Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences

**Canadian Science Advisory Secretariat (CSAS)**

**Proceedings Series 2013/018**

**Maritimes Region**

# Proceedings of the Regional Peer Review of the Musquash Estuary Marine Protected Area (MPA) Monitoring Data: Part 1 – Data Review

**January 29, 2013**
**St. Andrews, New Brunswick**

**Edward Kennedy, Chairperson**

**Lottie Bennett, Editor**

Bedford Institute of Oceanography
Fisheries and Oceans Canada
1 Challenger Drive, PO Box 1006
Dartmouth, Nova Scotia B2Y 4A2

October 2013

Canada

## Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

**Published by:**

Fisheries and Oceans Canada
Canadian Science Advisory Secretariat
200 Kent Street
Ottawa ON K1A 0E6

http://www.dfo-mpo.gc.ca/csas-sccs/
csas-sccs@dfo-mpo.gc.ca

© Her Majesty the Queen in Right of Canada, 2013
ISSN 1701-1280

**Correct citation for this publication:**

DFO. 2013. Proceedings of the Regional Peer Review of the Musquash Estuary Marine Protected Area (MPA) Monitoring Data: Part 1 – Data Review; January 29, 2013. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2013/018.

## TABLE OF CONTENTS

## SUMMARY

Part I of a Maritimes Regional Peer Review of the Musquash Estuary Marine Protected Area (MPA) monitoring data, which focused on a data review, was held on January 29, 2013, at the St. Andrews Biological Station, in St. Andrews, New Brunswick. Participants reviewed and discussed the sampling methodologies, data collection, and data analyses used for determining ecological baseline values for the MPA. Participation in this meeting included representatives of Fisheries and Oceans Canada (DFO), Conservation Council of NB (CCNB), University of New Brunswick (Saint John), and the Huntsman Marine Science Centre. The results of this meeting will be used in Part II of the Peer Review in June 2013 to assess whether the monitoring activities in the MPA have provided an adequate ecological baseline upon which to base future monitoring activities and whether the indicators are likely to be effective in assessing ecosystem change.

**Compte rendu de la réunion d'examen par les pairs des données de surveillance de la zone de protection marine (ZPM) de l'estuaire Musquash : Partie 1 – Examen des données : 29 janvier 2013**

## SOMMAIRE

La partie 1 de l'examen régional par les pairs de la région des Maritimes des données de surveillance de la zone de protection marine (ZPM) de l'estuaire Musquash, qui se voulait un examen des données, a eu lieu le 29 janvier 2013 à la station biologique de St. Andrews, à St. Andrews (Nouveau-Brunswick). Les participants ont examiné à fond les méthodes d'échantillonnage, la collecte des données et les analyses de données utilisées pour déterminer les valeurs écologiques de référence pour la ZPM. Les participants à cette réunion comprenaient des représentants de Pêches et Océans Canada (MPO), du Conseil de la conservation du Nouveau-Brunswick (CCNB), de l'Université du Nouveau-Brunswick (Saint John) et du Centre des sciences de la mer Huntsman. Les résultats de cette réunion seront utilisés dans la Partie 2 de l'examen par les pairs qui aura lieu en juin 2013 afin d'évaluer si les activités de surveillance dans la ZPM ont fourni des valeurs écologiques de référence adéquates sur lesquelles peuvent se baser les activités de surveillance futures et si les indicateurs sont susceptibles d'être efficaces pour évaluer les changements écosystémiques.

## INTRODUCTION

The Chair of the meeting, E. Kennedy, welcomed everyone and thanked them for coming. Participants introduced themselves (Appendix 1). Next, the Terms of Reference for the meeting were reviewed (Appendix 2), followed by the Agenda (Appendix 3) which was agreed to and finalised.

T. Floyd, the DFO Center for Science Advise (CSA) representative gave an overview of the science peer-review and advisory meeting process.

## ASSESSMENT

### INTRODUCTION

Presentation: Summary of Musquash Estuary MPA Monitoring Framework and Science Advisory Report (SAR)
Presenter: E. Kennedy
Rapporteur: T. Floyd

### PRESENTATION HIGHLIGHTS

An overview of the Maritimes Science Branch's commitments under the Health of the Oceans Program was presented as it relates to the development of the scientifically-defensible indicators, strategies, and protocols for monitoring the conservation objectives of the Musquash MPA. The conservation objectives of the MPA were reviewed followed by a brief summary of the Science Advisory Report (SAR) for the Musquash MPA Monitoring Framework. The SAR noted that an improved understanding of the ecosystem is essential to establish meaningful ecological baseline values. The SAR also proposed 15 ecological indicators for monitoring the MPA, along with strategies and protocols, but noted a lack of baseline data for these indicators. As baseline information improves, some of the indicators, protocols, and/or strategies may be refined, added, or deleted from the monitoring plan.

Discussion:

Participants identified the need to consider how activities for the Musquash MPA will be integrated within the larger umbrella of a network of MPAs and the associated monitoring requirements. The monitoring activities for individual MPAs need to be complementary to those monitoring activities for MPA networks. It also was recognized that monitoring multiple MPAs can be a significant workload issue that needs to be considered in future work planning.

### Review of Preliminary Results of Data Collected

### Benthic Biodiversity

Presenter: A. Cooper
Rapporteur: T. Floyd

Over the past three years, activities have been focused on establishing a scientifically-defensible baseline for benthic fauna in the MPA, specifically species diversity and abundance in three habitat types. Sampling has focused on benthic macrofauna given their role as the

base of the food chain, diversity of trophic roles, and their contribution to habitat stabilization. Establishing ecological baseline values requires consideration of natural variability and uncertainty in sampling; thus multiple measurements over a range of temporal and spatial scale are necessary.

The sampling design used was described which resulted in 146 benthic sampling grabs being collected over 3 habitat types in the lower estuary, which represented approximately 55% of the total number of grabs in the initial sampling design. The cost to carry out a sampling mission was approximately $10K which included sampling collection, processing, taxonomic identification, and sediment analyses, but not vessel costs, facilities, or data analyses and interpretation.

Following analyses on the three years of data, it was suggested that current sampling efforts are sufficient to establish baselines for species richness, species diversity within the different strata, and dominant taxa. Furthermore, analysis of correlation with other biological, physical, and chemical parameters would help in understanding the function of the benthic ecosystem components. In addition, further consideration is required on how to integrate other data sets into the data analyses.

Discussion:

There was a discussion on what amount of sampling would be sufficient to reduce uncertainty to provide statistically relevant results and whether the completion of all 9 planned sampling missions with 270 benthic grabs would have been sufficient. It was clarified that 170 samples would likely have been sufficient for statistical purposes, and in this study 146 benthic grabs were taken over 5 sampling missions.

It was recognized that given the early stages of this sampling effort, the emphasis is not actually on monitoring, rather characterizing benthic components of the estuary. Given that, there are still many knowledge gaps such as accurate estimates of biomass of specific species, fine scale resolution of habitat patchiness, etc. It was suggested that multibeam could be explored as a tool to help in mapping habitat patchiness. It also was suggested that grain size analysis could be further explored to look at sediment quality and the associated impact on species abundance and diversity.

It was recognized that full characterization of the benthic system was not practical to achieve given the available resources; thus monitoring effort in the future should be focused on indicators that represent the ‘high value’ ecosystem components for which baselines are available and are related to the MPA conservation objectives.

There was a discussion on the diversity indices that are being used. The indices that were presented are quite sensitive to sampling errors, but alternate ‘relatedness’ indices are much less sensitive. These indices require taxonomic information for the species, but once this is established the relatedness indices are very useful and robust. Thus, using relatedness indices make sense with respect to an ongoing monitoring program. There is temporal and spatial variability in benthic diversity and the resource implications of maintaining extensive monitoring programs need to be considered and balanced against establishing meaningful and cost effective proxies for monitoring.

Also, a lot of research is occurring related to establishing benthic indices at a trophic level and then combining that information for the community. Once the taxonomic structure is established

you may be able to set up a much simpler sampling protocol that will indicate trophic changes at a community level. It was suggested that this would be a good discussion for Part II of this Peer Review.

Discussions also focused on the need to do full sampling on an annual basis to maintain this baseline. It was suggested that once you have established the seasonality relationships and patterns then you can pick one season to sample (i.e., summer) in a reduced monitoring program. There was recognition that the program was not quite at the point where you can detect seasonality changes yet.

Obviously such level of sampling and monitoring cannot occur for all MPAs, particularly future ones. It likely is not required to understand in detail the structure and functioning of every aspect of the MPAs' ecosystems. Instead, there is a need to understand just enough to be confident that the monitoring programs developed, which will be cost effective, signal changes related to the conservation objectives as well as the factors that are driving the changes.

## Freshwater Monitoring and Oceanography

Presenter: B. Chang
Rapporteur: T. Floyd

Freshwater monitoring of the Musquash River was undertaken over the past three years. Both branches of the river were monitored at various water depths. The results were compared to the Lepreau station discharge and were found to be less than a 5% difference. The intent of the study is to determine the relationship of freshwater influence on the oceanography of the MPA due to river discharge. The dam operation complicates data collection especially during high flow conditions.

In addition to freshwater monitoring, other physical data have been collected for Musquash in recent years. For example, CTD transects were completed for the estuary, and during the annual canoe paddle of the estuary, temperature and salinity measurements were recorded. Some lower trophic level data have been collected in the estuary, but it was noted that phytoplankton data have not been collected in the MPA since 1999.

Effort also has been directed to understanding the water circulation in the Bay of Fundy immediately outside the Musquash MPA. This work was completed a number of years ago to assess potential impacts of a proposed fish farm near the mouth of the estuary. A 3d finite element model was used to model the circulation in the area.

Discussion:

Discussion on the freshwater aspects noted that freshwater discharge into the estuary isn't managed as much as other dams in the area, and that the water supply for the city impacts the lakes above the dams. As a characterization exercise that will assist with monitoring, the intent of the study was to understand the extremes of the freshwater input into the system. The goal would be to model an extreme freshwater event (such as in the spring with snow melt), and then compare it to discharge at Lepreau as a surrogate. The Lepreau discharge is continuously monitored, thus it may be possible to use the Lepreau freshwater data as an indicator of the freshwater discharge in the Musquash system. Over time there may be more frequent freshets, thus it will be important to understand if such freshwater discharges cause an ecosystem shift.

A more concerted effort is required to integrate the data that is being collected in the Musquash system, and this requires a coordinated effort to ensure data collection for the various indicators is occurring at comparable temporal and spatial scales. For example, oceanographic information hasn't been taken during the same time period as the benthic monitoring, thus it is difficult to make linkages between biological shifts and oceanographic variables. Modelling of the system (e.g., hydrodynamic and sediment transport) would be a useful tool for impact assessments. Understanding the range of natural variability may allow for the impacts of significant environmental effects to show up in changes in biodiversity.

## Sediment Analysis

Presenter: B. Law
Rapporteur: T. Floyd

Over recent years, opportunistic sampling enabled analyses on sediment grain size in the estuary. Sampling has ranged from cores, which enables understanding of sediment deposition over time and various metal and contaminant loads, to surface layer flocs, which enables understanding of the bioavailability of particulate organic matter and associated metals and contaminants. These sampling efforts and sediment analyses are useful for determining anthropogenic influence to the system as evidenced in the sediment.

The techniques used in the sediment analyses were presented, including the use of cesium to date sediments and sedimentation rates (which for the estuary is approximately 0.5 cm/year), and lithium normalisation.

Preliminary sediment analyses to detect levels of Vanadium (resulting from the Colson Cove leakage in Spring 2012) showed no significant difference in the sediments analysed.

From the data available, it is possible to determine sedimentation rates for the MPA. However, surficial grain size is lacking for some areas of the estuary which is required to improve estimates of bottom stress for specific benthic habitats in the estuary. Coupled hydrodynamics-sediment transport models would be required for more comprehensive modeling of the physical drivers of the ecosystem.

Discussion:

Participants discussed the relative stability of the benthic sediments in the estuary. Significant wave action can move things around but usually they would go back to the usual state over time. Sandy areas can turn into mud areas but usually this is due to large inputs of mud. Basically sedimentation rates over time don't change significantly without a significant input of new material.

## Juvenile Fish

Presenter: D. Methven
Rapporteur: T. Floyd

The study presented was noted to be a work in progress from a student at UNB Saint John. The objective of the study is to characterize near-shore fish assemblages in the Musquash estuary and to compare them with fish assemblages in adjacent estuaries. Sampling in the near shore in three areas (Five Fathom Hole, Black Beach and Heprin Basin) indicated that the Atlantic Silverside was the dominant species in all areas. There was good seasonal coverage (1 year) for Five Fathom Hole and Black Beach, and about six months of sampling in Heprim Basin. The sampling methods using both a standardized beach seine and Fyke nets were described. For the beach seine, the catches were made up of 18-24 species, with 5-8 species making up about 90-95 % of the catch. The fish assemblages were similar among the three sites, and catches generally were low in winter and increased in spring and summer. Species richness was low in winter (2 species on average) and higher in summer (5-6 species). For the Fyke net, catches were made up of approximately 9 species which were dominated by larger fish (e.g., smelt, tomcod, Pollock). Sites were fairly similar with respect to abundance, fish assemblages, and species richness.

Pelagic fish represented the major difference among the three sites, and there appeared to be seasonality differences for fish assemblage. The comparison of the fish assemblages with neighboring estuaries did not reveal any significant differences.

Overall, there were about 20 common species with 10 species representing the bulk of the biomass. Most species were small, pelagic, schooling, and highly mobile. Furthermore, most of the fish that were caught were juveniles, as indicated by size modes, and were expected to move gradually into deeper water. The differences among sampling sites were largely due to different proportions of common species, the variability appeared to be more at a temporal scale than a spatial scale.

Discussion:

There was a discussion on the migration patterns associated with these fish and it was suggested that most of the fish captured were endemic species using the near shore environment as protection from larger fish. There were a lot of juveniles present that would be expected to move to the offshore as they grow. The bulk of the dominant species formed schools and although it would be expected to have significant day to day variation, the catches tended to have a high percentage of recaptures. The presenter felt that the results were a good representation of fish assemblages, but additional sampling (i.e., tows per sampling trip) would improve the robustness of the data.

## OTHER MONITORING DATA

### Marine Debris and Illegal Dumping

Presenter: M. Abbott
Rapporteur: T. Floyd

The presenter described community activities focused on the Musquash estuary, specifically 3 to 5 beach / shore clean-ups per year which are required to combat debris and illegal dumping

in the area. The debris clean-up predominately removes food debris, plastic bottles, and other common litter (including floating debris) in accessible areas around the estuary (e.g., Black Beach, Gooseberry Cove). Illegal dumping clean-up is mostly focused on general waste, construction debris, and remnants from copper wire vandals.

Discussion:

This information represents pressures to the system and an important part of the framework is to get data related to the pressures. There is a need to consider how the information on pressures relates to the baseline ecological monitoring. Although these clean-up activities provides a macroanalysis of debris accumulation, eventually this material will breakdown and result in potential impacts to fish populations due to microplastics.

## STRATEGIES TO ADDRESS MONITORING DATA GAPS

Discussion:

One of the gaps that appear to be missing from the meeting presentations is data on macroalgae. There has been some past work completed on marcroalgae in the estuary, but it hasn't been updated for at least a decade. D Methven holds some information on macroalgae and there is a sampling protocol established for inter and subtidal species. However, an ecological baseline has not been established in order to assess changes.

Some additional monitoring protocols for effective and efficient data collection (for macroalgae and potentially other indicators) are the use of aerial photography and remote sensing (at fine scale resolution). There are researchers in the area (e.g., Jack Derhun) that have completed aerial transects for the area.

It was evident from the presentations and subsequent discussions at the meeting that there is reliable data on fish assemblages, benthic diversity, sediment characteristics and physical oceanography for the Musquash MPA. There also is commercial and recreational fishing data but currently reporting is not at a scale that is useful to monitoring. However, primary productivity, turbidity, and freshwater inputs information remains lacking.

There was a discussion on the types of related benthic species assemblages one would expect to see in ecosystems that are impacted by the pressures being observed in Musquash. Indicators should relate to the pressures that are expected in the area. Consideration needs to be given to understanding the ecological consequences of changes in indicator values, as well as an understanding of the magnitude (i.e., threshold) of change that should elicit a management response.

It was suggested to select a couple of indicators that would serve as proxies for "a healthy Musquash Estuary" which are based on the best available scientific information. However, it was stressed that it is still important to have a solid understanding of how the ecosystem functions and knowledge of which components management actions can influence. Detecting a change in the ecosystem does not necessarily mean there are management actions that can be taken to prevent or mitigate that change.

It also would be worthwhile to identify and evaluate those events that would result in significant changes to biodiversity in the Musquash Estuary, and what would need to be completed from a

monitoring perspective to detect these changes. For example, since there are baselines for contaminants, fish diversity, and benthic biodiversity, continued monitoring using similar protocols discussed in the presentations should be able to detect significant changes. Another approach already discussed is aerial photography to detect larger scale ecosystem changes to, for example, macroalgae communities.

Overall it was suggested that the monitoring program for Musquash focus on a few high risk pressures and monitor environmental indicators that would detect ecosystem impacts caused by such pressures.

## REVIEW OF PROPOSED DATA MANAGEMENT PRACTICES

### Data Management Issues and Recommendations

Presenter: P. Clement
Rapporteur: T. Floyd

Presentation Highlights:

There are two types of data that require consideration from a data management perspective: source data and data products. This is not unique to the Musquash MPA, but common for all MPAs. There is a regional MPA Data Management Framework that is in development, which will describe the commonalities, consistencies, and data management needs across MPAs in the region. The goal of the framework is to support the collection, analysis, archiving and accessing of data.

Moving forward, it is important to consider whether the benthos and fish data require a separate database, or whether the data can be incorporated within existing managed databases. Also, the integration of the biological data with other data sources (e.g., physical data) needs to be considered for scientific interpretation as well as database management. Another major consideration is how to incorporate partner monitoring data (i.e., DFO, UNB, CCNB, etc.) within a common platform and ensure equal access. Finally, the data management framework needs to be flexible to incorporate other data types and sampling methods, such as multibeam data, remote sensing data, lower trophic level data, and aerial photography.

Discussion:

The challenge we have at the moment is making the step from relational databases to analyses through a more geospatial database. The original need that was articulated was for the region to do a better job on the processes we have on making an approved set of products available. There seems to be a need to broaden our current set of products to include things that relate to other areas of the mandate beyond stock assessment. There are also two types of products: departmentally approved products that have been peer reviewed versus other products that may not have had the level of departmental scrutiny we would need to make them public. For MPA monitoring, there needs to be particular protocols for the data collection that needs to be tracked through some sort of database recognition/reference. A part of the protocols for collecting data specific to an indicator should include steps to ensure it is appropriately managed. Given staff turnover, it is especially critical for MPA data that may be collected sporadically (e.g., every 5 to 10 years) to have clear protocols for how data was used and how it is being managed.

Data discovery models are good for species distribution modelling but the Ocean Tracking Network (OTN) is probably more appropriate for oceanographic data given its evolved tracking module and two tier data management approach related to identifying data that is being used and conforming it to the OTN standards.

It is critical to ensure that all data collected for an MPA has metadata provided so that it can be tracked and managed, rather than lost. One complication is that the Musquash Estuary MPA regulations do not require data sharing for scientific activities occurring in the MPA, however proponents of scientific activities are requested to share data with Oceans Program staff.

## GIS ISSUES RECOMMENDATIONS

Discussion:

There were discussions with respect to the way in which geospatial data is managed in DFO. New spatially explicit data collected for MPAs should be integrated or accessible for other projects (e.g., physiographic classification) that would benefit from such data. The MPA Data Management Framework may address some of these challenges as it will house the various layers separately in a project folder. However, the capacity to maintain such a data management effort will be a challenge .

## SUMMARY AND NEXT STEPS

### Benthic Sampling

- Although benthic sampling is costly, current efforts appear to be sufficient to determine baseline values for species richness, diversity indices and dominant taxa. Caution is warranted in drawing conclusion on other ecological components due to under-sampling.
- Multibeam was seen as a tool that could be explored to help identify species and habitat patchiness.
- More focused sampling may be required on the ecosystem components that are of higher management concern or that are the most pertinent to addressing the conservation objectives.
- There was a suggestion to analyse the sampling data using relatedness indices.
- Also, a lot of research is occurring related to establishing benthic indices at a trophic level and then combining that information for the community. Once the taxonomic structure is established you may be able to set up a much simpler sampling protocol that will indicate trophic changes at a community level. It was suggested that this would be a good discussion for Part II of this assessment.
- It was suggested that once you have established the seasonality relationships and patterns then you can pick one season to sample (i.e., summer) in a reduced monitoring program.

### Freshwater Monitoring and Oceanography

- In the context of characterising the ecosystem to assist in interpreting future monitoring data, it is necessary to understand the extremes of the freshwater input into the system as it represents a major driver for ecosystem change. It would be ideal to have an extreme freshwater event modelled, and then compare to discharge at Lepreau as a surrogate. Over time there may be more frequent freshets and it will be important to understand if this causes an ecosystem shift.

## Sediment Analysis

- Existing metals inventory (no elevated levels) can be used as a baseline for future monitoring.
- Sedimentation rates have been estimated to be approximately 0.5 cm/year.
- In order to estimate bottom stress, additional surficial grain size samples are required.
- Accurate characterisation of the sources of sediment particles to the estuary (e.g., river input) is lacking.
- Coupled hydrodynamics- sediment transport models are needed for broad spectrum modeling.

## Juvenile Fish

- The results presented were a good representation of fish assemblages but additional tows per sampling trip would enhance the quality of the data.
- Approximately 20 species were common in the field collection with 10 species representing the bulk of the biomass, and there was more temporal than spatial variability.
- Most species were small, pelagic, schooling, and highly mobile, and a significant proportion of these were juveniles, as indicated by size modes, which were expected to gradually move into deeper water. The dominant species mostly were pelagics species (juvenile planktivores).
- Musquash estuary wasn't significantly different from either of the other estuarine sites in the context of species diversity and abundance. The sampling data collected for the estuary sites appear to show a diversity gradient as you move up into the Bay of Fundy.

## Marine Debris and Illegal Dumping

- There have not been significant changes to the amount or type of debris that has been accumulating in the estuary; Gooseberry Cove harbors mostly floating debris whereas Black Beach contains both floating and land-based debris.
- This information represented a type of pressure on the ecosystem. It was recognised that data relating to the pressures must be considered when determining the ecological monitoring baselines for the estuary.

## Other Monitoring

- There has been some work completed on marcroalgae but it hasn't been updated for a decade. D Methven (UNB Saint John) has some information on macroalgae for the estuary and there is a sampling protocol for inter and subtidal species. A baseline has not been established in order to assess changes. Standard transects through existing macrophytic communities and aerial photography could be used for more generalized monitoring.
- Aerial photography and remote sensing at a fine scale resolution should be further explored. Some work has been completed by Jack Derhun and he has several years of aerial transects up and down the coastline, which includes the Musquash estuary.
- It was suggested that the sampling activities to date have provided adequate data on fish assemblages, benthic diversity, sediment characteristics, and physical oceanography for the estuary. There are also commercial and recreational fishing data, but currently reporting is not at a scale that is useful to monitoring.
- Data on primary productivity, turbidity and freshwater inputs are not yet sufficient to provide baselines for the estuary.

- It was suggested that the monitoring program for Musquash focus on a few high risk pressures and monitor environmental indicators that would detect ecosystem impacts caused by such pressures.

## Review of Proposed Data Management Practices

- For MPA monitoring activities it is critical for protocols to be in place for data collection, including metadata records and linkages to appropriate databases.
- Given staff turnover, it is especially critical for MPA data that may be collected sporadically (e.g., every 5 to 10 years) to have clear protocols for how data was used and how it is being managed.

# APPENDIX 1. LIST OF PARTICIPANTS

## Review of the Musquash Estuary Marine Protected Area (MPA) Monitoring Data

29 January 2012

Hachey Conference Centre
St. Andrews, New Brunswick

ATTENDEES

| **Participant** | **Affiliation** |
|---|---|
| Abbott, Matthew | Conservation Council of NB (CCNB) |
| Blanchard, Marc | DFO Maritimes / Coastal Ecosystem Science |
| Chang, Blythe | DFO Maritimes / Coastal Ecosystem Science |
| Clement, Pierre | DFO Maritimes / Coastal Ecosystem Science |
| Cooper, Andrew | DFO Maritimes / Coastal Ecosystem Science |
| Doherty, Penny | DFO Maritimes / Oceans |
| Floyd, Trevor | DFO Maritimes / Centre for Science Advice |
| Gaudet, Odette | DFO Maritimes / C&P |
| Kennedy, Eddy | DFO Maritimes / Coastal Ecosystem Science |
| Law, Brent | DFO Maritimes / Coastal Ecosystem Science |
| Lawton, Peter | DFO Maritimes / Coastal Ecosystem Science |
| Methven, David | UNB Saint John / Biology |
| Pohle, Gerhard | Huntsman Marine Science Centre |

# APPENDIX 2. TERMS OF REFERENCE

## Review of the Musquash Estuary Marine Protected Area (MPA) Monitoring Data

## Regional Peer Review – Maritimes Region

**Part 1 – Data Review: January 2013 (St. Andrews, NB)**
**Part 2 – Assessment: March / April 2013 (St. Andrews, NB)**

Co-Chairs: Eddy Kennedy and Tana Worcester

### Context

The Musquash Estuary in southwest New Brunswick is unique in the region due to its size, expansive salt marshes, and relatively undisturbed natural condition. It is the largest ecologically-intact estuary in the Bay of Fundy. It exhibits a diverse number of habitat types and related biological communities. On December 14, 2006, the lands and waters in the Musquash Estuary, up to the ordinary water level at low tide, were designated a Marine Protected Area (MPA) through regulations made pursuant to Canada's *Oceans Act.* Certain intertidal areas adjacent to the MPA are also administered and protected by Fisheries and Oceans Canada (DFO) (i.e. Administered Intertidal Area or AIA). Although the MPA is regulated via the *Oceans Act* and the AIA is regulated via the *Fisheries Act*, the intent is to monitor and manage both areas holistically as an MPA. For the remainder of the document, any reference to the Musquash Estuary MPA will imply both the MPA and AIA.

In support of the Health of the Oceans Initiative (HOTO), DFO Science Branch is required to deliver scientifically defensible indicators, protocols, and strategies for monitoring MPAs that have been designated pursuant to the *Oceans Act*. To meet this requirements, DFO Science Branch developed an Ecosystem Monitoring Framework to address the conservation objectives for the Musquash Estuary MPA, consisting of a suite of fifteen indicators and advice on how to implement a cost-effective monitoring program that incorporates existing monitoring programs, protocols and strategies to the extent possible (DFO 2011). A Maritimes Region Science Advisory Process was conducted in December 2010 to review this framework. It was acknowledged that there was a lack of baseline data for many aspects of the Musquash Estuary ecosystem, thus, the proposed indicators were general rather than specific, with a range of monitoring strategies and protocols proposed as a first step to evaluating the indicators in tandem with improving baseline knowledge.

The proposed Regional Peer Review meetings would provide an opportunity to present and discuss relevant data that has been collected to establish a baseline for some of the indicators proposed within the Musquash Estuary MPA Ecosystem Monitoring Framework. These meetings will also provide an opportunity to discuss the proposed monitoring indicators, protocols and strategies (including data management considerations) to determine if changes are required to meet on-going MPA monitoring needs. The invitee list for the first meeting will focus on individuals or organizations that have been collecting monitoring data while the invitee list for the second meetings will focus on a broader audience.

## Objectives

Part 1 – Data Review

- To review preliminary results of the analyses of relevant data that have been collected to establish a baseline for the ecological indicators identified in the Musquash Estuary MPA Ecosystem Monitoring Framework. Specific questions to be addressed are:
    - What data have been collected, and how do they contribute to establishing adequate baselines for the Musquash MPA?
    - What were the collection methodologies used (strategies and protocols)?
    - Based on lessons learned, what changes should be made to these collection methods in the future?
    - How should the data be analyzed (including any preliminary results)?
    - How could different data sets best be integrated and reported as indicators of ecosystem change?
- To discuss possible strategies to address indicators (data gaps) that have not been, but still should be, included for effective monitoring of the Musquash Estuary MPA.
- To review proposed data management practices [and work flows] for historical and on-going data collection and analyses related to the Musquash Estuary MPA.

Part 2 – Assessment

- To review final results of the analyses of relevant data that have been collected to establish a baseline for the ecological indicators identified in the Musquash Estuary MPA Ecosystem Monitoring Framework. Specific questions to be addressed are:
    - Does the data collected to date provide an adequate baseline for on-going monitoring of the Musquash Estuary MPA?
    - Are the indicators monitored/presented to date likely to be effective in assessing ecosystem change?
- To provide recommendations on any changes to be made to the indicators, strategies, and protocols proposed in the 2010 Musquash Estuary MPA Ecosystem Monitoring Framework.
- To report on progress made on the data management practices [and work flow] for historical and on-going data collection and analyses related to the Musquash Estuary MPA.

## Expected Publications

- Proceedings
- Research Documents
- SAR (Assessment meeting only)

### Participation

- DFO Science Branch
- DFO Ecosystem Management Branch
- DFO Fisheries and Aquaculture Management Branch
- Environment Canada
- Academia
- Non-Government Organizations
- Fishing Industry
- Province of New Brunswick
- Aboriginal communities / organizations

### Reference

DFO. 2011. Musquash Estuary: A Proposed Monitoring Framework for the Marine Protected Area and Intertidal Area Administered by Fisheries and Oceans Canada. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/040.

## APPENDIX 3. AGENDA

**Review of Existing Data, Protocols, and Procedures for the Musquash Estuary MPA Ecosystem Monitoring Plan: Part 1 – Data Review**
**Regional Peer Review – Maritimes Region**

29 January 2013
Hachey Conference Centre
St. Andrew's Biological Station, St. Andrews, NB

Chair: Eddy Kennedy

29 January 2013 – Tuesday

8:30- 8:45 Introduction (E. Kennedy)

8:45- 9:00 Summary of Musquash Estuary MPA Monitoring Framework and Science Advisory Report (E. Kennedy)

9:00-10:15 TOR 1 Review of preliminary results of data collected

- Benthic biodiversity (A. Cooper)
- Oceanography (F. Page or alternate)

10:15–10:30 Break

10:30-12:00 TOR 1 Review of preliminary results of data collected

- Plankton (J. Martin or alternate)
- Bird surveys (EC_CWS)
- Juvenile Fish (UNB_D. Methven or alternate)
- Sediment grain size (B. Law)
- Other monitoring data
- General discussion and summary of main findings for TOR 1.

12:00-13:15 Lunch (not provided)

13:15-14:30 TOR 2 Strategies to address monitoring data gaps, if any

- General discussion in the context of whether the current suite of indicators provides complete and effective ecological monitoring that can assess whether the conservation objectives for the Musquash MPA are being met.

14:30-14:45 Break

14:45-15:45 TOR 3 Review of proposed data management practices

- Data management issues and recommendations (P. Clement)
- GIS issues recommendations (M. Greenlaw)

15:45-17:00 Summary and Next Steps