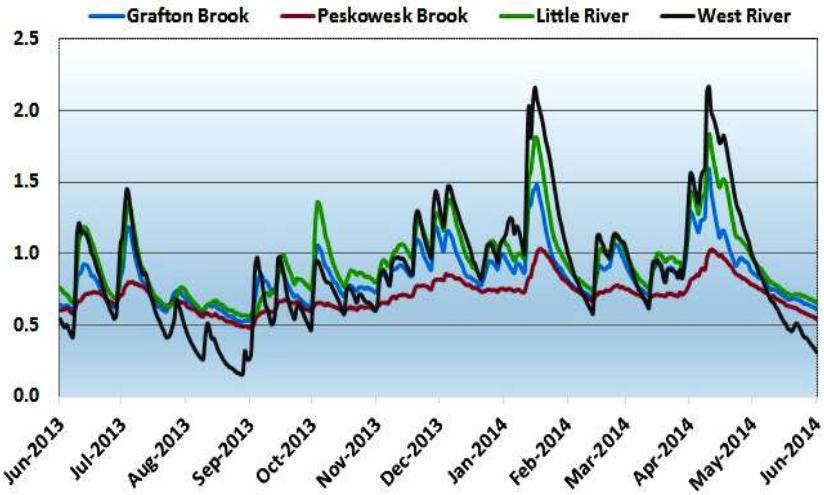
PARTNERS

- Parks Canada
- Water Survey of Canada, Environment Canada

Hydrologic characteristic	Stream flow parameter
Magnitude	Mean daily flow
Duration	Min. average flow for 30-day period
Timing	Julian data of annual min. flow
Frequency	Number of high flow pulses greater than 3 times median flow
Rate of change	Richards-Baker Index (RBI)

D. Ure, Parks Canada

Parameters used to create the Stream Flow Index



K. Rowter, Parks Canada

Daily water level (m) at four stream flow sites in Kejimkujik during a one year period

S. Walsh, Parks Canada

The exact depth of the submerged water level logger is measured using precision survey equipment

CONTACT

Kyle Rowter
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-4001
Fx. (902) 682-3367
kyle.rowter@pc.gc.ca
www.pc.gc.ca

Rationale

In order to address specific threats to freshwater aquatic ecosystems within the Annapolis River watershed, Clean Annapolis River Project (CARP) has begun the process of developing sub-watershed management plans for major tributaries of the Annapolis River. These sub-watershed plans allow for a holistic approach in the development of strategies to improve fish habitat conditions and fish populations on a watershed wide basis. Plans have been developed for several select priority sub-watersheds within the Annapolis system, and will be continue to be developed for several others. Species of particular conservation interest in selected sub-watersheds include native salmonids such as Brook trout and Atlantic salmon.

A site along the Nictaux River showing a placed boulder cluster as part of the 2014 restoration activities

Monitoring

SUB-WATERSHED RESTORATION PLANNING

OBJECTIVES

- To assess the existing condition of fish habitat on waterways within the Annapolis River watershed.
- To provide a strategy to improve fish habitat conditions and fish populations in priority sub-watersheds within the greater Annapolis River watershed.
- To focus conservation and monitoring efforts within the Annapolis River watershed by using an ecosystem-based management approach.

METHODS

- Priority sub-watersheds were identified in 2012 for the development of sub-watershed management plans to focus restoration efforts.
- Field surveys and information gathering were conducted in selected sub-watersheds to assess habitat quality and restoration needs.
- Field surveys included: water quality and stream morphology assessments, fish species assemblage and habitat quality surveys, benthic macroinvertebrate collection and aquatic connectivity assessments.
- Information gathering included: surveys, interviews with experienced anglers and fishing guides, meetings with stakeholders and literature reviews.
- Restoration and enhancement strategies were identified.
- Individual sub-watershed management plans were developed to guide implementation of future restoration actions.

RESULTS

- Information gathered from field surveys and interviews with experienced anglers and local guides was used to develop sub-watershed management plans for three priority sub-watersheds to date: Black River, Nictaux River and Moose River.
- Implementation of the Nictaux River sub-watershed management plan began in 2014 with restoration work aimed at improving fish habitat quality below a hydroelectric

RESULTS
Continued

generating station. Restoration work included: reconstruction of two rock weirs, partial reconstruction of two additional rock weirs and creation of complex habitat with boulder clusters and large woody debris.

- Fish passage improvements were made in selected sub-watersheds as a result of aquatic connectivity assessments that identified barriers to fish migration within tributaries.

YEARS OF DATA

- Ongoing project since 2012

PARTNERS

- Clean Annapolis River Project
- NSCL Adopt-a-Stream
- Province of Nova Scotia
- Fisheries and Oceans Canada
- RBC Blue Water Project
- East Coast Aquatics
- Clean Nova Scotia
- Annapolis Flyfishers Association

J. Medicraft, CARP

L. Freeman measuring a Brook trout caught in a fyke net deployed to assess fish assemblages present in the river

J. McCamon, CARP

CARP field crews conducting in field habitat suitability assessments for salmonids

L. Freeman, CARP

Restoration work occurring along the Nictaux River as part of its Sub-watershed Restoration Plan

CONTACTS

Lindsey Freeman and Levi Cliche
Clean Annapolis River Project
PO Box 395
314 St. George St
Annapolis Royal, NS B0S 1A0
Ph. (902) 532-7533
Fx. (902) 532-3038
lindseyfreeman@annapolisriver.ca
levicliche@annapolisriver.ca
www.annapolisriver.ca

Rationale

Wood turtles, a species listed as Threatened both federally and provincially, are the most terrestrial freshwater turtle species in Canada. Studies throughout the Wood turtle's range have identified numerous threats to populations, including habitat destruction through development in riparian zones, agricultural activities, mortality of adults due to road traffic and the loss of nesting habitat. Research and monitoring of Wood turtle populations in Nova Scotia has focused largely on the Saint Mary's and Musquodoboit watersheds, providing a useful baseline of information for Wood turtle populations and ecology in watersheds with intensive agricultural land use. The Annapolis River watershed contains features consistent with high quality habitat, but observed distribution of wood turtles is patchy. Clean Annapolis River Project (CARP) collects data on wood turtle habitat and populations in the watershed, identities and mitigates threats through public education and engages the community in stewardship and conservation initiatives.

S. Walton, CARP

A female Wood turtle after laying a nest

Monitoring

WOOD TURTLE MONITORING AND STEWARDSHIP

OBJECTIVES

- To understand the ecological requirements, including habitat use, range, seasonal movements and breeding grounds of Wood turtles in the Annapolis River watershed.
- To recognize and address threats leading to population decline in the watershed.
- To educate communities in the watershed on Wood turtles and their importance.
- To involve community members in conservation efforts through volunteer field activities and creation of voluntary stewardship plans.

METHODS

- Locations along the Annapolis River and tributaries were identified as critical Wood turtle habitat, and visual surveys were conducted to locate Wood turtles. Observations were collected using the Blanding's Turtle Recovery Protocol.
- Radio transmitters were attached to selected Wood turtles, which were tracked weekly during the nesting season and bi-weekly thereafter through telemetry surveys. The final overwintering locations of radio tracked turtles were determined in November and December.
- Preferred nesting grounds were identified and monitored nightly by volunteers during Wood turtle nesting season (late May, June) to document the nesting process. Successfully laid nests were protected using a nest cover.
- Volunteers watched for hatchlings to emerge, starting three months post nesting, and data was collected on each hatchling according to the Blanding's Turtle Recovery Protocol.
- Volunteers were educated on Wood turtle habitat, river ecology and conservation initiatives.

S. Walton, CARP

J. McCamon conducting a telemetry survey

RESULTS

- Eight previously un-observed Wood turtles were identified in 2014 through visual, nesting and telemetry surveys. Of the three Wood turtles identified through visual surveys, two had been previously notched in 2006 and 2007.
- Three nests were identified by volunteers. One of the nests

RESULTS
Continued

successfully hatched, producing seven hatchlings.

- Five stewardship plans were completed with two private residential land owners and three agricultural land owners.
- Four presentations on Wood turtle stewardship were hosted at different public libraries within the Annapolis watershed.
- Over 360 hours were contributed by 61 volunteers to visual surveys, nesting, emergence and telemetry surveys.
- Data was collected during nesting surveys on the nesting process, including habitat chosen, time of day and weather conditions when nesting occurred. Information was documented for each nest including number of eggs laid and status of each egg (*i.e.* fertilized, dead hatchling, etc.) through excavation of nests post emergence period.

YEARS OF DATA

- Year 3 of a 4 year project

PARTNERS

- Clean Annapolis River Project
- Nova Scotia Habitat Conservation Fund
- Canadian Wildlife Federation
- Environment Canada
- TD Friends of the Environment Foundation
- RBC Blue Water Project
- Acadia University
- Mersey Tobeatic Research Institute

S. Walton, CARP

A recently emerged Wood turtle hatchling

S. Walton, CARP

Volunteer S. Joudry with an adult Wood turtle, tracked by CARP, and a juvenile she identified on the shoreline bank

CONTACTS

Sarah Walton and Levi Cliche
Clean Annapolis River Project
PO Box 395
314 St. George St
Annapolis Royal, NS B0S 1A0
Ph. (902) 532-7533
Fx. (902) 532-3038
sarahwalton@annapolisriver.ca
levicliche@annapolisriver.ca
www.annapolisriver.ca

Photos on page 83, clockwise from top left:
- *Eastern ribbonsnake,* by W. Pitts
- *Blanding's turtle,* by W. Pitts
- *Heber Meadow, Kejimkujik,* by M. Crowley, Parks Canada
- *McGowan Lake Bog,* by W. Pitts
- *MTRI staff surveying near Roger's Brook, Kejimkujik,* by W. Pitts

Wetland sidebar photo: W. Pitts

WETLAND

Rationale

Atlantic Coastal Plain Flora (ACPF) is 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 Nova Scotia General Status Ranks and some are globally rare. There are over 90 species of ACPF in Nova Scotia, including the 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 three lakes in all of Canada. It is listed as 'Threatened' by the Species at Risk Act, 'Endangered' by the Nova Scotia Endangered Species Act and was recently re-assessed as 'Special Concern' by the COSEWIC. It is monitored annually by park staff and volunteers to assess its distribution and abundance on Kejimkujik Lake.

M. Crowley, Parks Canada

Water-pennywort

Monitoring

WATER-PENNYWORT MONITORING

OBJECTIVES

- To monitor Water-pennywort population abundance and density on Kejimkujik Lake.
- To assess water levels, stem height and percent damage within Water-pennywort stands.
- To survey Kejimkujik Lake to look for the establishment of new stands and for other rare ACPF.

METHODS

- Water-pennywort surveys were conducted annually on Kejimkujik and George lakes in early August.
- Surveys were conducted in both shoreline and aquatic habitats using transects to assess population abundance, density, stem height, water depth and percent damage of individual Water-pennywort ramets.
- Stand surface area was measured using a Global Positioning System (GPS).
- Extensive surveys were conducted every few years to search for new stands.

RESULTS

- Park staff and volunteers monitored Water-pennywort at six sites in Kejimkujik in August 2014. Water levels were similar to 2013 and quite high, with no flowers observed and numerous leaf stems > 1 m in length.
- Water-pennywort ramet density fluctuates at each stand between years in relation to water levels; however the aerial extent in Kejimkujik appears to be stable.
- With two years of high water levels in a row, density of plants was lower than in previous years.

YEARS OF DATA

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

PARTNERS

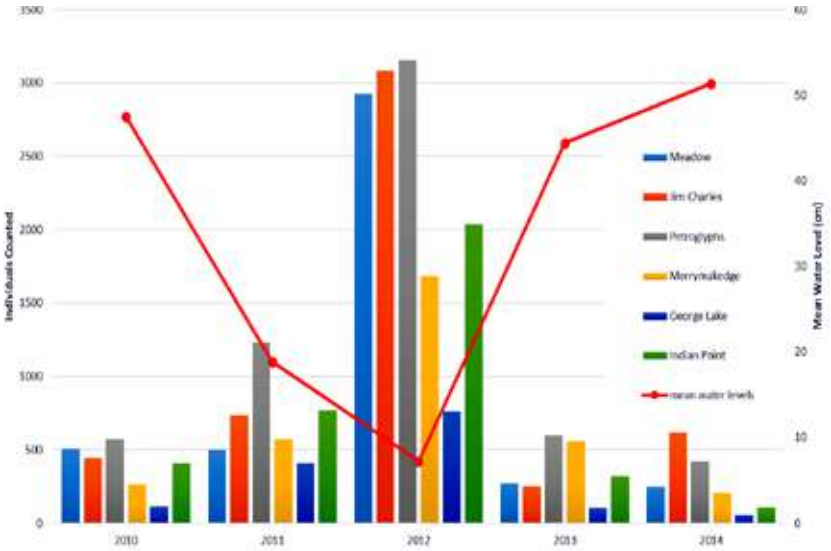
- Parks Canada
- Atlantic Coastal Plain Flora Recovery Team

M. Crowley, Parks Canada

Water level differences at Indian Point in 2012 and 2014

M. Crowley, Parks Canada

Water-pennywort monitoring at Jim Charles in 2012 (top photos) and 2014 (bottom photos) illustrate the differences observed in low and high water years

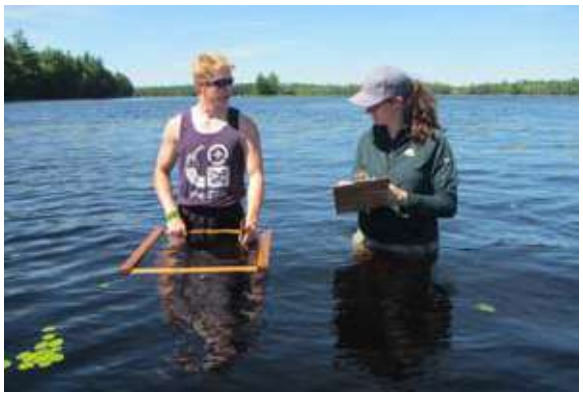


Parks Canada

Total counts of Water-pennywort at each stand from 2010 - 2014, in relation to mean water levels observed that year

M. Crowley, Parks Canada

Water-pennywort monitoring in Fairy Bay



W. Pitts

Waist deep monitoring at Indian Point in 2014

CONTACTS

Megan Crowley and Gabrielle Beaulieu
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-2185
Fx. (902) 682-3367
megan.crowley@pc.gc.ca
gabrielle.beaulieu@pc.gc.ca
www.speciesatrisk.ca/coastalplainflora
www.pc.gc.ca

Rationale

Blanding's turtles in Nova Scotia exist in three small populations and a few smaller concentrations in southwest Nova Scotia. They 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. Raccoons are the primary nest predators and their populations may be unusually high in human inhabited areas (*i.e.* campgrounds and communities). Rates of predation of unprotected nests are variable but can reach 100%. An annual volunteer-based nest protection program was established in Kejimkujik and later expanded to populations outside the park to engage the public in helping to protect and care for Blanding's turtle nests.

J. McNeil, MTRI

A Blanding's turtle nest being protected from predators with a cage placed by dedicated volunteers after nesting

Research

BLANDING'S TURTLE NEST PROTECTION

OBJECTIVES

- To protect Blanding's turtle nests from predation in order to improve recruitment into the populations.
- To provide an opportunity for volunteers to engage in species at risk recovery.
- To collect long-term data on female survivorship and recruitment, clutch size, hatching success, site fidelity and nesting frequency.
- To locate previously unknown nesting areas.

METHODS

Nest protection (June):

- Known nesting sites were monitored on a nightly basis during nesting season. Surveys began in early evening and continued until approximately 10 pm if no turtles were seen or until the last turtle had left the site.
- One female at Pleasant River was radio tracked to locate her nesting site.
- Volunteers watched females go through the nesting process and recorded data on turtle identity, behaviour, 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.

Hatchling emergence (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 hatchlings turtles at the nest site.
- A subset of hatchlings in Kejimkujik was radio tracked upon emergence from the nest to locate habitats used throughout fall and winter.

W. Whynot

E. Whynot measuring a turtle hatchling upon emergence at McGowan Lake

RESULTS

Nest protection (June):

- Nests were laid from June 8 - June 28 2014.
- Forty-three Blanding's turtle nests were located and protected.
- Seventy-five volunteers contributed close to 2000 hrs of effort to locate and protect these nests.
- Two young female's nests were found for the first time.
- One new nesting site was located in a Christmas tree lot outside the park.

M. Crowley

A female Blanding's turtle covering her eggs

Hatchling emergence (September - October):

- It was a record year for hatchings in Kejimkujik, with 226 hatchlings emerging from 26 nests.
- Emergence success was much lower at sites outside the park, with 53 hatchlings emerging from 17 nests; the reasons for the differences in success are not known but may be due to differences in substrate heat and moisture retention.
- Volunteers radio-tracked 15 hatchlings from Kejimkujik following release. Two of these were tracked and enclosed for the winter so that they can be tracked again in spring.

YEARS OF DATA

- Ongoing project since 1989 (Kejimkujik), 2000 (McGowan Lake) and 2002 (Pleasant River)

PARTNERS

- Parks Canada
- Mersey Tobeatic Research Institute
- Friends of Keji Cooporating Association
- Acadia University
- Blanding's Turtle Recovery Team
- Government of Canada through the federal Department of the Environment: Habitat Stewardship Program for Species at Risk
- Canadian Wildlife Federation
- Private donors

M. Crowley

Volunteers checking the status of a protected nest in Pleasant River

CONTACT

Jeffie McNeil
Mersey Tobeatic Research Institute
9 Mount Merritt Road
PO Box 215
Kempt, NS B0T 1B0
Ph. (902) 682-2371
Fx. (902) 682-2760
jeffie.mcneil@merseytobeatic.ca
www.merseytobeatic.ca
www.speciesatrisk.ca/blandings
www.friendsofkeji.ns.ca

Rationale

Blanding's turtles in Nova Scotia are listed as Endangered under both the federal Species at Risk Act and the Nova Scotia Endangered Species Act. They occur in the southwest region of the province, but the extent of their range is not well understood. Until the mid 1990's, the only known population occured in Kejimkujik. Two new populations outside the park were discovered in 1996-7 and have been monitored regularly since their discovery. In 2006, volunteers Harold and Diane Clapp discovered a small concentration of Blanding's turtles in the Tobeatic Wilderness Area and in 2012 they discovered another concentration on the Medway River. This ongoing project employs researchers and volunteers to monitor known populations, learn more about newly discovered areas and follow up on public sighting reports to find new locations of Blanding's turtles.

M. Crowley

Blanding's turtle

Research

BLANDING'S TURTLE DISTRIBUTION AND MONITORING

OBJECTIVES

- To conduct live-trapping and visual surveys in new areas to determine if Blanding's turtles are present.
- To radio track turtles found in new areas to determine seasonal habitat use.
- To conduct live-trapping and visual surveys in known populations to collect long-term data on survivorship, abundance and movement patterns of all age classes, including previously released head-started turtles.
- To provide an opportunity for volunteers to engage in species at risk recovery.
- To engage landowners in new occurence areas.
- To encourage new sighting reports from the public.

METHODS

M. Crowley

B. Toms finding a Blanding's turle using radio tracking equipment

- Live-hoop traps were set by trained staff and volunteers and baited with canned sardines in soy oil. Traps were set in groups of 1 - 11 traps per site, depending on habitat size and configuration. Traps remained set for 2 - 4 nights and were checked daily.
- Visual surveys were conducted on foot or by canoe, occasionally with the aid of trained conservation canines.
- All new turtles captured were measured, weighed and photographed. They were given a unique code by notching the outer scutes of their shell and were released at the capture site.
- On selected turtles, radio transmitters were attached to the back of the shell using epoxy. Care was taken to ensure that the selected transmitter weight did not exceed 5% of the turtle's body weight.

RESULTS

Distribution surveys:

- Four new areas were trapped for 122 trap nights, but no Blanding's turtles were captured through trapping.
- Two new Blanding's turtles were found on roads by local residents and MTRI volunteers. Both were near known populations, though not in established areas. One of these turtles was outfitted with a radio transmitter and tracked throughout fall.

RESULTS
Continued

Monitoring known populations:

- In Kejimkujik, 27 trap sessions (406 trap nights) and 44 hours of visual surveys were conducted with the goal of monitoring the population and re-locating past released head-started turtles. A total of 25 individual turtles were encountered from these efforts including ten adult males, four adult females, eight wild juveniles and three head-started juveniles. Five of the turtles found had not been seen in ten years or more including one who had not been seen since 1988.
- Outside the park, nine trap sessions (147 trap nights) were conducted to monitor known populations, resulting in 21 Blanding's turtle captures. One of these was a new 14 year old juvenile that may have emerged from a protected nest.

YEARS OF DATA

- Ongoing project since 1996

PARTNERS

- Mersey Tobeatic Research Institute
- Parks Canada
- Friends of Keji Cooporating Association
- Government of Canada through the federal Department of the Environment: Habitat Stewardship Program for Species at Risk
- Canadian Wildlife Federation
- Acadia University
- Blanding's Turtle Recovery Team
- Private donors

M. Crowley

A Blanding's turtle equipped with a radio-transmitter

CONTACT

Jeffie McNeil
Mersey Tobeatic Research Institute
9 Mount Merritt Road
PO Box 215
Kempt, NS B0T 1B0
Ph. (902) 682-2371
Fx. (902) 682-2760
jeffie.mcneil@merseytobeatic.ca
www.merseytobeatic.ca
www.speciesatrisk.ca/blandings
www.friendsofkeji.ns.ca

Rationale

Blanding's turtle nest protection began in 1989 and a formal nest protection program was introduced in 1999. The program has been an effective way of reducing nest predation. Headstarting has been used as a method of conservation in Kejimkujik since 2002. However, headstarting can be costly and labour-intensive with turtles being cared for in captivity for 1 - 2 years. The possibility of reducing rearing time, and therefore cost is of interest, but the implications of short-term headstarting on hatchling turtles needs to be understood beforehand.

W. Pitts

A Blanding's turtle hatchling in Kejimkujik

Research

BLANDING'S TURTLE HATCHLING HEADSTARTING

OBJECTIVES

- To determine if optimum conditions for incubation temperature and moisture produce hatchlings that are more robust than hatchlings incubated in wild nests.
- To determine if short term rearing (approximately one month) is a viable method of headstarting that does not negatively impact hatchling fitness.

METHODS

- Eggs from 12 nests were collected and transported to Oaklawn Farm Zoo for incubation at 27.5°C and 29.5°C (hereafter called *ex situ* hatchlings). An additional 14 nests were protected with enclosures in Kejimkujik.
- Half of the hatchlings from the protected nests were released a couple days following emergence (hereafter called *in situ* hatchlings), while the other half was captive-reared for approximately one month before being released (hereafter called captive-reared hatchlings).
- All hatchlings were measured, weighed and notched following emergence.
- A self-righting test was performed on all hatchlings before release. Hatchlings were flipped onto their carapace and timed for how long it took them to flip onto their feet.
- A predator response test was performed by all hatchlings before release. Hatchlings were placed in a trough of water, then the bottom of the trough was tapped behind the hatchling to initiate a flight response. Hatchlings were timed to determine how long it took them to swim 1 m. Hatchlings were ranked from 0 - 4 based on performance, with a higher value being a higher performance.
- All hatchlings were released at their original nest sites in Kejimkujik following testing.

W. Pitts

A protected Blanding's turtle nest in Kejimkujik

RESULTS

- Captive-reared hatchlings were larger in size than both *ex situ* and *in situ* incubated hatchlings.
- *Ex situ* hatchlings took longest to flip over (mean = 5.63 min), followed by *in situ* hatchlings (mean = 2.49 min) and then captive-reared hatchlings (mean = 1.91 min). *In situ* hatchlings

RESULTS
Continued

also took the most attempts to flip over (mean = 2.25), followed by *ex situ* (mean = 1.21), and then captive-reared (mean = 1.19).

- *Ex situ* hatchlings (mean = 2.48) ranked significantly lower than *in situ* hatchlings (mean = 3.21) based on swim performance. A significant difference was also found between captive-reared hatchlings (mean = 2.69) and *in situ* hatchlings. No significant difference was found between captive-reared and *ex situ* hatchlings.
- Incubation temperature did not have a significant affect on self-righting or predator response performance.

YEARS OF DATA

- Single year project

PARTNERS

- Acadia University
- Oaklawn Farm Zoo
- Parks Canada
- Friends of Keji Cooperating Association
- Mersey Tobeatic Research Institute

W. Pitts

A volunteer measuring the plastron of a Blanding's turtle hatchling

W. Pitts

Blanding's turtle hatchlings about to perform a self-righting test

CONTACTS

Wesley Pitts and Steve Mockford
Acadia University
Wolfville, NS
Ph. (902) 798-7438
103405p@acadiau.ca (Wesley Pitts)
stephen.mockford@acadiau.ca

Rationale

Eastern ribbonsnakes must find suitable underground sites to avoid freezing winter temperatures. However, it is not known if these sites typically occur within wetlands, at their edges or in adjacent terrestrial habitats. Knowing the characteristics of overwintering sites and their distance from the snake's summer wetlands is crucial for critical habitat identification, identifying threats and developing management plans for this species, which is listed as Threatened both federally and provincially. In winter 2009, the first known ribbonsnake overwintering area in a terrestrial habitat was identified in Nova Scotia and this site has been monitored annually since its discovery to document long-term use, number of snakes and site fidelity. Efforts continue to locate additional overwintering sites through systematic surveys of upland areas adjacent to known concentrations of ribbonsnakes.

W. Pitts

An Eastern ribbonsnake observed at Roger's Brook, Kejimkujik

Research

EASTERN RIBBONSNAKE OVERWINTERING HABITATS

OBJECTIVES

- To monitor the one known overwintering site to document site use, snake abundance and site fidelity.
- To conduct surveys around known concentration sites in spring and fall to potential additional overwintering sites.

METHODS

- Surveys occurred primarily in the habitats around Grafton Lake, Kejimkujik. Surveys took place regularly from early April to early May and occasionally in October and November.
- Sites where snakes are found were revisited regularly to estimate the number of snakes using the site and the period of occupancy. Surrounding wetlands were visited occasionally during the active season to mark snakes and determine when they were moving.
- Surveys were conducted by experienced biologists and trained volunteers and were aided by dogs trained to identify ribbonsnakes by scent.
- Detailed data were recorded on search effort, weather conditions, geographic coordinates, habitat characteristics, snake behaviour and morphology.
- Attempts were made to capture all detected ribbonsnakes. Snakes were individually marked by ventral scale clipping. Snakes were measured, weighed, photographed and released at the capture site.

J. McNeil, MTRI

A possible new overwintering site near Grafton Lake, Kejimkujik

RESULTS

- Volunteers Harold and Diane Clapp found what is believed to be a new overwintering site, only the second known in the province.
- The new site is on top of a beech dominated slope, approximately 200 m from water at Grafton Lake. Eight individual ribbonsnakes were found at this site over a two-week period in mid-April. One additional ribbonsnake was found at the same site in early October, providing more evidence that it is likely an overwintering site.
- Ribbonsnakes once again returned to the previously known overwintering site, with five individuals encountered in spring and one in fall.

YEARS OF DATA

- Ongoing project since 2009

PARTNERS

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

W. Whynot

E. Whynot volunteering with a visual survey at Grafton Lake, Kejimkujik

J. McNeil, MTRI

Volunteers D. Clapp and H. Clapp searching for ribbonsnakes

J. McNeil, MTRI

An Eastern ribbonsnake demonstrating why they are difficult to detect

CONTACTS

Jeffie McNeil and Brad Toms
Mersey Tobeatic Research Institute
9 Mount Merritt Road
PO Box 215
Kempt, NS B0T 1B0
Ph. (902) 682-2371
Fx. (902) 682-2760
jeffie.mcneil@merseytobeatic.ca
brad.toms@merseytobeatic.ca
www.speciesatrisk.ca/ribbonsnake

Rationale

Native insects, especially bees and flower flies, are the primary pollinators for many crops and native plants. The diversity and abundance of this important guild is in a global state of decline, the result of numerous threats including habitat loss, disease and climate change. Southwest Nova Scotia has been little sampled for pollinators. This area supports a suite of generally southern plants and animals found nowhere else in Canada. Most of these species have affinity with the Atlantic Coastal Plain (ACP) ecological region that extends along the coastal lowlands of the eastern seaboard from Massachusetts to Florida, and many are isolated in southwest Nova Scotia from their next nearest populations by hundreds of kilometers. Some insects with this pattern of ACP range in the United States and disjunct occurrence in southwest Nova Scotia are known, and it is likely that other species unique to Canada remain to be discovered in the region.


J. Klymko

Margined calligrapher (a flower fly) visiting Pink coreopsis

Research

ATLANTIC COASTAL PLAIN POLLINATOR SURVEYS

OBJECTIVES

- To document the pollinators of southwest Nova Scotia, with a specific goal of finding rare ACP-affiliated species.

METHODS

- Sampling was conducted in 2013 and 2014.
- Methods included hand collecting and trapping with Malaise traps (tent-like structures that intercept flying insects) and coloured pan traps (cups that catch pollinators that confuse the trap's bright colours with those of a flower). Traps were monitored by local volunteers and MTRI staff and interns.
- A variety of habitats were visited, including inland shrub barrens, shorelines, salt marshes and forests. Sites known to host plants associated with the ACP were targeted.

RESULTS

- In 2013, 419 flower fly and 578 bee specimens were collected. There were 78 flower fly species documented, including 14 species that had never been recorded in Nova Scotia. Forty-two bee species were documented, including two that had never been recorded in Nova Scotia.
- Many 2013 specimens still await identification.
- None of the bee or flower fly species documented in 2013 are thought to be unique to the Atlantic Coastal Plain, but all the data collected contribute significantly to our understanding of the pollinator species occurring in Nova Scotia.
- Samples collected in 2014 will be processed in the winter of 2015. In the samples there will undoubtedly be species new for Nova Scotia, and there may be nationally rare species associated with the Atlantic Coastal Plain.


J. Klymko

Long-horned yellowjacket fly (a flower fly), a species documented for the first time ever in Nova Scotia during the surveys

YEARS OF DATA

- Year 2 of a 2 year project

PARTNERS

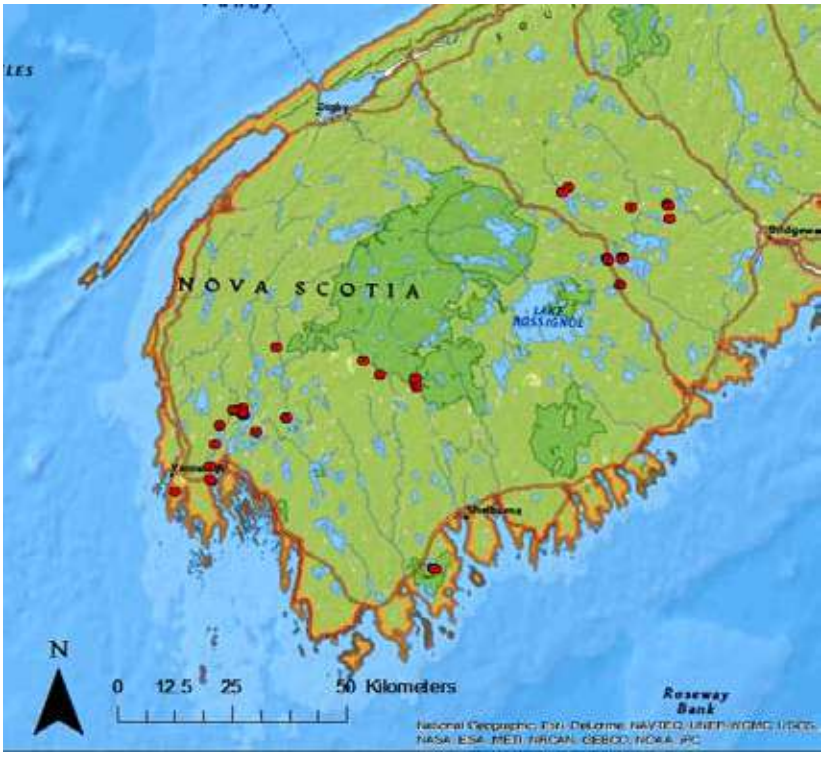
- Atlantic Canada Conservation Data Centre
- Nova Scotia Species at Risk Conservation Fund
- Sage Environmental Program
- The Echo Foundation
- Mersey Tobeatic Research Institute
- Nova Scotia Department of Natural Resources

J. Klymko

Volunteer S. Robinson at Malaise trap near Middle Ohio

J. Klymko

Tri-coloured bumble bee visiting Redroot



J. Klymko

Pollinator sampling sites

CONTACT

John Klymko
Atlantic Canada Conservation Data Centre
PO Box 6416
Sackville, NB E4L 1G6
Ph. (506) 364-2660
Fx. (506) 364 2656
jklymko@mta.ca
www.accdc.com

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, the long-range transport of air pollutants and climate change. This project monitors water quality and quantity in peatlands (bogs) at Kejimkujik. The specific measures that are reported are a water quality index, 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.

Fall wetland water quality monitoring at Moosebone Bog

Monitoring

WETLAND WATER QUALITY MONITORING IN KEJIMKUJIK

OBJECTIVES

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

METHODS

- Ten medium-large bogs, greater than or equal to 15 ha in surface area, were sampled for water quality and level at Kejimkujik.
- 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 hours.
- 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

- A preliminary examination of the data indicates that sub-measures have remained relatively stable and within the expected range of variation over the last seven years.
- Despite heavy rainfall events throughout 2014, water level data show that our wetlands are effective at moderating the "flashiness" that our rivers and streams exhibit. Heber Meadow fluctuated more than other bogs because of its direct connection to Kejimkujik Lake.

RESULTS
Continued

- Ranging between 3.55 and 4.91, the pH readings in the spring were slightly higher overall than those taken in the fall, but within the expected range of variability.
- As trend data become available (seven years of data are now available), a more in-depth analysis is planned.

YEARS OF DATA

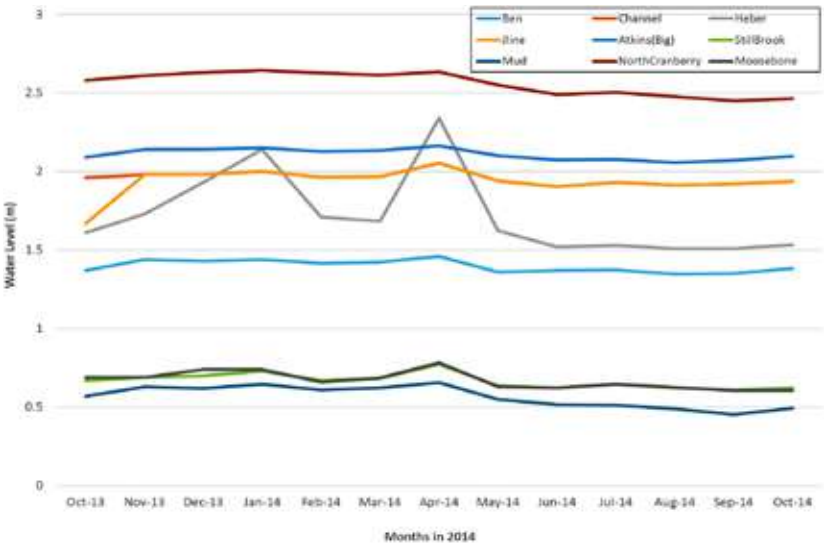
- Ongoing project since 2008

PARTNERS

- Parks Canada
- Environment Canada

K. Rowter, Parks Canada

G. Beaulieu extracting the hobo logger from the observation well at Atkins Bog



Parks Canada

Mean wetland water levels in Kejimkujik from October 2013 to October 2014

M. Crowley, Parks Canada

Volunteer G. Turner helping with wetland water quality sampling at Heber Meadow in the spring

CONTACTS

Gabrielle Beaulieu and Kyle Rowter
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-4001
Fx. (902) 682-3367
gabrielle.beaulieu@pc.gc.ca
kyle.rowter@pc.gc.ca
www.pc.gc.ca

Rationale

Eastern mountain avens (EMA) is listed as Endangered both federally and provincially. It is an herbaceous perennial that reproduces vegetatively through rhizomes, which produce clonal patches, and sexually by seed. It is only found in Nova Scotia, on Brier Island and at one site on the Digby Neck, and in alpine New Hampshire. It occurs in a variety of habitats in both New Hampshire and Nova Scotia, and consistent moisture is probably the one critical habitat requirement. In Nova Scotia, it usually grows with sphagnum in bogs and fens, although it is also found in drier areas such as roadsides and recovering pasture on Brier Island. Prior to this study, little was known about germination requirements for seeds from Nova Scotia populations. It is not known if patches in Nova Scotia are expanding or only stable through clonal growth in response to shrub encroachment. Propagation and growth studies can provide information on life history to be gathered without disturbing natural populations.

D. LaRue, MTRI

Eastern mountain avens

Research

REPRODUCTIVE BIOLOGY OF EASTERN MOUNTAIN AVENS

OBJECTIVES

- To investigate propagation *in situ* and *ex situ* by rhizome.
- To conduct *in situ* studies of rhizome characteristics and growth.
- To investigate germination requirements in the field and in the lab.
- To determine if EMA is actively reproducing on Brier Island.
- To study basic growth biology in the field and through *ex situ* studies.

METHODS

- Many of the individual plants that were tagged in the field in 2013 at several sites on Brier Island to track growth and new plant production were monitored.
- Rhizomes collected from several sites on Brier Island and taken to the K.C. Irving Environmental Science Centre at Acadia University (KCIC) for propagation under several conditions in 2013 were tracked in terms of growth and new rosette production.
- Plants resulting from seeds collected from several sites and taken to the KCIC for germination studies were monitored.
- Rhizomes and seeds set up in the field for propagation in 2013 were monitored for new rosettes.
- All rosettes were re-potted into a 3:1 mixture of potting soil and a mineral soil collected from Brier Island to provide drainage and native soil microorganisms.
- EMA rosettes at KCIC were set up to study the effects of shade and hydrology for growth and new rosette production.

D. LaRue, MTRI

Pots of seedlings with their offspring at the K.C. Irving Environmental Science Centre

RESULTS

- Some rhizome cuttings, of various sizes, produced new plants in each of the three types of media.
- Rhizome cuttings kept cold but indoors over winter did poorly in the mineral soil, but reasonable in the peat soil.
- All rosettes from rhizome cuttings did well when overwintered outside.
- Seeds without cold pretreatment germinated more erratically

RESULTS
Continued

and slowly than those with a cold pretreatment but had better survival.

- Most seedlings that survived from germination trials grew well and produced many new ramets (side rosettes on rhizomes).
- Rhizome and seed propagation efforts both at KCIC and on Brier Island produced new rosettes.
- Observations in the field indicated that given suitable substrate, EMA is actively reproducing by seed, and under some conditions is actively reproducing vegetatively.

YEARS OF DATA

- Year 2 of a 3 year project

PARTNERS

- Nova Scotia Museum of Natural History
- K. C. Irving Environmental Science Centre, Acadia University
- Mersey Tobeatic Research Institute

D. LaRue, MTRI

Regrowth in May 2014, of rosettes from rhizome propagation at the K.C. Irving Environmental Science Centre

D. LaRue, MTRI

Two new rosettes produced on a rhizome at the K.C. Irving Environmental Science Centre

D. LaRue, MTRI

Mass of seedlings fallen from a seed head onto bare peat soil on Brier Island

CONTACT

Diane LaRue
Mersey Tobeatic Research Institute
9 Mount Merritt Road
PO Box 215
Kempt, NS B0T 1B0
Ph. (902) 682-2371
laruedi@gmail.com

Rationale

Big Meadow Bog of Brier Island is the principal Canadian habitat for endangered Eastern mountain avens (EMA). Currently, the margins of the bog (the lagg) provide the open landscape for a metapopulation representing 40 - 45% of the total Canadian population. However, in 1958, Big Meadow Bog (the wetland) was subjected to an agricultural venture involving extensive ditching. This effort was ultimately unsuccessful and the effort abandoned, but its impacts have been colossal. With a lowered water table, the wetland dried out, shrubs and trees overgrew vegetation communities and the largest gull colony in eastern Canada moved in. After more than five decades, a team of core stakeholders has taken up the effort to end the degradation, restore this wetland and regain habitat for the endangered and globally rare Eastern mountain avens.

J. Swift

Eastern mountain avens produces a brilliant yellow flower, which many mistake for a buttercup

Research

RESTORING BIG MEADOW BOG, BRIER ISLAND

OBJECTIVES

- To collect baseline data on EMA, its wetland community and ecosystem function.
- To restore wetland hydrological function to the wetland.
- To increase available habitat for EMA and increase its population.

METHODS

- Installed network of 30 groundwater level monitoring wells and two surface water flow stations, delineated drainage patterns using LiDAR and wetland complex in and around project site as well as conducted water and soil analysis.
- Conducted full population survey of EMA, characterized and mapped distribution of vegetation communities using permanent plots and classification of aerial images.
- Experimentally removed shrubs competing with EMA in permanent sample plots.
- Conducted nesting gull survey, tracked gull movements using Global Positioning System (GPS) bands.
- Conducted various studies into EMA reproduction: documented seed germination and seedling survival in bogs, described growth from rhizome sections and seed germination in the greenhouse (see previous report).
- Student volunteers conducted interviews of longtime residents of Brier Island about recollections of Big Meadow Bog before and after ditching.

C. Smith

Nesting gulls cause direct destruction of native vegetation community and facilitate introduction of exotic species such as Velvet grass

RESULTS

- Interviews, historic photos, aerial photo analysis and carbon dated plant records showed that Big Meadow Bog was a typical peatland – bog/fen complex and that it had been altered dramatically by a series of hydrological modifications.
- The structure and function of the wetland had been significantly impaired. Drainage had been altered significantly by ditching activity and compounded by long term indirect effects including a subsidence of peat structure as result of drier conditions.
- Surveys of EMA documented a reduction in numbers of plants and a disappearance of some populations. Remaining populations were restricted to the wetland margin (the lagg),

RESULTS
Continued

which aerial photos showed was invaded by trees and isolated from 1988 to present day.

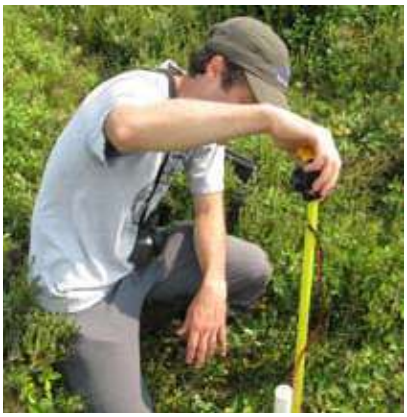
- Levels of nitrogen and phosphorus in soil and water were greatly elevated over the reference values. The highest levels in the northern portion of the wetland matched the area of highest density of nesting gulls.
- Attempts to rescue EMA in the degraded lagg by removing competing shrubs were not effective because EMA in cleared patches were sun damaged and gulls nested in the clearings.
- Efforts to propagate EMA from collected seeds were successful in both a greenhouse and in natural habitat (see previous report).

YEARS OF DATA

- Year 2 of a 5 year project

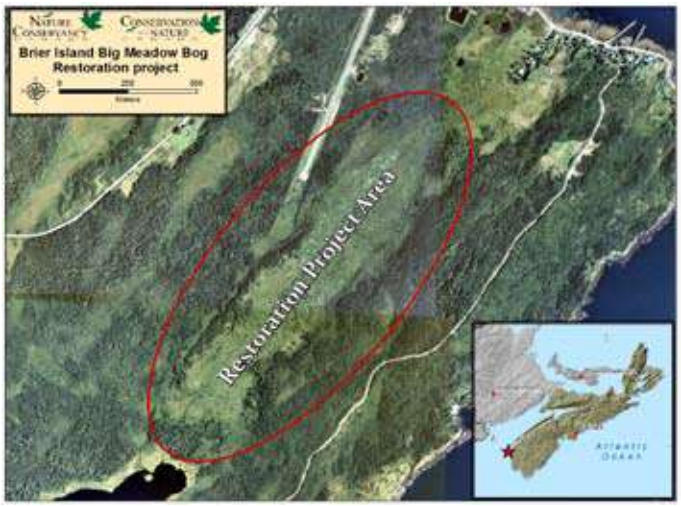
PARTNERS

- Nature Conservancy of Canada
- Nova Scotia Department of Natural Resources – Wildlife Division and Geoscience and Mines Branch
- Canadian Wildlife Service
- Fern Hill Institute for Plan Conservation
- Mersey Tobeatic Research Institute
- K. C. Irving Environmental Science Centre, Acadia University



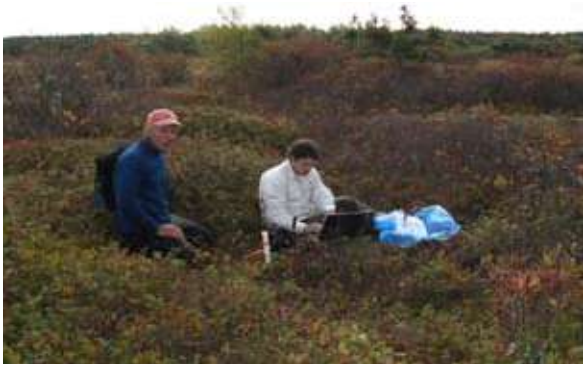
C. Smith

G. Kennedy, a hydrogeologist with NSDNR Geoscience and Mines, monitoring water levels in Big Meadow Bog, Brier Island



Nature Conservancy of Canada

Map of project location; south - central Brier Island showing non-linear drainage ditches along margins and in middle of wetland.



G. Kennedy

Project staff downloading groundwater data from monitoring wells in Big Meadow Bog, Brier Island

CONTACTS

Craig Smith
Nature Conservancy of Canada
7071 Bayer's Road, Suite 337
Halifax, NS B3L 2C2
Ph. (902) 405-4334
Craig.smith@natureconservancy.ca

Nick Hill
Fern Hill Institute for Plant Conservation
424 Bentley Rd.,
RR#1 South Berwick, NS B0P 1E0
Ph. (902) 698-0416
fernhillns@gmail.com

Photos on page 103, clockwise from top left:
- *Kids in the Forest Day,* by J. Barker, MTRI
- *Fly fishing in Kejimkujik,* by D. Reid, Parks Canada
- *Kejimkujik campers about to portage,* by J. Reid
- *Camping in Kejimkujik,* by J. Reid
- *Blanding's turtle volunteers,* by W. Pitts

Human Dimensions sidebar photo: J. Reid

HUMAN DIMENSIONS

Rationale

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

W. Pitts

One of the profile pictures used on the Monarch Butterfly Club Facebook page

Research

MONARCH BUTTERFLY STEWARDSHIP IN SNBR

OBJECTIVES

- To bring awareness of the Monarch butterfly to park visitors and residents of the Southwest Nova Biosphere Reserve (SNBR) and to promote the Butterfly Club, which encourages 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 Kejimkujik Visitor Center.
- To bring educational and teaching opportunities to the Maritimes.

METHODS

- Outreach events, which included public talks, Butterfly Club socials, presentations, garden planting and interpretive signs, were planned to spread the word and increase awareness of the Butterfly Club and how to help the Monarch butterfly.
- Butterfly Club kits were sold in a number of ways, including at farmer's markets across Nova Scotia in the summer and at the By The Mersey Gift Shop in Kejimkujik.
- Butterfly and caterpillar costumes and life stage models helped to facilitate learning experiences.

W. Whynot

Children enjoying an activity at the Butterfly Social

RESULTS

- The overwintering numbers of Monarchs were at an all-time low for the 2013 - 2014 season, dropping to less than 1 ha (0.67) in Mexico. This was expected with the very low numbers of butterflies observed in 2013 (none confirmed in Nova Scotia). However, the population in 2014 rebounded slightly and there were Monarch sightings reported throughout Southwest Nova Scotia. Monarchs and caterpillars were observed at MTRI and in the gardens of some Butterfly Club members, but none were observed in Kejimkujik.
- Over 1000 Butterfly Club members have planted butterfly gardens at their homes, schools, community centres and businesses, and are cumulatively working together to significantly increase the habitat for this species in Nova Scotia.

RESULTS
Continued

In 2014, Butterfly Club kits continued to be sold by Kejimkujik, Friends of Keji and MTRI.

- In 2014, MTRI hosted the 3rd Butterfly Social at the Art of Germany B&B in Caledonia. Weekly Monarch butterfly interpretive programs were held at Kejimkujik and a presentation was given on gardening for butterflies at the New Germany Garden Club. A MTRI summer seminar series talk was offered by volunteers about their experiences rearing Monarchs.
- Butterfly Club members have shared their stories and pictures at www.facebook.com/MonarchButterflyClub.

YEARS OF DATA

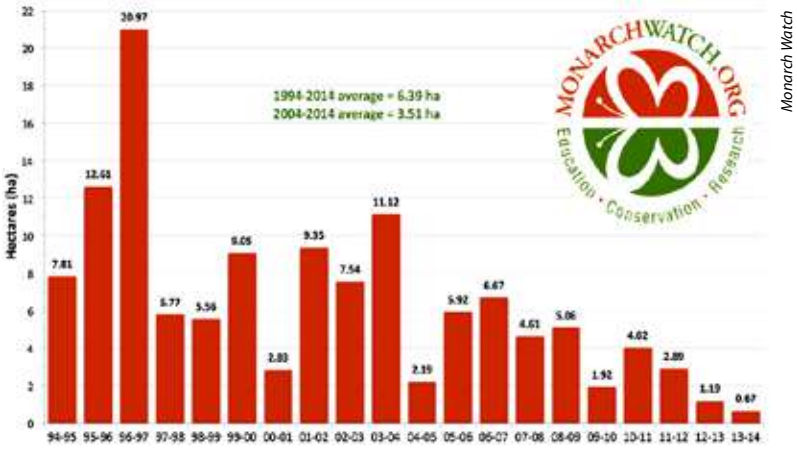
- Ongoing project since 2008

PARTNERS

- Parks Canada
- Friends of Keji Cooperating Association
- Mersey Tobeatic Research Institute
- Monarch Watch

W. Pitts

Monarch metamorphosis at MTRI



Monarch Watch

Total area occupied by Monarch butterfly colonies at overwintering sites in Mexico

CONTACT

Megan Crowley
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-2185
Fx. (902) 682-3367
megan.crowley@pc.gc.ca
www.pc.gc.ca

Rationale

The Southwest Nova Biosphere Reserve (SNBR) is one of Canada's "Biodiversity Hotspots". There are over 65 species at risk in the province and southwest Nova Scotia is home to over 80% of these plants and animals. Ecologists and Resouce Management Officers from Kejimkujik have partnered with MTRI 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 special region. Their 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 habitats that they depend on.

E.Aulenback

B. Latter, G. Murphy and R. Sanford moving their stones up to the Gold part of the Walk of Honour

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) and 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 surveys; 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 were developed to link science and stewardship to achieve awareness and appreciation for species at risk.

M.Crowley

Group shot at the Walk of Honour BBQ

RESULTS

- In 2014, over 200 volunteers contributed over 10,000 hours of their time toward environmental conservation in the SNBR. Since 2000, this is over 140,000 hours.
- At the 9th annual Volunteer Banquet in Nov 2014, more than 100 people gathered to celebrate these achievements. Eleven people were inducted into the "Walk of Honour", one moved from bronze to gold and Duncan Smith received the Key to Keji Volunteer of the Year award.
- A Walk of Honour BBQ was held in June to celebrate the volunteers inducted at the 2013 banquet. The Walk of Honour is behind the Kejimkujik Visitor Center and recognizes the volunteers that have cumulatively contributed over 250

RESULTS
Continued

M. Crowley

D. Murray receiving his award for his advancement into the Gold part of the Walk of Honour

(bronze), 1000 (gold) or 2000 (platinum) hours. Rick Brunt, Joan Hamilton, Layton Hamilton, and Wayne Lincoln added their stones to the bronze part of the walk. Bill Latter, ML Mills, Greg Murphy and Ray Sanford moved their stones from bronze to gold, and Shirley McCarthy moved her stone from gold to platinum.

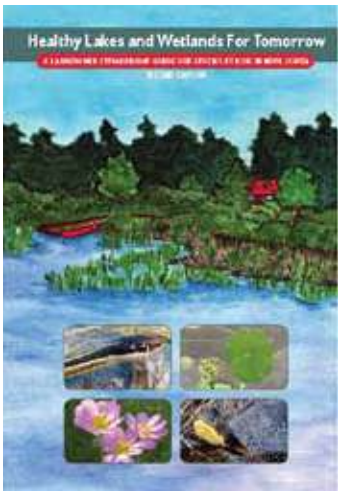
- A second edition of the "Healthy Lakes and Wetlands for Tomorrow: A Landowner Stewardship Guide for Species at Risk in Nova Scotia" and the "Species at Risk in Atlantic Canada: Identification and Information Guide for Department of National Defense Land Users" were both printed in March through partnerships with Parks Canada, MTRI and the Department of National Defense. The second edition of the "Species at Risk in Nova Scotia Guide" will be completed this winter.
- To learn more and keep informed about upcoming opportunities, visit the "Kejimkujik-Southwest Nova Volunteer Programs" Facebook page. Google "Volunteers in Action" on the Parks Canada YouTube Channel to view a slideshow video.

YEARS OF DATA

- Ongoing project since 2006

PARTNERS

- Parks Canada
- Friends of Keji Cooporating Association
- Mersey Tobeatic Research Institute
- Bear River First Nation
- Acadia First Nation
- Acadia University
- Dalhousie University
- Bird Studies Canada
- Southwest Nova Biosphere Reserve Association
- Government of Canada through the federal Department of the Environment: Habitat Stewardship Program for Species at Risk



MTRI

Cover of the second edition of the Healthy Lakes and Wetlands Guide

M. Crowley

Volunteers celebrating their efforts at the 9th annual Volunteer Banquet in November 2014

CONTACT

Megan Crowley
Parks Canada
PO Box 236
Maitland Bridge, NS B0T 1B0
Ph. (902) 682-2185
Fx. (902) 682-3367
megan.crowley@pc.gc.ca
volunteer.keji@pc.gc.ca
http://bit.ly/keji-volunteer
www.pc.gc.ca

Rationale

Since November 2009, MTRI has been promoting Forest Stewardship Council (FSC) certification of small woodland owners in Nova Scotia and providing training opportunities as a tool to achieve greater landowner engagement and to foster responsible forest stewardship on private land. In 2010, MTRI partnered with the Federation of Nova Scotia Woodland Owners (FNSWO) to facilitate affordable FSC certification for small private woodlot owners. Forest certification has been developing since the early 1990's as a response to public concern about unsustainable forest management systems around the world. It is a voluntary, market-based process developed to certify forest management practices to a set of globally recognized environmental, social and economic standards. In addition, in 2014, MTRI partnered with both the FNSWO and the Nova Scotia Woodlot Owners and Operators Association to organize field days led by experienced woodlot owner "mentors" as a part of a new joint Woodlot Management Mentorship Program.

J. Barker, MTRI

Woodlot owners attending a workshop in Perotte, Annapolis County

Research

WOODLAND STEWARDSHIP PROGRAM

OBJECTIVES

- To continue to work collaboratively to promote FSC certification in the Southwest Nova Biosphere Reserve (SNBR) and facilitate the certification of small, privately-owned woodlots.
- To prioritize outreach, education and landowner training to increase sustainable forest management and to encourage diverse use of forest resources.
- To collaborate with other forest-based organizations to develop and improve landowner engagement tools and sustainable management incentives and mechanisms.

METHODS

- Surveyed owners of small privately-owned woodlots about preferred locations, costs and topics of training workshops.
- Provided a range of presentations, training courses and in-field workshops in southwest Nova Scotia to promote FSC certification and to encourage ecologically-based, sustainable forest management and diversification of woodlot use to a variety of audiences, including youth.
- Worked on a one-to-one basis with landowners to develop FSC compliant management plans and certify small privately owned woodlots.
- Collaborated with partners to explore new ideas and innovations in the forestry sector that support sustainable forest management.

J. Barker, MTRI

An FSC audit taking place on private woodland as part of the MTRI-FNSWO pool

RESULTS

- Of the 107 woodlot owners surveyed across mainland Nova Scotia, favoured topics of interest included getting more from your woodlot, roads and trails - planning it right from the start, woodlots and wildlife, thinning for value and small scale harvesting equipment.
- Seven new woodland management plans covering approximately 940 acres of small privately owned woodlots were added to the MTRI FSC pool in 2014.
- Seventy-five participants attended five workshops or meetings offered during the spring and summer of 2014,

RESULTS
Continued

including two introductory forest management workshops, training on Global Positioning System (GPS) use for woodland owners, a Woodland Management Mentorship field day and a certification group annual gathering. Information booths were hosted at the Nova Scotia Department of Natural Resources' (NSDNR) Western Region Woodland Conference and at the Provincial Woodlot Owner of the Year field day.

- Activities were organized for over 200 elementary students from Lunenburg County at NSDNR's Kids in the Forest field day in October.
- Four presentations were given to promote forest certification and sustainable forest management.

YEARS OF DATA

- Ongoing project since 2009

PARTNERS

- Nova Scotia Department of Natural Resources
- Federation of Nova Scotia Woodland Owners
- Nova Scotia Woodlot Owners and Operators Association
- Mersey Tobeatic Research Institute

J. Barker, MTRI

T. Berry teaching woodlot management basics

J. Barker, MTRI

Students enjoying the NSDNR's Kids in the Forest field day

CONTACT

Jane Barker
Mersey Tobeatic Research Institute
9 Mount Merritt Road
PO Box 215
Kempt, NS B0T 1B0
Ph. (902) 682-2371
Fx. (902) 682-2760
jane.barker@merseytobeatic.ca
www.merseytobeatic.ca

Rationale

In 1927, the Tobeatic Game Sanctuary was established containing approximately 200 square miles. The boundaries took in parts of four counties: Queens, Shelburne, Yarmouth and Digby. Cofan and seven other cabins were built around these boundaries to accommodate the Sanctuary Wardens. In 1968, the Tobeatic Game Sanctuary became the Tobeatic Wilderness Management Area and the need for patrol cabins no longer existed. Today, Cofan is one of a few remaining functional warden cabins still standing in the Tobeatic. It sits on an ancient transit route of the Mi'kmaq on the Shelburne Heritage River System and has been a popular stopping place for hundreds of wilderness adventurers since the early seventies. In 2010, a small group of paddlers expressed their concern about the deteriorating condition of the cabin. Cofan received a minimal amount of maintenance during the 1980's, but the structure was slowly sinking into the ground. Several of the bottom logs had rotted and the woodstove was becoming a safety hazard. With the help of private donations, MTRI and Nova Scotia Environment (NSE) have partnered to rehabilitate Cofan. The project is using both volunteers and professional log builders and is expected to take two years to complete.

Monitoring

COFAN CABIN REHABILITATION PROJECT

C.Gray

Cofan Cabin in 2011 prior to rehabilitation efforts

OBJECTIVES

- To rehabilitate a culturally significant heritage cabin in the Tobeatic Wilderness Area.
- To provide a base camp for research and monitoring purposes.
- To provide a destination point, a stopover and a safe refuge for wilderness travellers in the Tobeatic as they journey through the Shelburne Heritage River System.

METHODS

- With the generous financial support of private donors, MTRI agreed to oversee the Cofan Cabin Rehabilitation Project in a joint partnership with NSE.
- A public consultation meeting was held and recommendations were implemented.
- A formal Management Agreement and Construction Plan was developed and approved by NSE.
- NSE and Nova Scotia Department of Natural Resources (NSDNR) contributed staff and resources to help with the selection and cutting of Red pine logs on site in the spring of 2014. Signage was posted in and around the cabin to inform potential users of the temporary closure during rehabilitation.
- In August 2014, MTRI assembled a trained team of log builders and volunteers to begin raising the fragile structure from the ground. Sills were replaced and rotten logs were removed and replaced. Old floor joists and floor boards were removed, and a new floor was built. Some of the existing sound logs were chinked using Permi Chink. The logs were treated with Borax, an all-natural wood preservative.

C.Gray

Early morning commute to the work site

RESULTS

- During the second phase of the rehabilitation project scheduled for spring 2015, the remaining rotten logs will be replaced. Windows will be enlarged to allow emergency access. The existing roof will be reinforced and covered with metal roofing material. A proper CSA approved woodstove and stainless steel chimney liner will replace the existing stovepipe.

RESULTS
Continued

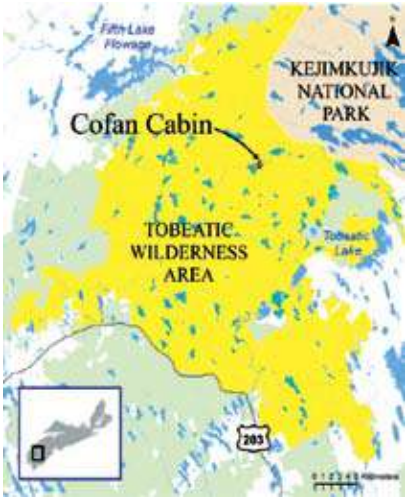
- When the cabin rehabilitation is complete, MTRI will continue to act as stewards for Cofan Cabin.
- MTRI will encourage paddlers to visit the site, use the cabin and experience the remoteness and beauty of the Tobeatic Wilderness Area.
- An interpretive panel will be erected, which will provide a brief history of the cabin and the surrounding area.
- MTRI and NSE will work together to ensure that Cofan Cabin remains structurally sound and safe for all who may use it in the future.

YEARS OF DATA

- Ongoing project since 2010

PARTNERS

- Mersey Tobeatic Research Institute
- Nova Scotia Environment
- Private donors
- Nova Scotia Department of Natural Resources



A. Belliveau, MTRI

Location of Cofan Cabin in the Tobeatic Wilderness Area

C.Gray

A dedicated group of volunteers, NSE and NSDNR staff and log builders

C.Gray

Log builder and volunteers jacking the cabin up out of the ground

CONTACTS

Colin Gray and Amanda Lavers
Mersey Tobeatic Research Institute
9 Mount Merritt Road
PO Box 215
Kempt, NS B0T 1B0
Ph. (902) 682-2371
Fx. (902) 682-2760
info@merseytobeatic.ca
www.merseytobeatic.ca

Rationale

In the summer of 2010, Kejimkujik was declared a "Dark Sky Preserve" by the Royal Astronomical Society of Canada (RASC), owing to its natural dark sky, the commitment of Parks Canada to follow outdoor lighting guidelines and the astronomy themed interpretative events that are a part of every summer season. RASC Halifax Centre members continue to advise Parks Canada staff on outdoor lighting issues and appropriate astronomy related activities. Each year, RASC volunteers assist with the "Dark Sky Weekend" in August, chosen to coincide with the absence of moonlight to highlight Kejimkujik's spectacular dark skies, free of light pollution.

Green laser pointer tour of the night sky at the Sky Circle in Kejimkujik

Monitoring

DARK SKY PRESERVE: MONITORING AND SUPPORT

OBJECTIVES

- To monitor outdoor lighting for sky glow, glare, and light trespass.
- To plan and lead astronomically themed activities in the park.
- To seek unique observing locations within the dark sky core.

METHODS

- In 2014, park facilities were toured to ensure that the levels and "throw" of outdoor lights was appropriate and fit the RASC guidelines.
- Keynote speaker and workshop leaders were arranged for the Dark Sky Weekend and volunteer RASC observers with telescopes complemented Parks Canada staff at Kejimkujik from 2010 to 2014.
- Parks Canada interpreters were advised on special astronomical events and provided training on telescope operation and event planning from 2010 to 2014.
- Good observing locations were investigated by foot and canoe from 2011 to 2014.

RESULTS

- A lighting audit was submitted to Kejimkujik Management in October 2014 which noted very good progress in converting lighting to full cutoff fixtures, very good compliance overall with RASC guidelines and a small number of light fixtures. A follow-up audit is recommended for 2016.
- The focus of continuing improvement of Kejimkujik lighting will be (1) reducing glare (direct viewing of a bare bulb) and (2) generational replacement of blue-white LED bulbs with eco-friendly amber bulbs.
- The 2014 Dark Sky Weekend had great content and participation, presented by a blend of RASC volunteers and Parks Canada staff. Activities were centred on the Sky Circle, constructed in 2011 in Jeremy's Bay Campground.

RESULTS
Continued

- Astronomy training for interpreters was provided by RASC in 2014.
- The 6th Dark Sky Weekend is scheduled for August 7 - 9 2015.

YEARS OF DATA

- Ongoing project since 2009

PARTNERS

- Parks Canada
- Royal Astronomical Society of Canada

D. Chapman, RASC

Night sky, south end of Portage R, Kejimkujik

D. Chapman, RASC

Workshop on use of StarFinder wheels at Kejimkujik

D. Chapman, RASC

Light pollution from Cornwallis/Clementsport direction, Big Dam Lake, Kejimkujik

CONTACT

David Chapman
Royal Astronomical Society of Canada
Halifax Centre
8 Lakeview Avenue,
Dartmouth, NS B3A 3S7
Ph. (902) 463-9103
dave.chapman@ns.sympatico.ca
halifax.rasc.ca

Rationale

Bats have become increasingly at risk in Canada due to White-nose syndrome since it was first observed in New York in 2006. Since then it has spread through bat-to-bat contact, arriving in Nova Scotia in 2010/2011. White-nose syndrome is caused by *Pseudogymnascus destructans*, a fungus which invades the body of bats while they overwinter in caves. The fungal infection causes the bats to awaken and burn their fat stores resulting in death by starvation or hypothermia. In 2013, MTRI and the Nova Scotia Department of Natural Resources (NSDNR) collaborated to create www.batconservation.ca. The website consists of a web portal for reporting bats and also directs users to the rare species reporting hotline where they can also submit reports of bats.

H. Mailhot

Little brown bats

Monitoring

PUBLIC REPORTING OF BATS IN NOVA SCOTIA

OBJECTIVES

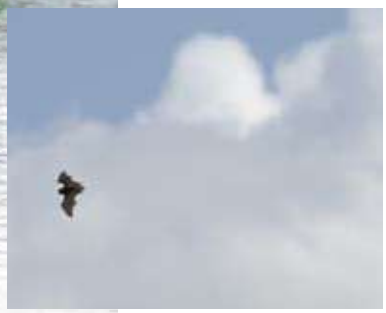
- To advertise the bat conservation website and rare species reporting hotline to Nova Scotians.
- To raise awareness of White-nose syndrome and the decline of bat populations.
- To collect information on bats observed in Nova Scotia.

METHODS

- The website was re-launched in May 2014 and advertised widely in Nova Scotia. The site was closed to submissions October 31 2014 and all sightings were referred to Nova Scotia Department of Natural Resources after that date.
- Records were spatially proofed and phone call data were added to the online database.

RESULTS

- The website received over 12,989 page views by 2,922 unique visitors.
- Over 900 individuals provided over 900 records to the database.
- Maps of the results were produced and a short report will be available on the bat conservation website.
- Any reports that mentioned large concentrations of bats, nuisance bats or injured bats were forwarded to Nova Scotia Department of Natural Resources.



M. F. Elderkin

Little brown bat seen flying during the daytime

YEARS OF DATA

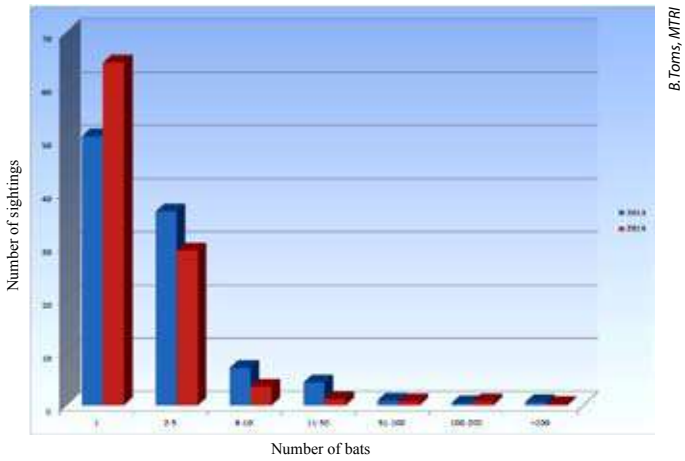
- Ongoing project since 2013

PARTNERS

- Nova Scotia Department of Natural Resources
- Mersey Tobeatic Research Institute
- Canadian Cooperative Wildlife Health Network

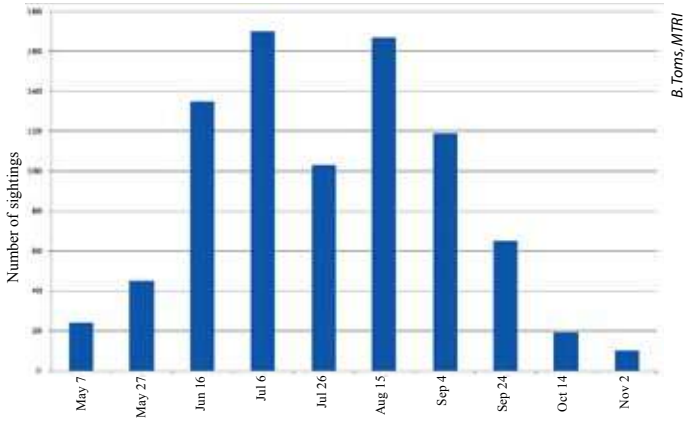
NSDNR

Dead bats at a mine site in Nova Scotia



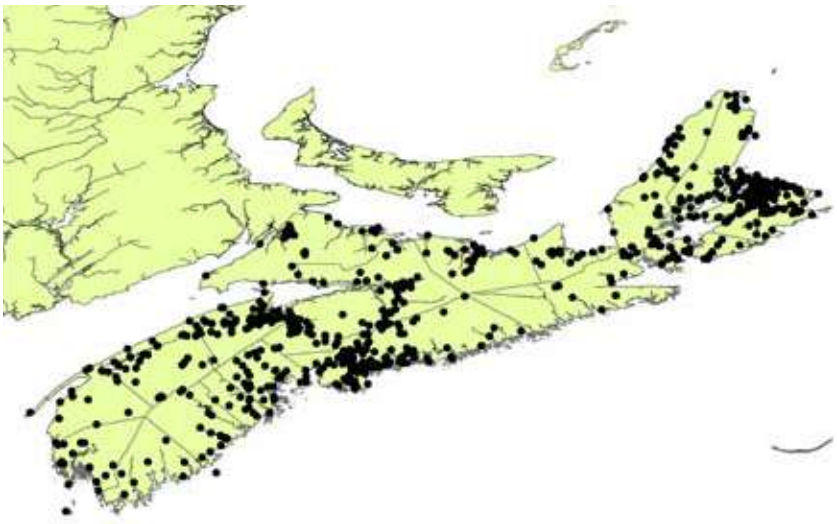
B.Toms, MTRI

Comparison of bat sighting counts in 2013 and 2014



B.Toms, MTRI

Frequency graph of bat sightings in 2014



www.batconservation.ca

Location of bat sightings submitted to the bat conservation website and rare species reporting hotline

CONTACT

Brad Toms
Mersey Tobeatic Research Institute
9 Mount Merritt Road
PO Box 215
Kempt, NS B0T 1B0
Ph. (902) 682-2371
Fx. (902) 682-2760
brad.toms@merseytobeatic.ca
www.merseytobeatic.ca
www.batconservation.ca

Rationale

Seniors Interviewing Seniors: Valuing and Sharing Rural Narratives provided seniors an opportunity to participate in a community-based project that helped to preserve the oral history of western Annapolis County and Queens County. Through sharing their memories and anecdotes, seniors gave a comprehensive overview of the past lifestyles, communities and biospheres of these counties. This information is important to record as it is in danger of being lost as our population ages. The project also addressed concerns regarding the isolation of seniors by encouraging their social participation and inclusion. The participants felt respected as their knowledge, observations and opinions were sought. The information that seniors shared gave valuable insights that MTRI and others with interests in the biosphere and history of the area can use in future research and initiatives.

A. Lavers, MTRI

Senior volunteers learning how to use the recording equipment and cameras for interviews

Research

SENIORS INTERVIEWING SENIORS

OBJECTIVES

- To collect information from local seniors to provide an oral history of the area.
- To help encourage seniors to get involved with current happenings in the community.
- To help seniors became more aware of how they might contribute to MTRI through their observations and to demonstrate how their knowledge and information can benefit researchers and ecosystems.
- To increase the profile of the area as an attractive, dynamic place to live.

METHODS

- A senior coordinator was hired and volunteer interviewers were trained.
- Seniors were contacted and interviewed by the coordinator and trained volunteers.
- Interviews were digitally recorded, written in text form, and photos were taken and annotated.
- Learning sessions for seniors were planned and presented, explaining the work conducted at MTRI.
- Data were made available to North Queens Heritage House Museum for its website.

W. Pitts, MTRI

An audience listening to a talk during a summer seminar at MTRI customized for seniors

RESULTS

- Over 100 seniors became involved in Seniors Interviewing Seniors; as coordinator, interviewees, interviewers and audiences at presentations.
- Seniors in the area became more aware of MTRI and its projects.
- Seniors who were interviewed shared information about lifestyles, community changes, species at risk, forestry and land use.
- Seniors received information about the Southwest Nova Biosphere at MTRI seminars, by reading MTRI information packets and during talks given at the Annapolis Royal Nursing

RESULTS
Continued

Home, Port Lorne Lunch and Learn and the Women's Institute regional meeting in Tupperville.

- Seniors felt respected and empowered by sharing their memories and observations.

YEARS OF DATA

- Single Year Project

PARTNERS

- Government of Canada - New Horizons for Seniors Program
- Mersey Tobeatic Research Institute
- North Queens Nursing Home
- Annapolis Royal Nursing Home
- North Queens Heritage House Museum
- Aging Well Together
- South Shore Health, Falls Prevention

M. Linley

Coordinator J. Grant-Smith giving a presentation about MTRI and New Horizons Project to a seniors group in Port Lorne

J. Grant- Smith, MTRI

Seniors from North Queens Nursing Home and the community listening to J. Barker explain forest stewardship at a special seminar at Mersey River Chalets

CONTACTS

Joyce Grant-Smith and Amanda Lavers
Mersey Tobeatic Research Institute
9 Mount Merritt Road
PO Box 215
Kempt, NS B0T 1B0
Ph. (902) 682-2371
Fx. (902) 682-2760
info@merseytobeatic.ca
www.merseytobeatic.ca

Rationale

Kejimkujik installed electrical services to campsites in the Slapfoot Loop at Jeremy's Bay Campground. The campground is located on the shore of Kejimkujik Lake. Numerous archaeological sites are known around the lakeshore including campsites, a large habitation site, petroglyphs and a burial site. The known sites attest to the Mi'kmaw occupancy of the area since time immemorial. As such, archaeological testing was required to determine if any cultural resources were present in the areas that were impacted by mechanical trenching for the electrical services. Parks Canada retained Kelman Heritage Consulting to conduct the archaeological testing program.

Study location in Slapfoot Loop

Research

ARCHAEOLOGICAL TESTING AT SLAPFOOT LOOP

OBJECTIVES

- To conduct archaeological testing to determine if buried cultural resources were present in the areas impacted by mechanical trenching during installation of buried electrical services at Slapfoot Loop.

METHODS

- Trench alignments where electrical infrastructure was installed were systematically shovel-tested at a 10 m interval prior to construction.
- Study area consisted of three main trench alignments, each approximately 80 m long, with several smaller off-shoot alignments, typically between 7 and 10 m long.
- In instances where trench alignments were less than 10 m long, shovel tests were positioned to get appropriate coverage.
- Shovel test pits, at least 40 cm wide, were excavated through the topsoil into sterile subsoil.
- Shovel test pits were primarily excavated using spade and shovel. In areas where hard, compacted gravels were present (road alignments/campground areas), a heavy iron pry-bar was used to break through the gravel.
- All soil removed from the test pits was screened through 6 mm hardware cloth to standardize artifact recovery, had they been present, in the excavated soils.
- Details of the archaeological testing program were documented in field notes, site plans, stratigraphic drawings and photographs.

Shovel test pit 25 (south profile) showing a lack of buried topsoil below the gravel

RESULTS

- Twenty-eight shovel test pits were excavated along the trench alignments with none registering as 'positive' for significant archaeological features, deposits or artifacts.
- Ten of the shovel test pits displayed evidence of disturbance related to road and/or campsite construction. In these units, the gravel that comprises the current surface, overlaid either mixed, disturbed subsoil, or undisturbed sterile subsoil, with

RESULTS
Continued

all traces of topsoil having been removed.

- The remainder of the shovel test pits did not show signs of disturbance.
- Sterile subsoil was typically encountered between 20 and 50 cm below the current surface.
- Very few modern items were recovered during the testing program. These included bottle caps, batteries, corks and various plastic wrappers/ containers. None of these items were considered archaeologically or historically significant.
- As a result of the archaeological shovel testing program, no further cultural resource management work was required for the overall project.

YEARS OF DATA

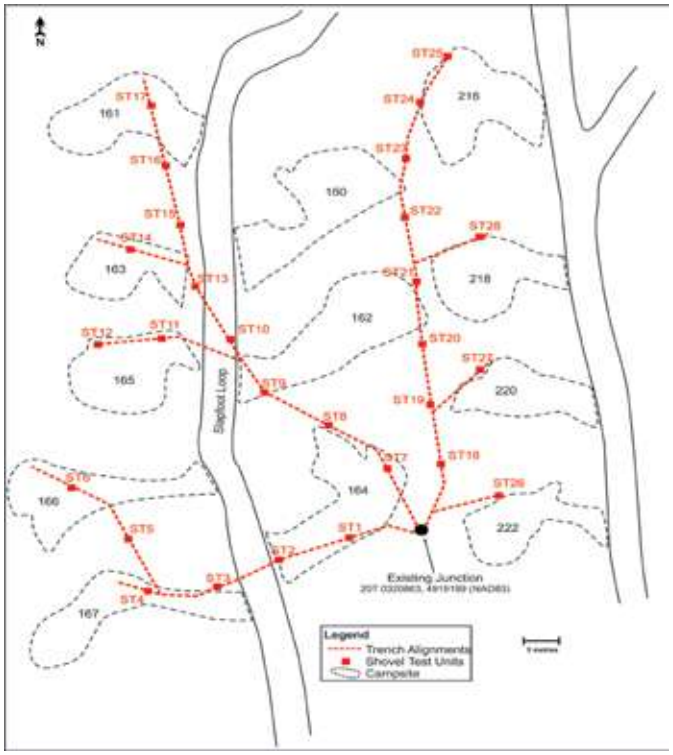
- Single Year Project

PARTNERS

- Kelman Heritage Consulting
- Parks Canada

D. Kelman

Shovel test pit 16 (south profile) showing typical undisturbed stratigraphy



D. Kelman

Shovel test locations within the Slapfoot loop of Jeremy's Bay Campground, Kejimkujik

CONTACT

Darryl Kelman
Kelman Heritage Consulting
6052 North Street
Halifax, NS B3K 1N8
Ph. 902-483-1065
Fx. 902-482-5083
dkelman@kelmanheritage.ca
www.kelmanheritage.ca

APPENDIX I: 2014 PROJECTS IN KEJIMKUJIK AND THE GREATER KEJIMKUJIK ECOSYSTEM

	Kejimkujik	Greater Kejimkujik Ecosystem	Monitoring	Research
COASTAL				
Piping Plover Monitoring Program	X		X	
Piping Plover Habitat Management	X		X	
Nova Scotia Piping Plover Conservation Program	X	X	X	
Invasive Green Crab Restoration Project	X		X	
Eelgrass Coastal Monitoring and Recovery	X		X	
Estuarine Water Quality Monitoring	X		X	
Soft-shell Clam Monitoring	X		X	
Ongoing Kejimkujik projects not included in this report:				
Barrier Beach Movement Monitoring	X		X	
Salt Marsh Erosion Monitoring	X		X	
FOREST				
Landbirds at Risk in Forested Landscapes	X	X	X	
Caledonia Christmas Bird Count	X	X	X	
Nocturnal Owl Survey	X	X	X	
McGowan Lake Chimney Swift Monitoring		X	X	
Jack Pine Budworm Population and Damage Assessments	X	X	X	
Boreal Felt Lichen Monitoring in Nova Scotia		X	X	
Relative Abundance of White-Tailed Deer in Kejimkujik	X		X	
Invasive Plant Monitoring and Restoration	X		X	
Plethodontid Salamander Monitoring	X		X	
Forest Health - Trees	X		X	
Red Oak Regeneration in Mixedwood Stands	X	X		X
Arthropod Diversity and DNA Barcoding	X			X
Ongoing Kejimkujik projects not included in this report:				
Forest Birds Monitoring	X		X	
Landscape Connectivity	X		X	
Forest Succession	X		X	
FRESHWATER				
ACPF Volunteer Plant Monitoring	X	X	X	
ACPF Stewards in Cottage Country		X	X	
Water Quality in ACPF Habitat		X	X	
Water Quality in the Tusket Catchment		X	X	
CURA H2O - Community Based Monitoring		X	X	
Lake Water Quality Monitoring in Kejimkujik	X		X	
Relationships Between Carbon and Mercury	X			X
Freshwater Inventory and Surveillance of Mercury	X			X
Mercury in Freshwater Food Webs	X			X

	Kejimkujik	Greater Kejimkujik Ecosystem	Monitoring	Research
The Kejimkujik-Mersey LoonWatch Program	X	X	X	
Adult Survivorship of Common Loons	X	X		X
Protecting Kejimkujik's Trout Fishing Legacy	X		X	
Stream Flow Monitoring	X		X	
Sub-Watershed Restoration Planning		X	X	
Wood Turtle Monitoring and Stewardship		X	X	
Ongoing Kejimkujik projects not included in this report:				
Brook Trout Monitoring	X		X	
Benthic Invertebrates Monitoring	X		X	
WETLAND				
Water-Pennywort Monitoring	X		X	
Blanding's Turtle Nest Protection	X	X		X
Blanding's Turtle Distribution and Monitoring	X	X		X
Blanding's Turtle Hatchling Headstarting	X	X		X
Eastern Ribbonsnake Overwintering Habitats	X	X		X
Atlantic Coastal Plain Pollinator Surveys		X		X
Wetland Water Quality Monitoring in Kejimkujik	X		X	
Reproductive Biology of Eastern Mountain Avens		X		X
Restoring Big Meadow Bog, Brier Island		X		X
Ongoing Kejimkujik projects not included in this report:				
Wetland Extent Monitoring	X		X	
Wetland Vegetation Monitoring	X		X	
HUMAN DIMENSIONS				
Monarch Butterfly Stewardship in SNBR	X	X		X
Species at Risk Stewardship in SNBR	X	X		X
Woodland Stewardship Program		X		X
Cofan Cabin Rehabilitation Project		X	X	
Dark Sky Preserve: Monitoring and Support	X		X	
Public Reporting of Bats in Nova Scotia		X	X	
Seniors Interviewing Seniors		X		X
Archaeological Testing At Slapfoot Loop	X			X

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