Salt Marsh Restoration Survey for the Eastern Coast of New Brunswick:

Point Escuminac to Cape Jourimain

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Conservation Council of New Brunswick

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Research and fieldwork for this project was carried out by Conservation Council staff (Krista Morrisey and Inka Milewski). Stacy Howroyd of Imprint Communication (Fredericton) created the map of the survey sites.

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Table of Contents

Summary

Thirty salt marshes along the eastern coast of New Brunswick (Point Escuminac to Cape Jourimain) were surveyed between July and November 2006. A checklist of potential human impacts, historic and current aerial photos and recent findings on the impact of sea-level rise and climate on the coastal zone of southeastern New Brunswick were used to assess the type and degree of human disturbance for each salt marsh.

Salt marshes in the northern portion of the survey (Escuminac to Kouchibouguac National Park) exhibited relatively few signs of human disturbance. Salt marshes between Richibucto and Grand Digue Point (including Shediac Island) exhibited low to moderate signs of human disturbance. Salt marshes in southeastern New Brunswick, between Cape Brûlé and L'Aboiteau, exhibited high levels of human disturbance. Marshes between Shemogue and Spence Cove (west of Cape Jourimain) had relatively low levels of human disturbance.

This survey did not identify any feasible opportunities for restoring disturbed or damaged salt marsh habitats. Improved protection for dunes and beaches which provide natural protection for salt marshes is recommended.

The salt marshes of southeastern New Brunswick are experiencing a phenomenon referred to as coastal squeeze where marsh habitat is surrounded by 'hard structures' like roads, houses and breakwaters that alter their hydrology (flow and movement of underground water) and prevent them from adapting to natural and human-induced changes.

This survey found that certain regulations in New Brunswick's Wetlands Conservation Policy, such as the requirement for a 30-metre buffer between significant wetland features and development activities, were not being respected or enforced. It was also apparent from this survey and other recent studies that a 30-metre buffer is inadequate to protect salt marsh habitat and adjacent communities from predicted increased rates of sea-level rise along the eastern coast of New Brunswick. It is recommended that the regulations defining the width of buffers be amended to provide increased protection for coastal wetlands.

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Introduction

The ecological and economic value of salt marshes have long been recognized (Teal and Teal 1969). Salt marshes, along with eelgrass beds and oyster reefs, are among the most important marine habitats in the world. They are important nursery areas for inshore and offshore fish, shellfish and bird. Salt marshes recycle nutrients for plants and animals, serve to stabilize sediments and reduce erosion and protect human communities from the effects of storm surges and sea-level rise. They are generally net importers of nutrients during the summer months when the grasses are growing. In winter, they are net exporters (Valiela et al. 1978).

New Brunswick has 2,269 km of coastline and eight percent (8%) of the total coastal habitat types (e.g, estuarine flats, saline ponds, dunes, beaches, islands) is salt marsh (Hanson and Calkins 1996). Gloucester County in northern New Brunswick has the greatest number and largest total area of salt marsh habitat in New Brunswick followed by Westmorland and Albert counties (Table 1). Of the province's 8470 hectares of salt marshes, 39% percent are associated with the Gulf of Saint Lawrence/Bay of Chaleur marine ecosystems, 29% along the Northumberland Strait, 24% in the Upper Bay of Fundy (Chignecto Bay) and 13% in the Lower Bay of Fundy area (Roberts undated).

Table 1. Distribution of Salt Marshes in New Brunswick (Hanson and Calkins 1996)

County	Number of Salt Marshes	Hectares	Marine Region
Gloucester	335	2816.1	Bay of Chaleur and Gulf of Saint Lawrence
Westmorland	222	2028.0	Northumberland Strait and Bay of Fundy
Albert	118	1736.6	Bay of Fundy
Kent	267	624.1	Northumberland Strait
Saint John	60	606.7	Bay of Fundy
Northumberland	143	500.2	Gulf of Saint Lawrence
Charlotte	48	146.9	Bay of Fundy
Restigouche	4	11.1	Bay of Chaleur

Up to 65% of New Brunswick's salt marshes have been lost during the past 300 years (Environment Canada 1987; National Wetlands Working Group 1988). Losses were initially due to extensive conversion of salt marsh to agricultural land by building dyke, particularly in the Upper Bay of Fundy region.

The first investigation on the threats to coastal habitats and resources in eastern New Brunswick was done in 1975 by consultants for the Department of Natural Resources and Energy (Hunter 1975). Their report documented the loss of salt marshes and other wetland habitat due to beach quarrying and infilling for the construction of cottages, homes, commercial buildings, roads, causeways, boat harbours and slips and shore protection structures such as breakwaters (Hunter

1975).

Beginning in the early 1990's, New Brunswick embarked on a process of developing a comprehensive wetland and coastal land use policy. Lori Roberts (undated) prepared a preliminary report on the status of salt marsh habitat in New Brunswick for the Department of Natural Resources and Energy's Wetlands and Coastal Habitat Program. For the study, salt marshes over 8 hectares in size (with some exceptions) were identified and categorized into four classes based on size, value to wildlife, associated habitat diversity, degree of disturbance and fragmentation and type of salt marsh (low versus high salt marsh). Roberts classified 141 salt marshes, 107 were on New Brunswick's north, east and southeastern coasts. Class I sites were large salt marshes with known (or assumed) high value for wildlife and Class IV were generally small, with little or no open water. Roberts determined that most of the salt marshes surveyed (73%) showed negligible to low signs of human disturbance. The remaining salt marshes exhibited moderate (15%) to low (12%) levels of disturbance.

Since the report by Roberts in the early 1990's, the allure of the ocean has spawned a trend of population growth in coastal areas, particularly southeastern New Brunswick. The warm, shallow sandy beaches and close proximity to one of New Brunswick's fastest growing regions (the Moncton/Dieppe area) and an aggressive provincial tourism marketing program have combined to make New Brunswick's east and south-east coast one of the most popular tourism destinations in New Brunswick (Milewski and Harvey 2001). The result has been a boom in residential/cottage development, marinas, eco-tourism projects and other human infrastructure along New Brunswick's east coast.

As a follow-up to the survey done by Roberts, the Conservation Council of New Brunswick conducted a survey of selected salt marshes along the east coast of New Brunswick between Point Escuminac and Cape Jourimain. The goal of the survey was to identify the type and overall degree of human disturbance for each salt marsh and assess opportunities for their restoration.

Methods

Thirty (30) salt marshes between Point Escuminac and Cape Jourimain (see map on page 8) were assessed between July and November 2006 (Table 2). It was impossible to access several sites by foot or vehicle (e.g., Indian Island and Shediac Island). These salt marshes were assessed by examining historic and current aerial photographs. The salt marshes in Kouchibouguac National Park and Cape Jourimain National Wildlife Area are under federal government management and, therefore, were not surveyed.

A checklist of indicators (adapted from L. Roberts undated report and O'Carroll 2006) was used to assess the degree of human disturbance in and around each salt marsh. These included: the presence of buildings (e.g., houses, camps, cottages, trailers), roads (e.g., private, Department of Transport), ATV tracks, boardwalks and footpaths; infilling; and impediments (causeways, breakwaters, culverts, drainage ditches and dykes) to water flow. The overall level of human disturbance for each marsh was ranked on a scale ranging from negligible to high level of disturbance. Salt marsh loss and degradation was qualitatively evaluated by comparing historical aerial photographs. The presence of waterfowl was also noted.

In October 2006, Environment Canada published a report on the impacts of sea-level rise and climate change on the coastal zone of southeastern New Brunswick. The publication included several studies that examined the changes over time of coastal habitats, including salt marshes, due to natural and human disturbances which were relevant to this study. Where appropriate, the information in the Environment Canada report was used to evaluate the threats to, and restoration opportunities for, salt marshes in this survey.

Table 2. 2006 Salt Marshes Survey Sites (Classification based on L. Roberts for DNRE)

Name	ID# (per L. Roberts)	Size (hectares)	Classification	County
Escuminac River	7-1-1	123.5	I	Kent
Rivière l'Anguille (north)	7-1-2	25.9	III	Kent
Indian Island	8-1-1	71.7	II	Kent
Mocauque du Cap	8-1-2	52	III	Kent
Rivière des Vaches	8-1-3	24.4	IV	Kent
Rivière du Cap	8-1-4	32.2	IV	Kent
Bass River Point	8-1-5	16.5	IV	Kent
Petit Chockpish	8-2-1	54.8	II	Kent
Notre Dame	8-3-2	19.9	IV	Kent
Rivière l'Anguille (south)	8-3-3	8	IV	Kent
Pointe Grande Digue	9-1-1	26.2	II	Kent
Shediac Island	9-1-2	11.4	IV	Westmorland
Cap Brûlé	9-1-3	13.1	III	Westmorland
Lac des Boudreau	9-1-4	92.3	II	Westmorland
Petit Barachois	9-1-5	34.5	II	Westmorland
Aboujagane River	9-2-1	4.3	IV	Westmorland
Robichaud	9-2-2	7.3	IV	Westmorland
Mouth of Kouchibouguac River	9-2-4	4.9	IV	Westmorland
Dupuis River	9-2-5	57	II	Westmorland
L'Aboiteau	9-2-6	57	II	Westmorland
Little Cape	10-1-1	14.2	III	Westmorland
Shemogue	10-1-2	49.3	II	Westmorland
Comeau Point	10-1-3	32.6	III	Westmorland
Fox Creek	10-1-4	105.2	II	Westmorland
Duguay Point	10-1-5	20.2	IV	Westmorland
Shemogue Head	10-1-6	14.5	II	Westmorland
Little Shemogue Harbour	10-2-1	32.2	II	Westmorland
Johnston Point Road	10-2-2	20.7	III	Westmorland
Grant Creek	10-2-5	37.7	III	Westmorland
Spence Cove	10-3-1	49.6	III	Westmorland

Results

Table 3 summarizes the type and degree of human disturbances for each salt marsh. A description of each salt marsh is in Appendix A.

Disturbance Levels

Escuminac Point and Rivière l'Anguille (north) salt marshes (north or Kouchibouguac National Park) are not readily accessible and exhibited relatively few signs of human disturbance. Salt marshes south of Kouchibouguac National Park, between Indian Island and Grand Digue Point (including Shediac Island) exhibited low to moderate signs of human disturbance. There was relatively little housing/cottage development around these salt marshes compared to southeastern New Brunswick. There was, however, considerable foot and vehicle (ATV) traffic along the beaches, dunes and marshes. (This assessment does not apply to salt marshes around Cocagne, Bouctouche or Shediac which were not part of this survey.)

Salt marshes in southeastern New Brunswick, between Cape Brûlé to L'Aboiteau, exhibited high levels of human disturbance and those west of Shemogue to Cape Jouriman had a low levels of human disturbance.

This survey did not include an assessment of the changes in quantity and quality of salt marsh habitat over time. However, the loss of salt marsh habitat features such as pannes, vegetated areas and creeks, particularly in high impact areas (Cap Brûlé, Lac des Boudreau, Petit Barachois,

Figure 1a. 1982 aerial photo of the western portion of Lac des Boudreau salt marsh. Municipal sewage lagoon empties into marsh. (NS Geomatics Services)

Figure 1b. 2001aerial photo of the western portion of Lac des Bourdreau salt marsh (NS Geomatics Services)

Aboujagane River, Robichaud and L'Aboiteau), was evident by comparing aerial photos for two time periods (1982 and 2001) (see Appendix A and Figure 1a and b).

Table 3. Human disturbances in and around selected salt marshes between Point Escuminac and Cape Jourimain 2006

Name	Buildings in and around marsh (houses, camps, cottages, trailer parks	Roads in an around marsh (private, DOT, ATV tracks, boardwalks, footpaths)	Portions of marsh infilled	Flow to and from marsh altered (causeways, culverts, drainage ditches, dykes)	Disturbance Level[2]
Escuminac River		X[1]			Negligible
Rivière l'Anguille (north)		X			Negligible
Indian Island		X			Negligible
Mocauque du Cap	X	X			Low
Rivière des Vaches	X	X			Low
Rivière du Cap	X	X		X	Low
Bass River Point	X	X			Low
Petit Chockpish	X	XX	X	X	Moderate
Notre Dame	X	X			Low
Rivière l'Anguille (south)	X	X			Low
Pointe Grande Digue	X	XX	X		Moderate
Shediac Island		X			Negligible
Cap Brûlé	XX	XX	XX	X	High
Lac des Boudreau	XX	XX	XX	X	High
Petit Barachois	XX	XX	XX	X	High
Aboujagane River	XX	XX	XX		High
Robichaud	XX	XX	XX		High
Mouth of the Kouchibuguac River	X	X	XX		Moderate
Dupuis River	XX	XX	XX		High
L'Aboiteau	XX	XX	XX	XX	High

[1]X indicates evidence of disturbance
XX significant evidence of disturbance

[2]Disturbance Levels: Negligible = 0 - 1 Xs; Low = 2- 3 Xs; Moderate = 4-5 Xs; High = 6 + Xs

Table 3 cont'd. Human disturbances in and around selected salt marshes between Point Escuminac and Cape Jourimain 2006

Name	Buildings in and around marsh (houses, camps, cottages, trailer parks)	Roads in and around marsh (private, DOT, ATV tracks, boardwalks, footpaths)	Portion of marsh filled in	Flow to and from marsh altered (causeways, culverts, dykes)	Disturbance Level[2]
Little Cape	X	X			Low
Shemogue	X	X		X	Low
Comeau Point	X	X		X	Low
Fox Creek	X	X		X	Low
Duguay Point	X	X			Low
Shemogue Head	X	X			Low
Little Shemogue Harbour	X	X			Low
Johnston Point Road	X	X		X	Low
Grant Creek	X	X			Low
Spence Cove	X	X			Low

[2]Disturbance Levels: Negligible = 0 - 1 Xs; Low = 2- 3 Xs; Moderate = 4-5 Xs; High = 6 + Xs

Hanson et al. 2006 quantified the changes (over time) in coastal habitat types due to human activities such as drainage and infilling for several areas of southeastern New Brunswick. Their study was part of Environment Canada's report on the impacts of sea-level rise and climate change on the coastal zone of southeastern New Brunswick. Hanson et al. 2006 examined five coastal areas. Two of their study areas - Shemogue and L'Aboiteau - encompassed salt marshes evaluated in this study.

The Shemogue study site covered 105 km of coastline from Trois Ruisseaux to just west of Cadman Corner and included approximately 13 230 ha of coastal habitat. Their study area encompassed nine salt marshes from this survey (Little Cape, Shemogue, Comeau Point, Fox Creek, Duguay Point, Shemogue Head, Little Shemogue Harbour, Johnston Point Road and Grant Creek). Hanson et al. 2006 described the Shemogue coastal area as underdeveloped which corresponds to the findings of this survey. The Aboiteau study area which covered 59 km of coastline and covered approximately 6 501 ha of coastal habitat encompassed four salt marshes from this survey (Aboujagane, Robichaud, Dupuis River and L'Aboiteau) (Hanson et a. 2006). The Aboiteau area was described as developed.

Hanson et al. 2006 found that, for the Shemogue area, the amount of vegetated salt marsh had decreased only 5% (15 ha) between 1944 and 2001 (Table 4). The length of breakwaters had increased from 0 metres in 1944 to1084 metres in 2001. For the Aboiteau area, salt marsh vegetation had decreased by 27% (85 ha) between 1944 and 2001, with most of the decrease occurred between1971 and 2001. Breakwaters construction in the Aboiteau area increased from

454 m to 8 324 in 2001.

Table 4. Coastal habitat changes for the Shemogue and Aboiteau areas of southeastern New Brunswick (Hanson et al. 2006)

	Shemogue Study Site (Hanson et al. 2006) area of coastal habitat in ha				Aboiteau Study Site (Hanson et al. 2006) area of coastal habitat in ha		
	1944	1971	2001		1944	1971	2001
Vegetated salt marsh	285.2	282.7	282.7		84.9	73.2	61.8
Total coastal wetland	478.1	473.3	473.3		266.0	238.5	212.9
Causeways and bridge	0.8	2.2	2.2		1.1	2.0	2.5
Length of Seawall (metres)	0	32	1084		454	868	8324

Restoration Opportunities

The survey did not identify any feasible opportunities for restoring salt marsh habitat altered or damaged by tidal barriers (causeways, culverts, dykes or aboiteaus). Most dykes in the area were removed years ago and the causeways have been in place for decades. Most culverts observed were in good condition and appeared adequate to accommodate the existing water flow.

The survey did not identify any opportunities to restore salt marsh habitat that had been filled in for residential or commercial development such as houses, cottages, trailer parks, parking lots or roads.

Many of the salt marshes in this survey are protected by barrier beaches, dunes and sand spits. These coastal features are very sensitive to natural and unnatural disturbance (O'Carroll et al. 2006). Foot and/or vehicle traffic was evident at almost every dune and beach area associated with a salt marsh (Table 3 and Figure 2 and 3). The survey did identify dune and beach areas that needs better protection in order to prevent an acceleration in the natural erosion process. These include Petit Chockpish, Mocauque du Cap, Cap Brûlé, Lac Des Boudreau, Petit Barachois, Aboujagne, Robichaud, Dupuis River, L'Aboiteau, Little Cap, Little Shemogue Harbour. Grant Creek and Spence Cove.

Figure 2. Footpath to beach at L'Aboiteau salt marsh (CCNB photo 2006)

Figure 3. Vehicle tracks in the Grant Creek salt marsh (CCNB photo 2006)

Discussion and Recommendations

Salt marshes are dynamic systems that can and do respond to changes induced by natural and unnatural disturbances. For example, salt marshes can respond to rising sea level by growing vertically, if there is sufficient sediment and organic matter, or by migrating inland, if there is sufficient land behind the marsh (O'Carroll et al. 2006). Salt marshes hemmed in by human infrastructure (roads, buildings, etc.) and intervention (e.g, infilling, breakwaters, dykes, etc) are less able to adapt. This phenomenon is referred to as 'coastal squeeze'(Nicholls and Branson 1998). The consequences of coastal squeeze can be a loss of salt marsh and other coastal habitat.

This survey documented human disturbances in salt marsh habitat along the eastern coast of New Brunswick. Based on this survey and other recent studies, the salt marshes of southeastern New Brunswick, particularly Cap Brûlè, Lac des Boudreau, Petit Barachois, Dupuis River and L'Aboiteau, are experiencing greater losses in salt marsh habitat due in large part to coastal squeeze. Salt marshes in these and other areas such as Cocagne and Shediac are surrounded by 'hard structures' like roads, homes and breakwaters that alter their hydrology (flow and movement of underground water) and prevent them from migrating inland (Hanson et al. 2006). To date, salt marshes along the northeastern coast (Point Escuminac to Petit Chockpish) have been less affected by coastal squeeze.

In addition to direct human disturbances, salt marsh (and other coastal) habitat in eastern New Brunswick is threatened by the effects of indirect human impacts, specifically the increasing rates of sea-level rise associated with climate change. According to a recent report published by Environment Canada (2006), the highest relative rate of sea-level rise will be experienced in the southeast (Table 5). Hanson et al. 2006 demonstrated that coastal areas like Shemogue, which are considered underdeveloped, experienced the least change in salt marsh habitat compared to adjacent developed areas like Aboiteau, Shediac and Cocagne despite a sea level rise in the region of 25-32 cm over the last century. Their research suggests that salt marshes which exhibit less human disturbance - coastal squeezing - have a greater potential to adapt to sea-level rise.

Table 5. Estimated relative sea-level rise (2000-2100) between Escuminac and Cape Jourimain (Environment Canada 2006)

Site	Relative sea-level rise (cm)
Cape Jourimain	59 ± 35
Shemogue	57 ±3 5
Cap-Pele	56 ± 35
Shediac	54 ± 35
Bouctouche	53 ± 35
Kouchibouguac	51± 35
Escuminac	50 ± 35

New Brunswick's Wetlands Conservation Policy is designed to protect wetland habitat like salt marshes. Based on information gathered through this survey, it is apparent that certain regulations in the policy, such as the requirement for a 30-metre buffer between wetland features and development activities, are not being respected or enforced. It is also apparent from this survey and recent studies on the impacts of sea level rise that a 30-metre buffer is inadequate to protect both salt marsh habitat and, in turn, adjacent human development from predicted sea-level rise along the eastern coast of New Brunswick. It is therefore recommended that the regulation defining the width of buffers in the Wetlands Conservstion Policy be amended to provide increased protection for salt marshes.

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Appendix A

Salt Marsh Survey: Individual Site Information

Salt Marsh Classification (per L. Roberts)

Category	Definition
Class I	large (> 100 hectares) and have a known (or assumed) high value to wildlife; include large lagoon or open water areas; highest management/protection priority
Class II	between 50 and 100 hectares in size; of value to wildlife
Class III	small but with valuable features (eg., open water, morphology, marsh type)
Class IV	small isolated marshes; little or no open water

7-1-1 Escuminac River

Total Size (ha): 123.5 (Class I)

Disturbance: Negligible
Roadways: dirt roads only
Behind Barrier Beach?: Yes
Vehicle Tracks?: tracks on beach and perimeter of marsh
Restoration opportunities?: No

Comments:

- Very poor access to marsh, limited to trucks and ATV's
- Camps/trailers set up at Point in summer
- most of the land around marsh (peat bogs) owned by DNRE
- marsh land under private ownership
- some peatlands lease from DNRE to private companies

2001 aerial photo of northern portion of Escuminac Point salt marsh (NS Geomatics Services)

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2001 aerial photo of southern portion of Escuminac Point salt marsh (NS Geomatics Services)

7-1-2 Rivière l'Anguille (north)

Total Size (ha): 25.9 (Class III)

Disturbance: Negligible
Roadways: dirt roads
Behind Barrier Beach?: Yes
Vehicle Tracks?: perimeter of marsh
Restoration Opportunities? No

Comments:

- most land around marsh (peat bogs) owned by DNRE
- marsh itself under private ownership

2001 aerial photo (NS Geomatics Services)

8-1-1 Indian Island

Total Size (ha): 71.7 (Class II Salt Marsh)

Disturbance: Negligible
Roadways Present?: No
Behind Barrier Beach?: Yes and behind South Richibucto Beach
Vehicle Tracks?: None
Restoration Opportunities? No.

Comments:

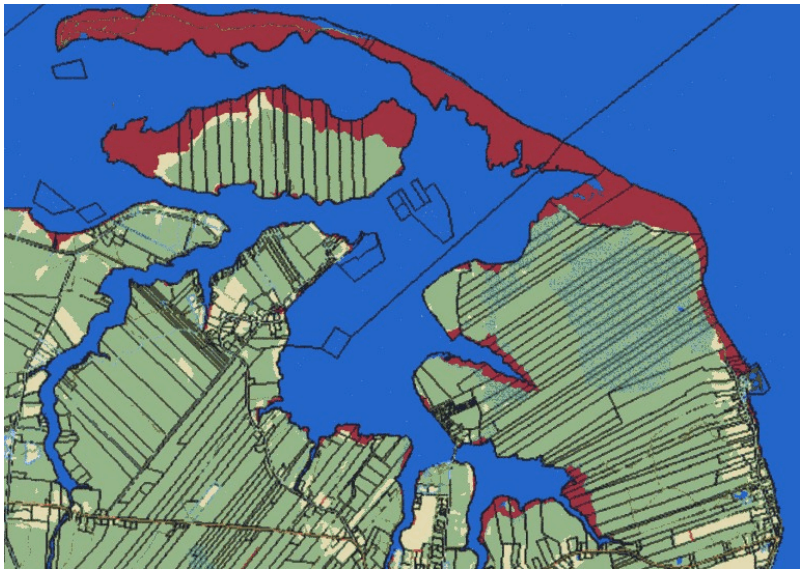
- Salt marsh on north side of Island inaccessible
- Long narrow strip

2001 aerial photo of Indian Island (centre) with South Richibucto beach to the north of the Island. Salt marsh is on the north side of Island. (NS Geomatics Services)

8-1-2 Mocauque du Cap

Total Size (ha): 52.0 (Class III)

Disturbance: Negligible
Roadways Present?: DOT and private
Behind Barrier Beach?: Yes
Vehicle Tracks?: Beach and dune areas
Restoration Opportunities? No



Main salt marshes of the Richibucto Harbour area: clockwise from centre left: Indian Island (8-1-1), Mocauque du Cap (8-1-2), Rivière des Vache (8-1-3) and Rivière du Cap (8-1-4). Map created using www.planet.snb browser.

Comments:

- marsh relatively undisturbed but some portions of dune that protect marsh show signs of damage by ATVs
- several marsh hawks observed
- (digital camera malfunctioned - all photos lost)

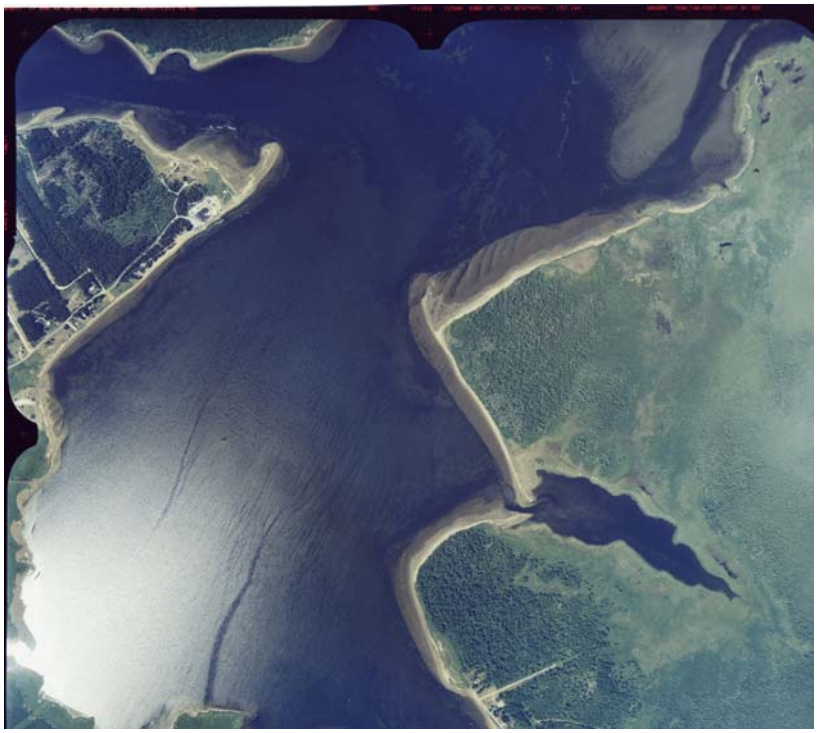
8-1-3 Rivière des Vaches

Total Size (ha): 24.4 (Class IV)

Disturbance: Low
Roadways present?: DOT
Behind Barrier Beach?: No
Vehicle Tracks?: Beach and salt marsh
Restoration Opportunities: No

Comments:

- a few shorebirds on edges of beach
- vehicle tracks half way around edge



2001 aerial photo (NS Geomatics Services)

8-1-4 Rivière du Cap

Total Size (ha): 32.2 ha (Class IV)

Disturbance: Low
Roadways Present?: DOT
Behind Barrier Beach?: No
Vehicle Tracks?: perimeter of marsh
Restoration Opportunities? No

Comments:

2001 aerial photo (NS Geomatics Services)

8-1-5 Bass River Point

Total size (ha): 16.5 ha (Class IV)

Disturbance: Low
Roadways Present?: Private
Behind Barrier Beach?: No
Vehicle Tracks?: None evident
Restoration Opportunities?: No

Comments:
- farm fields to edge of marsh

2001 aerial photo of Bass River Point (upper centre half of photo) (NS Geomatics Services)

8-2-1 Petit Chockpish

Total size (ha): 54.8 ha (Class II)

Disturbance: Moderate
Roadways Present?: DOT and several private
Behind Barrier Beach?: Yes
Vehicle Tracks?: Dune and beach
Restoration Opportunities?: No

Comments:

- two salt marshes in the Petit Chockpish area; smaller marsh just north of Côte Sainte Anne and a larger salt marsh further north
- increased land clearing, private road building and residential development is evident (compare 1983 aerial photo with 2001 photo)
- Sylvain Road is a private road that leads to the south edge of the smaller salt marsh (near Côte-Sainte-Anne); houses on this road are just behind the dune (see photo)
- signs at the end of Sylvain Road say "No ATVs" and "Piper Plover Breeding Area" however there were fresh ATV tracks on beach and dunes
- house foundation (less than 100 m from the edge of the salt marsh at the end of Sylvain Road) that appears to be abandoned in mid-construction (see photo at right)
- considerable agriculture activity around the larger marsh (see 2001aerial photo); limited or no buffers between farm land and marsh creeks
- lots of shorebirds, ducks on beach and in salt marsh

1983 aerial photo of 'upper' and 'lower' Petit Chockpish salt marsh (NS Geomatics Services)

Building foundation near the edge of marsh at the end of a private road. (CCNB photo 2006)

Homes behind dune at the edge of the lower portion of Petit Chockpish salt marsh. One house visible in 1983 aerial photo and 6 houses in 2001. View looking south. (CCNB photo 2006)

2001 aerial photo of 'upper' portion of salt marsh (NS Geomatics Services)

View of 'lower' portion of Petit Chockpish salt marsh looking north (CCNB photo 2006).

2001 aerial photo of 'lower' portion of Petit Chockpish salt marsh just north of the village of Côte-Sainte-Anne (lower right of photo) (NS Geomatics Service)

8-3-2 Notre Dame

Total Size (ha): 19.9 ha (Class III)

Disturbance: Low
Roadways Present?: DOT and private road around marsh perimeter
Behind Barrier Beach?: No
Vehicle Tracks?: No
Restoration Opportunities?: No

Comments:

- flock of waterfowl

2001 aerial (NS Geomatics Services)

View of a portion of the marsh (CCNB photo 2006)

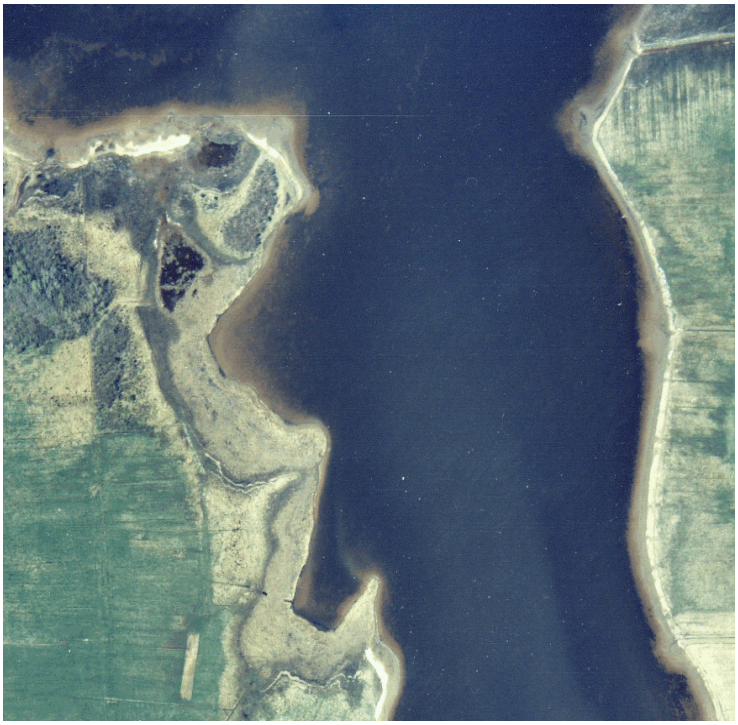
8-3-3 Rivière l'Anguille (south)
(down river from Notre Dame salt marsh)

Total Size (ha): 8.0 ha (Class IV)

Disturbance: Low
Roadways Present?: DOT and private round around marsh perimeter
Behind Barrier Beach?: partially
Vehicle Tracks?: No
Restoration Opportunities? No

Comments:

- open water areas of salt marsh are filling in; could be due to increased sediment loads in Cocagne River



1982 aerial photo of Rivière l'Anguille upper left (NS Geomatic Services)

2001 aerial of Riviere l'Anguille (NS Geomatics Services)

9-1-2 Shediac Island

Total Size (ha): 11.4 ha (Class IV)

Disturbance: Negligible
Roadways Present?: No
Behind Barrier Beach?: Yes
Vehicle Tracks?: No
Restoration Opportunities?: No

Comments:

2001 aerial (NS Geomatics Services)

9-1-1 Pointe Grande Digue

Total Size (ha): 26.2 ha (Class II)

Disturbance: moderate
Roadways Present?: DOT and private
Behind Barrier Beach?: barrier island/bar
Vehicle Tracks?: marsh
Restoration Potential?: No

Comments:

- breach in the sand spit occurred in the early 1990s; spit may disappear (O'Carroll et al 2006); until 1974 spit was one of the most heavily used sand-extraction sites in New Brunswick
- remnants of old dyke visible
- cows grazing to edge of marsh
- shorebirds, marsh hawk, gulls in marsh
- residential development encroaching around portions of the marsh; private roads extending to marsh edge (see photos below)

1982 aerial of Pointe Grand Digue (NS Geomatics Services)

2001 aerial photo (NS Geomatics Centre)

Fill dumped at the edge of the marsh. Private road (below) leading to marsh where fill dumped. (CCNB photo 2006)

Private road leading to marsh and area where fill (pictured above) was dumped (CCNB photo 2006)

9-1-3 Cap Brûlé

Total Size (ha): 13.1 ha (Class III)

Disturbance: High
Roadways Present?: DOT and private
Behind Barrier Beach?: Yes
Vehicle Tracks?: Perimeter
Previously Dyked?: No
Restoration Opportunities? No

Comments:

- marsh surrounded by housing development and portions have been filled in
- development continues to encroach on the marsh
- in 2004, portion of eastern marsh filled in for residential development; owner prosecuted and required to remove fill from a small portion of the marsh; decision pending regarding removal of remaining fill
- marsh still home to diverse bird population; black ducks, willet, Great Blue Heron, terns observed during site visit
- pasture area at the south end of marsh (near trailer park) is fenced off
- trailer park (lower left of aerial photo) has expanded over the years and now includes several small docks that lead into marsh waters

1982 aerial photo (NS Geomatics Services)

New area of marsh being filled in. (CCNB photo 2006)

2001 aerial photo (NS Geomatics Services)

9-1-4 Lac des Boudreau


2001 aerial (NS Geomatics Services)

Total Size (ha): 92.3 ha (-40 ha intertidal bay) (Class II)

Disturbance: High
Roadways Present?: DOT and private
Behind Barrier Beach?: Yes
Vehicle Tracks?: Perimeter
Previously Dyked?: No
Restoration Opportunities?: No

Comments:

- marsh habitat is disappearing; marsh is surrounded by housing development and portions have been filled in over time
- development continues to encroach on the marsh
- south-southwest area of marsh has a small trailer and cabin on the brackish portion of the marsh
- area near the marsh appears to be used as a storage/staging area for fill used by a construction company
- municipal sewage lagoons empties into salt marsh (see aerial)
- lots of water fowl

9-1-5 Petit Barachois

Total Size (ha): 34.5 (Class II)

Disturbance: High
Roadways Present: DOT and private
Behind Barrier Beach?: Yes
Vehicle Tracks?: beach and dunes
Previously Dyked? No
Restoration Opportunities?: No

Comments:

- southern portion of marsh is surrounded by housing development
- comparing aerials from 1982 and 2001, marsh habitat is shrinking
- portions of the marsh have been filled in over time
- development continues to encroach on the marsh
- East tip of marsh is cut off by D.O.T. road (Pointe Aux Bouleaux) and culvert has been added to connect each side of road; appears there is sufficient flow via culvert
- many birds observed incuding 6-7 Great Blue Herons

Eastern portion of Petit Barachois salt marsh (NS Geomatics Services)

View looking west from eastern part of Petit Barachois salt marsh (CCNB photo 2006)

9-2-1 Aboujagane River

Total Size (ha): 4.3ha (Class IV)

Disturbance: High
Roadways Present?: Private
Behind Barrier Beach?: No
Vehicle Tracks?: Beach
Previously Dyked?: No
Restoration Potential?: No

From left to right: Aboujagne River (9-2-1) salt marsh; Robichaud (9-2-2); Mouth Kouchibouguac River (9-2-4); Dupuis River (9-2-5) and large L'Aboiteau (9-2-6) salt marsh. Map created using www.planet.snb brower.

Comments:

- half the marsh filled in around 1992 for residential development
- some posts located at one corner at the edge of the marsh perhaps used to mark edge of marsh
- tidal barriers erected at south end of marsh near highly residential area
- small dock with access to residential property on salt marsh
- marsh is in the process of being subdivided into building lots and roads through centre has been installed and several ditches dug
- house lots an roads will take up 50% of existing marsh the rest is zoned "green belt"
- marsh health appear low; not much marsh grasses (Spartina alterniflora) - area covered mostly by beachgrass; what is now Spartina pectinatres was salt marsh before it was drained.

(CCNB photo 2006)

(CCNB photo 2006)

9-2-2 Robichaud

Total Size (ha): 7.3ha (Class IV)

Disturbance: high
Roadways Present?: DOT
Behind Barrier Beach?: Yes
Vehicle Tracks?: Perimeter
Previously Dyked?: No
Restoration Opportunities?: No

Comments:

- residential housing at the edge of marsh; gray house bordering the marsh, could be located within brackish portion of marsh.

(CCNB Photo 2006)

(CCNB photo 2006)

9-2-4 Mouth Kouchibouguac River

(Located near Gallant Settlement - southwest of Cape Pelé in southeastern New Brunswick

Total Size (ha): 4.9ha sm +8.4ha intertidal bay (Class IV)

Disturbance: Moderate
Roadways Present?: Private
Behind Barrier Beach?: No
Vehicle Tracks?: could not access marsh
Previously Dyked?: No
Restoration Opportunities?: No

Comments:

- cottage/residential area established since 1996 aerial photo
- area posted with dozens of no trespassing signs; difficult to access salt marsh
- appears to be some type of dyke created to permit beach access

2001 aerial photo of the Mouth of Kouchibouguac area (salt marsh enlarged below) NS Geomatic Services

Close-up of marsh area

9-2-5 Dupuis River

Total Size (ha): 57.0 ha (brackish) (Class II)

Disturbance: High
Roadways Present?: many private
Behind Barrier Beach?: Yes
Vehicle Tracks?: Beach
Previously Dyked?: No
Restoration Opportunities?: No

Comments:

- highly developed area; new homes built since 2001 aerial photo
- many private roads
- signs and roped off areas warn public to stay off the dune; no indication who put up the signs
- large variety of birds - Great Blue Heron, Common Tern, 3 Willets, 30-40 sandpipers, Greater or Lesser Yellowlegs, 3 semipalmated plovers, mallards, marsh hawk

Dupuis River salt marsh (left) is an extension of L'Aboiteau salt marsh (right). Map created using www.planet.snb browser.

(CCNB photo 2006)

(CCNB Photo 2006)

9-2-6 L'Aboiteau

2001 aerial photo of L'Aboiteau salt marsh (NS Geomatics Centre)

Total Size (ha): 57.0 (Class II)

Disturbance: High
Roadways Present?: DOT, beach road, fish plant road
Behind Barrier Beach?: Yes
Vehicle Tracks?: Beach
Previously Dyked?: No
Restoration Potential?: No

Comments:

- highly developed area includes a fish plant and several campgrounds and trailer parks
- private boardwalk, paths and private roads crisscross marsh and dune area
- road between dune and marsh at Aboiteau Parc
- several dune blow-outs onto marsh area
- in areas, farm fields mowed to edge of brackish marsh; part of marsh mowed in strips
- observed Great Blue Herons, 3 osprey, 1 marsh hawk

Farm field mowed to edge of brackish marsh and marsh mowed in strips. (CCNB photo 2006)

Private road runs across marsh and leads to footpath across dune (CCNB photo 2006)

L’Aboiteau salt marsh: Private road crosses the marsh to meet the dune. No grass growing on the dune as it is used as a walking path. (CCNB photo 2006)

L’Aboiteau salt marsh - houses at the edge of the marsh. (CCNB photo 2006)

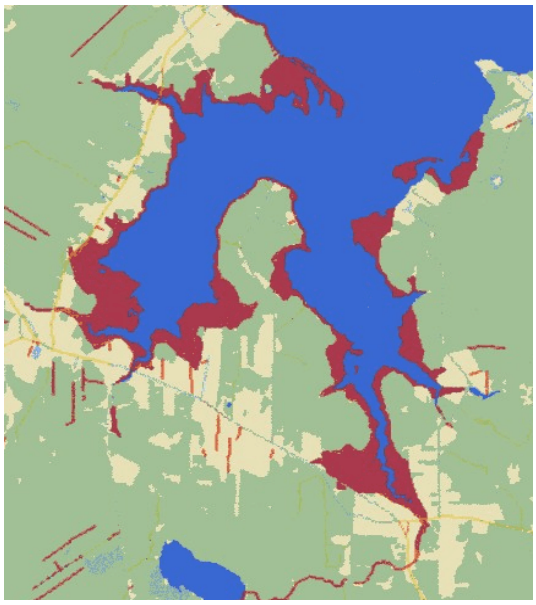
10-1-1 Little Cape

Total Size (ha): 14.2 ha (Class IV)

Disturbance: Low
Roadways Present?: DOT
Behind Barrier Beach?: partial
Vehicle Tracks?: marsh area
Previously Dyked?: No
Restoration Opportunities?: No

Comments:

- campground near marsh edge
- spotted approximately 150 ducks and juvenile bald eagle



Salt marshes around Shemogue Harbour. Counterclockwise from upper left: Little Cape (10-1-1), Shemogue (10-1-2), Comeau Point (10-1-3), Fox Creek (10-1-4), Duguay Point (10-1-5) and Shemogue Head (10-1-6). Map created using www.planet.snb browser.

2001 aerial of Little Cape salt marsh (NS Geomatics Services)

Duck blind (far field) and tracks through marsh. (CCNB photo 2006)

Campground near the marsh (CCNB photo 2006)

10-1-2 Shemogue

Total Size (ha): 49.3ha (Class II)

Disturance: low
Roadways Present?: DOT
Behind Barrier Beach?: No
Vehicle Tracks?: Perimeter
Previously Dyked?: No
Restoration Potential?: No

Comments:

- numerous unidentified shorebirds

2001 aerial photo of Shemogue salt marsh (left0 and Comeau Point salt marsh (right). (NS Geomatics Services)

View from culvert looking east. (CCNB photo 2006)

Wooden culvert in good condition (CCNB photo 2006)

10-1-3 Comeau Point

Total Size (ha): 32.6 ha (Class III)

Disturbance: Low
Roadways Present?: DOT
Behind Barrier Beach?: No
Vehicle Tracks?: no
Previously Dyked?: No
Restoration Opportunities?: No

Comments:

10-1-4 Fox Creek

Total Size (ha): 105.2 ha (Class II)

Disturbance: Low
Roadways Present?: DOT edge only
Behind Barrier Beach?: No
Vehicle Tracks?: Perimeter
Previously Dyked?: No
Restoration Opportunities:? No

Comments:

2001 aerial photo of portion of Fox Creek salt marsh (NS Geomatics Services)

CCNB photo 2006

10-1-5 Duguay Point

Total Size (ha): 20.2 ha (Class IV)

Disturbance: Low
Roadways Present?: DOT
Behind Barrier Beach?: No
Vehicle Tracks?: Perimeter
Previously Dyked?: No
Restoration Opportunities?: No

Comments:

- observed 10 + Great Blue Herons and 2 osprey

2001 aerial photo of Duguay Point salt marsh (lower left) and Shemogue Head salt marsh (centre). (NS Geomatics Services)

10-1-6 Shemogue Head

Total Size (ha): 14.5 ha (Class II)

Disturbance: Low
Roadways Present?: DOT
Behind Barrier Beach?: partial barrier
Vehicle Tracks?: Perimeter
Previously Dyked?: No
Restoration Opportunities?: No


CCNB photo 2006

Comments:

- marsh visible from DOT road
- 20-30 ducks, 5 Great Blue Heron
- 2 duck blinds
- cabin appears to built on marsh

10-2-1 Little Shemogue Harbour

Total Size (ha): 32.2 ha (Class II Salt Marsh)

Disturbance: Low
Roadways Present?: DOT
Behind Barrier Beach?: Yes
Vehicle Tracks?: Beach, salt marsh and perimeter
Previously Dyked?: No
Restoration Opportunities?: No

Comments:

- approximately100 ducks, shorebirds and 10 + Great Blue Herons
- duck blind located in marsh

Salt marshes around Little Shemogue Harbour. Counterclockwise from left: Little Shemogue Harbour (10-2-1), Johnston Point Road (10-2-2) and Grant Creek (10-2-5). Map created using www.planet.snb browser.

2001 aerial photo of Little Shemogue Harbour salt marsh (NS Geomatics Services)

10-2-2 Johnston Point Road

Total Size (ha): 20.7 (Class III)

Disturbance: Low
Roadways Present?: DOT
Behind Barrier Beach?: No
Vehicle Tracks?:
Previously Dyked?: No
Restoration Opportunities? No

Comments:

- lots of shorebirds: 10-15 Great Blue Herons, lots of gulls (possibly ring billed), black duck, osprey

2001 aerial photo of Johnston Point Road salt marsh (centre of photo) (NS Geomatics Services)

Well maintained wooden culvert (CCNB photo 2006)

View of the marsh (CCNB photo 2006)

Farm fence goes through the marsh (CCNB photo 2006)

10-2-5 Grant Creek

Total Size (ha): 37.7 (Class III)

Disturbance: Low
Roadways Present?: DOT
Behind Barrier Beach?: Yes
Vehicle Tracks?: marsh and dune
Previously Dyked?: No
Restoration Opportunities?: No

Comments:

- Numerous shorebirds, gulls, 5-6 herons
- farm fields to the edge of marsh but no disturbance on marsh
- 3 duck blinds
- nearby residential development underway but not in marsh area

2001 aerial photo (NS Geomatics Services)

Tire track within marsh and on sand dunes. (CCNB photo 2006)

10-31 Spence Cove

Total Size (ha): 49.6ha (Class III)

Disturbance: Low
Roadways Present?: DOT and private
Behind Barrier Beach?: partially
Vehicle Tracks?: yes
Previously Dyked?: Yes
Restoration Opportunities?: No

Comments:

2001 aerial photo (NS Geomatics Services)