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The Musquash Estuary Marine Protected Area Progress Report (2007-2013)

Canada

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The Musquash Estuary MPA: Seven Years in Review

The Musquash Estuary was designated as a Marine Protected Area (MPA) under federal legislation (the *Oceans Act*) in December of 2006. The process was initiated by non-government organizations and community interests in preserving one of the most natural estuaries that remain in the Bay of Fundy. This interest led to the formation of the Musquash MPA Planning Group, which included participants and supporters from the Conservation Council of New Brunswick, the Fundy North Fishermen's Association, Fisheries and Oceans Canada (DFO), the Province of New Brunswick, and residents of surrounding communities.

The Musquash Estuary was designated as an MPA in order to conserve and protect this unique estuary; one that has not been significantly impacted by human activities and development. The Musquash ecosystem encompasses a productive estuary, tidal flats and salt marsh environments that provide habitat for many species of fish, birds, invertebrates, and marine plants (Figure 1).

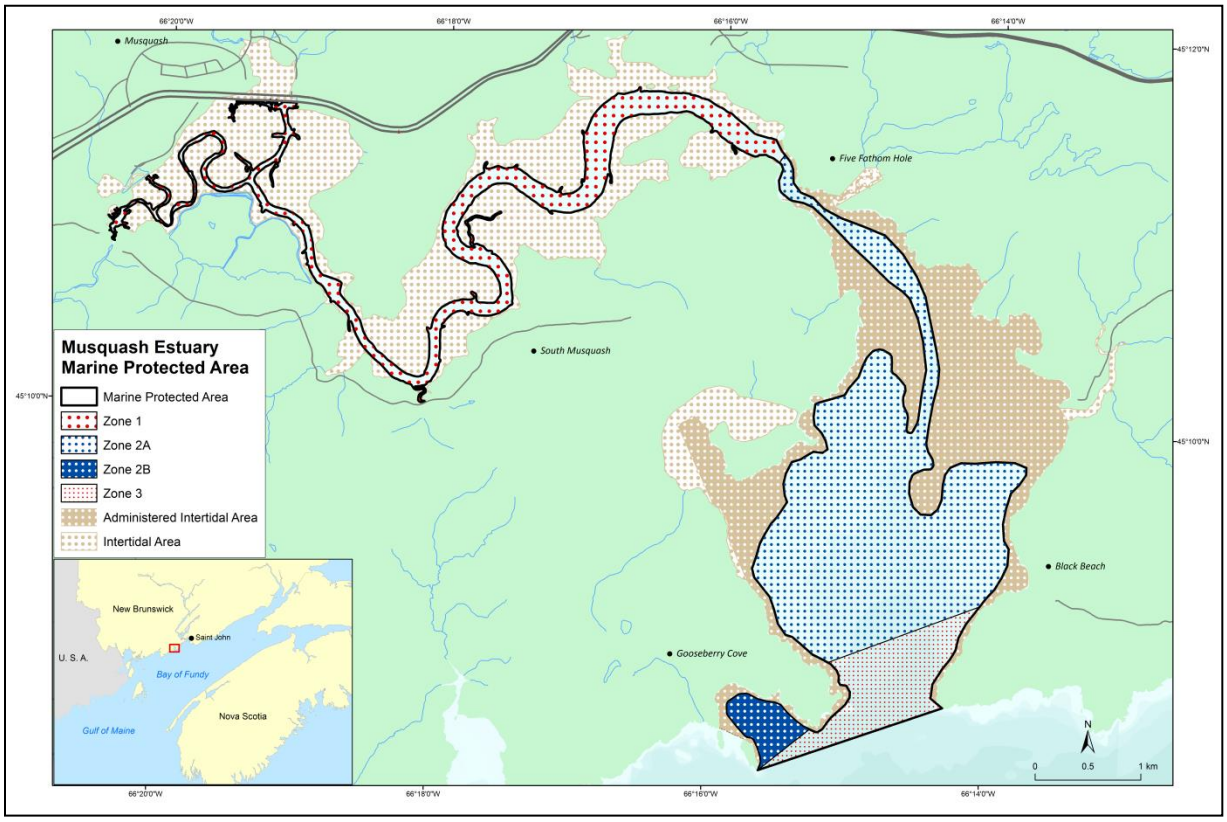

Figure 1. The Musquash Estuary MPA is located 20 km southwest of Saint John, New Brunswick and is connected to the Bay of Fundy. The MPA is divided into three zones and a DFO-Administered Intertidal Area that provide different levels of protection throughout the MPA. The zones were marked with permanent land markers so MPA users can distinguish among zones.

The MPA designation and associated Regulations under the *Oceans Act* only apply up to the low water mark in the estuary. In order to support the federal MPA and provide clear jurisdiction over activities in the area, the Government of New Brunswick transferred the administration and control of many of the submerged intertidal provincial Crown lands in the estuary to the Government of Canada through an Order in Council. The transferred intertidal lands, hereafter referred to as the Administered Intertidal Area (AIA), include the full extent of the MPA plus the intertidal area. The AIA is being managed by DFO in a manner consistent with the MPA conservation objectives. For the remainder of this report, any reference made to the MPA will include both the MPA and AIA.

The purpose of this report is to provide an update on the progress that has been made toward meeting the various objectives and priorities that were described in the Musquash Estuary Management Plan. This report highlights the exciting collaborative efforts and research activities that have occurred in the first seven years of the Musquash Estuary MPA.

The Management Plan

Following designation, the Musquash Estuary Management Plan for the Marine Protected Area and Administered Intertidal Area (DFO 2008) was developed to support the MPA Regulations and provide guidance for DFO managers, other regulators, user groups and the public on protecting and managing the estuary. The Management Plan outlines guiding principles, a series of conservation objectives, and a set of priorities and actions for MPA management from 2010-2015 (Table 1).

It provides information on regulatory measures, monitoring, enforcement and compliance, and managing human activities. It also provides the detail required to ensure that management decisions, prohibitions, and activity applications and processes are clearly understood. The conservation objectives for the MPA provide the basis for developing management priorities. Specific management actions are taken to ensure the integrity of the ecosystem is not compromised by human activities, and the MPA regulations and management strategies are providing adequate protection to the MPA.

Table 1. Principles, conservation objectives and management priorities for the MPA.

VISION
Conservation and protection of the marine ecosystem
GUIDING PRINCIPLES
• Integrated management • Ecosystem approach • Precautionary approach • Knowledge-based decision making • Collaboration and consultation • Management effectiveness • Adaptive management • Public awareness, education, and stewardship
CONSERVATION OBJECTIVES
Ensure no unacceptable reduction or human-caused modification in: • Productivity so that each component (primary, population, community) can play its role in the functioning of the ecosystem by maintaining abundance and health of harvested species; • Biodiversity by maintaining the diversity of individual species, populations, and communities within the different ecotypes; • Habitat in order to safeguard the physical and chemical properties of the ecosystem by maintaining water and sediment quality.
MANAGEMENT PRIORITIES (2010-2015)
• Inform federal and provincial regulators of their roles and responsibilities in management of the MPA • Inform estuary users of the allowed and prohibited activities in the MPA • Develop and implement an activity plan application form submission and evaluation process for the MPA • Develop and implement a monitoring plan for the MPA • Develop a review process to evaluate the effectiveness of the management plan in 2015
KEY MANAGEMENT ACTIONS
• Roles and responsibilities • Activity plans submission and evaluation process • Enforcement and compliance • Management plan review • Public awareness, education, and stewardship • Management agreements for adjacent lands and coastal waters • Monitoring and research

Working with Stakeholders

Management of the Musquash Estuary MPA is also guided by the advice of the Musquash Advisory Committee (MAC), which was established in 2002 during the MPA establishment process. The MAC includes active, engaged representatives from key stakeholder groups (regulators, academia, environmental non-government organizations, and industry) and First Nations. MAC meetings are held twice a year and provide opportunities for stakeholders to receive and provide updates of activities, share information, and to give input for decision-making.

Protecting the Estuary Environment: Surveillance and Compliance

General prohibitions within the *Musquash Estuary Marine Protected Area Regulations* (2006) state that no person shall:

> *(a) disturb, damage or destroy, or remove from the Area, any living marine organism or any part of its habitat; or*
>
> *(b) carry out any activity – including depositing, discharging or dumping any substance or causing any substance to be deposited, discharged or dumped – that is likely to result in the disturbance, damage, destruction or removal of a living marine organism or any part of its habitat.*

As described in the Management Plan, the MPA is divided into distinct management zones that provide the foundation for managing human activities in the MPA. Some activities that are allowed to occur within the MPA include:

- Aboriginal and recreational fishing,
- Commercial fishing for scallops (Zone 3), lobster, herring, and manual dulse harvesting,
- Activities carried out for national security, safety, law enforcement, and emergency response, and
- Research, monitoring, archeological, educational, commercial tourism, and restoration activities approved by DFO through an application process (Appendix A) under the Regulations.

Enforcement and compliance promotion initiatives are carried out to ensure that activities in the area are consistent with MPA conservation objectives and regulations. Compliance promotion activities are carried out by DFO with support from stakeholders including members of the MAC. Awareness-raising activities are coordinated with existing programs for the MPA, such as educational and stewardship initiatives, described later in this report.

DFO Conservation and Protection officers play the main role in enforcement in the MPA, conducting shellfish closure patrols, road patrols, and foot, air, and ATV patrols. There is also a community-based compliance monitoring effort called Musquash Watch. By distributing information materials and contact information, this initiative encourages MPA users and local residents to report any activities that may be potential violations.

Transport Canada conducts pollution surveillance for the Musquash Estuary MPA via the

National Aerial Surveillance Program (NASP). The MPA is considered in the flight plan for surveillance flights in the area and MPA managers receive these surveillance reports. The Canadian Coast Guard publishes an annual Notice to Mariners which contains information on the Regulations for the MPA, and guidance on vessel traffic in the MPA (Canadian Coast Guard 2013).

Advancing our Understanding of the Estuary Ecosystem

The Musquash Estuary has been an area of research interest for many years (Singh et al. 2000). Within the Bay of Fundy, researchers have highlighted the importance of Musquash given both its healthy condition and its common characteristics to similar systems in the region. Scientific research and monitoring activities will continue to play a critical role in the management of the MPA. Research increases the understanding of important physical, chemical, and complex biological processes in the estuary ecosystem. Monitoring these processes provides managers with accurate and timely information on the state of the ecosystem as well as potential threats. Research activities also contribute toward achieving the research and monitoring objectives that were outlined as key management actions in the Management Plan. Research and monitoring activities in the MPA are conducted by researchers from universities, government agencies, industry, and non-government organizations, and provide opportunities for collaboration and cooperation between these various groups.

Research falls under the category of activities that requires approval before they are allowed to be conducted in the MPA. Appendix A outlines the research and other activities approved for the period 2007-2013. Publications that have resulted from research in the Musquash Estuary are listed in the References and Publications section. Selected research activities that have taken place in the Musquash MPA are described below.

Oceanographic Data Collection

Researchers at St. Andrews Biological Station have monitored the oceanographic conditions to determine water currents, trajectories of water, and the movement of organic particles within the MPA (DFO 2009). Researchers at the Bedford Institute of Oceanography collected opportunistic sediment samples within the MPA and analysed them to determine an approximate sedimentation rate within the estuary of 0.4 cm per year (DFO 2013a).

Biodiversity Research

Researchers at the St. Andrews Biological Station and the University of New Brunswick have been working to establish baseline biodiversity levels for the MPA by sampling and recording species in the intertidal zone and near shore areas. Bottom sampling has also been conducted to determine benthic biodiversity levels within the estuary. It is estimated that there are approximately 200 benthic dwelling species in the estuary (Cooper et al. 2014).

Fish Research

Researchers at the University of New Brunswick have conducted several fish studies in the

MPA. These include efforts to determine fish biodiversity in near shore areas and measuring the movements of tomcod within the MPA. These studies contribute to the development of baseline data for fish species within the MPA, which can be used in comparison to fish assemblages in the future. The data collected were also used to compare the Musquash Estuary with other estuaries in the Bay of Fundy. In terms of fish species diversity and abundance, the Musquash Estuary was not found to have a significantly different composition as compared to other estuaries in the Bay of Fundy (DFO 2013b).

Researcher holding a juvenile tomcod

Photograph taken by David Methven

Bird Research

Several bird surveys, both opportunistic and scientific, have been conducted within the Musquash Estuary. The Maritimes Marsh Monitoring Program started a pilot program conducting standardized monitoring at 17 locations within the MPA in 2011 using auditory and visual survey methods (DFO 2013a).

Some of the bird species that can be found in the MPA include the Semipalmated Sandpiper (*Ereunetes pusillus*), the Black Guillemot (*Cepphus grille*), Pied-billed Grebe (*Pinicola enucleator leucura*) and the Common Loon (*Gavia immer*) (Singh and Buzeta 2005).

Habitat Characterization

Researchers have made efforts to describe the type and condition of the various habitats within the Estuary. For example, researchers at St. Andrews Biological Station have initiated the development of an “ecotype map” for the estuary, providing a visualization and estimated spatial coverage of the different habitats in the area. The project uses LiDAR data, high resolution mapping information that was collected in the region in 2006 and 2007 (Greenlaw et al. 2014). Regarding environmental quality efforts, DFO collected and analyzed sediment samples from several locations within the outer estuary in 2012. This was done to determine the levels of trace metals, which could occur as a result of activities outside the estuary, such as in the watershed. At the time of sampling, the preliminary findings indicate no elevated levels within the estuary.

How is the Musquash Ecosystem Doing? Developing Long-Term Ecosystem Indicators and Monitoring

Monitoring a range of indicators and threats is necessary to ensure the MPA is meeting its stated conservation objectives. Work on developing an ecological framework began prior to MPA designation (e.g., Rangeley and Singh 2000, Singh and Buzeta 2005, 2007). In 2011, a proposed monitoring framework was developed for the Musquash MPA. This included 15 indicators, aligned with each of the conservation objectives under the three main ecosystem categories of productivity, habitat, and biodiversity (Cooper et al. 2011). Subsequent Canadian Science Advisory Secretariat meetings were held to review the monitoring framework and the available data and data sources that could be used as measures for the monitoring indicators (DFO 2013a, b, c, d).

Research and monitoring activities have, and continue to be, undertaken in the Musquash Estuary to improve understanding of ecosystem structure and function. In 2013 a meeting was held to review a summary of current and potential monitoring and research activities for the Musquash Estuary. Discussion focused on the assessment of whether collected data provided an adequate baseline for on-going monitoring of the MPA and whether the indicators proposed in the monitoring framework are likely to be effective in assessing ecosystem change in light of the new baseline data collected. Data collected from research and monitoring activities pertaining to benthic biodiversity, physical oceanography, sediment dynamics and trace metals, fish community assemblages, and bird population surveys were reviewed in the context of providing baseline values within the MPA ecosystem. A monitoring plan will be released in 2015, based on the advice received during these meetings. A systematic monitoring program within the MPA ecosystem will be implemented once the monitoring plan is completed. Long-term monitoring will be needed to adequately assess whether the MPA's conservation objectives are being met.

How is the Management Team Doing?

In 2013 a complete review of Musquash MPA management activities between 2007 and 2012 was conducted, resulting in a report called the Management Review of the Musquash Estuary Marine Protected Area (OCMD 2015). While the monitoring plan is currently being developed to monitor the ecological components of the MPA, the management review focused on the evaluation of social and governance aspects of MPA management. A framework for evaluating MPA management effectiveness was developed, containing 50 indicators that collectively addressed 1) stakeholder interactions; 2) education, stewardship and outreach efforts; 3) research, monitoring, and other permitted activities; 4) management planning; 5) human and financial resource capacity; and 6) surveillance and enforcement. While the framework was designed primarily as an internal, staff-led assessment exercise, a questionnaire was also developed to allow members of the MAC to evaluate a subset of the indicators. This evaluation helped to identify the strengths and weaknesses of Musquash Estuary MPA management, and served to highlight priority issues that should be addressed to improve management performance. For example, the MPA scored high marks for education and outreach activities, and research, monitoring, and other permitted activities. However, the report also called for

improvements on surveillance, enforcement and compliance, stakeholder interactions, and planning. These findings are being used to guide work planning for the site.

Special Issues for the Musquash Estuary MPA

Several management challenges involve potential threats from outside the MPA boundary that may have impacts on the ecology within the MPA. These include aquaculture in adjacent areas, on-land contamination sources, and garbage and marine debris.

A finfish aquaculture operation was proposed at the mouth of Little Musquash Cove, an area approximately 2 kilometres to the west of the MPA. DFO Science conducted a review of the oceanographic connection between the proposed aquaculture site and the MPA to provide guidance on potential movement of organic waste from the site into the MPA (DFO 2009). The aquaculture site did not proceed in the area and this file is now considered closed.

Potential on-land contamination sources, such as from the Coleson Cove Thermal Generating Station solid waste landfill, continue to be an issue of concern. DFO has incorporated a survey of contaminant concentrations within bottom sediment and the water column into its MPA monitoring framework to address this issue (DFO 2013c).

An ongoing concern for the MAC is the recurring use of Black Beach as an illegal dump. This results in garbage entering the MPA and could cause negative impacts. There is also an issue at Gooseberry Cove where marine debris is continually washing up on the shore. DFO is working with the Conservation Council of New Brunswick to ensure debris is collected from Black Beach and Gooseberry Cove. The Fundy BayKeeper group conducts regular surveys of Black Beach and Gooseberry Cove and provides detailed reports on what they collect in each of the locations (Fundy Baykeeper 2009, 2010, 2011, 2012). “No Dumping” signs were installed at Black Beach, but dumping continues to be a problem at the site. DFO will continue to work with the relevant stakeholders, including the Government of New Brunswick and New Brunswick Power, to resolve this issue.

Another unique management challenge occurred when a pleasure craft caught fire, burned and sank while anchored off Black Beach within the MPA on October 10th, 2011. Due to potential negative environmental effects, the vessel was removed from the MPA as soon as possible. The salvage operations included the refloating of the vessel, the beaching of the vessel at Black Beach to allow for work on making it watertight, and towing it out of the MPA. Given the nature of the incident, the Canadian Coast Guard Environmental Response Unit monitored the salvage operation to ensure that the necessary precautions were taken to avoid any oil spill from the vessel. The MPA has been flagged as a priority for the Canadian Coast Guard, Fisheries and Oceans Canada, and the Atlantic Emergency Response Team (ALERT) for any future incidents that may occur in the MPA that require environmental response.

Expanding Protection in the Watershed

A complementary mosaic of terrestrial and marine conservation actions have emerged in the past decade in the Musquash area. Recognizing the importance of the Musquash watershed,

the Nature Conservancy of Canada (NCC) started work to protect the lands surrounding the Musquash River and Estuary in 2001[1]. The NCC has successfully protected over 4000 acres of land covering 84% of the coastline surrounding the Musquash Estuary through land purchases and donations (Figure 2). As well, Ducks Unlimited Canada has a wetland restoration area and the Province of New Brunswick's Protected Natural Area protects the Musquash watershed. This additional land protection can help reduce potential impacts of land-based activities on the estuary.

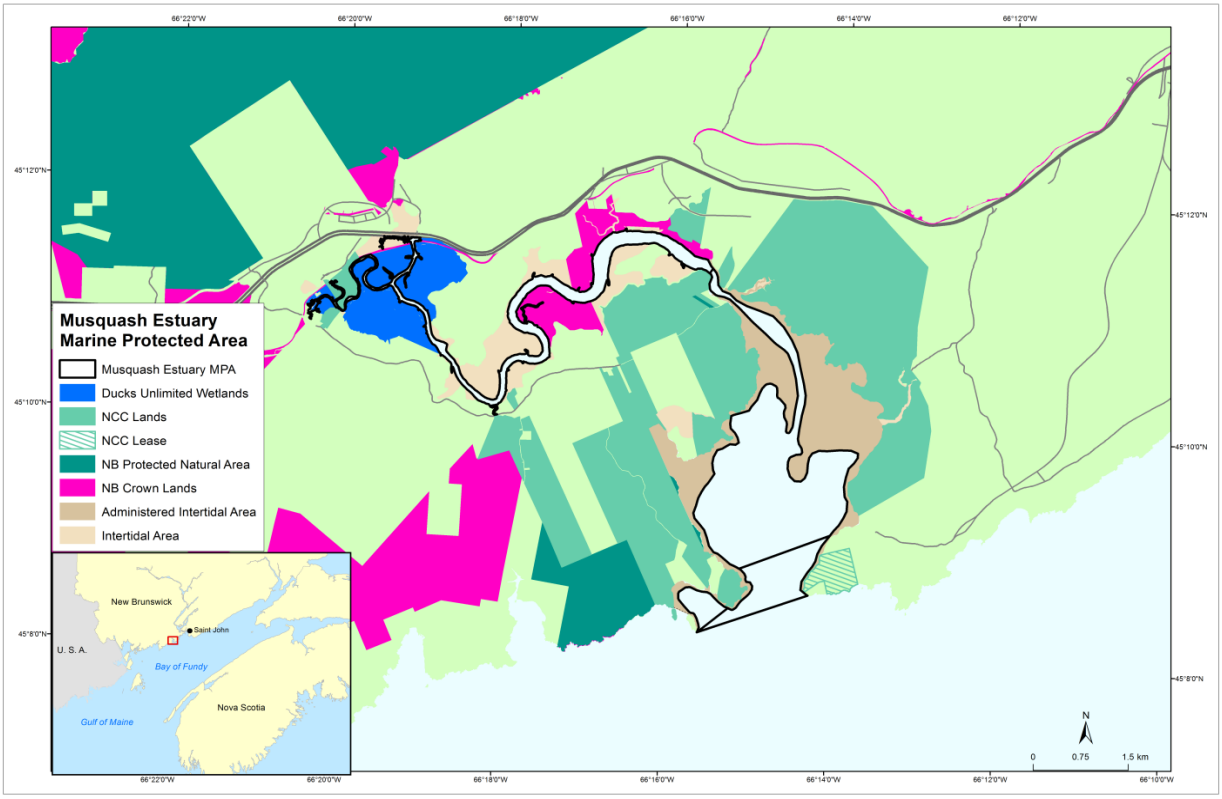

Figure 2. Complementary conservation efforts around the Musquash Estuary MPA (based on data from Ducks Unlimited Canada 2014, GeoNB 2014 and Nature Conservancy of Canada)

Community Involvement and Partnerships

Given the proximity to coastal communities, management and public awareness efforts with local residents play an important part in the protection of the MPA. As the designation process was initiated by several community interests, the community is still a very important component of the MPA, seven years after its establishment. Friends of Musquash Inc. is a group that was

[1] http://www.natureconservancy.ca/en/where-we-work/new-brunswick/featured-projects/musquash_estuary.html#.Ukr6A4arTQc

formed by community members so they could actively participate in MPA management, including education, communication and community research monitoring programs. One way that community members can participate in MPA compliance monitoring is through the Musquash Watch initiative described earlier.

There are several examples of innovative community participation. In August 2013, painter Aleta Karstad spent 10 days in the Musquash Estuary painting several scenes. Community members provided her with a workspace and the trip was arranged by the NCC. She completed several paintings of the estuary. As well, an oral history project was completed, involving interviews with several life-long residents in the Musquash area. This provided an opportunity to gather previously undocumented information on the past uses of the estuary and the rich history of the area.

Every year since 1998, the Conservation Council of New Brunswick has hosted the Musquash Paddle. The paddle is an opportunity for community members and visitors to experience the Musquash Estuary from a kayak or canoe and have a guide that is extremely knowledgeable of the estuary. In 2007 the first summer after the Musquash Estuary was designated as an MPA, paddle participation was the largest to date with approximately 250 participants. Every year the paddle is well attended and community members can learn about the MPA and the estuary ecosystem while experiencing its natural beauty.

Photo by: Maxine Westhead

Bringing the Estuary to the Public

Public awareness and education are critical factors in ensuring the long term success of an MPA, especially in the Musquash Estuary MPA which has coastal access. Compliance with MPA regulations is higher when community members, MPA users, and the general public are aware of objectives and management strategies of an MPA. Education and outreach tools are most effective when they target appropriate user groups, stakeholders and the public, present a straightforward message, and use the most appropriate product to communicate the message. Several partners have been involved in educational and outreach activities including DFO, MAC, the Conservation Counsel of New Brunswick, NCC, Environment Canada and the Government of New Brunswick. The following outreach products have been developed:

- The Management Plan
- A brochure describing the MPA
- A brochure called “Discover Musquash” that describes the MPA and recreational activities that residents and visitors are able to undertake in the MPA

- An awareness brochure describing some of the hazards within the MPA (e.g. navigation hazards)
- Magnets featuring the MPA and contact information to find out more about the MPA and report concerns
- A banner for use at public events
- A website

There have also been several initiatives to inform people of the MPA and raise awareness while they are participating in activities within and around the area. Some of these include:

- Permanent markers on land to delineate the zones
- Buoys that mark the location of navigation hazards that cannot be seen at high tide
- Field signs describing the ecology of the MPA posted at different access points
- A sign that is visible from the Trans-Canada highway

Photos by: Jessica Corkum (Highway sign), DFO (Buoys), Dave Thompson (Zone marker), Rabindra Singh (Field signs)

The Musquash Estuary has also been highlighted at several events including the Bedford Institute of Oceanography Open House which occurs every 5 years and brings in over 10,000 visitors. Public events such as World Oceans Day activities in St. Andrews and on the Halifax Waterfront have also highlighted Musquash. There have also been several presentations given to grade school and university students by DFO staff, Fundy Baykeeper and others that highlight the MPA. The annual Musquash Paddle has proven to be a great educational opportunity and participants are provided with information about the MPA before the start of the event.

A Look Ahead: Continuing to Protect the Estuary

The Musquash Estuary MPA continues to be a model for coastal MPA management. The efforts in managing the estuary have demonstrated how the principles of integrated management and collaboration can be realized within and around an MPA. The Musquash Estuary MPA has helped to form relationships among community members, local environmental non-governmental organizations, stakeholders, government, and industry through the MAC. DFO will continue to work with the MAC on addressing management challenges and public outreach and education for the MPA. The 10th anniversary of designation will be in 2016 and a celebration will be planned in collaboration with the MAC.

With the release of the Musquash Estuary ecosystem monitoring plan, a suite of ecological indicators will be monitored, and reported against to provide a means of prioritizing management activities. These will aim to highlight the benefits of the MPA, and to provide early warning signals of issues within the estuary. The Management Plan for the Musquash Estuary MPA will also be updated in 2015 and will contain ongoing and new management priorities to be addressed. Management actions will be monitored, evaluated, and communicated, as they have been here, in future progress reports.

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Appendix A: Approved Musquash Estuary MPA and AIA activities from 2007 to 2013

The Musquash MPA Regulations stipulate that anyone proposing to conduct scientific research and monitoring, educational activities, archaeological studies, commercial tourism, or habitat restoration projects within the MPA must submit a detailed activity application for Ministerial consideration and approval.

Proposed activity plans are reviewed by DFO and the MAC to assess environmental impacts of the individual activity along with cumulative effect of all activities in the MPA. The requirement of the submission of an activity plan for certain activities is an important regulatory mechanism used to limit human impacts in MPAs before they occur.

The table below contains information on the activities that were approved within the Musquash Estuary MPA from 2007 to 2013.

Study / activity name	Organization	Purpose	Date(s)
Annual paddle	Conservation Council of NB	To provide interested members of the public an opportunity to view the Musquash MPA, and learn about its ecology. To collect basic data to support monitoring of the MPA.	2007-2013
Kayak tour	Seascape Kayak Tours Inc.	Educating participants about the natural history of the Musquash Estuary.	2007-2008
Ecological monitoring activities	St. Andrews Biological Station (DFO)	To gather physical and biological oceanographic data from within the MPA that will inform the monitoring program and help enable an assessment of water exchange between the MPA and the adjacent Bay of Fundy.	2008-2010
Canadian Shellfish Sanitation Program water monitoring	Eastern Charlotte Waterways, Inc.	Sampling water to measure the levels of fecal coliforms to determine if conditions are appropriate for shellfish harvesting.	2008
Intertidal survey	University of New Brunswick Saint John (UNBSJ)	To conduct research of near shore biodiversity of the MPA by examining intertidal invertebrate and plant communities.	2009
Fish sampling	UNBSJ	To conduct research on biodiversity in the MPA by studying near shore fish assemblages.	2009
Fish tagging	UNBSJ	To determine if tomcod are moving into and out of the Musquash MPA.	2011
Tour for members of the Gulf of Maine Council	NB Dept. of Environment	Boat tour of Musquash MPA to familiarize Gulf of Maine Council delegates with the Musquash MPA.	2011

Study / activity name	Organization	Purpose	Date(s)
Vessel salvage	All-Sea Atlantic	Removal of a vessel that had caught fire and sunk within the MPA.	2011
Environment Canada - Atlantic Ecosystems Initiative	Eastern Charlotte Waterways, Inc.	Sampling water to measure salinity, total nitrogen and phosphorous, chlorophyll a, dissolved oxygen, and water clarity to aid in monitoring eutrophication in the estuary.	2013
Documentary filming	One Planet	Filming a documentary on the Bay of Fundy that will highlight the Musquash MPA.	2013