REPLACEMENT CLASS SCREENING REPORT

WATER COLUMN OYSTER AQUACULTURE IN NEW BRUNSWICK





Transport Canada Transports Canada

Canada

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LIST OF ACRONYMS

ACOA	*Atlantic Canada Opportunities Agency*
AC CDC	*Atlantic Canada Conservation Data Center*
AMP	*Adaptive Management Process*
BMF	*Bay Management Framework*
BMP	*Best Management Practices*
CEAA	*Canadian Environmental Assessment Act*
CFIA	*Canadian Food Inspection Agency*
COSEWIC	*Committee on the Status of Endangered Wildlife in Canada*
CSPR	*Class Screening Project Report*
CSSP	*Canadian Shellfish Sanitation Program*
CWS	*Canadian Wildlife Services*
DFO	*Fisheries and Oceans Canada*
DO	*Dissolved oxygen*
EC	*Environment Canada*
ECC	*Environmental and Socio-Economic Components of Concern*
FA	*Federal Authorities*
GIS	*Geographic Information System*
GPS	*Global Positioning System*
INAC	*Indian and Northern Affairs Canada*
ITC	*Introductions and Transfer Committee*
MCFR	*Management of Contaminated Fisheries Regulations.*
MSCR	*Model Class Screening Report*
NBDAA	*N.B. Department of Agriculture and Aquaculture*
MOU	*Memorandum of Understanding*
NWPA	*Navigable Waters Protection Act*
NWPP	*Navigable Waters Protection Program*
PCA	*Parks Canada Agency*
RA	*Responsible Authority*
RCS	*Replacement Class Screening*
RCSR	*Replacement Class Screening Report*
SARA	*Species at Risk Act*
TSS	*Total Suspended Solids*
TC	*Transport Canada*
the Agency	*Canadian Environmental Assessment Agency*
the Registry	*Canadian Environmental Assessment Registry*
VEC	*Valued Environmental and Socio-Economic Components*

Measurements:

micron (µm)	*micrometer: unit for measuring length, equal to one one-millionth of a meter*
pico (p)	*unit for measuring length, equal to one one-trillionth of a meter*

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NOTE: In order to simplify the text the use of the term oyster always refers to the indigenous species of oyster: *Crassostrea virginica*. The text makes reference to cultured species vs. wild species to distinguish between oysters in aquaculture systems and oysters growing under natural conditions with the understanding that the cultured oysters are indigenous to New Brunswick.

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1. INTRODUCTION

The *Navigable Waters Protection Act* (NWPA) is a Federal statute designed to protect the public right of navigation in the waters of Canada. Any work built or placed in any navigable waterway in Canada requires an authorization. The NWPA is administered by the Navigable Waters Protection Program (NWPP) of Transport Canada (TC). A "work" under NWPA includes a structure that may interfere with navigation. For aquaculture, a work would include cages for fish, suspended lines for shellfish, or any other aquaculture structure attached to the bottom or in the water column. By federal regulation, aquaculture works are authorized for a given period of time. The *Canadian Environmental Assessment Act* (the Act) requires that certain NWPA authorizations undergo an environmental assessment (EA). TC is responsible for conducting the federal EA process in accordance with the Act for works that require an authorization under NWPA.

The culture of oysters in New Brunswick has been carried out since allocation of leases began in the late 1800's [1]. Both bottom and off-bottom culture techniques were used throughout the history of the N.B. industry, however since the 1980's, culture techniques have gradually been shifting from bottom to suspended culture. Bottom culture techniques require a longer growing period resulting in a higher risk of losses to diseases and a higher exposure to predators. Water column culture techniques offer better prospects for maintaining commercially viable operations.

Water column oyster aquaculture projects in N.B. have similar design, construction, operation and decommissioning characteristics. They also have similar planning and permitting process requirements as well as a predictable and mitigable range of potential environmental effects. Given this context, TC, in collaboration with Fisheries and Oceans Canada (DFO) initiated the preparation of this class screening in order to establish a more consistent and streamlined federal EA process for water column oyster aquaculture works on leases managed by the N.B. Department of Agriculture and Aquaculture (NBDAA).

1.1. BACKGROUND

This Replacement Class Screening Report (RCSR) follows recommendations made to federal agencies by the Office of the Commissioner for Aquaculture Development to explore and develop class screenings, within the provisions of the Act, as a means to bring a greater measure of predictability, consistency and timeliness to the environmental review process [2]. The concept of a coordinated approach to EA was also recommended by the Senate committee on Fisheries and Aquaculture to ensure that the review of aquaculture projects be built around a comprehensive procedure covering environmental review and management, site selection, design criteria and operating conditions [3].

There was also a demand regionally for a process to streamline the aquaculture review process. Numerous oyster lease applications were submitted for an EA review and most of these projects were very similar in nature and, therefore, comments from government

reviewers were often repetitive. As well, reviewers felt the project by project evaluation was not adequately capturing the potential cumulative environmental effects in the bays where the aquaculture leases were being proposed.

In 2003, DFO and NBDAA, through the Canada/N.B. Memorandum of Understanding (MOU) on aquaculture, began a planning exercise to streamline the site review process for water column oyster aquaculture. The Bay Management Framework (BMF) for oyster culture was developed and presently consists of four components:

- Bay management planning exercise
- EA class screening report
- Adaptive management process
- Code of practice

Bay Management Planning Exercise

Although Atlantic Canada has vast coastlines, the environment, in particular, is an important limiting factor. Some of the difficulties in establishing viable aquaculture operations include limitations on the number of sites with suitable depth, temperature, salinity or protection from adverse elements. Decisions on siting are important because they directly relate to the types and the magnitude of the possible impacts of aquaculture operations on the ecosystem.

During this bay management planning exercise, sites in eastern N.B. where water column oyster aquaculture could operate in a sustainable manner were reviewed by federal and provincial authorities. The use of GIS allowed the identification of Valued Ecosystem Components (VECs) as well as potential user conflicts. Ecological reviews of the bays and layers of information, such as locations of bird colonies, avian species at risk, migrating and staging areas for waterfowl, fish habitat, wetlands, dunes, salt marshes, etc. were presented on maps. Possible use scenarios in conjunction with various management options were evaluated. This approach combined a number of GIS databases with current knowledge on user impacts to create an analytical tool to guide towards sustainable development. Zones were subsequently defined where shellfish leases could be best located to protect the environment, to reduce conflict with other users and to meet regulatory requirements.

The bay management planning exercise is described in more detail in Section 5. The detailed maps are included in Appendix 3.

EA Class Screening Report

Rather than completing an EA for each project, the Act allows for the EA of some repetitive projects to be streamlined through the use of a class screening report. This kind of report is built on and uses the knowledge of a given *type* of project accumulated through past EAs. The class screening report identifies measures that are known to reduce or eliminate the likelihood of these adverse environmental effects for a type or “class” of project. TC, NBDAA and DFO felt the EA class screening process, which is discussed in more detail in Section 1.2, could streamline the review

of water column oyster aquaculture projects and improve the consistency of mitigation measures.

Adaptive Management Process

Operating under the Canada-New Brunswick MOU for Aquaculture, the New Brunswick Shellfish Aquaculture Environmental Coordination Committee (NBSAECC) is implementing an Adaptive Management Process (AMP) to ensure the sustainable development of the shellfish aquaculture sector. Yearly, the committee reviews the data resulting from field surveys and research conducted by federal and provincial agencies. This committee tracks the continuously evolving scientific and technical knowledge related to the activities of this sector and recommends changes in shellfish aquaculture management practices. The AMP will continue to provide continuous feedback as to the effectiveness of the BMF in regards to sustained aquaculture development, based on sound environmental planning and management.

Code of Practice

The BMF supports the development and use of an industry code of practice as an invaluable document for improving the sustainable development of oyster culture in eastern N.B. The N.B. Professional Shellfish Growers Association developed and adopted a Code of Practice in 2005. A Code of Practice provides technical advice and guidance on courses of action to achieve or exceed husbandry and production standards required of the industry. It serves to reinforce responsible aquaculture practices. Although the Code of Practice is a voluntary instrument, it complements the numerous regulatory mechanisms in place and defines practical steps to achieve greater environmental stewardship within the industry.

1.2. CLASS SCREENING AND THE CANADIAN ENVIRONMENTAL ASSESSMENT ACT

The Act and its regulations set out the legislative basis for federal EAs. The legislation ensures that the environmental effects of projects involving the federal government are carefully considered early in project planning. The Act applies to projects that require a Federal Authority (FA) to make a decision or take an action, whether as a proponent, land administrator, source of funding or regulator (issuance of an authorisation). The FA then becomes a Responsible Authority (RA) and is required to ensure that an EA is conducted for a project prior to making its decision or taking action.

Most projects are assessed under a screening type of assessment. A screening systematically documents the likelihood of significant adverse environmental effects of a project or activity, and determines the need to modify the project plan or recommend further mitigation to eliminate or minimize the significance of these effects.

The screening of some repetitive projects may be streamlined through the use of a class screening report. A replacement class screening consists of a single report that defines a well understood

class of projects and describes the associated environmental effects, design standards and mitigation measures for projects assessed within this class. It includes a conclusion of significance of environmental effects for all projects assessed by the replacement class screening. The Agency may declare such a report appropriate for use as a class screening after taking into account comments received during a period of public consultation. Once the Agency declares a RCSR, no further EA or decision regarding the significance of the environmental effects are required for projects within the class, provided that design standards and mitigation measures described in the report are implemented. Upon declaration, the RCSR is in effect for five (5) years.

This RCSR streamlines the determination of effects of water column oyster aquaculture, addresses all of the potential impacts and improves consistency in applying acceptable management and mitigation measures for that undertaking. The RCSR works together with the management plans developed for each bay to ensure the potential interactive and cumulative effects of all past, present or planned projects in a particular bay are examined.

It is important to note that the declaration of the RCSR by the Agency does not eliminate other federal, provincial, or municipal regulatory requirements for the project. In particular, public notification processes required under the NWPA and the provincial *Aquaculture Act* will continue on a case-by-case basis. As well, the declaration of the RCSR by the Agency has no bearing on the proponent's responsibility to meet the relevant federal and provincial legislation and municipal by-laws related to the project. Mitigation measures and BMPs defined under the RCSR are provided to the proponent through a one-window approach managed by the RA.

1.3. RATIONALE FOR REPLACEMENT CLASS SCREENING

Section 19 (1) of the Act states that the Agency "may declare a report to be a class screening report if projects of the class described in the report are not likely, in the opinion of the Agency, to cause significant effects when the design standards and mitigation measures described in the class screening report are applied." Section 19 (2) (a) further states that a class screening report may be used as "a replacement for the screening required by section 18, and the decision required by section 20, for projects of the class".

The applicability of the RCSR to the projects is based upon the following six criteria:

1.3.1. Well-defined Class of Projects:

NBDAA defines suspended culture as a form of aquaculture conducted in the water column or at the surface, where the structures are anchored but float or move with the tides. Off-bottom culture is defined as a form of aquaculture conducted in the water column, with the rearing structure either directly placed on the substrate or raised off the substrate. In these latter cases, the structures are fixed in place but do not move with the tides. This

RCSR covers these two categories of techniques, commonly referred to as water column oyster culture. It does not include bottom culture, which is conducted directly on or in the substrate of an aquaculture site

This RCSR will cover water column oyster aquaculture works. This "class" of aquaculture projects is common in eastern N.B. They share similar design, construction, operation and decommissioning characteristics, as well as similar planning and permitting requirements. This RCSR consolidates the knowledge of this class from the many individual EAs that have been completed in the past.

1.3.2. Well-understood Environmental Setting:

Many individual EAs have been completed on types of project proposals considered to be part of this class. These numerous reviews have contributed to the understanding of conditions suitable to water column oyster aquaculture in N.B.

As part of the planning process under the BMF, ecological overviews were prepared for each bay by reviewing scientific literature related to these ecosystems. The ecological overview information was then taken into account in the bay management plans to reduce potential impact of activities on sensitive habitats. Maps with Traditional Ecological Knowledge about the location of nearshore resources were used to complement the scientific information.

1.3.3. Unlikely to Cause Significant Adverse Environmental Effects:

Review of completed and ongoing projects in the class shows that the potential for significant adverse effect of projects in this class can be mitigated. As well, current published information provided by scientists on the impact of shellfish aquaculture shows that potential significant adverse effects can be mitigated.

The RCSR utilizes the ecological overviews prepared for each bay as part of the bay management planning exercise to understand spatio-temporal interaction of water column oyster aquaculture and the environment, and identifies mitigation measures to be required of each project subject to this class.

1.3.4. No Project-Specific Follow-up Measures Required

No project-specific follow-up measures are required for projects in this class. To ensure mitigation measures are effective, results from the Adaptive Management Process designed to assess the overall effectiveness of the BMF will be utilized, as needed, to update this RCSR.

1.3.5. Effective and Efficient Planning and Decision-Making Process

This RCSR is one component of the BMF. It complements the bay management plans. By avoiding sensitive habitats and incorporating effective mitigation strategies directly into the design, early in the

planning stage, the RCSR avoids the likelihood of significant adverse environmental effects.

1.3.6. Public Concerns Unlikely:

Two pilot-projects were conducted in Richibucto and Tabusintac bays and extensive public consultations were conducted with stakeholders to compile and analyse issues related to shellfish culture. Concerns raised by the public, groups or agencies were used to make adjustments to the bay management plans. Whenever possible, potential sources of conflict between the industry and other users were identified and avoided during the planning process. In addition, input from a number of earlier individual provincial and federal consultation processes was used to define the VECs in this RCSR. It is, therefore, reasonable to expect that projects covered by this RCSR are not likely to result in public concerns.

As the class of projects meets the necessary criteria, the RCSR is deemed to be applicable.

1.4. CEAA CONSULTATION PROCESS FOR THE RCSR

Consultation for the development of the RCSR was conducted both formally and informally through meetings, telephone conversations, letters and facsimiles. A number of formal consultations for the zones considered suitable for water column oyster aquaculture were carried out between federal and provincial agencies for each of the bays listed in the Appendix.

The regulatory authorities consulted to prepare this RCSR include:

- Fisheries and Oceans Canada;
- Environment Canada;
- Canadian Wildlife Service;
- Canadian Food Inspection Agency;
- Transport Canada;
- Parks Canada;
- Indian and Northern Affairs Canada;
- Atlantic Canada Opportunities Agency;
- Public Works and Government Services Canada;
- The N.B. Department of Agriculture and Aquaculture
- The N.B. Department of Environment;
- The N.B. Department of Natural Resources
- The N.B. Department of Wellness, Culture and Sport

The Union of N.B. Indians, North Shore Mi'kmaq District Council, Saint John River Valley Tribal Council and MAWIW Council Incorporated, altogether representing fifteen First Nations, were contacted by way of a letter explaining the RCSR project. Each Council was also contacted by telephone to ensure that the letter was received for their review. The draft document was made available for review and comments were considered and incorporated into the final document.

In addition to the groups consulted during the pilot phase, stakeholder groups, resource organizations or individuals consulted include:

- The N.B. Professional Shellfish Growers Association;
- The Maritimes Fishermen Union;

The draft RCSR was reviewed and discussed prior to submission of a final draft to the Agency. Following submission of the final draft, the Agency conducted a 30-day public consultation on the RCSR. All comments received were taken into consideration and incorporated into the final RCSR, as appropriate, prior to its declaration by the Agency.

1.5. NWPA AND PROVINCIAL CONSULTATION PROCESSES

In addition to the RCSR process, consultation still occurs on a project-by-project basis, both federally and provincially. The proponent of these works must still carry out advertising associated with the NWPA process by giving notice of the works in two different local newspapers and the Canada Gazette. Under the *N.B. Aquaculture Act* and *General Regulation - Aquaculture Act*, NBDAA cannot issue an aquaculture lease or occupation permit or grant an application to alter the boundaries of a lease unless public notice of the application has been given by the applicant in accordance with the regulations. The applicant is required to publish a notice of the proposed work in two local newspapers associated with the given area. NBDAA also notifies adjacent property owners within 100 m of the proposed aquaculture site.

1.6. CANADIAN ENVIRONMENTAL ASSESSMENT REGISTRY

The purpose of the Canadian Environmental Assessment Registry (the Registry) is to facilitate public access to records relating to EAs and to provide notice in a timely manner. The Registry consists of two components – an Internet site and a project file.

The Internet site is administered by the Agency. The responsible authority and the Agency are required to post specific records to the Internet site in relation to a class screening report.

Upon declaration of the class screening report, the Agency requires responsible authorities to post on the Internet site of the Registry, at least every three months, a statement of projects for which a RCSR was used. The statement should be in the form of a list of projects, and will include:

- the title of each project for which the RCSR was used;
- the location of each project;
- a contact number; and
- the date when it was determined that the project fell within the category of projects covered by the report.

The project file component is a file maintained by the responsible authority during an EA. The project file must include a copy of the RCSR. The responsible authority must maintain the file, ensure convenient public access, and respond to information requests in a timely manner. Further information regarding the Registry can be found in the publication: “The Canadian Environmental Assessment Registry”, prepared by the Agency

1.6.1. Report of cumulative assessment

The RA must also provide annual confirmation to the Agency of cumulative effects assessment conditions to ensure that no new projects cause any significant adverse environmental effects.

Note: The schedule for posting a statement is:

- July 15 (for projects assessed from April 1 to June 30);
- October 15 (for projects assessed from July 1 to September 30);
- January 15 (for projects assessed from October 1 to December 31); and
- April 15 (for projects assessed from January 1 to March 31).

2. PROJECTS SUBJECT TO CLASS SCREENING

The candidate class for this RCSR is the works associated with water column oyster aquaculture projects (described in section 4) in bays subject to the BMF. A detailed description of activities related to water column oyster aquaculture is found in Section 4.

2.1. PROJECTS SUBJECT TO THE ACT

To require an EA under the Act, a project must:

- be an undertaking in relation to a physical work, or a physical activity captured in the *Inclusion List Regulation* of the Act, and
- an RA must have one or more of the following responsibilities under section 5 of the Act:
  - is the proponent of a project;
  - grants money or other financial assistance to a project;
  - grants an interest in land to enable a project to be carried out; or
  - exercises a regulatory duty in relation to a project, such as issuing a permit, license, or authorization that is covered under the Law List Regulations.

In 1999, a guidance document from the Agency concluded that aquaculture structures have a 'fixed location' and constitute a "physical work" for the purpose of the Act, if

- they are set firmly in place and will not drift away from their intended location; and
- they are not designed to be frequently moved in and out of the water or frequently moved from place to place within the water.

Water column oyster culture structures meet these two conditions and are therefore considered projects under the Act. The Law List Regulations include an NWPA Section 5(1) (a) permit - a permit to build a work on, over, under, through, or across a navigable waterway. TC is required to complete an EA before authorizing these works.

2.2. PROJECTS EXCLUDED UNDER THE ACT

Projects are exempt from EA if they are listed in the *Exclusion List Regulations*. The project class for water column oyster aquaculture is not exempted through the exclusion list.

2.3. PROJECTS SUBJECT TO THE RCSR

This RCSR covers:

- The installation, construction, operation and decommissioning or modification of proposed or existing works used for the culture of eastern oysters (*Crassostrea virginica*) in the water column that require NWPA authorization in bays and within areas defined in the BMF (see Appendix 3).

2.4. PROJECTS NOT SUBJECT TO THE RCSR

Some projects may only have certain elements or components which are not covered by this RCSR. These include:

- The land-based activities associated with water column oyster aquaculture;

In such a case, this RCSR may be used for the water column oyster aquaculture works and an individual screening done for that

portion of the project that does not apply.

Projects not subject to the RCSR, and therefore requiring an individual EA, include projects:

- that are located outside of culture areas defined in the BMF;
- for the culture of aquatic species other than the eastern oyster (*Crassostrea virginica)*;
- that are likely to have an adverse effect on species at risk either directly or indirectly such as by adversely affecting their habitat, and/or that would require a permit under the SARA;
- that are located in a closed or prohibited zone as defined in the Canadian Shellfish Sanitation Program (CSSP) under a prohibition order as specified by the Management of Contaminated Fisheries Regulations (MCFR);
- that are located in a conditionally approved zone as defined by the CSSP under a prohibition order as specified by the MCFR if a license has not been (or will not be) issued in accordance with section 3 (2) of the MCFR.

If issues are identified during the EA process that are not addressed in this RCSR, the project is eliminated from the RCS and an individual screening will be conducted under the Act. While a project may require an individual EA, the contents of this RCSR may be used in the preparation of the individual screening report.

For the purposes of this document, species at risk include:

- species identified on the List of Wildlife Species at Risk set out in Schedule 1 of the *Species at Risk Act* (SARA), and including the critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act*.
- species that have been recognized as "at risk" by COSEWIC or by provincial or territorial authorities.

3. ENVIRONMENTAL REVIEW METHODS

The purpose of this section is to describe the method used to ensure the potential effects of water column oyster aquaculture operations are mitigated and addressed in a consistent manner.

To accomplish this, Valued Ecosystem Components (VECs) are identified and selected through an issue scoping approach. Study boundaries for the EA are defined and established for ecological, socioeconomic and spatial purposes. Interactions between project activities and the VECs are described for the project and the resulting potential environmental effects of the works are outlined. Mitigation measures are applied to reduce the potential of environmental effects and then an analysis of residual environmental effects and their significance is completed. Effects of the environment on the project and potential cumulative effects are also examined.

3.1. SCOPING METHOD

VECs are selected based on:

- their ecological importance to the existing environment,
- the relative sensitivity of environmental components to project influences,
- their relative social, cultural or economic importance, and
- suggestions by FAs based on their regulatory mandate.

The first step in the selection of VECs involved issues scoping to identify Environmental and Socioeconomic Components of Concern (ECCs). This was based on concerns expressed by various stakeholders, non-government organizations, scientific community and government departments and agencies; consideration of available literature and reference materials; and previous assessment experience. Comments received during earlier notification processes were considered in the definition of ECCs.

Next the pathways (or linkages) by which the proposed project activities may affect each ECC were assessed. The pathways of concern were discussed during a planning exercise that involved federal and provincial authorities. These discussions led to the definition of areas within particular bays where effects of water column oyster aquaculture on selected ECCs could be effectively mitigated. Where interactions between ECCs and the proposed project were identified, these were identified as VECs and carried forward to be assessed further in the RCSR (refer to section 5.2).

In order to recognize every jurisdiction's mandate and in keeping with the federal-provincial MOU on aquaculture, VECs already assessed by the province during their review process were not duplicated in this RCSR.

3.2. BOUNDARIES

An important aspect of the EA process is the determination of the study boundaries. A boundary is a function of the location, as well as the extent and duration of potential interactions between the proposed undertaking and a VEC.

3.2.1. Project Boundaries

Project boundaries refer to the spatial and temporal extent of project activities and are dictated primarily by the project specifics.

3.2.2. Ecological Boundaries

Ecological boundaries refer to the temporal and spatial scales over which environmental components or populations function. The establishment of temporal ecological boundaries takes into consideration the:

- magnitude, frequency and trends in the natural variation of a population or ecological component;
- time required for a biological, physical and / or chemical response to an effect to become evident, and
- time required for a population or ecological system to recover from an effect and return to its pre-impact state.

The degree of potential impact on a particular species or environmental component is also influenced by a number of spatial characteristics including:

- the time of the year that the species or component is present in the proposed project areas;
- the timing of sensitive life history periods (such as larval life phase or bird nesting periods) in relation to the schedule or proposed activities; and
- whether the project cycle includes a period of dormancy.

Spatial ecological boundaries are determined by the distribution, patterns of movements, and potential areas of interactions between an environmental component and the project.

3.2.3. Socioeconomic boundaries

Socioeconomic boundaries refer to the temporal and spatial scales for economic systems and socioeconomic aspects of the environment, which include:

- the time required for a responses to a change in the socioeconomic environment to become evident; and
- the time required for the socioeconomic environment to recover from an effect and return to the original state.

In considering the effects of the project under the Act, socioeconomic effects are considered only principally as they derive from any change that the project may cause on the environment. A distinction is made between socioeconomic effects attributable to changes in the environment ("indirect" effects) and socioeconomic effects arising from the project itself ("direct" effects).

A "direct" effect on socioeconomic conditions is unrelated to any change in the environment and is not an "environmental effect" as defined under the Act. "Direct" effects on socioeconomic conditions do not have to be considered in determining whether the project is likely to cause significant adverse environmental effects.

Spatial boundaries are established on the basis of the spatial characteristics of the socio-cultural and economic environment. These take into consideration resource harvesting activities, some of which are specific to particular places (i.e. fisheries resources) and times (i.e. fishing seasons).

3.3. ASSESSMENT OF POTENTIAL EFFECTS ON VECS

The assessment focuses on the potential interactions between the various project components and the VECs. Potential negative and positive effects are assessed on the basis of a review of relevant literature, consultation with experts and professional judgment. The assessment is detailed in a matrix for each VEC in table 4.

3.4. ASSESSMENT OF POTENTIAL EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Under the Act, the EA must consider the potential for interactions of the environment on the project. These are discussed in Section 5.3.

3.5. ASSESSMENT OF CUMULATIVE EFFECTS ON VECS

Under the Act, the EA must also consider cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out. The assessment of cumulative effects is consistent with the principles described in the Agency's Cumulative Effects Assessment Practitioners Guide [4]. Cumulative environmental effects are environmental effects that result from the project under review, in combination with past, present and projected projects or activities. These are discussed in Section 5.6.

3.6. SIGNIFICANCE OF ENVIRONMENTAL EFFECTS

Under the Act, the significance of environmental effects must be considered. The definition of 'significant' for the VECs in the RCSR has been set based on scientific determination, social values, public concerns and economic judgment.

The CEAA Reference Guide [5] and Responsible Authority Guide [6], which recommend consideration of the following criteria when determining significance of environmental effects:

- magnitude;
- geographic extent;
- duration and frequency;
- reversibility; and
- ecological (and / or socioeconomic) context.

Table 1 contextualizes each of the criteria for use in the RCSR. The following criteria are used in defining whether a residual environmental effect is significant or not:

3.6.1. Significant

A residual environmental effect is considered significant when it induces frequent, major levels of disturbance and/or damage and when the effects last longer than a year and, extend beyond the project boundary following the application of mitigation measures. It is either reversible with active management over an extended term or irreversible.

3.6.2. Not significant

A residual environmental effect is considered not significant when it has infrequent, minor or negligible levels of disturbance and/or damage and when the effects last less than a year and are contained within the project boundaries following the application of mitigation measures. An effect that is not significant is reversible with or without short-term active management.

3.7. MITIGATION MEASURES

The mitigation measures and conditions that FAs may impose on a project must be related to the regulated project, necessary to mitigate the project's adverse effects and related to a matter within federal jurisdiction. Numerous screenings for water column oyster culture projects were reviewed individually before the preparation of this RCSR. Mitigation measures recommended by these screenings were reviewed and adapted, as required, to minimize or reduce the potential adverse effects of the project. Federal and provincial departments reviewed them to ensure the most up-to-date mitigation measures were selected. Following the application of mitigation, residual effects (those which remain after mitigation) are evaluated against the established significance criteria. Mitigation measures are listed in Table 4.

3.8. BEST MANAGEMENT PRACTICES

A number of best management practices (BMPs) have been identified by federal and provincial departments in previous individual EAs. Although BMPs are not enforceable by any federal legislation, the agencies involved in the preparation of this RCSR recognize that they constitute an important approach to avoiding and minimizing environmental impacts of any work. While they are not part of the listed mitigation requirements, BMPs are included in this RCSR. They will be forwarded to the proponent as part of the information package that accompanies every project approval. The aquaculture industry's obligation to implement the mitigation measures and to consider the BMPs outlined in the RCSR will be further communicated and reinforced through presentations at local aquaculture meetings. EC is prepared to help TC communicate best management practices (BMPs).

Legislation administered by EC includes general provisions related to protecting the environment which are applicable to a broad range of activities such as those associated with aquaculture (Appendix 4).). It is the responsibility of the proponent to comply with this legislation. EC has indicated that it may audit and / or inspect any aquaculture project, including those subject to the RCSR, for compliance with EC-administered legislation. In this regard, BMPs identified in this RCSR should be considered by the proponent as an important means of minimizing impacts and achieving compliance with applicable federal legislative requirements. A finding that aquaculture activities are in contravention of federal environmental legislation may result in the suspension of federal permits in addition to enforcement action.

Table 1 – Criteria used in the definition of significance of environmental effects

Criteria	Importance level rating		
	Negligible (1)	Minor (2)	Major (3)
Magnitude (M)	Localized effect on specific group, habitat, or ecosystem, returns to pre-Project levels in one generation or less, within natural variation.	Portion of a population or habitat, or ecosystem, returns to pre-Project levels in one generation or less, rapid and unpredictable change, temporarily outside range of natural variability	Affecting a whole stock, populations, habitat or ecosystem, outside the range of natural variation, such that communities do not return to pre-Project levels for multiple generations
Geographic Extent	Limited to aquaculture footprint and vicinity	Limited to aquaculture lease and vicinity	Extends beyond the aquaculture lease area.
Duration of Effect	Less than one season	Less than one year	A year or longer
Frequency of Effects	Occurs on a monthly basis or less frequently	Occurs on a weekly basis	Occurs on a daily basis or more frequently
Reversibility	Effects are reversible over short term without active management	Effects are reversible over short term with active management	Effects are reversible over extended term with active management or effects are irreversible.

4. PROJECT CLASS DESCRIPTION

4.1. ACTIVITIES ASSOCIATED WITH WORKS USED FOR WATER COLUMN OYSTER CULTURE

In N.B., oysters are typically cultured in shallow protected coastal bays using either on-bottom or water column culture techniques. Eastern N.B. waters, in particular, provide favourable growing conditions for oysters in large part because of their high productivity, suitable water temperatures, salinity and oxygen content. The growth period for oysters extends from May to November, depending on latitude, and corresponds to the seasons when water temperatures are above 4°C, or roughly the period that is ice-free. By using a mechanism that has been compared to hibernation, oysters in northern latitudes stop feeding and change their metabolism when temperatures fall below 4°C.

A number of water column culture methods that suspend oysters in the water column are used in N.B. at the present time. They may include longline culture in bags, trays, individual cages, or on rope strings, or on French tables or trestles. NBDAA defines suspended culture as a form of aquaculture conducted in the water column or at the surface, where the structures are anchored but float or move with the tides. Off-bottom culture is defined as a form of aquaculture conducted in the water column, with the rearing structure either directly placed on the substrate or raised off the substrate. In both of these latter cases, the structures are fixed in place but do not move with the tides. This RCSR covers these two categories of techniques, commonly referred to as water column oyster culture. It does not include bottom culture, which is conducted directly on or in the substrate of an aquaculture site.

4.1.1. Culture systems

Suspended culture

Grow-out bags made of high density, UV resistant polymer (often referred to by the manufacturer's name, such as Vexar™ or Durethene® bags) contain the oysters and are floated near the water surface either by using the longline or cage system. Each bag measures approximately 0.8m x 0.4m x 0.13 m.

In the longline system, grow-out bags are set with one buoy on each side and secured by parallel lines anchored to the bottom. The most common design used consists of two rows of ± 50 grow-out bags, but many variations of this system can be observed. Two main anchors maintain the longline in a fixed location; these consist of concrete blocks, metal anchors or screw anchors. The lines are kept separated by spreader bars installed every ten bags or so. Growers can adjust the buoyancy of the grow-out bags by changing the location of the buoys on the bags. When the buoys are located on the side, the bags float at the water surface and are in partial contact with air; when the buoys are located on the upper side, the bags are submerged immediately under the water surface. Each longline system measures approximately 60 m from anchor to anchor, and is spaced 6-10 m apart to provide water circulation around the cages and access for regular maintenance. Growers

usually install 15 to 20 longlines per hectare. Longlines are usually oriented in a manner to reduce wear from tides and currents on equipment.

Cages are made of the same wire-meshed material as lobster traps, with each unit designed to contain between 2 to 6 grow-out bags, six being the most common configuration. The grow-out bags are placed in sections of the cage, which look somewhat like drawers, with no more than two bags sitting over one another. Each cage is equipped on the upper side with two buoys allowing it to float immediately below the surface. Buoys can be made of a variety of materials, including Styrofoam and PVC. The cages are secured either by using single anchors or on longlines. On average, growers will install 12 cages per 50 m longline and a maximum of 20 lines per hectare (240 cages/ha). Lines are separated by a 10 m corridor to allow boat access.

Another less common suspended technique is the rope culture, whereby clusters of oysters are attached to a rope at regular intervals. Ropes are suspended in the water column or floated at the water surface level using specifically designed supports, using a system equivalent to a longline. Oysters on rope strings remain submerged all the time.

Off-bottom culture

Oyster tables, also known as French oyster tables, consist of a metal tubular structure on which grow-out bags containing the oysters are supported. This platform raises the bags sufficiently to ensure water circulation around the oysters and to prevent contact with the sediments. Depending on the site, oysters can be uncovered during each tidal cycle or remain constantly under water. Another off-bottom technique consists in raising the oyster bags on runners placed on the sediment. Both of these techniques require setting the structures in sections of the lease with little or no eelgrass to ensure proper water circulation. Oyster tables and runners are removed at the end of the growing season.

4.1.2. Installation

The installation of structures is generally done by boat or on the ice. For longlines, anchors are installed either directly on the marine sediment or driven within the marine sediments. In general, the anchoring system is designed to be permanent. French tables and runners are installed directly on the site. The installation of one structure takes from a few minutes to less than an hour, depending on the structure.

4.1.3. Operation

Oyster culture requires no supplement of food and no treatment with pharmaceuticals, disinfectants, or hormones. Maintenance of the structures includes periodically changing the density of oysters to ensure optimum growth and conditions; this occurs 2 or 3 times during the growing season (May to November). Fouling is removed by air drying or by pressure washing. This is done regularly, depending on growth of epifauna which varies during the season,

being more pronounced in the spring and less so in the fall. In general, air drying takes a couple of days. Operational waste from the work (i.e., shells, rope) is the responsibility of the proponent and is returned for disposal on land. Generally, displaced equipment (e.g. cages, bags, buoys) is immediately retrieved and returned to the lease, weather pending.

Densities

To ensure optimal growth and shell shape during the active growing season, aquaculturists regularly sort and grade their oysters while gradually reducing the number of oysters per bag. Oyster seeds (15-30 mm) are reared at densities of 500-1000 oysters/bag. As soon as the oysters grow above 35 – 50 mm, density is reduced to an average of 175-250 oysters per bag.

As oysters take on average between 3 to 4 years to grow using water column techniques, there are usually 4 "size classes" present on a lease at any given time. Space is allocated to accommodate the movement of these classes. Oysters are collected (Age 0) in the summer and overwintered in the fall or spring along with the oysters from the previous summers. Marketable oysters can be harvested in specific seasons, depending on permit conditions.

Oyster spat collection

Oyster spat or oyster seeds can be purchased from local growers or can be collected by the producer. The collection of oyster spat on public oyster beds is a licensed fishery under the *Fisheries Act* and regulated by DFO under their Integrated Fisheries Management Plans. Oyster seeds can only be collected from approved oyster collection areas or on individual leases.

A variety of collectors can be used to attract oyster larvae looking for a clean surface to settle. In addition to shells, growers use collectors made from a variety of material (PVC, cardboard, wire, brick) covered in a lime-concrete slurry made to mimic the characteristics of oyster shells. Collectors with that slurry are left to cure to ensure the surface is adequate for the oyster larvae to adhere to and is solid enough to sustain a few months of immersion while being brittle enough to be easily removed.

Timing to install the collectors is critical. Oysters spawn anywhere between early to late July depending on latitude. After a couple of weeks of drifting in the currents, mature larvae cement themselves to the collector's surface. When oyster seeds reach a certain size, the collectors are transferred to the lease (if seed are not collected from the lease area itself). Depending on their size, oysters may be stripped from the collectors in the fall or the following spring, sorted by size and transferred to the grow-out bags.

Overwintering

To avoid ice damage, oyster culture structure must be overwintered in deeper waters, in areas that are not prone to ice jams or frequent ice movement. Overwintering corresponds to the dormancy period of oysters.

Typically, oysters are moved to the deepest portion of the site

and sunk to the bottom during the winter months (November to April). If the grow out lease does not provide the depth required for safe overwintering, a separate area must be approved. Transferring the stock in deeper waters is usually delayed as late as possible in the season to maximize the oysters' growth and fitness before the hibernation period.

Oysters are overwintered in bags or cages. The longlines are submerged below the ice and positioned above the seabed using weights to counter the buoyancy of the equipment. Bags/cages may also be directly deposited on the substrate. Some cage systems are equipped with buoys that can be filled with water. These cages are sunk directly on the surface of the sediments. Grow-out bags in cages without this technology are usually removed and overwintered on longlines. Sunken lines are located by GPS or triangulation to facilitate retrieval during winter harvesting or for re-suspension. Oysters are re-deployed on the lease site the following spring; re-suspension is carried out as soon as possible after ice break-up.

Harvesting

In N.B. harvesting is regulated by a permit system which dictate harvest seasons. Harvesting of products is conducted in accordance with criteria established under the Canadian Shellfish Sanitation Program (CSSP).

Harvesting is generally conducted by boat; grow-out bags are light enough to be lifted by hand from the structures and loaded onto vessels. The heavier cages may require a winch to hoist onto the vessel. Bags and stock are transported to a boat landing, where they can be stockpiled briefly while awaiting transport to a processing facility.

During winter harvesting, overwintering sites are typically accessed by all terrain vehicle or snowmobiles. The ice is cut with a chain saw or auger and the stock retrieved manually or with the use of manually operated hydraulic equipment. Divers may be required to assist in the retrieval of stock. To avoid freezing, the grow-out bags are placed in insulated containers and transferred to a vehicle waiting at the shore for transport to the processing facility.

Predator Control

There are no lures, fish offal, food or bait used in the culture of oysters, which could potentially attract fish or large predators such as seals. Concerns related to depredation or removal of stock from gear is uncommon in the case of water column oyster culture, because the stock is protected within the grow-out structure. Thus anti predator nets are never used on bottom or around the perimeter of oyster leases.

Incidence of predators is more critical during the spat collection phase when oysters are small and not protected within the grow-out bags. Predators, like crabs and starfish, are generally hand-removed. As recommended by the N.B. Introductions and Transfer Committee, when collectors are transferred between bays, bio-fouling and extraneous organisms are controlled by spraying with

undiluted vinegar or by dipping the collectors for a few seconds in a freshwater or diluted lime bath (the diluted lime solution is disposed of on land). Competitors or predators found within the grow-out bags are manually removed each time density is adjusted.

Birds are not predators of oysters at aquaculture sites, but have been observed perching and loafing on equipment. They may also be attracted to fouling organisms on bags as these constitute an easily available food source. Acoustic scaring devices which create loud noises to scare birds have not been used by the oyster aquaculture industry [7]. In order to avoid disturbing and negatively impacting species of conservation concern (e.g. Piping plovers and colonial nesters), the Canadian Wildlife Service (CWS) CWS has recommended against the use of acoustic scaring devices and will not issue scare permits. Most birds in N.B. are protected under the *Migratory Birds Convention Act* and associated regulations.

4.1.4. Decommissioning

Within 90 days of cessation of aquaculture activities, the holder of the aquaculture occupation permit or the aquaculture lease is required under provincial jurisdiction (N.B. *Aquaculture Act*, 1988, c. A-9.2, and 91 158 of the N.B. Regulation under the *Aquaculture Act*) to restore the site to its original condition. If the holder does not restore the aquaculture site within the prescribed time or in a manner considered satisfactory by that authority, NBDAA will have the site restored, and the holder will be liable for all restoration costs.

4.2. TEMPORAL SETTING

Installation of an individual structure takes less than an hour; installation of a project (i.e. a number of structures) will vary depending on the surface being used. On average, total installation time will take approximately one week per hectare, irrespective of the technique used[1]. Installation of anchors for suspended structure is generally done once and lasts the lifetime of the project. Installation of off-bottom structures is generally done once per season. In ice-prone areas, off-bottom structures are removed yearly, before freeze-up. As indicated above, installation usually occurs in the spring, immediately after ice-out, with some operators opting to install anchors in the winter.

Water column oyster aquaculture does not require daily maintenance to sustain production, therefore site visits range from daily during the active season, to weekly during the maintenance phase, to once per season during the winter. The duration of the project is considered seasonal, with generally more activities during the ice-free period.

4.3. SPATIAL SETTING

In general, water column oyster aquaculture projects in N.B. are located in shallow estuaries within areas protected from exposure to adverse winds or weather conditions. Adult oysters are tolerant

[1] S. Doiron, (NBDAA) personal communication

of extremes in ambient temperatures. They can be commonly found in waters with an annual range of -2°C to 36°C. The optimal temperature range for oyster growth is 14 to 28°C. Oyster tolerance to temperature change varies depending on life stages.

As with temperature, oysters have a wide tolerance for varying salinity, with an optimum range between 14 and 28 parts per thousand (ppt). Dissolved oxygen also plays a role in oyster survival and growth. Oyster metabolism may be vulnerable to low oxygen levels; this again varies depending on life stages. To meet salinity, temperature and oxygen levels requirements, growing sites are generally located in the mesohaline portion of the estuary.

Water column oyster aquaculture requires the use of the upper water column, (i.e. a depth equal to that of the grow-out bag or cage). Therefore, oysters can be grown from the intertidal to subtidal area. The areas selected for oyster culture in this RCSR exclude oyster culture in the first 100 m from the high water mark, therefore excluding water column oyster aquaculture from most intertidal zones.

Growing sites are usually located in sheltered portions of the estuaries, behind land masses that protect the structures from damage by high winds or extreme weather conditions. Oysters grow by building a thin fringe on the margin of each shell. This delicate fringe is easily damaged when oysters are repeatedly moved. While some damage to the fringe contributes to rounded shell formation, an attribute sought by consumers, repeated damage reduces overall oyster growth during the season. Thus open estuarine sites are generally avoided by oyster growers to limit accidents and malfunctions and to ensure optimal oyster growth.

Marketing of oysters is governed by the CSSP. Classification of shellfish harvesting areas is determined through a sanitary survey and water quality monitoring. Oyster growing activities are prohibited near wharves, bridges, and other sources of chemical and bacteriological contamination. On average, this excludes commercial and recreational shellfish harvesting activities from 35% of Atlantic estuaries [8], particularly where there are major industrial activities and/or dense human settlements.

4.4. ENVIRONMENTAL SETTING

The following section describes the biology of oysters and how they interact with the environment. A description of the environmental setting of each bay covered by the RCSR is provided in Appendix 3.

4.4.1. Oyster's role in the environment

The eastern oyster (*Crassostrea virginica*) also known as the American oyster, is the oyster species native to N.B. and it occurs along the east coast of North America, from Louisiana to the southern Gulf of St.-Lawrence (SGSL). Oysters are bivalves, a class of molluscs characterised by being laterally compressed, bilaterally symmetrical, and having a paired external bivalved shell which protects the body of the animal [9]. They grow by feeding on phytoplankton (microscopic plants), organic matter, bacteria and,

to a lesser degree, on zooplankton (microscopic animals) [10].

Food particles and other particulate matter are drawn into the oyster by the motion of small cilia located on the gills. Food particles retained by the gills are subsequently conducted by ciliary action to the mouth and then to the stomach. Oysters are able to sort particles by size (particles greater than 3 µm and smaller than 100 µm) before ingestion as well as to preferentially select organic material, such as benthic and pelagic diatoms, based on nutritional value, while rejecting inorganic particles[10]. Digested food is rejected as feces; undigested particles encased in a mucus coating are rejected as pseudo feces.

In nature, oysters form large aggregations, called oyster reefs, which are perpetuated through gregarious settlement. These three-dimensional reefs are considered important fish habitat by virtue of the shelter and food they provide. These natural aggregations have been termed as "foundation species", because they play a number of important roles [11]; [12]; [13]. Oyster reefs can help stabilize the substrate. The shells themselves provide hard substrata for attachment of sessile organisms. Fauna and flora associated with oyster reefs is often more diverse than that of surrounding areas [14]; [15]; [16]; [17]. Oyster reefs are still present in N.B. estuaries, mostly in contaminated areas where they are indirectly protected from harvesting. Oysters in culture are believed to fill many of the same ecological roles as oysters in natural communities [13].

4.5. SOCIO-ECONOMIC SETTING

Oyster culture is not a recent activity in North America; bottom culture is believed to have begun in New Jersey around 1810. Subsequently, oyster culture expanded and eventually reached the Maritimes. The first leases for oyster culture were granted in 1865 by the government of Prince-Edward Island (P.E.I.) and in the 1880's and 90's, portions of N.B. bays became reserved for oyster culture [18]; [1].

By the mid-1800's, a number of oyster reefs in N.B. had been depleted and by the early 1900's, overall oyster production began to seriously decline due to over harvesting. With market demands for oysters exceeding natural production, active programs were established to encourage oyster culture, including the development of an experimental research station and water column culture techniques. Following the decline of oyster populations in the 1950s due to an epidemic disease (Malpeque disease), natural oyster reefs nearly disappeared in N.B. It was estimated that almost 99% of oysters were lost in P.E.I. [19], while production in N.S. and N.B. may have decreased by as much as 90% [1]. Following this massive decline, efforts were directed at purchasing oyster seed (i.e. spat), collectors and equipment to rehabilitate natural oyster populations and oyster farming began in earnest. Between 1977 and 1980, areas in N.B. became the sites of an experimental program to grow oysters using a number of on-bottom and off-bottom culture techniques. Since then, the culture methods described in this RCSR have been widely adopted by the industry.

To this day, N.B.'s production of oysters continues to be dependent on naturally-produced stocks and commercial landings from natural oyster reefs still dominate the oyster industry. Aquaculture's contribution to commercial landings has begun to increase and is anticipated to equal the contribution from the commercial fishery by 2010 [20]. Those combined landings are still considered low when compared to pre-1950's landings.

The transition from on-bottom culture to water column culture gives the impression that oyster stocking densities have increased, when the opposite has occurred. As a means of comparison, stocking densities[2] recommended for bottom culture of oysters averaged 3 kg to 15 kg per square meter [21]; [22]. Current average oyster densities used in suspension are estimated at an average of 2-4 kg/m^2 on long-lines[3] to 8 kg/m^2 on French tables [23]. In nature, healthy oyster reefs contain oyster densities in excess of hundreds of oysters/m^2. Authors estimate that they can reach values equivalent to 25 to 55 kg/m^2 [24]; [25] with some reaching 124 kg/m^2 .[4]

[2] All densities expressed in wet weight, with shell included

[3] S. Doiron (NBDAA) personal communication

[4] L. Comeau (DFO) personal communication

5. ANALYSIS OF ENVIRONMENTAL EFFECTS

The following section first describes the bay management planning exercise carried out by federal and provincial regulatory authorities and how the exercise lead to the definition of areas suitable for the development of water column oyster aquaculture. By virtue of excluding oyster culture from specific areas, this planning exercise reduced the potential for interactions of water column oyster projects with a number of ECCs, thereby avoiding adverse environmental effects.

The remainder of Section 5 considers other ECCs as VECs, and analyzes the environmental effects of water column oyster aquaculture, as well as the effects of the environment on the aquaculture works. Mitigation measures to address potential environmental effects are summarized. Following the application of mitigation measures, a significance determination is made for any residual environmental effects. A discussion of cumulative environmental effects completes this section.

5.1. N.B. BAY MANAGEMENT PLANNING EXERCISE AND VEC SELECTION

When selecting a site for water column oyster aquaculture, many factors must be taken into account, such as water depth, current flow, salinity, temperature, wind and waves, oxygen content, bacterial contamination, ice conditions, proximity of other resource users, patterns of marine traffic, and proximity to suppliers and services (e.g., wharves, roads, air transportation, and communications). Thus, the industry is generally constrained by the availability of suitable grow-out sites.

Further to this, aquaculturists must situate their sites in locations where potential adverse effects on the ecosystem are minimized while the economic viability and feasibility of the operations is maintained.

The bay management planning exercise used maps of each bay prepared by NBDAA over which departments, by means of layers of geo-referenced information, indicated areas where they had regulatory concerns. This planning exercise ultimately produced maps with areas designated as suitable for water column oyster aquaculture.

The following sections outline information provided by each department in relation to its mandate that was included as a geo-referenced layer for mapping of bays in the bay management planning exercise.

5.1.1. N.B. Department of Agriculture and Aquaculture (NBDAA)

Aquaculture leasing and licensing is managed by the NBDAA. Proponents submit their applications to obtain an aquaculture lease, or occupation permit, and an aquaculture licence for aquaculture sites situated on Crown Land. An aquaculture license is required to undertake the culture of aquatic species. The license

provides the authority to conduct aquaculture at a specific site in accordance with the *Aquaculture Act* and associated Regulations and the terms and conditions outlined in the license. The license also specifies the species authorized for cultivation. Licenses may include terms and conditions related to:

- adherence to an aquaculture site development plan approved by the Registrar,
- standards relating to site utilization, stocking densities and production at aquaculture sites,
- the year class of the aquacultural produce that may be cultivated;
- the length of a fallow period for an aquaculture site;
- measures to be taken to minimize the risk of environmental degradation,
- measures to be taken to prevent the escape of aquacultural produce,
- measures to be taken to minimize the risk of disease, disease agents, parasites, toxins or contaminants spreading to other aquaculture sites,
- measures to be taken to ensure the maintenance of applicable health, grade and genetic standards, and
- any other matter the Registrar considers necessary for the purposes of enforcing the N.B. *Aquaculture Act* and associated Regulations.

Aquaculture Development Plans

NBDAA provided the most recent data of all existing leases for each bay. Broad scale maps including information about aquatic resources locations were used as base maps for planning purposes. Another layer of geo-referenced information included planned shellfish aquaculture development areas. These proposed areas were developed based on the information gathered over the years through scientific observations, public consultation when reviewing individual site applications and local knowledge from field staff.

As for all other applications for shellfish aquaculture, these development plans were drafted by taking into consideration the following factors:

- The proposed development area is not located less than 300 metres over water from a wharf, breakwater or other marine structure;
- The proposed development area is not placed so as to deny a riparian owner of an adjacent property access to the mean low water mark;
- The proposed development area is not located in a growing area that is subject to chemical or bacteriological contamination, unless the reason for closure of the area in question is such that it allows for mollusc depuration, in accordance with a protocol approved by the responsible agencies.
- The site has no known aboriginal or traditional fisheries, is not interfering with known navigation channels, is away from known sensitive environments, is not within the boundaries of a National Park; and does not interfere with known recreational activities.

The proposed aquaculture development plans prepared by DAFA described areas which were further divided into four classes by using the following categories:

- Class A: designates proposed areas suitable for the development of aquaculture activities for all culture methods including bottom, near-bottom and water column culture.

- Class B: designates proposed areas suitable for the development of aquaculture activities for bottom and near-bottom culture methods.
- Class C: designates proposed areas suitable for the development of aquaculture activities for bottom culture methods only.
- Class D: designates areas where regular water column oyster aquaculture activities are not considered for a variety of reasons. These areas may be considered for temporary overwintering sites.

Maps with these layers of information were then vetted and adjusted with each of the following agencies, based on their regulatory mandate.

5.1.2. N.B. Department of Natural Resources (NBDNR)

Provincial Crown Land

NBDNR manages upland and submerged Crown Land under the administration of the Minister of Natural Resources. These lands encompass approximately 5.4 million hectares of which 3.3 million hectares are upland and 2.1 million hectares are submerged Crown land. The Minister of Natural Resources is responsible for the management, development, utilization, and protection of Crown lands as well as the management of fish, wildlife, minerals and timber.

The Crown Lands Branch within NBDNR is responsible for reviewing applications to use or acquire Crown Land. It is also responsible for the implementation of land transactions including leases, easements, exchanges, purchases, grants, licenses of occupation and transfers of administration and control of land to other departments and governments such as NBDAA for aquaculture purposes.

If there are no other commitments or demand for the property, the Minister of Natural Resources may issue Licences of Occupation to allow applicants to occupy submerged Crown land for temporary periods or transfer the administration and control of the lands to the Minister of Agriculture and Aquaculture for long term use.

As part of this undertaking, NBDNR provided a layer describing areas secured for conservation in N.B., along with locations of Ecologically Significant Areas (ESAs) such as wetlands, dunes, breeding bird colonies and endangered species locations (see list in Appendix 3). Where applicable, a buffer zone was added around these locations (see section below on species of special conservation concern).

5.1.3. N.B. Department of Environment (NBDOE)

Coastal Zone Protection

The NBDOE has developed guidelines describing zones of protection for watersheds under a Coastal Areas Protection Policy for N.B. [26]. The policy objectives of that document are:

- To reduce threats to personal safety by storm surges and flooding events, and to minimize the danger to emergency and rescue personnel;
- To minimize the contamination of water and wetlands from

hazardous materials;

- To maintain a coastal buffer zone to protect inland areas from storm surges.
- To minimize public expenditures related to storm damage public infrastructure such as roads, bridges, public buildings, erosion control structures.

The policy guidelines identify zones of protection within each designated watershed. These zones are defined as:

- Zone A: coastal lands core area, lower low water tide mark to higher high water tide mark (includes beaches, dunes, coastal marshes, rock platforms and dyked land)
- Zone B: coastal lands buffer area, 30 m setback from the edge of Zone A.
- Zone C: coastal transition area, landward and beyond Zone C.

By definition, intertidal or subtidal shellfish culture projects are not included in the above mentioned Policy, although it is expected that these types of projects may be reviewed in the near future through a provincial EIA process lead by NBDOE.

A 100 m coastal buffer zone was constructed using the Service N.B. 1:10,000 database defining the coastline boundary as a guideline to restrict aquaculture development within Zone A and incorporated as a layer of geo-referenced information in the planning maps.

5.1.4. N.B. Department of Wellness, Culture and Sport (NBDWCS)

Archaeological Services

The NBDWCS is responsible for the comprehensive management of the Province's archaeological heritage. In N.B., submerged archaeological sites can include such things as shell middens, First Nation artefacts, and a variety of locations where humans have left traces of themselves. The Archaeological Services review projects on a case-by-case basis to ensure that heritage and archaeological resources are protected.

Because of the scarcity of information on archaeological resources present in the province, particularly underwater resources, no mapping information could be provided. However, the nature of water column oyster aquaculture works is deemed unlikely to alter or destroy artefacts. There is a small likelihood that previously unidentified resources could be accidentally disturbed during construction of water column oyster aquaculture works. As a precaution, a measure is added to this RCSR such that if archaeological resources are discovered, the provincial authorities are contacted to ensure information is recorded and appropriate preservation procedures are followed.

5.1.5. Fisheries and Oceans Canada

DFO is responsible for the application of the *Fisheries Act* (FA), which applies to any body of water that may contain fish or may be

considered as fish habitat. DFO administers a number of regulations associated with the FA, including the Marine Mammals Regulations and the Management of Contaminated Fisheries Regulations. DFO is also responsible for the protection and recovery of aquatic wildlife species at risk under the *Species at Risk Act* (SARA).

DFO provided the resource mapping series with broad scale information about aquatic resources locations in each bay as a base layer for planning purposes. These maps present Traditional Ecological Knowledge on fish habitat and species distribution. In addition, scientists and managers from DFO provided input to coordinate the management plans for each bay by taking into consideration commercial, recreational and aboriginal fishing interests and other regulatory concerns.

Commercial and recreational fisheries

Although "direct" effects on socioeconomic conditions do not have to be considered in determining, under the Act, whether a project is likely to cause significant adverse environmental effects, NBDAA and DFO took into consideration direct socioeconomic effects prior to the application of the RCS process. Most bays in N.B. support commercial, recreational and aboriginal fisheries. In general, the main commercial fishing activities that exist, within the bays themselves, include eel, alewife, smelt, oysters, and mussels, lobster, rock crab, soft-shell clams, quahogs, surf clams and razor clams.

Fishery officers were consulted and they identified the locations of fishing gear which were added to the maps. Other sources of data, such as information on landings compiled by using the statistical districts, were also provided for planning purposes. The 100 m coastal buffer zone suggested by NBDoE was recognized by DFO as a suitable means to ensure access to the foreshore for recreational and commercial resource harvesters.

First Nations Fisheries and Interests

First Nations are active in fisheries (i.e. communal or commercial fishing licenses for food, social or ceremonial purposes), in shellfish aquaculture or receive funding for aquaculture development in certain bays covered by this planning exercise. Data currently available on aboriginal fisheries in N.B. and First Nations priorities were considered during the planning exercise.

A number of First Nations communities have already shown significant interest in the commercial potential of shellfish culture for economic development. This interest arises not only because of the potential economic returns, but also because of the compatibilities that exist between aboriginal communities and shellfish culture.

Indian and Northern Affairs Canada through Natural Resources Canada provided information about land commitments within the study sites for the First Nations concerned. This information layer was added during the bay planning exercise.

Carrying Capacity

Oysters feed on microscopic organic particles and rely on the surrounding environment to supply food. As a result, the maximum sustainable shellfish stocking density of a region is determined by the natural production and importation of food in a given estuary. The natural productivity of any estuary is dependent on various factors, including the hydrodynamics of the bay and input of nutrients.

Based on their broader mandate, DFO and NBDAA are currently involved in long term monitoring of mollusc productivity to determine spatial and temporal variation in shellfish populations in bays with and without oyster and mussel culture in the SGSL. Outside the normal natural variations, this monitoring program confirms that there are no significant changes in bivalve population productivity where oyster culture is introduced. Differences in productivity are observed between bays more so than between sites, thus suggesting that differences are linked primarily to annual changes in nutrient input, plankton blooms or temperature fluctuations rather than to growers' interventions within a given bay. Productivity in natural and cultivated shellfish populations is being monitored to ensure that any decline in productivity, outside of normal natural variations, is documented and addressed by more intensive research and, where applicable, by changes in management practices. The shellfish productivity monitoring program will continue to provide input to the BMF Adaptive Management Process.

DFO requested that a panel of scientists be brought together under the National Advisory Process (NAP) to characterize the potential environmental risks of bivalve aquaculture in the marine environment. A qualitative risk assessment carried out by DFO confirmed that the anticipated scale of negative effect with water column oyster culture is low. As a result, DFO concluded that the potential impact to carrying capacity was best reduced by adopting a BMF, whereby less susceptible zones could be designated for oyster culture while controlling coverage in each bay.

Canadian Shellfish Sanitation Program

The shellfish growing area classification was presented as a layer on the maps used for the planning exercise. The Canadian Shellfish Sanitation Program (CSSP) is a federal program jointly administered by DFO, EC and the Canadian Food Inspection Agency (CFIA). The main program objective is to:

- ensure that all bivalve mollusc shellfish growing areas meet approved water and tissue quality criteria,
- identify pollution sources for these areas, and
- ensure that shellfish sold commercially are harvested, transported and processed in an approved manner [8].

The legal authority for the CSSP is provided by the Management of Contaminated Fisheries Regulations under the *Fisheries Act* and the Fish Inspection Regulations of the *Fish Inspection Act* (FIA). EC is responsible for conducting water quality surveys of the shellfish growing areas. CFIA regulates the handling, storage, transportation, processing and labelling of all fish and shellfish products destined

for inter-provincial and international export as well as import; and the Marine Biotoxins Control Program.

Fisheries and Oceans, Conservation and Protection Branch (C&P) is responsible for the enforcement of closure regulations, and enacting the opening and closing of shellfish growing areas (CFIA 2004). The overall classification of shellfish growing areas is managed by DFO, through scientific advice received from EC and CFIA. DFO provided the most up-to-date classification information for each bay during the planning exercise. Accredited scientific data on water quality (i.e. *E. coli* counts, surface temperature and surface salinity) and shellfish quality for fixed monitoring stations were provided by EC and CFIA.

5.1.6. Environment Canada

EC is responsible for the application of several federal acts. The *Migratory Birds Convention Act*, the Migratory Bird Sanctuary Regulations and Migratory Bird Regulations ensure the preservation of migratory birds and their habitat. EC has the authority to control toxic substances under the *Canadian Environmental Protection Act*, 1999, (CEPA) and under Section 36 of the *Fisheries Act,* to prohibit the deposition of deleterious substances into waters frequented by fish. EC is responsible for the Canada *Wildlife Act*, which allows the establishment of National Wildlife Areas. EC is also responsible for the overall administration of the *Species at Risk Act* (SARA) and is responsible for the protection and recovery of non-aquatic wildlife species at risk. EC assisted in the coordination of the bay management plans for each bay cited in the appendix by taking into consideration the following regulatory concerns.

Sanitary Bacteriological Surveys

Geo-referenced data of the shoreline sanitary survey was provided by EC and entered as another layer of information for planning purposes. As previously mentioned, the shellfish growing area classification is a result of the bacterial monitoring surveys and the shoreline sanitary survey. Typically, three additional standards defined by the CSSP are described for specific areas that may still be found in approved shellfish growing waters:

- 300 m (minimum) prohibited zone around major pollution point source discharges (i.e. sewage and outfall pipes)
- 125 m (minimum) prohibited zone around permanent or floating structures such as wharves, docks and marinas
- 300 m (minimum) prohibited zone around dredging disposal site.

Sanitary survey data represents point sources of pollution as well as actual and potential anthropogenic impacts on coastal areas, thus identifying areas to avoid during the planning for aquaculture works.

Species of Special Conservation Concern and non-aquatic Species at Risk

Water column oyster aquaculture operations can potentially result in interactions with species of special conservation concern (e.g. waterfowl, shorebirds, seabirds, and species at risk). Seabirds are commonly observed on or near water column oyster

aquaculture works, presumably because they constitute landing surfaces and roosting sites, or because of the food source offered by epibionts growing on equipment. EC's Canadian Wildlife Service (CWS) has made recommendations for protecting wildlife and their habitat by identifying areas of particular importance and suggesting the creation of buffer zones which will assist in mitigating potential disturbances and interactions between water column oyster aquaculture, non-aquatic species at risk and sensitive bird species.

Sensitive bird species listed to date in N.B. include Terns, Great Blue Heron, the Harlequin Duck, the Barrow's Goldeneye and the Piping Plover. CWS suggested areas of additional protection for sensitive coastal habitat in each estuary. They include coastal wetlands and known bird congregation areas such as breeding islands or moulting areas.

A review of previous EC recommendations indicated that the following buffer zones had been recommended as mitigation measures for protecting migratory birds and species of conservation concerns:

- 250 m buffer zone (minimum) for Piping Plover
- 200 m buffer (minimum) zone for terns during the breeding season
- 200 m buffer (minimum) zone for all other bird species
- 1 km buffer zone of activities with a high disturbance factor, and 300 m buffer zone of no activities from the edge of heron colonies (mid-March through mid-August).
- 150 m buffer zone for all other bird island colonies

For the RCSR, a 300 m extended buffer zone was selected as it provided a conservative area for mitigation against potential disturbances and allowed for the protection of sensitive coastal habitats including habitat identified as critical for Species at Risk. The 1 km buffer zone was not used because water column oyster aquaculture activities generally would not have a "high disturbance" factor associated with their operations when mitigation measures are applied and the buffer zone is respected.

The extended buffer zone thus established was constructed from the high water mark around sensitive coastal areas. Analysis of the virtual footprint of the area confirmed that very few water column oyster aquaculture leases have been proposed for development near these sensitive coastal habitats by the province.

Waterfowl require feeding habitats; these habitats have similar characteristics as those sought by the aquaculture industry (i.e. sheltered, shallow, high productivity and food). Floating and submerged aquaculture structures may also reduce the reach of open water used by waterfowl and marine birds. This can result in displacement and disturbance of flocks of staging waterfowl and may also affect certain species requiring long distances for take-off or landing on the water. Extended buffer zones defined during the planning process address these concerns.

Conservation Areas

The Convention on Wetlands of International Importance, signed in Ramsar, Iran, in 1971, is an intergovernmental treaty which provides the framework for national action and international

cooperation for the conservation and wise use of wetlands of international importance [27]. Ramsar seeks to ensure the sustainable, wise use of wetland resources including designation of wetland sites of international importance and to ensure that wetland resources are conserved. EC is the lead federal agency for the designation and protection of Ramsar sites. The Tabusintac Lagoon and estuary is the only Ramsar site of concern for this RCSR and was among the first of the Bay Management Plans to be developed due to its status as an area of international significance.

Areas of special protection, such as Ramsar sites, were presented as a layer of information in the mapping tool and provisions were made to ensure that interactions with water column oyster aquaculture works were planned in a sustainable manner.

Wetlands

The Federal Policy on Wetland Conservation in Canada [28] promotes the conservation of Canada's wetlands to sustain their ecological and socio-economic functions. It outlines a number of specific goals and strategies to ensure a no net loss of wetland functions. Water column oyster culture is carried out in the aquatic portion of estuaries; there is limited potential for project effects on wetlands which occupy the partially submerged and terrestrial portion of those estuaries. Buffer zones defined during the planning process are protecting wetlands. However, site access may be a potential pathway of concern.

Land-based access to the sites occurs on a limited basis during the winter. Access to the intertidal zone by motor vehicles other than boats is prohibited under provincial regulations (*N.B. Motor Vehicle Regulation – Trespass Act*) except when operating such vehicles on ice or on frozen ground that is completely covered by snow. As a precaution, the use of existing public access points such as wharves and roads is encouraged to minimize disturbances to wetlands.

5.1.7. Parks Canada

Parks Canada has authority over all lands in the National Parks of Canada and is the sole authority for enforcement of the *Canada National Parks Act*. National Parks, National Historic Parks and other properties falling under Parks Canada jurisdiction are defined by jurisdictional boundaries listed under the official Canada Lands Survey Records. Park boundaries were presented as a layer of information in the mapping tool and provisions were made to exclude them from water column oyster aquaculture areas. Parks Canada personnel were consulted for their information on the ecological integrity of areas within their jurisdiction.

Summary of bay management planning process

As each department added information about areas unsuitable for water column oyster aquaculture, pathways to several ECCs were eliminated; therefore, they were no longer considered as VECs in this RCSR. They are summarized in Table 2.

Table 2 : ECCs managed under the BMF

Environmental resource	Environmental and Socio-economic Component of concern	Provisions adopted under the BMF
Biophysical environment	Wetlands	Buffer zone excludes project from wetlands.
	Species of Special Conservation Concern and other Sensitive Species (birds)	Known areas where wildlife, mainly marine birds concentrate for migration, resting, feeding, moulting, breeding and nesting were avoided during the planning process. Buffer zones mitigate against disturbance of Species of Special Conservation Concern and their habitats.
	Species at risk (non-aquatic)	Buffer zones mitigate against project interactions from areas where birds listed in SARA congregate for migration, resting, feeding, moulting, breeding and nesting.
	Carrying capacity	Limitation of total surface area of bays reserved for water column oyster aquaculture. Long term monitoring program of mollusc productivity.
Socioeconomic environment	Harvesting of marine resources	Bay management plans and provincial process make provisions to reduce conflict with commercial, recreational and aboriginal fishers Buffer zone and navigation corridors provides shoreline access for harvesting of resources
	Conservation areas	Buffer zone and provincial process limit access to conservation areas. Projects excluded from provincial and national parks. Ramsar site designation considered during planning process.
	Heritage and Archaeological resources	Provincial process limits access to known heritage and archaeological resources. Nature of activity is deemed unlikely to alter or destroy artefacts.
	First Nations	Bay management plans limits interactions with First Nations lands and interests.

5.2. DEFINITION OF VECS

This section discusses more ECCs and their selection, or not, as VECs. Table 3 summarizes this discussion.

5.2.1. Air quality

Air quality was reviewed for consideration as a VEC. It is defined, on a local basis, in terms of the presence or absence of pollutants, formed directly or indirectly as by-products of industrial activities and the burning of fossil fuels. The majority of oyster aquaculturists in N.B. (65%) have adopted the lower emission and lower noise level four stroke engines. Smaller sources of emissions would be power generators or hydraulic equipment and from vehicles, such as four-wheeler and skidoos, used for harvesting over the ice during winter. The overall contribution of air emissions from these sources is not considered significant, thus air quality is not a VEC in this RCSR.

5.2.2. Marine water quality

Water is essential to human life and to the health of the environment. Marine water quality relates to the composition of water as affected by natural processes and human activities. It can be defined by a body of water's physical, microbiological and chemical characteristics. Marine water quality could be affected by water column oyster aquaculture works, thus it is considered a VEC.

5.2.3. Fish and fish habitat

N.B.'s oyster culture projects are primarily located in nearshore coastal waters, which are critical to many aquatic species. They are part of the southern Gulf of St. Lawrence ecotype which is one of the most productive marine ecosystems in Canada. These coastal waters provide a rich and varied habitat for a diversity of marine life. Fish and fish habitat could be affected by water column oyster aquaculture works, thus it is considered a VEC.

5.2.4. Marine mammals

Seals, whales, dolphins and porpoises are found throughout the Gulf of St. Lawrence. Whales are seldom found in shallow estuarine waters. Scientists[5] have confirmed that the potential for spatial interactions with whales, dolphins and porpoises was considered negligible. Of the four species of seals in the St Lawrence, Harbour and Grey seals are the most likely to occur in shallow bays. Culture infrastructures are not designed to retain or attract marine mammals, and oysters are not recognized prey for these species. The infrastructures are permeable and present little risk for entanglement. There are no reported incidents of interactions between marine mammals and oyster culture infrastructures, thus the likelihood of interaction was determined to be negligible. Therefore marine mammals are not considered a VEC in this RCSR.

[5] JF Gosselin, DFO, personal communication

5.2.5. Aquatic species at risk

Scientists were consulted on the habitats for the aquatic species currently listed under SARA. Species listed occupy deeper offshore habitats and the potential for interactions was considered negligible. Therefore Aquatic Species at Risk is not considered a VEC in this RCSR.

5.2.6. Marine migratory birds

Although relatively few birds are year-round residents of N.B.'s nearshore habitats, many species seasonally inhabit rivers, estuaries, beaches, dunes, barrier islands, wetlands and salt marshes during their annual migrations and breeding seasons (including in the winter). N.B. is part of the Atlantic Flyway, one of the four principal bird migration routes in North America. Migratory birds could be affected by the presence of water column oyster aquaculture works; therefore, marine migratory birds are considered a VEC in this RCSR.

5.2.7. Transportation and navigation

Local residents and visitors value being able to navigate on N.B.'s bays for the purpose of transportation, commerce or recreation. The public's right to navigation could be affected by the presence of water column oyster aquaculture works; therefore, transportation and navigation is considered a VEC.

The resulting VECs are as follow:

- Marine Water Quality
- Fish and Fish Habitat
- Migratory birds
- Transportation and Navigation

Table 3 – Issues Scoping and Pathway Analysis - Summary

Environmental resource	ECC	Possible Pathway of concern	Rationale
Atmospheric environment	Air quality	Minor contribution	No significant concern
Biophysical environment	Marine Water Quality	Potential for changes in physico-chemical and microbiological characteristics	Included as a VEC – concerns identified
	Fish and Fish Habitat	Potential for changes in aquatic animal health Potential for introduction of exotic species Potential for interactions with eelgrass	Included as a VEC – concerns identified
	Marine Mammals	Potential for interactions is considered negligible	No significant concern
	Species at risk (aquatic)	Potential for interactions is considered negligible.	No significant concern
	Marine migratory birds	Potential for disturbance and displacement Potential for attraction of marine migratory birds.	Included as a VEC – concern identified
Socio-economic environment	Transportation and Navigation	Potential for interactions with other users	Included as a VEC – legislation and concern identified

5.3. DESCRIPTION OF POTENTIAL INTERACTIONS OF WATER COLUMN OYSTER AQUACULTURE WORKS AND VECS

The potential environmental effects on each VEC are described and analyzed in the following discussion. The environmental impacts of shellfish culture vary depending on the scale of culture, the culture method and local conditions [29]; [30]; [31]. For the purpose of this RCSR, the spatial boundary for the proposed project is defined as the works associated with the lease area itself. The temporal boundary is the complete life cycle of the work (i.e. installation, modification, and decommissioning) for the occupation or use of the site.

Unless where otherwise indicated, information about potential interactions was obtained from the 2006 National Advisory Process (NAP) [32] on assessing habitat risks associated with bivalve aquaculture in the marine environment.

5.3.1. Marine water quality

The marine water quality VEC considers marine sediments, microbiological composition and marine waters.

Chemical composition

Marine water quality could be affected by spills of oil and gas. The industry has generally opted to use more efficient boat motors, which should reduce the likelihood of chronic spills of oil and gas in the water column during construction and operation. There is potential for some contamination during the re-fuelling of boats. All

equipment should be kept in good repair and operating efficiently to reduce the potential for chronic spills; motors should be re-fuelled with care to prevent drips or spills; re-fuelling should take place at a location where spill cleanup equipment is readily available; equipment used for remediation and mitigation must be accessible at all times and facility workers should be trained in the safe and effective use, storage and disposal of fuel and petroleum products. During winter harvesting operations, fuelling of equipment should be conducted off the ice, in areas with impermeable surfaces.

Marine Water Quality could be affected by the use of equipment during operation and maintenance. As a result, anchors and other equipment are to be made of clean and non-toxic material; concrete anchors should be pre-cast and pre-cured away from the water to avoid seepage of potentially toxic substances into the water body.

Marine Water Quality could be affected by spills during accidents and malfunctions. EC requires the proponent to promptly contain, clean-up and report any spill or leaks to the 24-hour environmental emergencies reporting system (1-800-565-1633) with the following information: location of the spill source; area of impact; dimensions of impact; area characteristics; wildlife in the area; and wind and current direction. The proponent should have an Emergency Contingency Plan (ECP) and Emergency Preparedness Plan (EPP) in place for the project (refer to CAN/CSA-Z731-03 Emergency Preparedness for industry). Facility workers should be trained in safe work practices and emergency response.

If equipment must be fuelled on the ice because of an emergency, an impermeable surface (i.e., a tarp or absorbent pad) should be used to assist in containing spills. If a spill occurs on the ice, the spill must still be reported to the 24 hour reporting system for further instruction.

After application of these measures, residual environmental effects are likely to be of small magnitude and temporary.

Microbiological composition

Marine water quality could be affected by bacteriological and viral pathogens. There are a number of diffuse sources of pathogens in estuaries, including agricultural operations, wastewater and septic systems, boating activities, etc. These are continuously monitored through the CSSP program.

There is concern that boats used for the aquaculture operations could become sources of pathogens by discharging human waste or contaminated greywater from vessels. The discharge of human waste and contaminated greywater in coastal waters is prohibited under section 36 of the *Fisheries Act*. There is also concern that water column oyster aquaculture works may be attracting and concentrating sea birds in the vicinity of sites, thus increasing the risk of microbiological contamination from bird deposition. As mentioned earlier, the Canadian Shellfish Sanitation program (CSSP) is a common responsibility of the CFIA, DFO and EC. It aims to give reasonable assurance to consumers that molluscs grown and

harvested in Canada are safe and healthy to eat. Achieving microbiologically safe bivalve molluscs and reducing the risk of bacterial contamination of oysters from suspended bags can be controlled by a variety of mechanisms; including submerging of oysters for 30 days in approved shellfish growing areas. The CSSP defines these mechanisms and criteria with individual growers and monitors the situation to ensure that appropriate measures are implemented on a site-specific basis. For instance, Supplier Quality Assurance Agreements (SQAA) can be defined with federally registered processing plants to ensure the safety and quality of the shellfish supply and effective means of control for delivery and transportation of goods. Growers using water column aquaculture techniques may require entering into a Supplier Quality Assurance (SQA) agreement with a federally registered processor. The CFIA should be contacted for more information regarding these requirements.

Sustainable development of water column oyster aquaculture can contribute to the prevention and control of aquatic pollution since it relies essentially on good-quality water resources. With these measures in place, residual environmental effects are unlikely to be significant.

Nutrients

Shellfish play a critical role in the cycling of nutrients (carbon, nitrogen and phosphorus). In temperate estuarine habitats, oysters have been shown to optimize nitrogen recycling [11].

Food eaten by oysters is either used for growth and reproduction or excreted and rapidly remineralized into dissolved ammonium, which in turn may enhance primary production of phytoplankton and macrophytes (eelgrass and algae) [33]. Material not digested by the oysters is transferred to the sediments surface as pseudofaeces. A portion of this biodeposit is removed by scavengers or resuspended while another portion becomes gradually incorporated into the sediment. Through a series of processes with aerobic and anaerobic sediments, dissolved nutrients are subsequently buried in the sediments or lost to the atmosphere [34]. This mechanism can act both as a nutrient retention mechanism and as a process which recycles nutrients. In the case of water column oyster aquaculture, the nutrient recycling capabilities of oysters is believed to be optimal since growth rates are increased (i.e. higher nutrient absorption) and mature individuals are regularly extracted (i.e. nutrients sequestered) and replaced with rapidly growing juveniles [35].

There is concern that increased accumulation of biodeposits under water column oyster aquaculture works could exceed the capacity of the site to disperse or assimilate biodeposits, thus leading to nutrient enrichment. To avoid this effect, the proponent is required to adjust the population density in accordance with the provincial aquaculture permit conditions established under the N.B. *Aquaculture Act* and Regulations. In N.B., oyster culture works are seasonal and are located in areas affected by tidal and wave energy. It is estimated that current velocities of 0.20 to 0.25 m s^{-1}

are required to re-suspend and disperse biodeposits [36]; [37]. These velocities are regularly exceeded in bays where water column oyster aquaculture is conducted [38] thus limiting the potential for that effect.

No significant changes in sediment chemistry typical of nutrient enrichment were detected along transects outside and within oyster leases in N.B.; this lack of footprint may be attributed to tidal energy and winter storms, to the seasonal nature of these operations and to the relatively low stocking density of oysters [23]. As a result, nutrient enrichment in the footprint of oyster culture sites in N.B. is not considered a significant concern.

Marine sediments

Even if there are no nutrients added, mollusc rearing can potentially concentrate organic matter (i.e. biodeposits, shells and epibionts) locally under the culture area. There is concern that deposition of this organic matter could result in changes to the substrate.

There could be deposition of organic material during cleaning of epibionts from lines and structures. Mitigation to reduce this effect consists of cleaning structures through air drying or other environmentally-friendly methods. There could also be deposition of non-organic material from operation and maintenance. As mitigation, the proponent is required to bring all operational waste back to shore and to ensure it is stored, disposed or recycled in accordance with provincial regulations and/or local by-laws.

There is concern that installation, construction and modification of water column oyster aquaculture works may cause disturbance of the seabed and result in temporary increases in turbidity. These activities last from a few hours to a few days. Mitigation is to install and remove structures on calm days to minimize the suspension of fine sediment particles into the water column. Anchors should preferably be installed during the winter when effects would be minimal. Physical disturbance to the site during installation, harvesting and maintenance is to be minimized.

There is concern that water column aquaculture works can act as sediment curtains. Culture structures could lead to increased deposition rates of suspended sediment or conversely the addition of structures can result in increased water velocity through the remaining open area of the lease, thus promoting the flushing of sediment. Reduced water flow may result in a decrease of natural erosion by wave action, which in turn can be followed by siltation and accumulation of suspended matter in cultured areas [30]. To reduce that effect, the site infrastructures are to be aligned to minimize impact on tidal currents and water flow.

There is concern that biodeposits could accumulate under the water column oyster aquaculture works, which could in turn lead to intense microbial activity and subsequent oxygen depletion and anoxic conditions. As seen earlier, this effect is more likely to occur in areas with limited current or tidal energy. Mitigation includes locating and installing structures where they will not inhibit dispersal of biodeposition, adjusting population density and

maintaining sufficient distances between growing lines (see mitigation in section on marine plants).

Incidental disposal of shells from a boat, ship, platform or other structure that is part of normal water column oyster aquaculture operations is not considered ocean disposal. However, disposal of fish offal or shellfish waste in the ocean requires a Disposal at Sea Permit under the *Canadian Environmental Protection Act* (CEPA 1999).

Bivalves play a role in controlling turbidity by reducing both the inorganic and organic material suspended in the water column. They remove this material and reject the undigested material as mucus-bound biodeposits. The grain size of that material effectively increases, becoming less buoyant and sinking to the bottom, where it becomes more resistant to erosion and re-suspension [39]; [37]. Mucus-bound deposits have increased cohesion, which tends to help stabilize the substrate and to delay silting up of the system [40]; [41]. Reduction of turbidity may improve light conditions and stimulate photosynthesis (primary production) [33]. These effects are considered beneficial.

After application of these measures, residual environmental effects are likely to be of small magnitude and temporary.

5.3.2. Fish and Fish Habitat

Fish

Accidental events could result in fish mortality – see mitigation for chemical contamination under Marine Water Quality.

Aquatic animal health

There is concern that movement of oysters between different watersheds during operation and maintenance could impact aquatic animal health in local and remote sites. An active surveillance program for shellfish health has been in place for a number of years and no changes in local profiles of shellfish diseases have been observed in wild and cultured populations in N.B. [6].

Serious diseases in shellfish could occur under open water column oyster aquaculture conditions as was witnessed in N.B. during the 1950's Malpeque disease outbreak. Diseases are an inherent part of the natural aquatic ecosystem. Exposure to diseases can occur when populations have not previously been exposed to existing pathogens or when exotic infectious agents are introduced into the environment. Therefore, culture species can act as a vector for the transmission of pathogens to wild species and vice versa. There are few existing cures, antibiotics and other treatments for shellfish diseases and when they exist, they are of little or no effectiveness [42].

Mitigation measures focus on responsible movement of oysters within and across water bodies by following the requirements of the provincial Introductions and Transfer Committee License (ITC) and

[6] M. Stephenson, (DFO Shellfish Health), personal communication

encouraging proactive surveillance, prior to any emergency disease outbreak. This could provide the data that is essential in order to respond immediately and effectively to isolate the source and identify the extent of the problem. The use of landfill sites to dispose of infected stocks rather than discharging them into the surrounding waters is required. In addition debris and waste management must be done in accordance with applicable legislation, guidelines, and best management practices.

Following application of these mitigation measures, the residual environmental effects are likely to be minor.

Exotic and invasive species

The development of shellfish aquaculture worldwide, along with an increased demand for live shellfish, has increased the risks of transfer and introduction of exotic invasive aquatic organisms. Potential impacts on shellfish from accidental introduction could result in consequences for both cultured and wild stocks. Competition from exotic epibionts can impact the food availability and result in reduced fitness or mortality of both cultured and wild bivalves and/or other biota.

Mitigation measures focus on responsible movement of oysters and equipment, including boats, within and across watershed boundaries by following the requirements of the provincial ITC License and requesting proactive surveillance to attempt to detect exotics, prior to any introduced species outbreak. The conditions of that license may require that all shellfish be washed and cleaned of all mud, extraneous material and other bio-fouling attached to the shell prior to leaving the harvest site. Disposal or recycling of that organic material must be done in accordance with Federal and/or Provincial Regulations and/or local by-laws.

The proponent is also encouraged to adopt appropriate husbandry practices in a manner which will minimize the colonization of marine organisms. Shellfish should be de-clumped and cleaned in the water from where they were collected and transported in a minimal amount of water. Spray-down of equipment is recommended to minimize the movement of epifauna.

Where ITC conditions do not apply, equipment and boats that are being transferred from one marine water body to another should be cleaned of any sediments, plants or animals by washing with freshwater and/or spraying with undiluted vinegar or treated with hyper saline waters, prior to being mobilized to the project site. The proponent is encouraged to learn to identify invasive species of concerns and to report any sightings to DFO.

After application of these measures, the residual environmental effects are likely to be minor.

Spawning habitat

Cultivated oysters, like their wild counterparts, are integral components of marine ecosystems and can have both direct and indirect effects on various other biotic communities. There is concern that cultured oysters are predators of larvae of other invertebrates.

Estuaries are used for spawning by a number of invertebrates. Their young are released as free-floating larvae which drift in the currents for a certain period until they mature and transform into juveniles and adults. These larvae are generally in a size class that exceeds the oyster's preferential food size, but there is a window during which larvae can potentially be ingested by oysters [43].

Mechanisms that regulate suspension feeding are important in controlling predation of larvae and, hence, in structuring marine benthic communities. Predation by filter feeders on pelagic larvae is mediated by a combination of physical, chemical, and biological processes[44]. Estuarine species respond to intense and predictable predation not only by increasing fecundity, but by evolving adaptations that directly improve larval fitness [44], defensive adaptations such as larval spines, setae and shells, behavioural patterns during transport and settlement [45], temporal separation of larvae [46] and production of chemical substances [47]. Considering that oysters are native to N.B. estuaries, it is reasonable to assume that such mediation mechanisms are present in pelagic larvae of other species.

In addition, predation on larvae by benthic filter-feeders has been shown to be selective, not indiscriminate [47]. For example, oysters will discriminate between phytoplankton cells and inert particles and select particles individually for either ingestion or rejection. Particles that are too small (<3 to 5 μm) or too large (> 100 μm, equal to larvae in size) are sorted before ingestion and rejected [43]; [48].

Experimental and field studies have demonstrated that substantial numbers of competent larvae can manage to metamorphose in the presence of adult filter-feeders despite their high filtration and predation rates [49], in part because larvae are likely to be entrained only within a narrow region around the shell of each adult and in part because larval behaviour, deliberate or not, can potentially reduce the likelihood of entrainment by the adult feeding current [45].

The pelagic larvae of invertebrates are considered an important food-source for filter-feeding organisms, predation being an important mechanism of energy transfer in the food chain. Therefore, the likelihood of interactions between adult oysters and larvae of other species exists, but is not considered more detrimental than interactions that occur within wild populations. On the other hand, possible positive interactions include the likelihood that the reproductive output of oysters, gametes and larvae will act as a source of food to other filter feeders. This addition of gametes to the marine environment could also cause the development or restoration of oyster beds where they existed prior to the 1950's [13], which is considered beneficial.

There is concern that water column oyster aquaculture structures could interfere with spawning in anadromous fish species that have semi-buoyant eggs such as shad, alewife, tomcod and striped bass. These fish generally spawn upstream of or at the salt-water wedge (low salinity). Because water column oyster aquaculture works are located in the mesohaline portion of the

estuary (mid-salinity), the potential for spatio-temporal interactions between water column oyster aquaculture works and spawning anadromous fish is considered negligible. Other anadromous species, like salmon, trout and smelt spawn in freshwater; therefore, the likelihood of interactions is considered negligible.

Feeding habitat

There is concern that cultured oysters could compete for food with other estuarine species. Experimental studies have been unable to demonstrate food depletion near water column oyster aquaculture, even at high oyster densities [50]. Field studies have documented higher diversity and abundance of organisms, including plankton, invertebrates and fish in the vicinity of oyster reefs and oysters in culture [17]; [46]; [51]; [16]; [15]; [52]; [53], suggesting that primary and secondary production is not limited by competition for food.

In order to minimize competition for food and space, bivalves have evolved using different strategies, which allow them to use a wide range of habitat and to coexist in similar environments, particularly in temperate estuaries where food is not considered limiting [54]. Modeling studies simulating the impact of oyster culture on food webs predict that oyster culture would indirectly impact the diets of estuarine components [55]. Contrary to what one might expect, increasing the surface area of cultivated oysters can cause secondary production to increase, providing food for top predators, particularly juvenile fish. These results suggest that the presence of oysters in culture indirectly provides more food to nekton and birds and that oyster culture has a small impact on the stability of the ecosystem. Or in other words, that temperate estuarine ecosystems have long been adapted to the presence of oysters [55]. Another study predicts similar results and that adding oyster (either in aquaculture or by restoring oyster reefs) should increase benthic primary production, zooplankton and fish densities, while modulating phytoplankton blooms and reducing medusa (jelly-fish) [56]. A recent survey conducted in the SGSL to assess faunal communities (i.e. fish and invertebrates) within suspended oyster aquaculture leases and at varying distances away from leases observed significantly higher total organism abundance within lease sites while no significant difference in species richness was found[7]. This suggests that water column oyster aquaculture works may have a positive effect on these communities.

Natural oyster populations are still considered to be depleted when compared to historical values and densities of oysters in culture are lower than densities in natural oyster reefs. Interaction between cultured oysters and other shellfish populations is therefore likely to be less significant than interactions that occurred with natural oyster populations. Competition for resources is believed to rarely be an important determinant of individual growth of bivalve molluscs, especially in present day conditions of eutrophication [57].

[7] M. Skinner (UNB, Fredericton) personal communication

Submerged structures often create new habitat for aquatic organisms such as algae, invertebrates and crustaceans [58]. The organisms growing on bivalves in suspension may then, in turn, attract other organisms. Oysters and the associated fauna which "drop off" from culture operations may enhance the amount of food available to benthic predators [59]. The reef effect caused by water column oyster aquaculture structures can also result in increases in habitat and food availability to some pelagic species of fish, birds and large invertebrates, such as lobsters and crabs [30]. Ongoing studies have shown that oyster aquaculture structures also accumulate varied species and sizes of epifauna (e.g. amphipods, algae, arthropods, molluscs, etc.) which in turn provides food for other species, particularly juvenile fish[8].

In addition, aquaculture gear, by virtue of their inherent structural complexity, can serve as refuge and protect juvenile fish and lobster from predation. A link has been established between higher abundance of organisms in suspended aquaculture gear (when compared to other estuarine habitats) due to this enhanced predator protection [60]. The feces and pseudo feces produced by the oyster contain organic matter which can form an important energy source for benthic invertebrates and fish species feeding at the sediment/water interface [13]. Pseudo feces constitute a source of incompletely digested particles which can be recycled directly for consumption, thus providing a source of food with high nutritional value for benthic organisms [61]; [36]. Overall, the potential for effects on food supply is not expected to be of significant concern.

Rearing habitats

There is concern that benthic communities beneath structures may be adversely affected during operation and decommissioning of the water column oyster aquaculture works. Anchoring and/or repositioning longlines could disturb the substrate. This could potentially displace and/or directly impact benthic species within the footprint of the structures. This impact is likely to be minor and temporary.

During operation of the water column oyster aquaculture works, there could be losses of shells, shellfish stock and epibionts which could potentially accumulate on the seabed underneath the structures. The incidental introduction of shells can provide substrate for spat settlement which, in turn, can increase diversity and recruitment of species. The deposition of small spat falling from grow-out bags may result in recruitment to the wild population while reducing predation pressure on benthic communities through the addition of new prey [30]. Increased aggregation and spawning fitness of predators such as plaice, starfish, crabs and lobsters as a result of deposition under shellfish culture has been documented [62]. Bivalves in culture are believed to act in much the same way as those in natural communities insomuch as they provide a stable attachment site for the growth of a number of fouling organisms and associated fauna and refuge

[8] M. Hardy (DFO, mollusc ecology) personal communication

areas for free-living fauna [13]. Grow-out bags can create reef effect and protect juvenile fish hiding within epibionts or in the shade of the structure. Physical structures, such as rafts, blocks, ropes and buoys related to culture operations may add three-dimensional habitat that further enhances the diversity and abundance of biota [58]. One of the documented positive aspects of coastal shellfish cultivation has been the provision of substrata and shelter in otherwise barren sites [63] [60]. Overall, the impact of oyster culture on rearing habitats is unlikely to be significantly adverse.

Migration habitat

Floating or submerged structures occupy space and there is concern that they may displace the "direct line" movement of fish. Water column oyster culture installations do not include leaders, nets, or other obstacles that could either trap or kill fish or stop or impede their migration. No bait or food is used that could lure predators to the installations. They are therefore considered permeable and the potential for interference with migration is considered minimal.

Nursery habitat

Water column oyster culture works are also considered permeable to mobile larvae. There is no reported accidental by-catch of juvenile fish from water column oyster aquaculture works. Potential positive interactions include the reef effect of water column oyster aquaculture works which could potentially create nursery habitat. In fact, it has been shown that water column aquaculture gear can provide important nursery habitat for a number of recreationally and commercially important fish and invertebrate species [60]. Potential impacts of water column oyster aquaculture works on nursery habitat located in marine plants are described below.

Marine plants

Eelgrass (*Zostera marina*) is a marine flowering plant found mainly in quiet intertidal and shallow subtidal zones with a sandy or muddy substrate. Eelgrass is widely viewed by scientists as a keystone species in coastal marine ecosystems. Eelgrass distribution is related to salinity and water depth and is limited by the amount of sunlight that can penetrate the water column. Natural variability in the size and position of eelgrass beds can be substantial over time [64]. There is consistent evidence of a widespread decline in eelgrass distribution and abundance in the Maritime Provinces. Researchers working in the SGSL and anecdotal evidence suggest that major declines in eelgrass biomass and/or cover have occurred within the past decade. Reasons suggested for declines in eelgrass distribution may be geographically specific, or may reflect synergistic interactions among several factors. These include eutrophication [65]; [66], disturbance by green crab [67], and environmental changes [68].

Eelgrass plays an important role in maintaining coastal biodiversity by providing protection and cover for a variety of organisms. The networks of roots and stems of eelgrass help to

stabilize the substrate trap debris and take up dissolved nutrients with each tidal cycle. They are also an important source of organic matter which is recycled by bacteria and converted into food resources for other organisms. Eelgrass is therefore considered to be fish habitat, particularly nursery habitat for a number of aquatic organisms while also providing important rearing and forage habitat for several species of fish and birds.

The most common concern is related to past practices whereby oyster culture was conducted by partial removal of eelgrass in order to increase water flow and facilitate harvesting of oysters. This practice is no longer carried out with water column aquaculture. In any case, removal of eelgrass is prohibited, except in accordance with the conditions of a license issued under section 44 of the *Fisheries Act* or an authorization to destroy fish habitat under section 35 of the *Fisheries Act*. Therefore, the proponent cannot harvest or knowingly destroy marine plants.

Oyster culture projects require that structures be placed in the water, often over eelgrass habitats. While mechanisms of positive interactions between natural aggregations of suspension-feeding bivalves and marine plant communities have been suggested [67, 68], the same may not be true for bivalves in suspension culture [13].

Eelgrass root systems are shallow and so can be dislodged easily by a range of activities, including trampling, anchoring, digging, dredging and powerboat wash. The removal of plants typically results in increased patchiness which may destabilize the bed and increase the likelihood of additional losses. There is potential for localized impact to eelgrass during installation of structures; consequently, the proponent is required to minimize disturbances to eelgrass by sizing anchors appropriately or by installing them permanently in order to prevent dragging under tension or adverse weather conditions. Anchors should preferably be installed over the ice when eelgrass is dormant. Moorings should not be located in eelgrass beds and other sensitive coastal habitats.

Eelgrass requires a particular light regime to photosynthesise and grow. The amount of sunlight that filters through the water column is reduced as water depth increases, and is also affected by the clarity of the water. Turbidity can potentially affect eelgrass growth by reducing light penetration, thus restricting the amount of photosynthetically active radiation available to the submerged plants. Increases in turbidity are a commonly cited factor in the decline of eelgrass beds worldwide [69]. Filtration from bivalves is theorized to improve water clarity by removing and precipitating suspended matter [70] which results in increases in light penetration and survival of eelgrass [71]; [72]. Increased turbidity caused by phytoplankton blooms has been implicated in the loss of eelgrass beds [73]; [74]. Oysters are long-lived animals that overwinter and increase their feeding activity in the spring in response to rising water temperatures. The pre-harvest oyster population is believed to be an important consumer of the spring phytoplankton bloom, which may be critical in dampening large blooms[39]. Therefore, in this case, the presence of oyster culture

is likely to have positive effects.

There is concern that water column oyster aquaculture works will shade portions of eelgrass beds which may result in diminished fitness or die-off of eelgrass. To avoid eelgrass impacts from shading, the proponent is required to space rows of water column oyster aquaculture works at a minimum of 3 m apart and to not exceed 50% coverage of the surface area of the lease [75]. In addition, suspended aquaculture works should be anchored in such a way as to allow swaying of the structures during each tidal cycle and to avoid overlap with the same area of eelgrass over time. Also, because they can't move with the tides, off-bottom structures should be located in areas with minimal eelgrass beds. Structures should also be designed and installed to maximize openings to increase light penetration.

There is concern that biodeposition from water column oyster aquaculture could adversely affect eelgrass. A study done in N.B. suggested that deposition under water column oyster aquaculture structures was quickly dispersed or processed by the benthic community [23]. Therefore, this impact is not expected to be significant. After application of these measures, the residual environmental effects on marine plants are likely to be localized and minor.

5.3.3. Marine migratory birds

There is concern that water column oyster aquaculture operations can potentially attract marine migratory birds. Increased abundance of birds around water column oyster aquaculture sites has been observed. This is mainly due to the provision of perching areas (buoys, platforms, etc) and to the diverse communities of organisms growing on the structures, offering an interesting food source for a variety of species [13]. The proponent is encouraged to explore alternatives to reduce bird attraction and avoiding potential for interactions from occurring. Also it is recommended that no litter (including food scraps) be left in coastal areas since they can artificially enhance the populations of avian and mammalian predators. Keeping the site free of waste and mortalities during operation will reduce the attraction of birds and other wildlife.

During the bay planning exercise, EC recommended a number of buffer zones around areas of particular importance to marine migratory birds as mitigation against potential disturbance and displacement. Additional concern relates to the disturbance and displacement of birds during travel to and from the site. The proponent should avoid concentrations of seabirds, waterfowl and or shorebirds and their habitat during spring and fall migration, when anchoring equipment, accessing wharves or ferrying supplies. All vessels and machinery should be well muffled. To avoid disturbing marine migratory birds, equipment should not be stored or repaired on beaches or wetlands. Personnel should be educated on measures to be taken to avoid disturbing migratory birds. In addition, transferring of stock into deeper waters for overwintering should be delayed as late as possible in the season to limit

interactions with birds during fall migration periods.

Should water column oyster aquaculture equipment wash up on beaches identified as critical habitat during spring or summer, the proponents would be expected to contact the Canadian Wildlife Service (CWS) and New Brunswick Department of Natural Resources (NBDNR) to ensure that Piping Plovers, other species at risk, or beach nesting migratory birds are not disturbed during retrieval of equipment and to ensure compliance with SARA, the MBCA, and the *New Brunswick Endangered Species Act*. CWS and NBDNR may restrict access to some areas of beaches during sensitive periods.

Should water column oyster aquaculture equipment wash-up in National Wildlife Areas or Migratory Bird Sanctuaries, or should beach clean-up activities be planned in these areas, the proponents would be expected to contact CWS to ensure that sensitive wildlife resources are not disturbed and to ensure compliance with the National Wildlife Area Regulations and the Migratory Bird Sanctuary Regulations. Failure to do so may result in charges under these regulations.

Should water column oyster aquaculture equipment wash-up on land within Kouchibouguac National Park, or should beach clean-up activities be planned, no access to the National Park should take place without the permission of Parks Canada.

Following the implementation of these measures, residual environmental effects are unlikely to be significant.

5.3.4. Transportation and navigation

Coastal areas support the activities of many resource users, including marine transportation, tourism and recreation, resource harvesting, etc. Because of the presence of water column oyster aquaculture works, there is potential for interference with navigation corridors. As mitigation, the proponent is required to comply with all conditions of the NWPA authorisation issued by the NWPP. Following the implementation of these mitigations, residual environmental effects are unlikely to be significant.

5.4. IMPACT OF THE ENVIRONMENT ON THE PROJECT

5.4.1. Climate

Potential effects of the environment on project activities are weather related. Oyster culture sites are subject to the environment in which they are located. Climatic conditions vary from normal to extreme. Heavy winds or abnormal weather or ice patterns could result in damage to water column oyster aquaculture works and loss of oysters. The following measures are recommended:

- engineer site design to withstand extreme weather conditions;
- use proven technologies and incorporate redundancy into the system design;
- conduct installation during benign weather conditions, to minimize potential for accidents;
- transfer stock during benign weather conditions to minimize

the potential for accidents.

Since interactions between the climate and the project are usually short-term and can be anticipated and mitigated, residual environmental effects are unlikely to be significant.

5.5. ACCIDENTS AND MALFUNCTIONS

Accidents and malfunctions were considered relative to each identified VEC. With the nature of the projects to be captured under this RCSR, the potential environmental effects resulting from accident and malfunction includes

- potential for fuel and oil spills which could impact marine water, fish and fish habitat, birds and their habitat; and
- potential for damage to structures from adverse climate.

Significant adverse residual effects on the project resulting from accidents and malfunctions are unlikely with proper implementation of the identified mitigation measures.

5.6. EVALUATION OF CUMULATIVE ENVIRONMENTAL EFFECTS

The Act requires that the assessment of potential environmental effects also considers the potential of cumulative environmental effects. Cumulative environmental effects are defined as 'changes to the environment that are caused by an action in combination with other past, present and future human activities'. Cumulative effects can occur when environmental effects take place so frequently in time and so densely in space that the effects of individual impacts cannot be assimilated.

With the implementation of mitigation, many of the potential effects associated with water column oyster culture works are short-lived, localized, and reversible. In addition, the seasonal nature of the water column oyster aquaculture activities limits the duration and frequency of potential effects. Their capacity to act in a cumulative manner is deemed to be minimal. Water column oyster aquaculture activities are controlled under Provincial and Federal permits and authorizations; interactions with other activities that could produce cumulative effects are considered in advance and can be mitigated.

The bay management planning exercise, carried out by the different agencies, looked at the sum of existing and likely future projects in order to reduce the potential for cumulative environmental effects. BMF is a comprehensive and integrated management tool that considers water column oyster aquaculture within the context of other human activities that may affect a bay, including watershed activities [32]. Planned and existing activities were considered during the exercise to define and apply buffer zones which would limit potential interactions with the aquaculture works. The AMP will continue to provide continuous feedback as to the effectiveness of the BMF in regards to sustained aquaculture development. TC will work with this committee as part of its obligation to cumulative effects monitoring. This RCSR will be updated regularly and will take into consideration any new information about potential cumulative environmental effects.

As an expert federal authority, EC has also agreed to work with TC and other interested parties in reviewing cumulative environmental effects resulting from multiple projects and activities affecting wildlife values in the Environmental Setting identified for the RCSR, (Appendix 3).

With mitigation measures in place the likelihood of cumulative residual effects occurring is expected to be minimal and significant adverse residual effects are unlikely.

5.7. MONITORING

In the case of water column oyster aquaculture operations, project-specific follow-up programs are not typically required nor conducted.

Table 4 – Potential Environmental Effects on VECs and Measures - Summary

VECs	Environmental Effects	Project Phase	Measures
A. Marine Water Quality	1. Potential for chronic spill of petroleum products	Construction Maintenance Operation Decommissioning	Equipment accessing the site must be kept in good repair and operating efficiently to reduce the potential for chronic spills. Motors should be re-fuelled with care to prevent drips or spills. Re-fuelling should take place at a location where spill cleanup equipment is readily available. Facility workers should be trained in the safe and effective use and disposal of fuel and petroleum products. When conducting winter harvesting activities on the ice, fuelling of equipment should be conducted off the ice, in areas with impermeable surfaces. Anchors are to be made of clean and non-toxic material; concrete anchors should be pre-cast and pre-cured away from the water to avoid seepage of potentially toxic substances into the water body.
	2. Potential for accidental spill of petroleum products	Accidental event	Spill response kit should be kept in a readily accessible location to facilitate rapid and effective response. Any spill or leaks must be promptly contained, cleaned up, and reported to the 24-hour environmental emergencies reporting system (1-800-565-1633) with the following information: location of the spill source; area of impact; dimensions of impact; area characteristics; wildlife in the area; and wind and current direction. The proponent should have an Emergency Contingency Plan (ECP) and Emergency Preparedness Plan (EPP) in place for the project. Refer to CAN/CSA-Z731-03 Emergency Preparedness for industry. During an emergency, if equipment must be fuelled on the ice, an impermeable surface (i.e., a tarp or absorbent pad) should be used to assist in containing spills. If a spill occurs on the ice, the spill must still be reported to the 24 hour reporting system for further instruction. Facility workers should be trained in safe work practices and emergency response.
	3. Potential for modification of sediment physico-chemical characteristics	Construction Maintenance Operation	The proponent is encouraged to maintain and clean the structures through air drying or other environmentally-friendly methods. The proponent is required to bring all operational waste back to shore and to ensure it is stored, disposed or recycled in accordance with provincial regulations and/or local by-laws. Physical disturbance to the site during installation, harvesting and maintenance should be minimized. The proponent is required to adjust the population density in accordance with the provincial aquaculture permit conditions established under the N.B. *Aquaculture Act* and Regulations. The site infrastructure should be aligned so as to minimize impact on the tidal current and water flow. The proponent is encouraged to install and remove structures on calm days to minimize the

Table 4 – Potential Environmental Effects on VECs and Measures - Summary

VECs	Environmental Effects	Project Phase	Measures
			suspension of fine sediment particles into the water column and to preferably install anchors in the winter when effects of turbidity on other organisms would be minimal Disposal of fish offal or shellfish waste in the ocean requires a Disposal at Sea Permit under the *Canadian Environmental Protection Act* (CEPA 1999).
	4. Potential for modification of microbiological composition	Construction Maintenance Operation	The proponent should contact CFIA for more information regarding their shellfish growing, harvesting, transportation and Supplier Quality Assurance Agreements requirements.
B. Fish and Fish Habitat	1. Potential for changes in aquatic animal health	Maintenance Operation	When shellfish are transported and released in another water body, Fisheries Regulations require that those organisms have no disease or disease agent and that the organisms have no adverse effect on the genetic characteristics or size of fish populations of the receiving watershed. The proponent is therefore required to obtain the necessary License to release or transfer shellfish and/or an Import permit from the N.B. Introductions and Transfers Committee. The proponent is required to conduct regular health inspections of its stock as per the conditions of the NBDAA permits and to report any disease outbreak immediately to DFO. The proponent is required to properly dispose of dead or moribund oysters on-land rather than discarding them into the surrounding waters. Disposal must be done in accordance with Provincial Regulations and/or local by-laws.
	2. Potential for introduction of exotic species	Maintenance Operation	When shellfish are transported and released in another water body, the Fisheries Regulations require that those organisms have no invasive organisms present. The proponent is therefore required to obtain the necessary License to release or transfer shellfish and/or an Import permit from the N.B. Introductions and Transfers Committee. All shellfish be washed and cleaned of all mud, extraneous material and other bio-fouling attached to the shell prior to leaving the harvest site. Disposal or recycling of that organic material must be done in accordance with Provincial Regulations and/or local by-laws. The proponent is required to conduct regular health inspections of the stock as per the conditions of the NBDAA, to learn to identify invasive species of concerns and to report any sightings to DFO. The proponent is encouraged to select its site, to deploy its structure and to adopt appropriate husbandry practices to minimize the colonization of marine organisms. All organic material removed during maintenance should be disposed of at an approved location, in accordance with provincial regulations and/or local by-laws. The proponent is encouraged to clean shellfish in the water from where they were collected and to transport them in a minimal amount of water. Spray down of equipment is recommended to minimize

Table 4 – Potential Environmental Effects on VECs and Measures - Summary

VECs	Environmental Effects	Project Phase	Measures
			the movement of epifauna. Equipment and boats that are being transferred from one marine water body to another should be cleaned of any sediments, plant or animals by washing with freshwater and or/spraying with undiluted vinegar or treated with hyper saline waters, prior to being mobilized to the project site. The proponent is encouraged to learn to identify invasive species of concerns and to report any sightings to DFO.
	3. Potential for interactions with marine plants	Construction Maintenance Operation Decommissioning	The proponent is encouraged to avoid locating moorings in eelgrass beds and other sensitive coastal habitats. The proponent should be aware that eelgrass (*Zostera marina*) is considered fish habitat. Except in accordance with the conditions of a License issued under Section 44 of the *Fisheries Act* or an authorization to destroy fish habitat under Section 35 of the *Fisheries Act*, the proponent cannot harvest or knowingly destroy marine plants. The proponent is required to minimize disturbances to eelgrass by sizing anchors appropriately or by installing them permanently, to prevent dragging under tension or adverse weather conditions. The proponent is encouraged to install anchors during the winter. Off-bottom aquaculture structures should be located in areas with minimal eelgrass beds.
	4. Potential for shading of fish habitat	Maintenance Operation	The proponent is required to space rows of water column aquaculture works at a minimum of 3 m apart and to not exceed 50% coverage of the surface area of the lease. The proponent is encouraged to anchor suspended aquaculture works in such a way to allow swaying of the structures during each tidal cycle and to avoid overlap with the same area of eelgrass over time. Structures should be designed and installed to maximize openings to increase light penetration.
C. Migratory birds	1. Potential for attraction of birds	Construction Maintenance Operation	Equipment should be designed to reduce opportunities for birds to land on floating structures Scare permits will not be issued for projects assessed under this RCSR. No litter (including food scraps), waste or mortalities should be left in coastal areas since it can attract and/or artificially enhance populations of avian and mammalian predators of eggs and chicks of birds. Concentrations of waterfowl and/or shorebirds and their habitat should be avoided.
	2. Potential for disturbance of birds	Construction Maintenance Operation	The proponent should avoid concentrations of seabirds, waterfowl and or shorebirds and their habitat during spring and fall migration, when anchoring equipment, accessing wharves or ferrying supplies. Personnel should be educated on measures to be taken to avoid disturbing migratory birds. All vessels and machinery should be well muffled.

Table 4 – Potential Environmental Effects on VECs and Measures - Summary

VECs	Environmental Effects	Project Phase	Measures
			Equipment should not be stored or repaired on beaches or wetlands. Transferring of stock into deeper waters for overwintering should be delayed as late as possible in the season to limit interactions with birds during fall migration periods. Should aquaculture equipment wash up on beaches identified as critical habitat during spring or summer, the proponents would be expected to contact the Canadian Wildlife Service (CWS) and New Brunswick Department of Natural Resources (NBDNR) to ensure that Piping Plovers, other species at risk, or beach nesting migratory birds are not disturbed during retrieval of equipment and to ensure compliance with SARA, the MBCA, and the New Brunswick Endangered Species Act. CWS and NBDNR may restrict access to some areas of beaches during sensitive periods. Should aquaculture equipment wash-up in National Wildlife Areas or Migratory Bird Sanctuaries, or should beach clean-up activities be planned in these areas, the proponents would be expected to contact CWS to ensure that sensitive wildlife resources are not disturbed and to ensure compliance with the National Wildlife Area Regulations and the Migratory Bird Sanctuary Regulations. Failure to do so may result in charges under these regulations. Should aquaculture equipment wash-up on land within Kouchibouguac National Park, or should beach clean-up activities be planned, no access to the National Park should take place without the permission of Parks Canada.
D. Transportation and Navigation	1. Potential for interference with navigation	Construction Maintenance Operation	The proponent is required to comply with all conditions of the NWPA authorisation issued by the Navigable Waters Protection Program
E. Impact of the environment on the project	1. Potential for interactions with ice and severe weather	Accident and malfunction	The proponent is encouraged to select its site, to deploy its structure and to adopt appropriate husbandry practices to minimize hazards posed by meteorological events. This means to engineer site design to withstand extreme weather conditions; to use proven technologies and incorporate redundancy into the system design; and to conduct installation during benign weather conditions, to minimize potential for accidents.

6. ROLES AND RESPONSIBILITIES

6.1. THE RESPONSIBLE AUTHORITY

TC is the Responsible Authority for this RCSR. As such, TC will be responsible for determining whether a project fits within the class and for all reporting and coordination requirements under the Act. TC will be responsible for further amendments and updating of this RCSR and for providing a list of the mitigation required under the RCSR to the proponent(s) to ensure the implementation of mitigation measures.

In keeping with subsections 20(2.1) of the Act, TC will request assistance from those Federal Authorities (FAs) that provided expert advice, in ensuring the implementation of mitigation measures identified by FAs for these projects. TC will establish a protocol to notify other federal departments when the RCSR is used to request assistance in ensuring that mitigation measures are being implemented by the proponent.

6.2. OTHER RESPONSIBLE AUTHORITIES

As explained earlier, the majority of water column oyster aquaculture projects trigger a review under the Act because of the potential issuance of an approval or authorization under a provision identified on the *Law List Regulations*. In certain circumstances, water column oyster aquaculture projects may not require such an approval or authorization, but may require an EA because of potential federal funding, or because they may take place on federal land. If another FA determines they have a responsibility to complete an EA of a project that falls within this class, TC requests this FA to notify them to ensure coordination of mitigation measures. As well, the FA and TC will discuss options for fulfilling reporting requirements.

6.3. OTHER EXPERT DEPARTMENTS

In certain circumstances, the completion of a RCSR for water column oyster culture projects may require consultation or a referral to a federal department for expert advice or, as is the case with DFO and EC. Both agencies have formally agreed to use the process outlined in the RCSR to fulfill their EA requirements when identified as an RA for projects assessed by this RCSR.

DFO, in the role of a Federal Authority, participated in the development of this RCSR for water column oyster aquaculture and helped to coordinate the BMF. DFO provided mitigation, as defined in the Policy for the Management of Fish Habitat (1986) to the generic environmental assessment and an analysis of pathways of effects. The aim of the mitigations is to reduce and/or eliminate the pathways of effects to fish and fish habitat. DFO conducted a risk assessment of using the RCSR approach in assessing water column oyster aquaculture projects and is confident that this approach and mitigation measures provided therein will ensure the objectives of its department's Habitat Policy are met.

DFO acknowledges the limitations placed on the use of this RCSR, which include the conditions outlined in sections 2. Referrals

to DFO will only be required when the works or undertakings requires an approval as per the habitat provisions of the *Fisheries Act*. Through this referral process, DFO (in the role of a FA) can provide additional advice and mitigation to TC on a project-by-project basis. If DFO issues specific authorizations or approvals associated with a project under the *Fisheries Act*, they become a RA in accordance with the *Law List Regulations* of the Act. In such cases where TC and DFO are both RAs for a project, they have agreed that TC will coordinate completion of the RCSR.

EC is an expert federal authority. In this capacity, the department offered specialist knowledge and information pertinent to RCSR preparation (e.g., project-environment interactions of concern, best management practices). EC may audit water column oyster aquaculture sites subject to the RCSR for compliance with legislation administered by the department including the *Canadian Environmental Protection Act*, *Fisheries Act* (Section 36), *Species at Risk Act* and the *Migratory Birds Convention Act* (Appendix 4). BMPs that should be considered by the proponent in achieving compliance include, but are not limited to, those measures identified in Section 5. EC offered specialist knowledge and information pertinent to RCSR preparation (i.e. project-environment interactions of concern and BMPs). EC is prepared to help TC communicate BMPs and conduct annual verification of cumulative effects.

6.4. THE PROPONENT

Project proponents are responsible for providing project specific information to NBDAA, to publish information about their project in newspapers and the *Canada Gazette* as per provincial and federal requirements and for ensuring that design standards and mitigation measures described in the RCSR are implemented. The proponent is encouraged to support an industry code of practice, if one exists, and to conduct site work using the BMPs detailed in this RCSR.

A RCSR should not be taken to imply approval of the project in accordance with any other federal and provincial legislation and municipal by-laws. Proponents are therefore responsible for obtaining all relevant licenses, permits, and authorizations required to operate their site and ensuring that the project meets all other federal, provincial and municipal legislative requirements.

Overall, the proponent must follow the terms and conditions of all aquaculture authorizations issued by the NBDAA under the N.B. *Aquaculture Act* and the Site Specific Marking Plan as identified by NWPP, TC.

Table 5 : Residual Environmental Effects Across Project Phases following the application of Mitigation Measures – Summary

VECs	Project Phase*	Residual Environmental Effect	M	GE	D	F	R	S/NS
Marine Water Quality	A-1	Minor	1	2	1	1	1	NS
	A-2	Temporary changes in water quality	1	2	1	1	1	NS
	A-3	Minor	1	1	1	1	1	NS
	A-4	Minor	1	2	1	1	1	NS
Fish and Fish Habitat	B-1	Minor	1	2	1	1	1	NS
	B-2	Minor	1	2	1	1	1	NS
	B-3	Localized disturbance to eelgrass	1	1	2	1	1	NS
	B-4	Localized shading of eelgrass	1	1	1	2	1	NS
Migratory birds	C-1	Localized attraction of birds	1	2	1	2	1	NS
	C-2	Localized disturbance of birds	1	2	1	2	1	NS
Transportation and Navigation	D-1	Minor	1	2	1	1	1	NS
Effect of the Environment on the project	E-1	Minor	1	2	1	1	1	NS

* refer to table 4 for description of project phase and corresponding code

LEGEND :

Magnitude (M)

1- Localized effect on specific group, habitat, or ecosystem, returns to pre-Project levels in one generation or less, within natural variation.

2- Portion of a population or habitat, or ecosystem, returns to pre-Project levels in one generation or less, rapid and unpredictable change, temporarily outside range of natural variability

3 - Affecting a whole stock, populations, habitat or ecosystem, outside the range of natural variation, such that communities do not return to pre-Project levels for multiple generations

Geographic Extent (GE)

1- Limited to aquaculture footprint and vicinity

2- Limited to aquaculture lease and vicinity

3- Extends beyond the aquaculture lease area.

Duration (D)

1- Less than one season

2- Less than one year

3- A year or longer

Frequency (F)

1- Occurs on a monthly basis or less frequently

2- Occurs on a weekly basis

3- Occurs on a daily basis or more frequently

Reversibility ®

1- Effects are reversible over short term without active management

2- Effects are reversible over short term with active management

3- Effects are reversible over extended term with active management or effects are irreversible.

7. PROCEDURES FOR AMENDING THE REPLACEMENT CLASS SCREENING REPORT

The purpose of an amending procedure is to allow the modification of the RCSR after experience has been gained with its operation and effectiveness. The reasons for such modification may include:

- clarification of ambiguous areas of document and procedures;
- streamlining or modifying the planning process in areas where problems may have arisen;
- minor modifications and revisions to the scope of assessment to reflect new or changed regulatory requirements, policies or standards; and
- new procedures and environmental mitigation practices that have been developed over time
- extension of the application of the RCSR to RA(s) who were not previously declared users of the report and/or
- addition and / or modification of appendices with other bay management plans.

The RA will notify the Agency in writing of its interest to amend the RCSR. It will discuss the proposed amendments with the Agency and affected federal government departments and may invite comment from stakeholders and the public on the proposed changes. The RA will then submit the amended RCSR to the Agency, along with a request that the Agency amend the RCSR and a statement providing a rationale for the amendment.

The Agency may amend the RCSR without changing the declaration period if the changes:

- are minor;
- represent editorial changes intended to clarify or improve the screening process;
- do not materially alter either the scope of the projects subject to the RCSR or the scope of the assessment required for these projects; and
- do not reflect new or changed regulatory requirements, policies or standards.

The Agency may initiate a new declaration for the RCSR for the remaining balance of the original declaration period or for a new declaration period if the changes:

- are considered to be substantial; or
- represent modifications to the scope of the projects subject to the class or the scope of the assessment required for these projects.

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9. GLOSSARY

(Definitions obtained from the translation database Termium unless otherwise indicated)

Aquaculture: the farming of aquatic organisms in marine or freshwater. It implies some form of intervention in the rearing or growing process to enhance production. It also implies individual or corporate ownership of the stock or crop being farmed.

Aquaculturist: Leaseholder of an aquaculture site (private flat, leased area) who is involved in the production and marketing of aquaculture products.

Aquatic Species: "aquatic species" means a wildlife species that is a fish, as defined in section 2 of the *Fisheries Act*, or a marine plant, as defined in section 47 of that Act.

Approved area: Shellfish growing areas may be designated as "Approved" if the area is not contaminated with faecal material, pathogenic micro-organisms, poisonous or deleterious substances, or unacceptable levels of marine biotoxins to the extent that consumption of the shellfish might be hazardous. (CSSP).

Barrier island: Barrier islands are long, narrow, offshore sand bars rising above the mean high-water level, forming an island parallel to the coastline and protecting inland areas from waves and storms. Barrier islands are formed as a result of geological processes, including those of erosion and accretion.

Benthos: The plants and animals that inhabit the bottom of a water body, attached or unattached, from the deepest levels up to the high-water marks.

Biodeposits: sediments of biological origin (mainly feces and pseudofeces)

Biodeposition: process whereby sediments of biological origin are deposited on the bottom of a water body.

Biodiversity: the variety of all life forms: the different plants, animals and micro-organisms, their genes and the ecosystems of which they are a part.

Biofouling: the attachment of microorganisms, plants, algae, and/or animals to a surface in contact with water for a period of time.

Bottom culture: means a form of aquaculture conducted on or in the substrate of an aquaculture site. (NBDAA)

Buffer zone / extended buffer zone: A part of land or water free of water column oyster aquaculture activities to alleviate the effects of the use of one area on another.

Coastal zone: includes coastal waters and those areas landwards of the coastal waters where there are processes or activities that affect the coast and its values.

Closed area (contaminated area A growing area where the harvesting of shellfish is not permitted, except by special licence for specific purposes, due to contamination by faecal material, pathogenic micro-organisms, poisonous or deleterious substances, or unacceptable levels of marine biotoxins to the extent that consumption of the shellfish might be hazardous. (CSSP).

Cocktail oyster: designation for marketing of oysters year-round with no size restriction on aquaculture leases only (DFO).

Commercial oyster fishery: harvesting of commercial-sized oysters for marketing during specific season with size restriction, allows harvesting on public oyster beds (DFO).

Conditionally approved area: is the classification of a shellfish growing area to meet the Approved criteria for a predictable period. These growing areas are subject to intermittent pollution. The period meeting the Approved criteria is conditional upon established performance standards specified in a management plan. A conditionally approved shellfish growing area is a closed area when the area does not meet the approved growing area criteria and is temporarily closed by the shellfish control authority. (CSSP).

Conservation area: area of value that is the object of a special protection by law or other regulation

Critical habitat: under the *Species at Risk Act*, defines the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or an action plan for the species.

Dune: Stretch of coastal sand hills, often part of barrier island systems.

Ecosystem: basic ecological unit formed by the natural environment and the organisms, animals and plants that live there.

Ecosystem services: organisms and environmental processes interacting to create a healthy environment for human beings, from production of oxygen to soil formation and maintenance of water quality.

Ecologically Significant Areas: sites having a rich diversity of species or sites with special features, e.g. rare plants or animals (NB Nature Trust)

Environmentally Significant Areas: an area containing significant and sensitive resources which require special protection e.g. Important Bird Areas, RAMSAR sites, provincial ESAs (EC).

Epibionts / Epifauna: An organism that lives on the surface of another, especially one that is not normally parasitic on it.

Estuary: A partially enclosed body of water in the lower reaches of a river, which is freely connected with the sea and which receives fresh water supplies from upland drainage areas.

Fish Habitats: "spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes." (*Fisheries Act*).

Fish: "includes parts of fish, shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals." (Fisheries Act).

Intertidal zone: The region of shoreline between the limits of mean high and mean low tide levels.

Invasive species: a species occurring beyond its accepted natural distribution as a result of human activities and which threatens valued ecological resources by the damage it causes.

Lease: A defined geographic area in a marine environment described by a federal or provincial agency and approved by the Competent Authority (Shellfish Control Agency or provincial equivalent) for the purposes of culturing, harvesting and/or relaying (exploratory or commercial) of bivalve molluscs. This definition includes all leases, licences of occupation or permits issued to an individual, group or company by the Competent Authority (NBDAA).

Macrophytes: large aquatic plants.

Mesohaline: refers to the salinity of brackish water; between 5% and 18% salinity.

Migratory bird: includes the sperm, eggs, embryos, tissue cultures and parts of birds listed under the Convention on migratory birds (EC)

Mitigation: actions taken during the planning, design, construction and operation of works and undertakings to alleviate potential adverse effects on the environment.

Nekton: aquatic animals that are actively swimming (e.g. fish).

Off-bottom culture: means a form of aquaculture conducted in the water column, with fixed rearing structures place directly or raised off the substrate, in both cases structures do no move with the tides (NBDAA)

Oyster bed/oyster reef: aggregation of live oysters and empty shells occupying the bottom of an estuary.

Phytoplankton: Group of microscopic aquatic plants present in plankton

Picoplankton: single celled planktonic organisms with sizes ranging from 0.2 to 2.0 μm (includes bacteria).

Prohibited area: shellfish shall not be harvested from prohibited areas for any purpose, with the exception of seed and spat which may be collected under special license. (CSSP)

Protected areas: An area dedicated primarily to protection and enjoyment of natural or cultural heritage, includes Migratory Bird Sanctuaries, National Wildlife Area, National and Provincial Parks (EC).

Residence: "residence" means a dwelling-place, such as a den, nest or other similar area or place that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating (SARA).

Salt marsh: marsh overflowed or regularly flooded by the sea.

Salt-water wedge: wedge-like intrusion of a mass of salt water flowing in from the sea under the freshwater in a tidal waterway, which constitutes the boundary between the freshwater and saltwater.

Seed stock or seed oysters: small oysters which either are from natural harvested spat or were grown in a breeding pond, used for suspension or bottom culture and sometimes to develop public beds.

Sensitive coastal habitat: a coastal ecosystem having an especially vulnerable ecological integrity (Parks Canada).

Spat collection: process whereby oyster farmers harvest seed stock during spatfall on collectors suspended in the water column. The collected spat are separated from the cultch for subsequent grow-out, either on the bottom or in suspended structures (DFO).

Spat: after the eggs have been released and fertilized, they become oyster larvae which feed in the water column. They drift there with the currents for 2-3 weeks before transforming into spat, whereupon they attach to a firm structure (collectors, shells, rocks, etc.) and grow into mature oysters (DFO).

Species at Risk: an extirpated, endangered or threatened species or a species of special concern (SARA).

Species of Special Concern: a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats (SARA).

Subtidal zone: that portion of the sea bottom below the low tide line.

Suspended culture: means a form of aquaculture conducted in the water column or at the surface, where the structures are anchored but float or move with the tides (NBDAA).

Water column culture: refers to suspended and off-bottom culture techniques used to grow oysters, but not to bottom culture.

Watershed: geographic concept designating a territory whose land is drained by any one body of water, such as a bay or a river, and which includes groundwater, surface water and wetlands.

Wetland: a wetland is land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soil, hydrophytic vegetation and various kinds of biological activity which are adapted to a wet environment. Wetlands include bogs, fens, marshes, swamps, and shallow waters as defined in the *Canadian Wetland Classification System* (EC)

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APPENDIX 1 - LIST OF MITIGATION MEASURES & BMPS

Table 6 –Mitigation Measures and BMP summary

VECs	Regulation	Mitigation	BMP
Marine Water Quality	EC sect. 36 FA		Equipment accessing the site should be kept in good repair and operating efficiently to reduce the potential for chronic spills. Spill response kit should be kept in a readily accessible location to facilitate rapid and effective response. The proponent is required to promptly contain, clean up, and report any accidental spill to the 24-hour environmental emergencies reporting system (1-800-565-1633) with the following information: location of the spill source; area of impact; dimensions of impact; area characteristics; wildlife in the area; and wind and current direction. If a spill occurs on the ice, the spill must still be reported to the 24 hour reporting system for further instruction. Motors should be re-fuelled with care to prevent drips or spills. Re-fuelling should take place at a location where spill cleanup equipment is readily available. Facility workers should be trained in the safe and effective use and disposal of fuel and petroleum products and in safe work practices and emergency response. The proponent should have an Emergency Contingency Plan (ECP) and Emergency Preparedness Plan (EPP) in place for the project. Refer to CAN/CSA-Z731-03 Emergency Preparedness for industry. During winter operations, fuelling of equipment should be conducted off the ice, in areas with impermeable surfaces. During an emergency, if equipment must be fuelled on the ice, an impermeable surface (i.e., a tarp or absorbent pad) should be used to assist in containing spills. Anchors are to be made of clean and non-toxic material; concrete anchors should be pre-cast and pre-cured away from the water to avoid seepage of potentially toxic substances into the water body. The proponent should contact CFIA for more information regarding their shellfish growing, harvesting, transportation and Supplier Quality Assurance Agreements requirements.

Table 6 –Mitigation Measures and BMP summary

VECs	Regulation	Mitigation	BMP
Fish and Fish Habitat	DFO Sect 35 FA	The proponent is required to adjust the population density in accordance with the provincial aquaculture permit conditions established under the N.B. *Aquaculture Act* and Regulations. The proponent is required to bring all operational waste back to shore and to ensure it is stored, disposed or recycled in accordance with provincial regulations and/or local by-laws.	The proponent is encouraged to maintain and clean the structures through air drying or other environmentally-friendly methods. The site infrastructure should be aligned so as to minimize impact on the tidal current and water flow. Physical disturbance to the site during installation, harvesting and maintenance should be minimized. The proponent is encouraged to install and remove structures on calm days to minimize the suspension of fine sediment particles into the water column and to preferably install anchors in the winter when effects of turbidity on other organisms would be minimal.
	DFO Sect 44 & 35 FA	The proponent should be aware that eelgrass (*Zostera marina*) is considered fish habitat. Except in accordance with the conditions of a License issued under Section 44 of the *Fisheries Act* or an authorization to destroy fish habitat under Section 35 of the *Fisheries Act*, the proponent cannot harvest or knowingly destroy marine plants. The proponent is required to minimize disturbances to eelgrass by sizing anchors appropriately or by installing them permanently, to prevent dragging under tension or adverse weather conditions. The proponent is required to space rows of water column aquaculture works at a minimum of 3 m apart and to not exceed 50% coverage of the surface area of the lease.	The proponent is encouraged to avoid locating moorings in eelgrass beds and other sensitive coastal habitats. The proponent is encouraged to anchor suspended aquaculture works in such a way to allow swaying of the structures during each tidal cycle and to avoid overlap with the same area of eelgrass over time. The proponent is encouraged to install anchors during the winter. Off-bottom aquaculture structures should be located in areas with minimal eelgrass beds. Structures should be designed and installed to maximize openings to increase light penetration.
	DFO Sect 55 & 56 Fisheries General Regulations	When shellfish are transported and released in another water body, Fisheries Regulations require that those organisms have no disease or disease agent or exotic species present and that the organisms have no adverse effect on the genetic characteristics or size of fish populations of the receiving watershed. The proponent is therefore required to obtain the necessary License to release or transfer shellfish and/or an Import permit from the N.B. Introductions and Transfers Committee. The proponent is required to properly dispose of dead or moribund oysters on-land rather than discarding them into the surrounding waters. Disposal must be done in accordance with Provincial Regulations and/or local by-laws.	The proponent is encouraged to select its site, to deploy its structure and to adopt appropriate husbandry practices to minimize the colonization of marine organisms. All organic material removed during maintenance should be disposed of at an approved location, in accordance with provincial regulations and/or local by-laws. The proponent is encouraged to de-clump and clean shellfish in the water from where they were collected and to transport them in a minimal amount of water. Spray down of equipment is recommended to minimize the movement of epifauna. Equipment and boats that are transferred from one marine water body to another should be cleaned of any sediments, plant or

Table 6 –Mitigation Measures and BMP summary

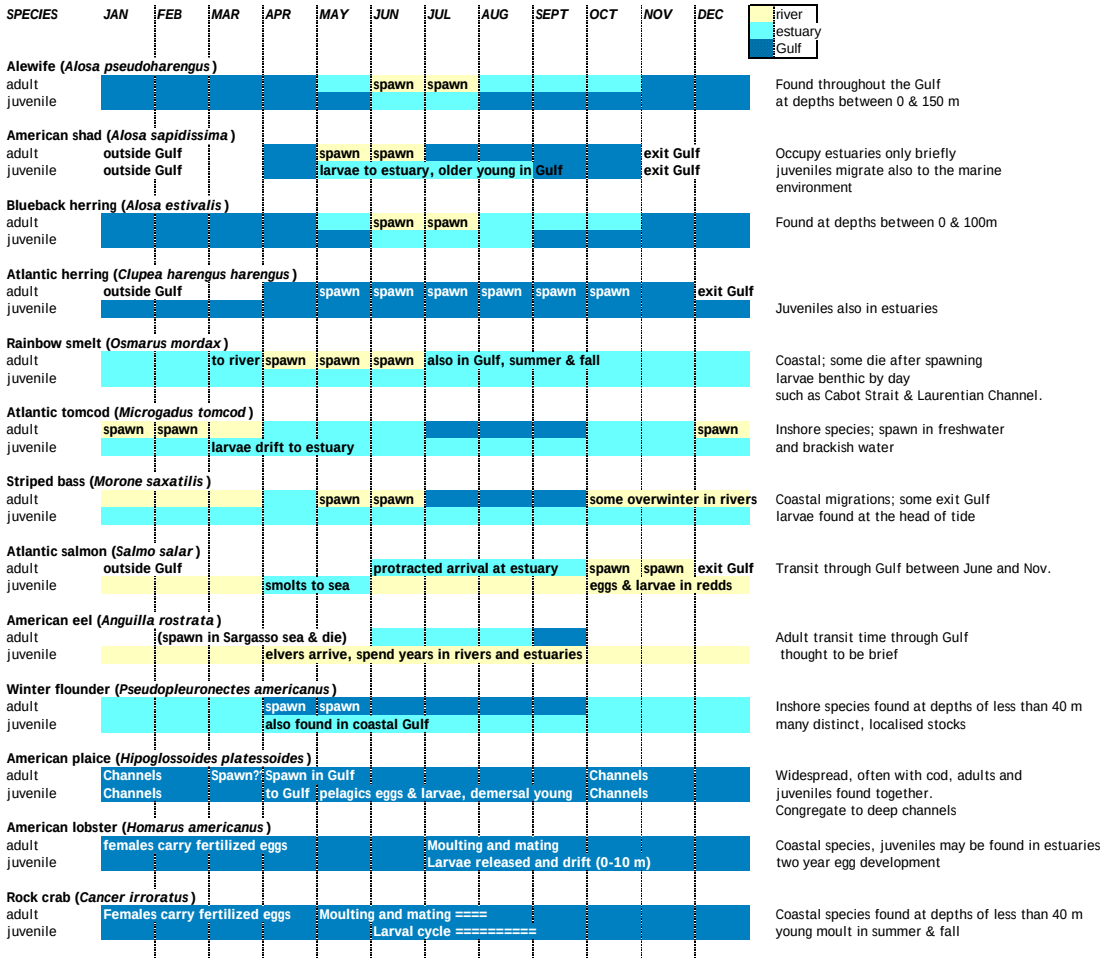
VECs	Regulation	Mitigation	BMP
		All shellfish be washed and cleaned of all mud, extraneous material and other bio-fouling attached to the shell prior to leaving the harvest site. Disposal or recycling of that organic material must be done in accordance with Provincial Regulations and/or local by-laws. The proponent is required to conduct regular health inspections of its stock as per the conditions of the NBDAA permits and to report any disease outbreak immediately to DFO.	animals by washing with freshwater and or/spraying with undiluted vinegar or treated with hyper saline waters, prior to being mobilized to the project site. The proponent is encouraged to learn to identify invasive species of concerns and to report any sightings to DFO.
Migratory birds	EC Migratory Birds Regulations		Equipment should be designed to reduce opportunities for birds to land on floating structures.. Scare permits will not be issued for projects assessed under this RCSR. No litter (including food scraps), waste or mortalities should be left in coastal areas since it can attract and/or artificially enhance populations of avian and mammalian predators of eggs and chicks of birds. The proponent should avoid concentrations of seabirds, waterfowl and or shorebirds and their habitat during spring and fall migration, when anchoring equipment, accessing wharves or ferrying supplies. Personnel should be educated on measures to be taken to avoid disturbing migratory birds. All vessels and machinery should be well muffled. Equipment should not be stored or repaired on beaches or wetlands. Transferring of stock into deeper waters for overwintering should be delayed as late as possible in the season to limit interactions with birds during fall migration periods. Should aquaculture equipment wash up on beaches identified as critical habitat during spring or summer, the proponents would be expected to contact the Canadian Wildlife Service (CWS) and New Brunswick Department of Natural Resources (NBDNR) to ensure that Piping Plovers, other species at risk, or beach nesting migratory birds are not disturbed during retrieval of equipment and to ensure compliance with SARA, the MBCA, and the New Brunswick Endangered Species Act. CWS and NBDNR may restrict access to some areas of beaches during sensitive periods.

Table 6 –Mitigation Measures and BMP summary

VECs	Regulation	Mitigation	BMP
			Should aquaculture equipment wash-up in National Wildlife Areas or Migratory Bird Sanctuaries, or should beach clean-up activities be planned in these areas, the proponents would be expected to contact CWS to ensure that sensitive wildlife resources are not disturbed and to ensure compliance with the National Wildlife Area Regulations and the Migratory Bird Sanctuary Regulations. Failure to do so may result in charges under these regulations. Should aquaculture equipment wash-up on land within Kouchibouguac National Park, or should beach clean-up activities be planned, no access to the National Park should take place without the permission of Parks Canada.
Oceans Disposal	EC *Canadian Environmental Protection Act* 1999		Disposal of fish offal or shellfish waste in the ocean requires a Disposal at Sea Permit under the *Canadian Environmental Protection Act* (CEPA 1999).
Transportation and Navigation	TC - NWPA	The proponent is required to comply with all the conditions of the NWPA authorisation issued by the Navigable Waters Protection Program	The proponent is encouraged to select its site, to deploy its structure and to adopt appropriate husbandry practices to minimize hazards posed by meteorological events. This means to engineer site design to withstand extreme weather conditions; to use proven technologies and incorporate redundancy into the system design; and to conduct installation during benign weather conditions, to minimize potential for accidents.
others	Wetlands Policy	Access to the intertidal zone by motor vehicles other than boats is prohibited under provincial regulations, unless operating such vehicle on ice or on frozen ground that is completely covered by snow (*N.B. Motor Vehicle Regulation – Trespass Act*).	The proponent is encouraged to avoid or minimize disturbance to the shore, to wetlands and other sensitive coastal areas and to use existing trails, roads, wharves or cut lines, wherever possible, as access routes to limit unnecessary clearing of vegetation, disturbance of wildlife and to prevent soil compaction in wetlands and other sensitive coastal areas.
	N.B. Archaeological Services		If archaeological resources are discovered, provincial authorities should be contacted to ensure information is recorded and appropriate preservation procedures are followed.

APPENDIX 2 - SPATIO-TEMPORAL DISTRIBUTION OF MARINE BIOTA ON THE EAST COAST OF N.B.

Table 7- Spawning and migration of estuarine fish species (commercial) in the Southern Gulf of St. Lawrence



Contributors: Sophie Bastien-Daigle, Ghislain Chouinard, Roland Cormier, Simon Courtenay, Leslie-Ann Davidson, Hélène Dupuis, François Grégoire, Denis Haché, Tom Hurlbut, Wade Landsburg, Roderick Morin, Mikio Moriyasu and Guy Robichaud.

Note: this table represents highly simplified life-cycles based on present knowledge of the fish species described. It is only intended as a general illustration and does not attempt to fully explain the complexities and natural variations of biological processes and habitat utilization in these fish.

Table 8 - List of Sensitive Marine Bird Species and Associated Seasonal Occurrence

Commmon name	Family	Latin Name	Abundance in NB	Migrations	Summer occurrence	Winter occurrence	Local breeding
Common Loon	Gaviidae	*Gavia immer*	Common migrant in coastal areas	Common migrant	Non-breeding birds generally remain along the coast in summer	Winters primarily in coastal marine areas near shore; also in large freshwater lakes	Generally nests on shores of freshwater lakes
Northern Gannet	Sulidae	*Morus bassanus*	Common migrant in coastal areas		common offshore in migration	uncommon offshore in winter	
Red-necked Grebe	Podicipedidae	*Podiceps grisegena*	Common migrant in coastal areas	Common migrant		Very rare winter resident, open ocean or large lakes	
Black-crowned Night-heron	Ardeidae	*Nycticorax nycticorax*	Uncommon to locally abundant		early April to early November		Colonial nesters in trees, rookeries are very sensitive to human disturbance
Great Blue Heron	Ardeidae	*Ardea herodias*	Fairly common to locally abundant;		Late March to early November		Communal treetop nests, rookeries, are very sensitive to human disturbance.
Black Duck	Anatidae	*Anas rubripes*	Present year round	Uncommon to locally abundant migrant from late March to late May and from August to November;	Lakes, wetlands, rivers and agricultural areas.	Fairly common winter resident; coastal bays, salt marshes and estuaries.	Fairly common breeder usually on the ground among clumps of dense vegetation near water.
Mallard	Anatidae	*Anas platyrhynchos*	Fairly common breeder		Lakes wetlands, rivers, city parks, agricultural areas and sewage lagoons.	Found in coastal salt marsh, lagoons and estuaries.	In tall vegetation or under bush, often near water.
Northern Pintail	Anatidae	*Anas acuta*	Fairly common to common	early April to late May late August to early November;		rare winter resident	locally common breeder
American Wigeon	Anatidae	*Anas americana*	Uncommon to locally abundant	early March to early June late August to October		rare and somewhat local in winter	locally common breeder

Table 8 - List of Sensitive Marine Bird Species and Associated Seasonal Occurrence

Commmon name	Family	Latin Name	Abundance in NB	Migrations	Summer occurrence	Winter occurrence	Local breeding
Northern Shoveler	Anatidae	*Anas clypeata*	Uncommon to fairly common	late March to early June from September to early November		very rare winter resident near salt marshes	locally uncommon breeder in wetlands
Gadwall	Anatidae	*Anas strepera*	Uncommon to locally common	mid-April to mid-October		very rare winter resident	
Lesser Scaup	Anatidae	*Aythya affinis*	Migrant	mid-March to mid-May late August to early November		rare winter resident	rare breeder
Greater Scaup	Anatidae	*Aythya marila*	Uncommon to abundant	late February to May from September to November	brackish or saltwater habitats	uncommon to locally common winter resident	rare to locally common breeder
Brant	Anatidae	*Branta bernicla*		April to early June October to November	very rare visitor in summer	very rare visitor in winter	
Bufflehead	Anatidae	*Bucephala albeola*	Common to locally abundant			late October to early May	
Barrow's Goldeneye (eastern population)	Anatidae	*Bucephala islandica*	Rare to locally common			late October to mid-April	locally uncommon breeder – near fast flowing streams
Common Goldeneye	Anatidae	*Bucephala clangula*	Common to locally abundant from mid-October to mid-April.	Open water of bays and estuaries; occasionally fresh water lakes before they freeze up.	Widespread;	Open Water of bays and estuaries ; occasionally fresh water lakes before they freeze up.	Locally common breeder. Breeds in marshes, ponds, lakes and rivers.
Long-tailed Duck	Anatidae	*Clangula hyemalis*				Winters along coast, in open ocean or large freshwater lakes	
Harlequin Duck – (eastern population)	*Anatidae*	*Histrionicus histrionicus*	Locally rare	March to early May September to November		locally uncommon to common winter resident	very local breeder
Red-breasted Merganser	*Anatidae*	*Mergus serrator*	Locally abundant	late March to May October to November		common winter resident;	Locally common breeder.

Table 8 - List of Sensitive Marine Bird Species and Associated Seasonal Occurrence

Commmon name	Family	Latin Name	Abundance in NB	Migrations	Summer occurrence	Winter occurrence	Local breeding
Common Merganser	*Anatidae*	*Mergus merganser*	Common	late September to late April		Common from late September to April; found in coastal bays and estuaries.	Common breeder; breed in large rivers and deep lakes.
Hooded Merganser	*Anatidae*	*Lophodytes cucullatis*	Rare to locally uncommon spring migrant;; Locally common fall migrant ;	Late March to mid-May; mid-September to November		A few regularly overwinter	Rare and very local breeder. Usually breeds in tree cavity;
Canada Goose	*Anatidae*	*Branta canadensis*	Common to locally abundant migrant	March to May and from September to November		Uncommon to locally abundant winter resident	Uncommon breeder
White-winged Scoter	*Anatidae*	*Melanitta fusca*	Fairly common spring migrant	April to mid-May		winters in coastal estuaries and bays with shallow water	
Black scoter	*Anatidae*	*Melanitta nigra*	Very common spring migrant	April to mid-May		winters in shallow marine coastal waters usually over pebble or sand bottom	
Surf scoter	*Anatidae*	*Melanitta perspicillata*	Common migrant	April to Mid-May		winters in coastal waters usually over rocky bottoms	
Common Eider	*Anatidae*	*Somateria molissima dresseri*	Uncommon breeder	Common migrant	Uncommon in summer	Occasional wintering	Breeds on a few offshore islands
King Eider	*Anatidae*	*Somateria spectabilis*	Rare			rare to locally uncommon winter visitor	
Gyrfalcon	*Falconidae*	*Falco rusticolus*	Very rare	Rare migrant	Uncommon	Near coast, mid-October to mid-April	
Bald Eagle	*Accipitridae*	*Haliaeetus leucocephalus*	Uncommon resident but can be locally common	Uncommon migrant	Increasing in eastern parts of province	Rare winter resident	Breeds in forested areas near large bodies of water

Table 8 - List of Sensitive Marine Bird Species and Associated Seasonal Occurrence

Commmon name	Family	Latin Name	Abundance in NB	Migrations	Summer occurrence	Winter occurrence	Local breeding
Osprey	*Pandionidae*	*Pandion haliaetus*	Common summer resident and migrant	April and October migrant	Common along coastline and major rivers		common breeder near open water and estuaries
Piping Plover	Charadriidae	*Charadrius melodus*	Locally uncommon	early April to mid-May mid-August to late September;	Critical habitat on coastal beaches and offshore islands		rare and very local breeder;
American Golden-Plover	Charadriidae	*Pluvialis dominica*	Uncommon fall migrant	mid-July to mid-November			
Killdeer	Charadriidae	*Charadrius vociferus*	common to abundant from mid March to late October;			A few remain until December and some overwinter when winters are mild.	Open ground, fields, lakeshores, sandy beaches, mudflats, gravel stream beds, wet meadows and grasslands;
Upland Sandpiper	Scolopacidae	*Bartramia longicauda*	Rare to uncommon	mid-April to late September		occasionally seen on offshore islands as late as November	
Red Knot	Scolopacidae	*Calidris canutus*	Rare to locally common migrant	Mid May Late October	Intertidal, marine habitats, near coastal inlets, estuaries and bays		
Purple Sandpiper	Scolopacidae	*Calidris maritima*	uncommon to locally uncommon	from mid-April to early June	mid-July to early November	a few overwinter	
Pectoral Sandpiper	Scolopacidae	*Calidris melanotos*	Fairly common to locally common fall migrant	mid-April to mid-May November	late July to late October		
Willet	Scolopacidae	*Catoptrophorus semipalmatus*	Rare to locally common		late-April to early October	some birds linger into November	Barrier beach ponds, tidal estuaries, salt marshes
Hudsonian Godwit	Scolopacidae	*Limosa haemastica*	Uncommon to locally common fall migrant	mid-July to early November			
Red-necked Phalarope	Scolopacidae	*Phalaropus lobatus*	rare along coasts	early May to early June mid July to mid-October	Offshore		

Table 8 - List of Sensitive Marine Bird Species and Associated Seasonal Occurrence

Commmon name	Family	Latin Name	Abundance in NB	Migrations	Summer occurrence	Winter occurrence	Local breeding
Wilson's Phalarope	Scolopacidae	*Phalaropus tricolor*	Rare migrant ; very rare and local summer resident	mid-May to mid- June from early August to October			
Solitary Sandpiper	Scolopacidae	*Tringa solitaria*	Uncommon to rare	late April and mid-October			
Whimbrel	Scolopacidae	*Numenius phaeopus*	Rare spring and uncommon fall migrant	May early July to late October			
Sanderling	Scolopacidae	*Calidris alba*	Rare spring and common fall migrant	late May to mid June Mid-July to early December			
Semipalmated Sandpiper	Scolopacidae	*Calidris pusilla*	Uncommon spring and very common fall migrant	Mid-May to early June; early July to late October;			
White-rumped Sandpiper	Scolopacidae	*Calidris fuscicollis*	Rare spring and common to locally abundant fall migrant	Mid-May to mid-June Mid-July to mid-November			
Least Sandpiper	Scolopacidae	*Calidris minutilla*	Common migrant	early May to early June late June to early November			
Greater Yellowlegs	Scolopacidae	*Tringa melanoleuca*	Common migrant	mid-April to eary June early-July to late October;			
Lesser Yellowlegs	Scolopacidae	*Tringa flavipes*	Rare in spring ; Common fall migrant	Late-April to early June; early July to late-October			
Ruddy Turnstone	Scolopacidae	*Arenaria interpres*	Uncommon spring and common fall migrant	Mid-May to late June Mid-July to mid-November			

Table 8 - List of Sensitive Marine Bird Species and Associated Seasonal Occurrence

Commmon name	Family	Latin Name	Abundance in NB	Migrations	Summer occurrence	Winter occurrence	Local breeding
Spotted Sandpiper	Scolopacidae	*Actitis macularia*	Common summer resident and migrant		common from late April to late October;		Shorelines, gavel beaches, ponds, marshes, drainage ditches, rivers, streams, swamps and sewage lagoons; occasionally see in cultivated land.
Short-billed Dowitcher	Scolopacidae	*Limnodromus griseus*	Uncommon spring and common fall migrant	Early May to early June late July to late October;			
Dunlin	Scolopacidae	*Calidris alpina*	Rare spring and common fall migrant	Late April to late June late July to early December			
Black-bellied Plover	Charadriidae	*Pluvialis squatarola*	Common migrant	Late-April to early June Mid-July to mid-November			
Semipalmated Plover	Charadriidae	*Charadrius semipalmatus*	Uncommon spring and very common fall migrant	Late-April to mid-June Mid-July to mid-November;			
Iceland Gull	Laridae	*Larus glaucoides*	Common winter resident		October to May		
Glaucous Gull	Laridae	*Larus hyperboreus*	Uncommon winter resident		late October to mid-May		
Black-headed Gull	Laridae	*Larus ridibundus*	Rare to uncommon migrant and summer visitor				
Bonaparte's Gull	Laridae	*Larus philadelphia*	Common migrant and summer visitor		Early April to late December		
Great Black-backed Gull	Laridae	*Larus marinus*	Common year-round resident and migrant		Coastal nesting colonies.	Harbours, bays, landfills and open water on large lakes.	Usually colonial, but also breeds in isolated pairs; rocky islands, cliffs, beaches.

Table 8 - List of Sensitive Marine Bird Species and Associated Seasonal Occurrence

Commmon name	Family	Latin Name	Abundance in NB	Migrations	Summer occurrence	Winter occurrence	Local breeding
Herring Gull	Laridae	*Larus argentatus*	Very common resident and common migrant		Coastal nesting colonies	Abundant at urban sites, lakes and bays;	Colonial nesters on undisturbed islands,.
Ring-billed Gull	Laridae	*Larus delawarensis*	Common migrant and summer resident; uncommon in winter		Mid-March to late December		Sparsely vegetated islands, open beaches, breakwaters and dredge-spoil areas.
Black-legged Kittiwake	Laridae	*Rissa tridactyla*	Locally uncommon in spring and summer; Occasional in fall				Colonial nester on cliffs
Common Tern	Laridae	*Sterna hirundo*	Common summer resident		mid-May to late October		Breeds on isolated coastal islands
Arctic Tern	Laridae	*Sterna paradisaea*	Locally uncommon to rare		mid-May to late September		Uncommon breeder on coastal islands
Caspian Tern	Laridae	*Sterna caspa*	Rare migrant ; casual in mid-summer	Late April to early June Late July to early October			
Common Murre	Alcidae	*Uria aalge*	Rare visitor				
Black Guillemot	Alcidae	*Cepphus grylle*	Year round resident ; locally common breeder; locally common in late fall to early winter				May nest singly or in small colonies; along rocky shores, low cliffs
Short-eared Owl	Strigidae	*Asio flammeus*	Sporadic breeder; , Uncommon to locally fairly common spring and fall migrant.	Widespread, often in interior fields and farmlands.	Coastal marshes and dunes	Winter visitor from early October to April	Rare to uncommon breeder from April to September.
Snowy Owl	Strigidae	*Nyctea scandiaca*	Irregular; rare to locally common winter visitor		few birds may linger into midsummer at coastal sites	from mid-October to early May, near beaches	

Table 8 - List of Sensitive Marine Bird Species and Associated Seasonal Occurrence

Commmon name	Family	Latin Name	Abundance in NB	Migrations	Summer occurrence	Winter occurrence	Local breeding
Nelson's Sharp-tailed Sparrow	Fringillidae	*Ammodramus nelsoni*	Fairly common summer resident; Occasionally seen in winter	mid-May to mid-June September to early November	Salt marshes June to August;		Uncommon to locally common breeder
Savannah Sparrow	Fringillidae	*Passerculus sandwichensis*	Common summer resident ; Common spring and summer migrant; Rare in winter		in meadows, grassland and marshlands mid-April to mid-November		Common breeder in fields, meadows, grasslands and in drier parts of salt marshes
Lapland Longspur	Emberizidae	*Calcarius lapponicus*	Uncommon fall migrant	late September to early May		Occasionally over-winters, sometimes in mixed flocks with Horned Larks and Snow Buntings	
Bank Swallow	Hirundinidae	*Riparia riparia*	Common to locally abundant	Common migrant along the coast from late April to May and from late August to September.			Locally common breeder from late May to early August; colonial; steep banks, shoreline bluffs, gravel pits.
Horned Lark	Alaudidae	*Eremophila alpestris*	common to locally abundant	April through mid-August	Mostly along coasts	Winter resident from late September to April	Locally uncommon breeder

APPENDIX 3 –DESCRIPTION OF THE ENVIRONMENTAL SETTING OF EASTERN N.B. BAYS AND BAY MANAGEMENT MAPS

Table 9 – Water body nomenclature and delimitation[9]

Bay Management Areas (BMAs)	Associated Water Bodies	CFIA Zones
1. HERON ISLAND From: Delimitation line extending from Hamilton Point to coordinate point 706800E 5322880N (UTM NAD27, Zone 19) To: Delimitation line extending from Black Point to coordinate point 717300E 5319400N (UTM NAD27, Zone 19)	Shoal Bay Heron Channel Canning Cove McKinnon Cove Dickie Cove Portion of Chaleur Bay	1E and 1F
2. CARAQUET From : Pointe de Maisonette To : Pointe de Pokesudie on Pokesudie Island	Caraquet Bay Rivière du Nord Caraquet River Caraquet Harbour Caraquet Channel	3A, 3B, 3C
3. SAINT-SIMON / SHIPPEGAN / LAMÈQUE / MISCOU From: Pointe de Pokesudie on Pokesudie Island To: Pointe de Petite-Lamèque and mouth of Shippegan Gully and Miscou Bay	St-Simon River North St-Simon Bay South St-Simon Bay St-Simon Inlet Petite-Passe de Pokesudie Brûlée Bay Shippegan Bay Ruisseau Bar Petite-Lamèque Bay Lamèque Bay Shippegan Harbour Caribou Bay Barachois de Pointe-Canot	3D, 3E, 3F, 3G, 3H, 3I

[9] **NOTE**: BMF maps follow each ecosystem overview. Maps show existing and proposed leases combined. Leases shown within buffer zones had been approved and grandfathered by anterior review and approval processes.

Bay Management Areas (BMAs)	Associated Water Bodies	CFIA Zones
	Grande Batture Miscou Channel Miscou Harbour Campbells River MacGregors Mal Bay Windsors Mal Bay	
4. PETIT-POKEMOUCHE / POKEMOUCHE From: Mouth of Shippegan Gully To: Green Point in Four Roads	Petit-Pokemouche Bay Barachois à Colas Pokemouche River (Lac Inkerman) Pokemouche Bay Grande Anse/Cove	3N, 3O
5. TRACADIE / TABUSINTAC From: Green Point in Four Roads To: Pointe à Barreaux in Rivière-du-Portage To : Old Seal Gully	Baie de Tracadie Ruisseau Sureau Blanc Big Tracadie River Big Tracadie River/The Lake Ruisseau à Georges form shore Tabusintac River Tabusintac Bay French Cove	3P, 3Q, 4A
6. MIRAMICHI From: Old Seal Gully To: Point Escuminac	Neguac Bay Gammon Bay Miramichi Inner Bay Miramichi River Miramichi Bay Napan Bay Black River Bay du Vin Bay du Vin Harbour Baie Ste-Anne McLeans Cove Herring Cove	4B, 4C, 4D, 4E, 4F, 4G, 4I

Bay Management Areas (BMAs)	Associated Water Bodies	CFIA Zones
7. RICHIBUCTO From: Tidal water of the mouth of Richibuto Gully To: Richibucto Cape in Cap Lumière *Note: This area excludes the tidal waters within the limits of Kouchibouguac National Park*[10]	St-Charles River Le Barachois Petite Rivière Aldouane Anse à Fidèle Richibucto Harbour Richibucto River Passe de l'Ile Baie du Village	5E, 5F, 5G, 5H
8. BUCTOUCHE / COCAGNE From: Richibucto Cape in Cap Lumière To: Ward Road near Bar-de-Cocagne / Cormierville	Fond de la Baie Buctouche Bay Bouctouche Harbour La Passe Cocagne Harbour	6A, 6B, 6C, 6D, 6^{E}, 6F, 6G, 6H
9. SHEDIAC / PETIT BARACHOIS / SHEMOGUE / BAYFIELD / SPENCE COVE From: Ward Road near Bar-de-Cocagne / Cormierville To: Wharf at Caissie Cape To : Fagan Point To: Cape Bruin To: Cape Spear To: Jackson's Point (NS)	Shediac Bay Shediac Harbour Petit Barachois Shemogue Harbour Little Shemogue Harbour Spence Cove Peacock Cove Baie Verte Anse Big Cove Big Cove	7A, 7B, 7C, 7D, 7E, 7F, 7G, 7H, 7I, 7J, 7K, 7L

[10] Kouchibouguac National Park is an exclusion zone for aquaculture siting with respect to this RCSR. Definition of Kouchibouguac National Park of Canada as per the *Canada National Parks Act*: Kouchibouguac National Park of Canada.

1 Environmental Setting: Heron Island

Approximate Boundaries of Environmental Setting

Major embayment of Heron Island as well as smaller inlets and harbours:

- Shoal Bay
- McKinnon Cove
- Heron Channel
- Dickie Cove
- Canning Cove
- Portion of Chaleur Bay

Marine Environment

Heron Island is located in the Baie des Chaleurs, approximately 2.0 km north of New Mills, New Brunswick. Its shoreline is influenced by 3 metre tides [76]. The island is the property of the Province of NB and is considered an Important Bird Area and ecotourism attraction.

Fish and Fish Habitat:

The following inshore commercial fish and marine invertebrate species are known to occur within this study area:

Fish

- Alewife (*Alosa pseudoharengus*)
- American eel (*Anguilla rostrata*)
- Atlantic herring (*Clupea harengus harengus*)
- Atlantic mackerel (*Scomber scombrus*)
- Atlantic salmon (*Salmo salar*)
- Rainbow smelt (*Osmerus mordax*)
- Striped bass (*Morone saxatilis*)
- Tomcod (*Microgadus tomcod*)
- Winter flounder (*Pseudopleuronectes americanus*)

Molluscs and crustaceans

- American lobster (*Homarus americanus*)
- Bar clam (*Spisula solidissima*)
- Blue mussel (*Mytilus edulis*)
- Razor clam (*Ensis directus*)
- Rock crab (*Cancer irroratus*)
- Softshell clam (*Mya arenaria*)

Migratory Birds, Seabirds, Shorebirds, and Waterfowl:

The following marine and coastal bird species have been identified in the study area:

- American Black Duck (*Anas rubripes*)
- American Widgeon (*Anas americana*)
- Belted Kingfisher (*Ceryle alcyon*)
- Black Guillemot (*Cepphus grille*)
- Blue-winged Teal (*Anas discors*)
- Common Eider (*Somateria mollissima*)
- Common Goldeneye (*Bucephala clangula*)
- Common Mersanger (*Mergus merganser*)
- Common Snipe (*Gallinago gallinago*)
- Common Tern (*Sterna hirundo*)
- Double-crested cormorant (*Phalacrocorax auritus*)
- Great Black-backed Gull (*Larus marinus*)
- Great Blue Heron (*Ardea herodias*)

- Herring Gull (*Larus argentatus*)
- Killdeer (*Charadrius vociferus*)
- Mallard (*Anas platyrhynchos*)
- Northern Pintail (*Anas acuta*)
- Osprey (*Pandion haliaetus*)
- Pied-billed Grebe (*Podilymbus podiceps*)
- Ring-billed Gull (*Larus delawarensis*)
- Ring-necked Duck (*Aythya collaris*)
- Savannah Sparrow (*Passerculus sandwichensis*)
- Spotted Sandpiper (*Actitis macularia*)
- Swamp Sparrow (*Melospiza georgiana*)

Marine Mammals:

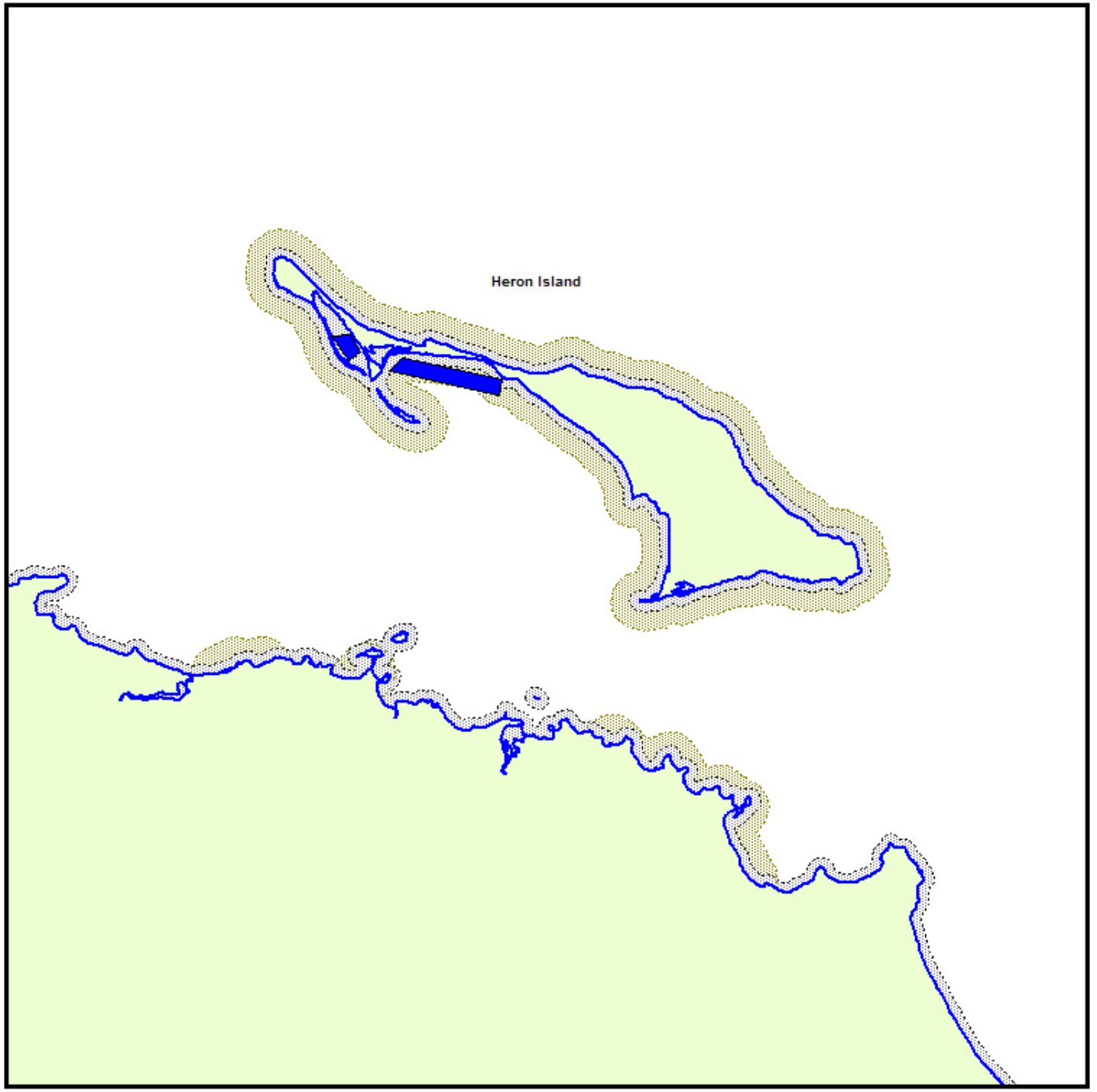
No sensitive marine mammal species were identified within the study area [77].

Designated Areas:

Heron Island is designated Important Bird Area.

Transportation and Navigation:

The main sources of transportation in this area include container ships (to the north of Heron Island), commercial fishing vessels and recreational boating. The area is generally ice free from March 15 to January 1 [78].



Legend

- Buffer zone
- Extended buffer zone
- Class A bottom, near-bottom and water column culture
- Class B bottom and near-bottom culture
- Class C bottom culture
- Class D no regular water column oyster aquaculture activities

For more specific information refer to: Section 5.1.1

January 23, 2007

2 Environmental Setting: Caraquet

Approximate Boundaries of Environmental Setting:

Major embayments of Caraquet as well as smaller inlets and Harbours:

- Caraquet Bay
- Rivière du Nord
- Rivière Caraquet
- Caraquet Harbour
- Caraquet Channel

Marine Environment:

Caraquet Bay is semi enclosed; it is separated from the Baie des Chaleur by a major dune system (dune de Maisonnette). Freshwater flows into the bay from three rivers, the Rivière du Nord, Petite Rivière Caraquet and Rivière Caraquet. The depth of marine waters ranges from approximately 0.3 to 16.7m. The tides in the area are semi-diurnal with a mean tidal range of approximately 0.1 to 1.8 m (low to high tidal range) [76].

Fish and Fish Habitat:

The following inshore commercial fish and marine invertebrate species have been identified within this study area:

Fish

- Alewife (*Alosa pseudoharengus*)
- American eel (*Anguilla rostrata*)
- Atlantic herring (*Clupea harengus harengus*)
- Atlantic mackerel (*Scomber scombrus*)
- Atlantic Salmon (*Salmo salar*)
- Rainbow smelt (*Osmerus mordax*)
- Sea-run trout (*Salvelinus fontinalis*)
- Smooth Flounder (*Liopsetta putnami*)
- Striped bass (*Morone saxatilis*)
- Tomcod (*Microgadus tomcod*)
- Winter flounder (*Pseudopleuronectes americanus*)

Molluscs and crustaceans

- American lobster (*Homarus americanus*)
- American oyster (*Crassostrea virginica*)
- Bar clam (*Spisula solidissima*)
- Blue mussel (*Mytilus edulis*)
- Quahog (*Mercenaria mercenaria*)
- Razor clam (*Ensis directus*)
- Rock crab (*Cancer irroratus*)
- Softshell clam (*Mya arenaria*)

An American lobster spawning area is indicated as occurring within the bounds of this study area.

Migratory Birds, Seabirds, Shorebirds, and Waterfowl:

The following marine and coastal bird species have been identified within the study area:

- American Black Duck (*Anas rubripes*)
- American Widgeon (*Anas americana*)
- Belted Kingfisher (*Ceryle alcyon*)
- Black-crowned Night-Heron (*Nycticorax nycticorax*)
- Blue-winged Teal (*Anas discors*)

- Canada geese (*Branta Canadensis*)
- Common Snipe (*Gallinago gallinago*)
- Common Tern (*Sterna hirundo*)
- Double-crested cormorant (*Phalacrocorax auritus*)
- Gadwall (*Anas strepera*)
- Great Black-backed Gull (*Larus marinus*)
- Great Blue Heron (*Ardea herodias*)
- Green-winged Teal (*Anas crecca*)
- Herring Gull (*Larus argentatus*)
- Horned Lark (*Eremophila alpestris*)
- Killdeer (*Charadrius vociferus*)
- Mallard (*Anas platyrhynchos*)
- Northern Harrier (*Circus cyaneus*)
- Northern Pintail (*Anas acuta*)
- Northern Shoveler (*ANas clypeata*)
- Osprey (*Pandion haliaetus*)
- Pied-billed Grebe (*Podilymbus podiceps*)
- Piping Plover (*Chardrius melodus*)
- Red-breasted Merganser (*Mergus serrator*)
- Ring-billed Gull (*Larus delawarensis*)
- Ring-necked Duck *(Aythya collaris*)
- Savannah Sparrow (*Passerculus sandwichensis*)
- Spotted Sandpiper (*Actitis macularia*)
- Swamp Sparrow (*Melospiza georgiana)*

Marine Mammals:

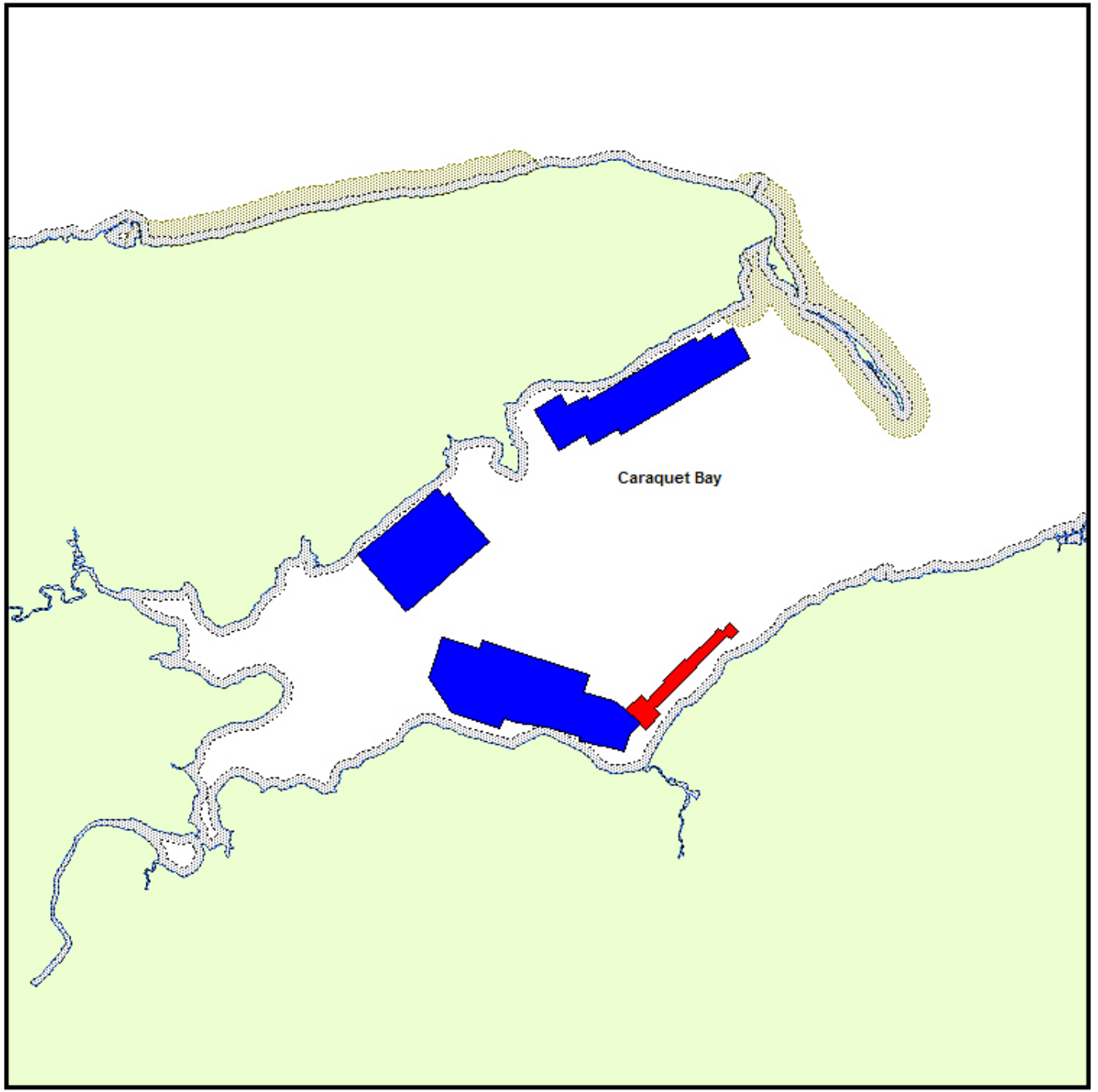
No sensitive marine mammal species were identified within the study area [77].

Designated Areas:

None identified [77].

Transportation and Navigation:

The main source of transportation in this area is by way of commercial fishing vessels and recreational boating. The area is generally ice free from April 15 to January 1[79].

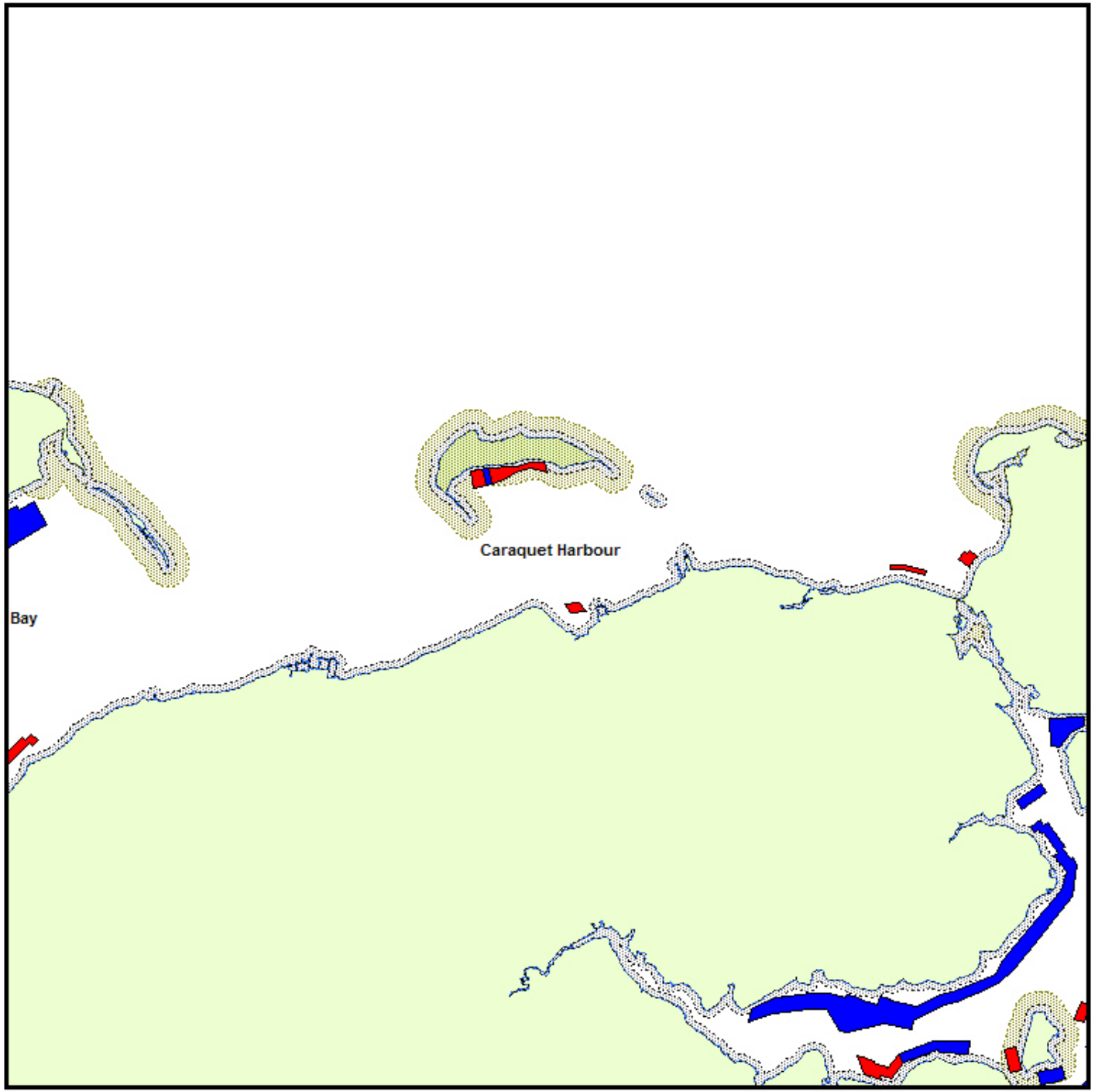


Legend

- Buffer zone
- Extended buffer zone
- Class A bottom, near-bottom and water column culture
- Class B bottom and near-bottom culture
- Class C bottom culture
- Class D no regular water column oyster aquaculture activities

For more specific information refer to: Section 5.1.1

January 23, 2007



Legend

- Buffer zone
- Extended buffer zone
- Class A bottom, near-bottom and water column culture
- Class B bottom and near-bottom culture
- Class C bottom culture
- Class D no regular water column oyster aquaculture activities

For more specific information refer to: Section 5.1.1

January 25, 2007

3 Environmental Setting: St.-Simon, Shippegan, Lamèque, Miscou Island

Approximate Boundaries of Environmental Setting Area:

Major embayments of St.-Simon, Shippegan, Lamèque and Miscou Island as well as smaller inlets and harbours:

St-Simon River	Petite-Lamèque Bay
Shippegan Bay	Ruisseau Bar
St-Simon-Nord Bay	Lamèque Bay
St-Simon-Sud Bay	Caribou Bay
St-Simon Inlet	Windsors Mal Bay
Petite-Passe de Pokesudie	Miscou Harbour
Shippegan Harbour	MacGregors Mal Bay
Brûlée Bay	Miscou Channel
Barachois de Pointe Canot	Campbells River
Grande Batture	Windsor Mal Bay

Marine Environment:

This area includes several bays, harbours and estuaries, the most important being St-Simon, Shippegan, Lamèque and Miscou. Two gullies allow the exchange of waters between the Gulf of St Lawrence and the Baie des Chaleurs.

Freshwater flows from five small tributaries into St-Simon Bay. St-Simon-Nord Bay and St-Simon-Sud Bay are separated by Munro Island; the two bays empty through St-Simon Inlet into Shippegan Bay.

Shippegan Bay separates Lamèque Island from the mainland. The northern part of the bay opens up to the Baie des Chaleurs; barrier beaches separate the southern part of the bay from the Gulf of St Lawrence where the only exchange is through a 225m gully. Freshwater flows into Shippegan Bay from the St Simon River and its tributaries, which include the Brideau River and other small tributaries.

Lamèque Island has two main bays: Lamèque Bay and Little Lamèque Bay. Both are U shaped and open into Shippegan Bay. Freshwater flows from two tributaries into Lamèque Bay, while only one small tributary flows into Little Lamèque Bay, on the eastern side.

Miscou Bay is situated between the Islands of Lamèque and Miscou. The western side of the bay is open to the Baie des Chaleurs while the eastern side of the bay is protected by an extensive dune system and is only open to the Gulf of St Lawrence via two gullies, the main one being the Pigeon Hill gully. Freshwater flows into Miscou Bay from 3 tributaries located on Lamèque Island.

The depth of marine waters ranges from approximately 0.3 to 16.7m. Tides are semi-diurnal in this area with a mean tidal range of approximately 0.1 to 1.8 m (low to high tidal range) [76].

Fish and Fish Habitat:

The following inshore commercial fish and marine invertebrate

species are indicated as occurring within this study area:

Fish

- American eel (*Anguilla rostrata*)
- Alewife (*Alosa pseudoharengus*)
- Atlantic herring (*Clupea harengus harengus*)
- Atlantic mackerel (*Scomber scombrus*)
- Rainbow smelt (*Osmerus mordax*)
- Sea-run trout (*Salvelinus fontinalis*)
- Smooth Flounder (*Liopsetta putnami*)
- Striped bass (*Morone saxatilis*)
- Tomcod (*Microgadus tomcod*)
- Winter flounder (*Pseudopleuronectes americanus*)

Molluscs and crustaceans

- American lobster (*Homarus americanus*)
- American oyster (*Crassostrea virginica*)
- Bar clam (*Spisula solidissima*)
- Blue mussel (*Mytilus edulis*)
- Quahog (*Mercenaria mercenaria*)
- Razor clam *(Ensis directus*)
- Rock crab (*Cancer irroratus*)
- Softshell clam (*Mya arenaria*)

Migratory Birds, Seabirds, Shorebirds, and Waterfowl:

The following marine and coastal bird species have been identified as being in the study area:

- American Black Duck (*Anas rubripes*)
- American Widgeon (*Anas americana*)
- Belted Kingfisher (*Ceryle alcyon*)
- Black-crowned Night-Heron (*Nycticorax nycticorax*)
- Blue-winged Teal (*Anas discors*)
- Canada geese (*Branta Canadensis*)
- Common Snipe (*Gallinago gallinago*)
- Common Tern (*Sterna hirundo*)
- Double-crested cormorant (*Phalacrocorax auritus*)
- Gadwall (*Anas strepera*)
- Great Black-backed Gull (*Larus marinus*)
- Great Blue Heron (*Ardea herodias*)
- Green-winged Teal (*Anas crecca*)
- Herring Gull (*Larus argentatus*)
- Horned Lark (*Eremophila alpestris*)
- Killdeer (*Charadrius vociferus*)
- Mallard (*Anas platyrhynchos*)
- Northern Harrier (*Circus cyaneus*)
- Northern Pintail (*Anas acuta*)
- Northern Shoveler (*ANas clypeata*)
- Osprey (*Pandion haliaetus*)
- Pied-billed Grebe (*Podilymbus podiceps*)
- Piping Plover (*Chardrius melodus*)
- Red-breasted Merganser (*Mergus serrator*)
- Ring-billed Gull (*Larus delawarensis*)
- Ring-necked Duck (*Aythya collaris*)
- Savannah Sparrow (*Passerculus sandwichensis*)
- Spotted Sandpiper (*Actitis macularia*)
- Swamp Sparrow (*Melospiza georgiana*)

Marine Mammals:

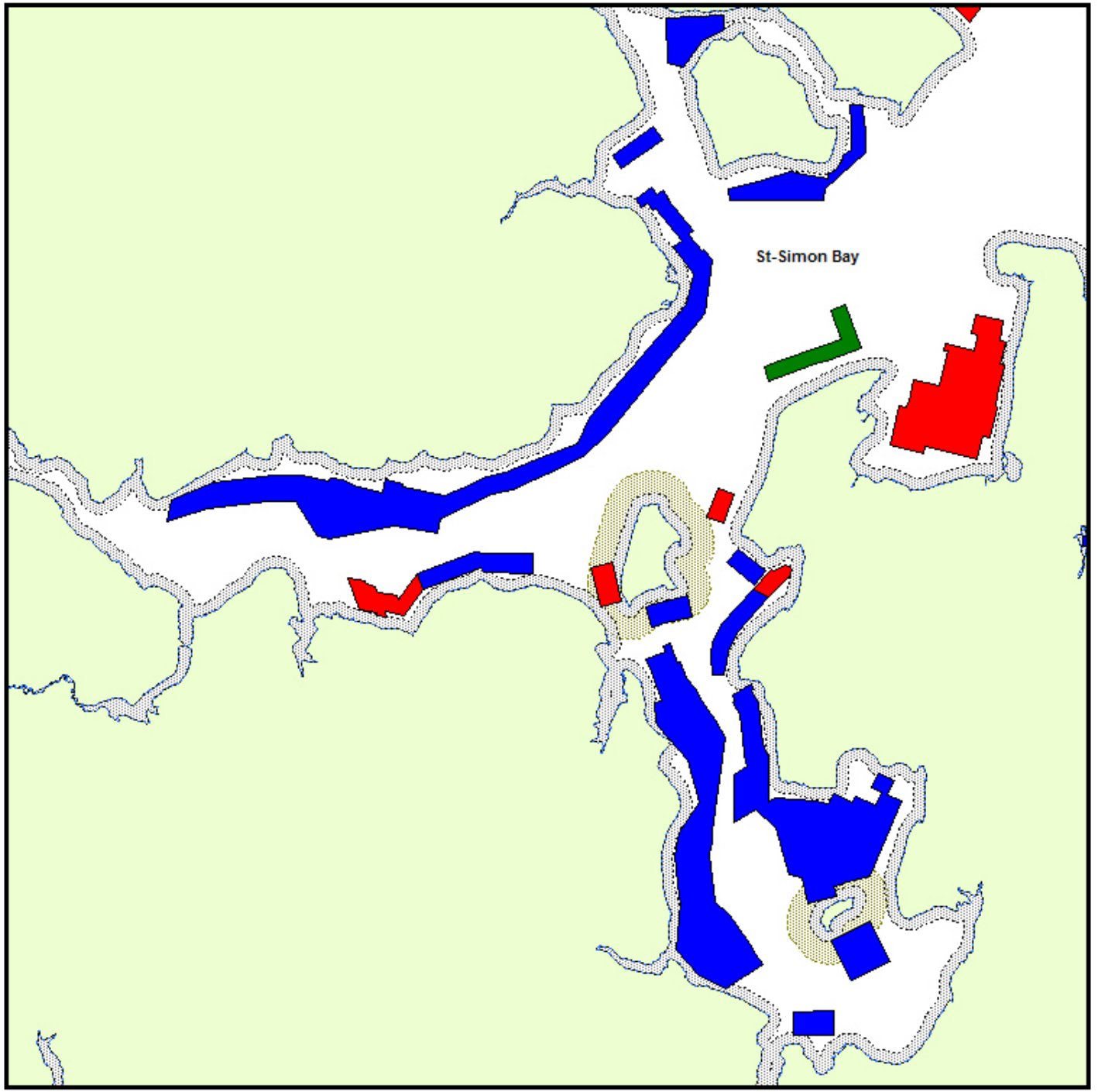
No sensitive marine mammal species were identified within the study area [77].

Designated Areas:

Miscou Island is designated Important Bird Area.

Transportation and Navigation:

The main source of transportation in this area is by commercial fishing vessels and recreational boating. The area is generally ice free from April 15 to January 1 [78].

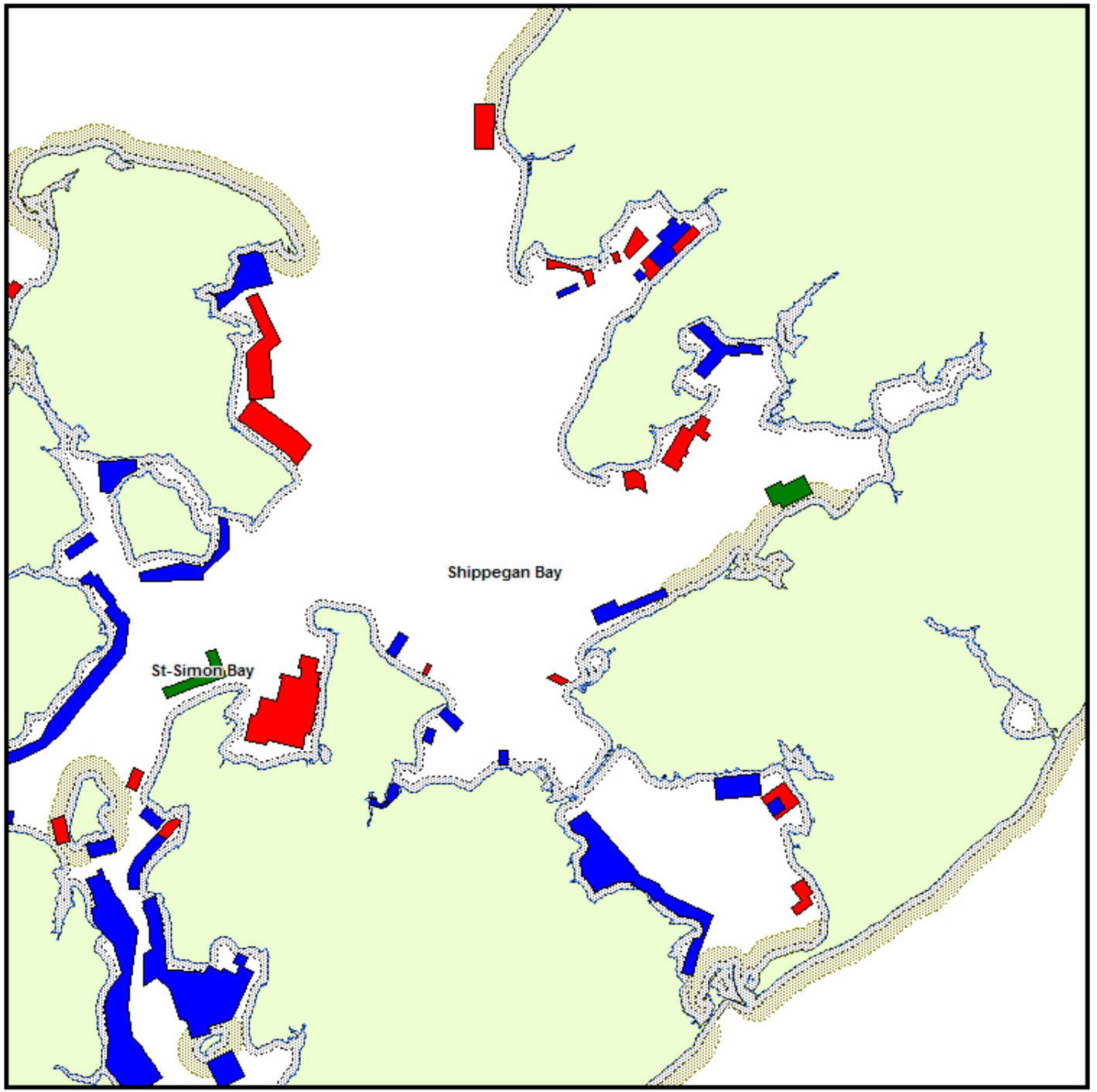


Legend

- Buffer zone
- Extended buffer zone
- Class A bottom, near-bottom and water column culture
- Class B bottom and near-bottom culture
- Class C bottom culture
- Class D no regular water column oyster aquaculture activities

For more specific information refer to: Section 5.1.1

December 11, 2006

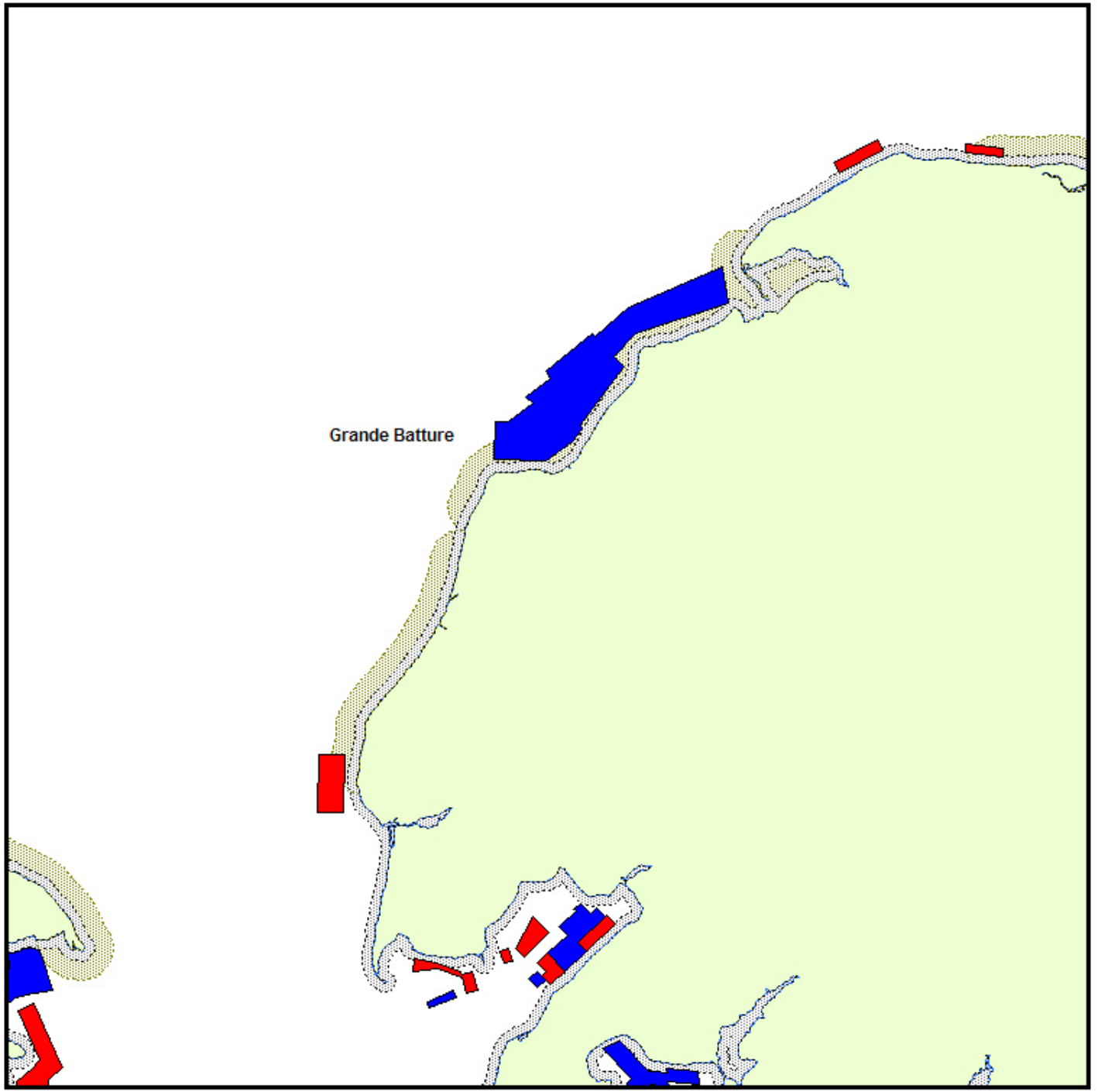


Legend

- Buffer zone
- Extended buffer zone
- Class A bottom, near-bottom and water column culture
- Class B bottom and near-bottom culture
- Class C bottom culture
- Class D no regular water column oyster aquaculture activities

For more specific information refer to: Section 5.1.1

January 24, 2007

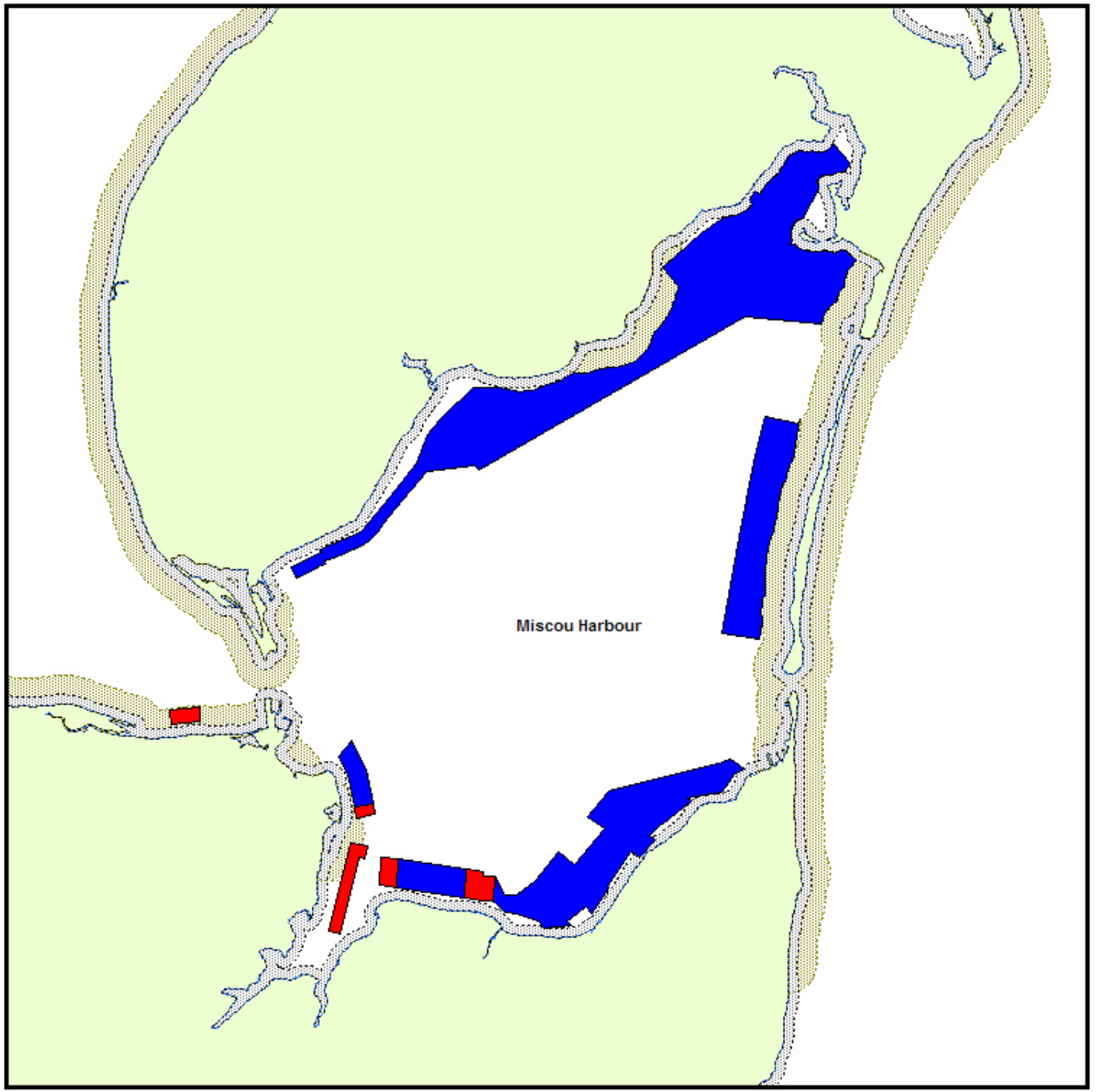


Legend

- Buffer zone
- Extended buffer zone
- Class A bottom, near-bottom and water column culture
- Class B bottom and near-bottom culture
- Class C bottom culture
- Class D no regular water column oyster aquaculture activities

For more specific information refer to: Section 5.1.1

January 25, 2007



Legend

- Buffer zone
- Extended buffer zone
- Class A bottom, near-bottom and water column culture
- Class B bottom and near-bottom culture
- Class C bottom culture
- Class D no regular water column oyster aquaculture activities

For more specific information refer to: Section 5.1.1

December 11, 2006

4 Environmental Setting: Petit-Pokemouche / Pokemouche

Approximate Boundaries of Environmental Setting Area:

Major embayments of Pokemouche Bay as well as smaller inlets and Harbours:

- Petit-Pokemouche Bay
- Pokemouche Bay
- Barachois à Colas
- Grande Anse Cove
- Pokemouche River (Inkerman Lake)

Marine Environment:

Pokemouche Bay is protected from the Gulf of St Lawrence by a large dune system. Tidal waters enter the bay through a channel and gully. Freshwater flows into the bay from one main river (Pokemouche River) which is fed by several smaller tributaries. The estuarine portion includes subtidal and intertidal waters and flats and is bordered by salt marches, dunes, peat bogs and forested areas. Tides are semi –diurnal with a mean tidal range of approximately 0.3 to 1.3 m (low to high tidal range) [76].

Fish and Fish Habitat:

The following inshore commercial fish and marine invertebrate species are indicated as occurring within this study area:

Fish

- American eel (*Anguilla rostrata*)
- Alewife (*Alosa pseudoharengus*)
- Atlantic herring (*Clupea harengus harengus*)
- Atlantic mackerel (*Scomber scombrus*)
- Rainbow smelt (*Osmerus mordax*)
- Sea-run trout (*Salvelinus fontinalis*)
- Smooth Flounder (*Liopsetta putnami*)
- Striped bass (*Morone saxatilis*)
- Tomcod (*Microgadus tomcod*)
- Winter flounder (*Pseudopleuronectes americanus*)

Molluscs and crustaceans

- American lobster (*Homarus americanus*)
- American oyster (*Crassostrea virginica*)
- Bar clam (*Spisula solidissima*)
- Blue mussel *(Mytilus edulis*)
- Quahog (*Mercenaria mercenaria*)
- Razor clam (*Ensis directus*)
- Rock crab (*Cancer irroratus*)
- Softshell clam (*Mya arenaria*)

An Atlantic lobster spawning area is located within the bounds of this study area.

Migratory Birds, Seabirds, Shorebirds, and Waterfowl:

The following marine and coastal bird species have been identified as being in the study area:

- American Black Duck (*Anas rubripes*)
- American Widgeon (*Anas americana*)
- Belted Kingfisher (*Ceryle alcyon*)
- Black-crowned Night-Heron (*Nycticorax nycticorax*)

- Blue-winged Teal (*Anas discors*)
- Canada geese (*Branta Canadensis*)
- Common Snipe (*Gallinago gallinago*)
- Common Tern (*Sterna hirundo*)
- Double-crested cormorant (*Phalacrocorax auritus*)
- Gadwall (*Anas strepera*)
- Great Black-backed Gull (*Larus marinus*)
- Great Blue Heron (*Ardea herodias*)
- Green-winged Teal (*Anas crecca*)
- Herring Gull (*Larus argentatus*)
- Horned Lark (*Eremophila alpestris*)
- Killdeer (*Charadrius vociferus*)
- Mallard (*Anas platyrhynchos*)
- Northern Harrier (*Circus cyaneus*)
- Northern Pintail (*Anas acuta*)
- Northern Shoveler (*ANas clypeata*)
- Osprey (*Pandion haliaetus*)
- Pied-billed Grebe (*Podilymbus podiceps*)
- Piping Plover (*Chardrius melodus*)
- Red-breasted Merganser (*Mergus serrator*)
- Ring-billed Gull (*Larus delawarensis*)
- Ring-necked Duck (*Aythya collaris*)
- Savannah Sparrow *(Passerculus* sandwichensis)
- Spotted Sandpiper (*Actitis macularia*)
- Swamp Sparrow (*Melospiza georgiana*)

Marine Mammals:

No sensitive marine mammal species were identified within the study area [77].

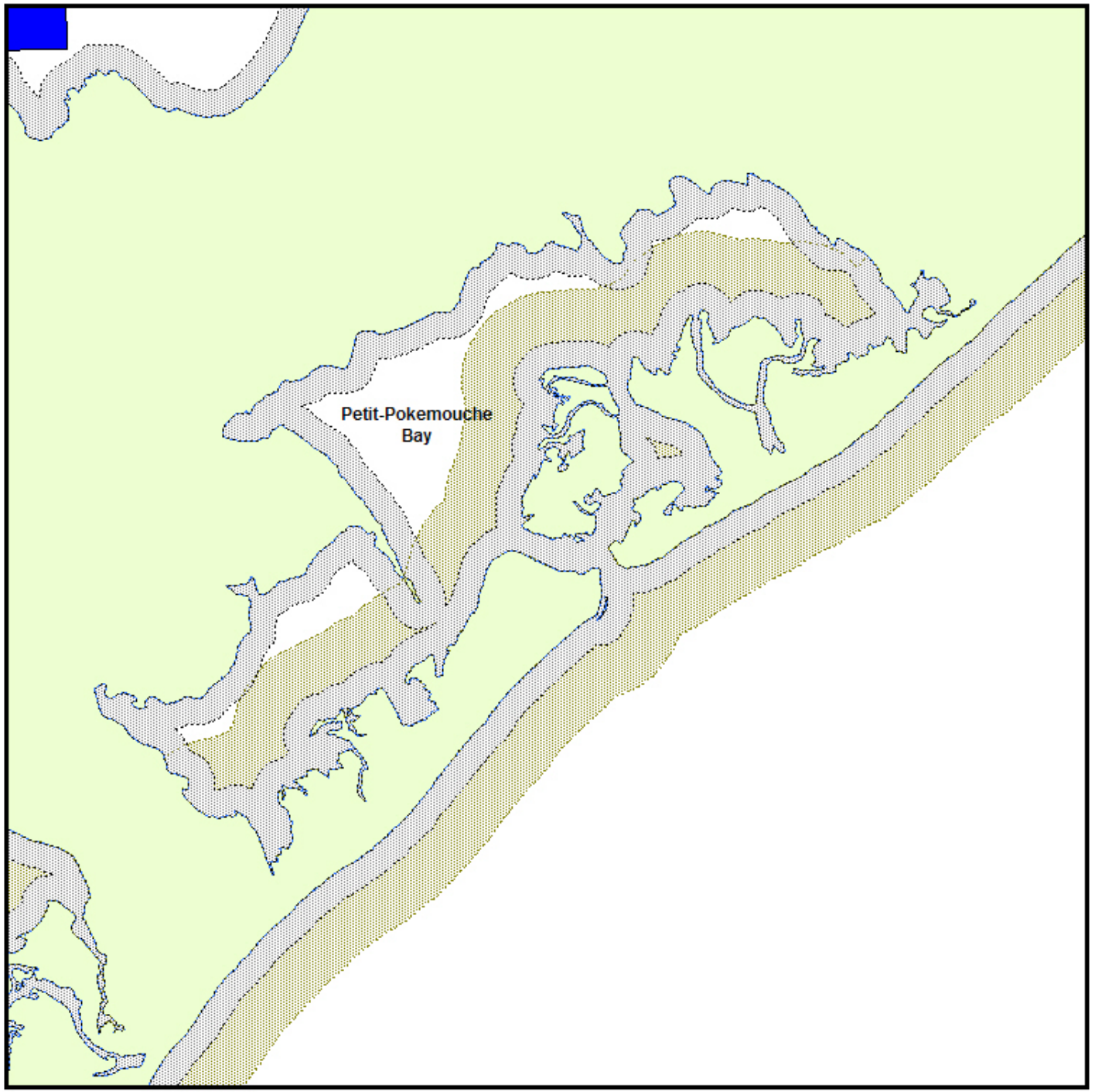
Designated Areas:

The following ESA's can be found in this area [77]:

- Baie de Petit Pokemouche ESA
- Grand Passage (Pokemouche Beaches ESA)
- Pokemouche Beach South / Plover Ground ESA
- Pokemouche River & Estuary ESA
- Pallot Road ESA
- The beaches of Pokemouche and Grand Passage are designated Important Bird Areas
- Pointe aux Rats Musqués is an Important Bird Area

Transportation and Navigation:

The main source of transportation in this area is by commercial fishing vessels. The area is generally ice free from April 15 to January 1 [78].

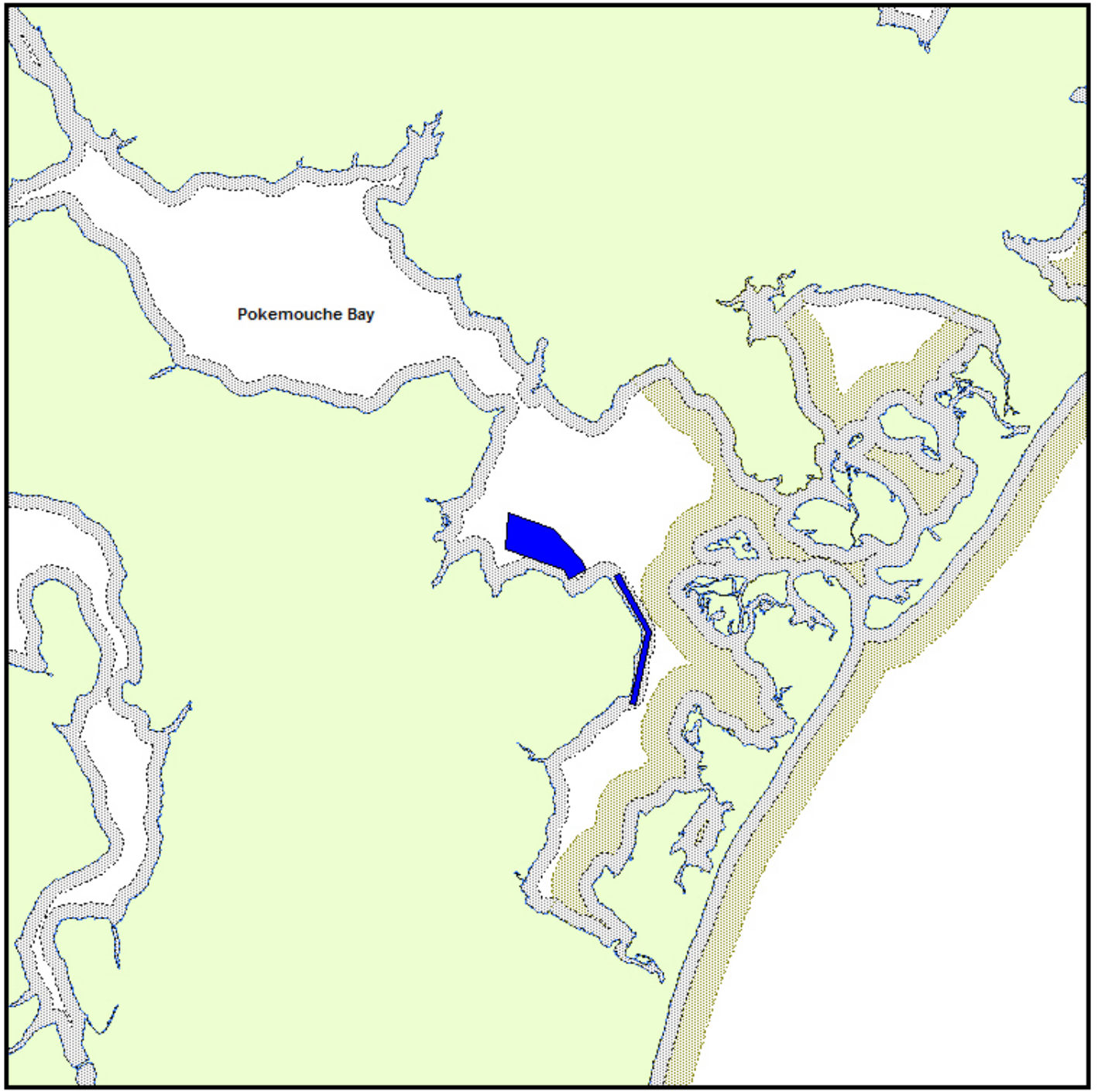


Legend

- Buffer zone
- Extended buffer zone
- Class A bottom, near-bottom and water column culture
- Class B bottom and near-bottom culture
- Class C bottom culture
- Class D no regular water column oyster aquaculture activities

For more specific information refer to: Section 5.1.1

January 25, 2007



Legend

- Buffer zone
- Extended buffer zone
- Class A bottom, near-bottom and water column culture
- Class B bottom and near-bottom culture
- Class C bottom culture
- Class D no regular water column oyster aquaculture activities

For more specific information refer to: Section 5.1.1

December 11, 2006

5 Environmental Setting: Tracadie and Tabusintac

Approximate Boundaries of Environmental Setting:

Major embayments of Tracadie and Tabusintac Bays as well as smaller inlets and harbours:

- Tracadie Bay
- Big Tracadie River
- Ruisseau Sureau Blanc
- Big Tracadie River / The Lake
- Ruisseau à George
- Tabusintac Bay
- Tabusintac River
- French Cove

Marine Environment:

Tracadie River includes a coastal estuary protected from the Gulf of St. Lawrence by barrier island systems. Tidal waters enter via two main channels near Pointe-à-Bouleau, and Val Comeau, with a smaller gully near Tracadie Beach. Freshwater flows into the estuary from the Little Tracadie River, Big Tracadie River and Rivière du Portage. Tabusintac River includes a coastal estuary protected from the Gulf of St. Lawrence by barrier island systems. Tidal waters enter the bays through channels and gullies near Ross Point, French Cove and Big Cove. Freshwater flows from the Tabusintac River and smaller tributaries. The Tabusintac watershed covers an area of 717 $km^{2.}$

The estuarine portion of both rivers includes subtidal and intertidal waters and flats and is bordered by salt marshes, dunes, peat bogs and forested areas. Water depths average 1-3 m, with a maximum of 2-4 m in the channels. Tides are semi-diurnal with a mean tidal range of approximately 0.3 to 1.3 m (low to high tidal range) [76].

Fish and Fish Habitat:

The following inshore commercial fish and marine invertebrate species have been identified within this study area:

Fish

- Alewife (*Alosa pseudoharengus*)
- American eel (*Anguilla rostrata*)
- Atlantic herring (*Clupea harengus harengus*)
- Atlantic mackerel (*Scomber scombrus*)
- Atlantic salmon (*Salmo salar*)
- Sea-run trout (*Salvelinus fontinalis*)
- Rainbow smelt (*Osmerus mordax*)
- Striped bass (*Morone saxatilis*)
- Winter flounder (*Pseudopleuronectes americanus*)

Molluscs and crustaceans

- American lobster (*Homarus americanus*)
- American oyster (*Crassostrea virginica*)
- Bar clam (*Spisula solidissima*)
- Blue mussel (*Mytilus edulis*)
- Quahog (*Mercenaria mercenaria*)
- Razor clam (*Ensis directus*)
- Rock crab (*Cancer irroratus*)
- Softshell clam (*Mya arenaria*)

Migratory Birds, Seabirds, Shorebirds, and Waterfowl:

The following marine and coastal bird species have been identified as being in the study area:

- American Black Duck (*Anas rubripes*)
- American Widgeon (*Anas americana*)
- Arctic Tern (*Sterna paradisaea*)
- Belted Kingfisher (*Ceryle alcyon*)
- Black scoter (*Melanitta nigra*)
- Blue-winged Teal (*Anas discors*)
- Canada geese (*Branta Canadensis*)
- Common Snipe (*Gallinago gallinago*)
- Common Tern (*Sterna hirundo*)
- Gadwall (*Anas strepera*)
- Great Black-backed Gull (*Larus marinus*)
- Great Blue Heron (*Ardea herodias*)
- Herring Gull (*Larus argentatus*)
- Horned Lark (*Eremophila alpestris*)
- Killdeer (*Charadrius vociferus*)
- Northern Harrier (*Circus cyaneus*)
- Northern Pintail (*Anas acuta*)
- Pied-billed Grebe (*Podilymbus podiceps*)
- Piping Plover (*Chardrius melodus*)
- Red-breasted Merganser (*Mergus serrator*)
- Ring-billed Gull (*Larus delawarensis*)
- Savannah Sparrow (*Passerculus sandwichensis*)
- Spotted Sandpiper (*Actitis macularia*)
- Surf scoter (*Melanitta perspicillata*)
- White-winged scoter (*Melanitta fusca*)

Marine Mammals:

No sensitive marine mammal species were identified as occurring within the study area [77].

Designated Areas:

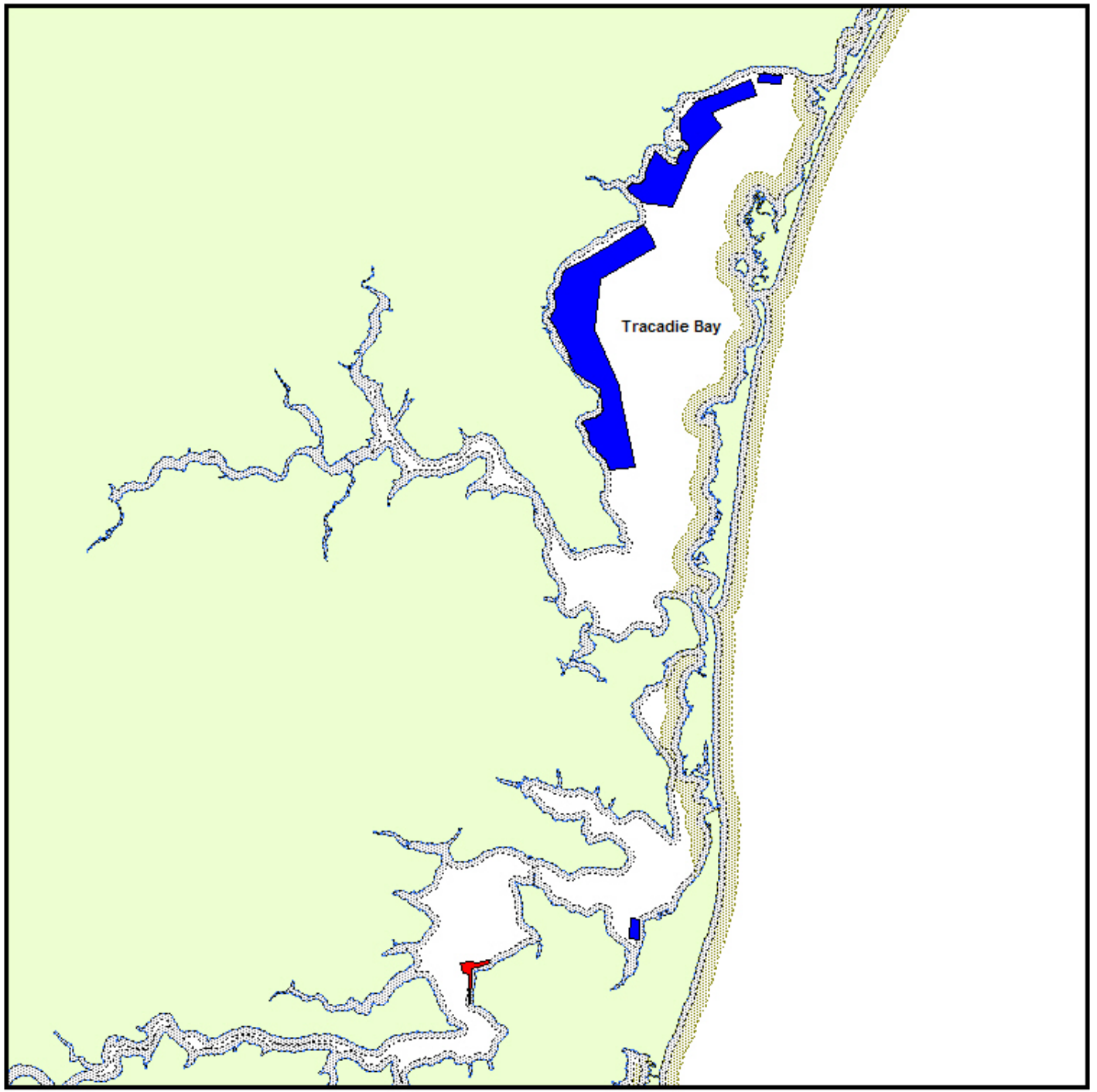
The following ESA can be found in this area [77]:

- Tracadie Beach, sandspit and Lagoon ESA
- Tracadie Sewage Lagoon ESA
- Walsh's Island ESA
- Tabusintac River & Estuary ESA
- Blacklands Sandspit & Swinging Point ESA
- Cedar Road Beach/Salt Marsh ESA
- Grand Lac/Pointe à Barreau ESA
- Jackos Point & Black Point ESA
- Pointe de L'Île Marsh ESA
- Tabusintac Gully & Sand Spits ESA
- Val Comeau Sandspit ESA
- Wishart Point Marsh ESA

The Tabusintac Lagoon and River Estuary area is listed as a wetland of international importance by the Ramsar Convention on Wetlands [27] and an Important Bird Area. Tracadie bay and Pointe à Bouleau are designated Important Bird Areas.

Transportation and Navigation:

The main source of transportation in this area is by commercial fishing vessels. The area generally is ice free from April 15 to January 1 [78].

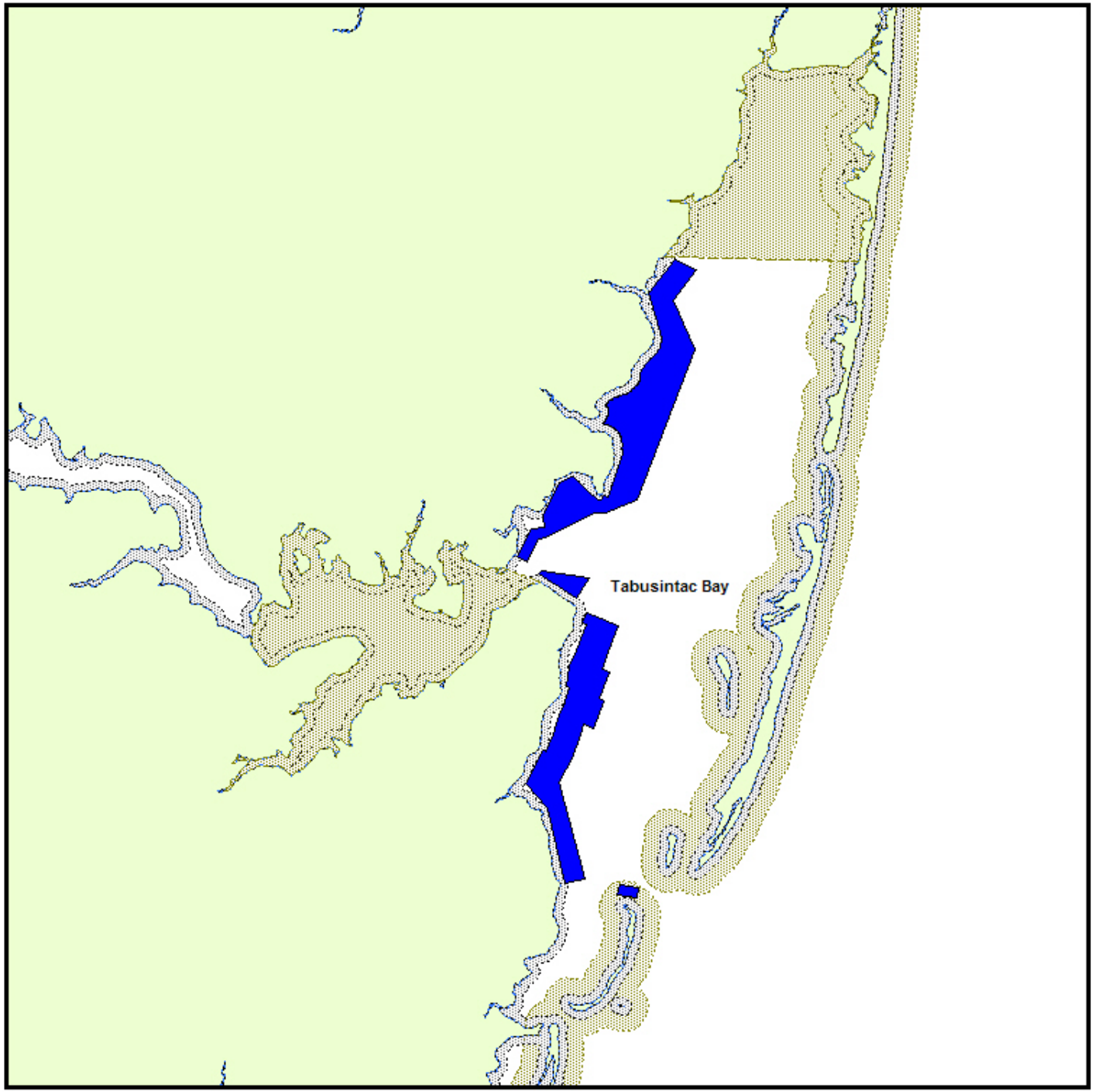


Legend

- Buffer zone
- Extended buffer zone
- Class A bottom, near-bottom and water column culture
- Class B bottom and near-bottom culture
- Class C bottom culture
- Class D no regular water column oyster aquaculture activities

For more specific information refer to: Section 5.1.1

January 24, 2007



Legend

- Buffer zone
- Extended buffer zone
- Class A bottom, near-bottom and water column culture
- Class B bottom and near-bottom culture
- Class C bottom culture
- Class D no regular water column oyster aquaculture activities

For more specific information refer to: Section 5.1.1

January 24, 2007

6 Environmental Setting Miramichi Bay

Approximate Boundaries of Environmental Setting:

Major embayments of Miramichi Bay as well as smaller inlets and Harbours:

- Neguac Bay
- Napan Bay
- Gammon Bay
- Black River
- Inner Miramichi Bay
- Bay du Vin
- Bay du Vin Harbour
- Miramichi River
- Miramichi Bay
- Baie Ste-Anne
- Mclean's Cove
- Herring Cove
- Escuminac

Marine Environment:

This area includes several bays, harbours and estuaries, the most important being Neguac Bay, Miramichi Inner Bay, Bay du Vin and the Miramichi River. Two gullies, separated by Portage Island, permit the exchange of waters between the Gulf of St Lawrence and the Miramichi Inner Bay. Freshwater flows from 8 rivers into the Miramichi Inner Bay which opens into the Gulf of St-Lawrence.

The depth of marine waters in the area ranges from approximately 0.2 to 12.9 m. The tides are semi-diurnal with a mean tidal range of approximately 0.2 to 1.6 m (low to high tidal range), [76].

Fish and Fish Habitat:

The following inshore commercial fish and marine invertebrate species have been identified within this study area:

Fish

- American eel (*Anguilla rostrata*)
- Alewife (*Alosa pseudoharengus*)
- Atlantic herring (*Clupea harengus harengus*)
- Atlantic mackerel (*Scomber scombrus*)
- Rainbow smelt (*Osmerus mordax*)
- Sea-run trout (*Salvelinus fontinalis*)
- Smooth Flounder (*Liopsetta putnami*)
- Striped bass (*Morone saxatilis*)
- Tomcod (*Microgadus tomcod*)
- Winter flounder (*Pseudopleuronectes americanus*)

Molluscs and crustaceans

- American lobster (*Homarus americanus*)
- American oyster (*Crassostrea virginica*)
- Bar clam (*Spisula solidissima*)
- Blue mussel (*Mytilus edulis*)
- Quahog (*Mercenaria mercenaria*)
- Razor clam (*Ensis directus*)
- Rock crab (*Cancer irroratus*)
- Softshell clam (*Mya arenaria*)

An Atlantic lobster spawning area is located within the bounds

of this study area.

Note –The only confirmed spawning site for the Gulf of St. Lawrence population of Striped Bass (*Morone saxatilis*) is located in the Northwest Miramichi River. The Miramichi estuary is also an important nursery habitat for that species [80].

Migratory Birds, Seabirds, Shorebirds, and Waterfowl:

The following marine and coastal bird species have been identified as being in the study area:

- American Black Duck (*Anas rubripes*)
- Arctic Tern (*Sterna paradisaea*)
- Belted Kingfisher (*Ceryle alcyon*)
- Common Tern (*Sterna hirundo*)
- Double-crested Cormorant (*Phalacrocorax auritus*)
- Great Black-backed Gull (*Larus marinus*)
- Herring Gull (*Larus argentatus*)
- Killdeer (*Charadrius vociferus*)
- Northern Harrier (*Circus cyaneus*)
- Osprey (*Pandion haliaetus*)
- Piping Plover (*Chardrius melodus*)
- Red-breasted Merganser (*Mergus serrator*)
- Ring-billed Gull (*Larus delawarensis*)
- Savannah Sparrow (*Passerculus sandwichensis*)
- Swamp Sparrow (*Melospiza georgiana*)

Marine Mammals:

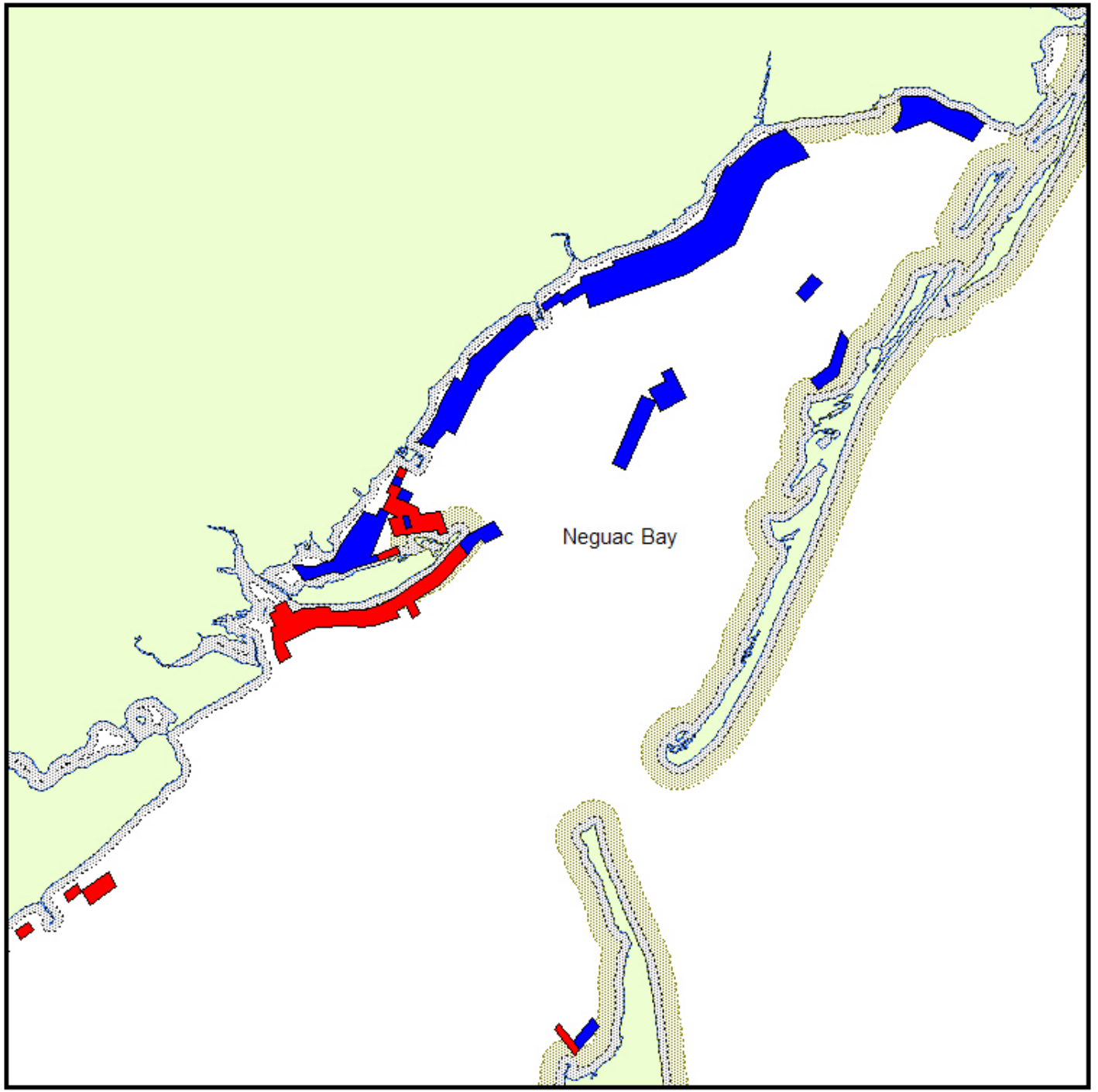
No sensitive marine mammal species were identified as occurring within the study area [77].

Designated Areas:

- Bartibog River ESA
- Bay du Vin Island ESA
- Bay Du Vin River ESA
- Black River ESA
- Cheval Point ESA
- Egg Island ESA
- Grand Dune Inlet ESA
- Hay Island/Ile au Foin ESA
- Loggieville ESA
- Miramichi River & Estuary ESA
- Napan Bay ESA
- Neguac Beach Sand Spits ESA
- Point Aux Carr ESA
- Portage Island National Wildlife Area ESA
- Fox Island ESA
- Huckleberry Island ESA
- Point Escuminac ESA
- Preston Beach/ McLeans Cove Salt Marsh ESA
- Neguac sand spit and Escuminac beaches are designated Important Bird Areas.

Transportation and Navigation:

The main sources of transportation in this area are container shipping, commercial fishing vessels and recreational boating. The area is generally ice free from March 15 to January 1 [78].

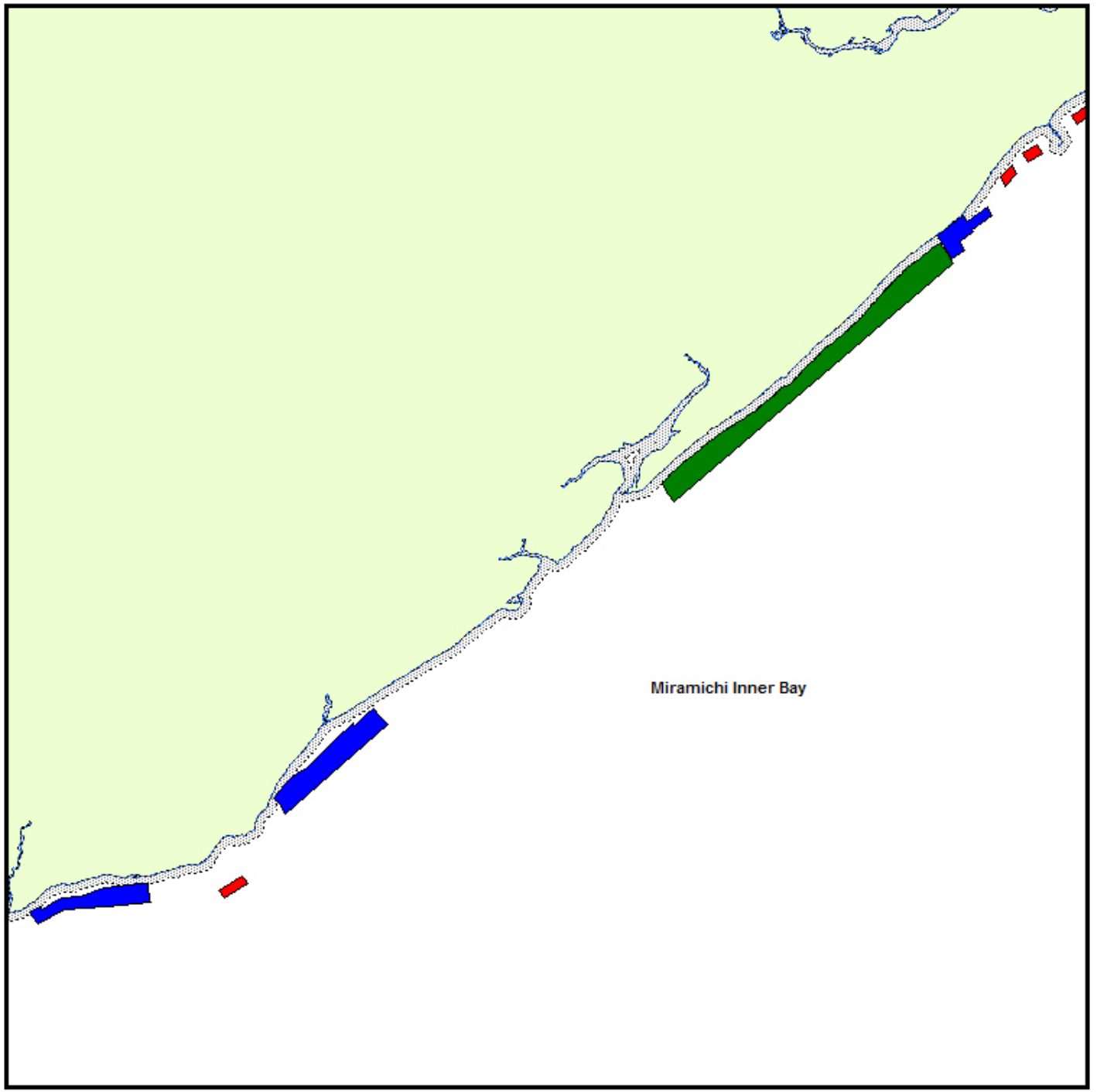


Legend

- Buffer zone
- Extended buffer zone
- Class A bottom, near-bottom and water column culture
- Class B bottom and near-bottom culture
- Class C bottom culture
- Class D no regular water column oyster aquaculture activities

For more specific information refer to: Section 5.1.1

January 24, 2007



Legend

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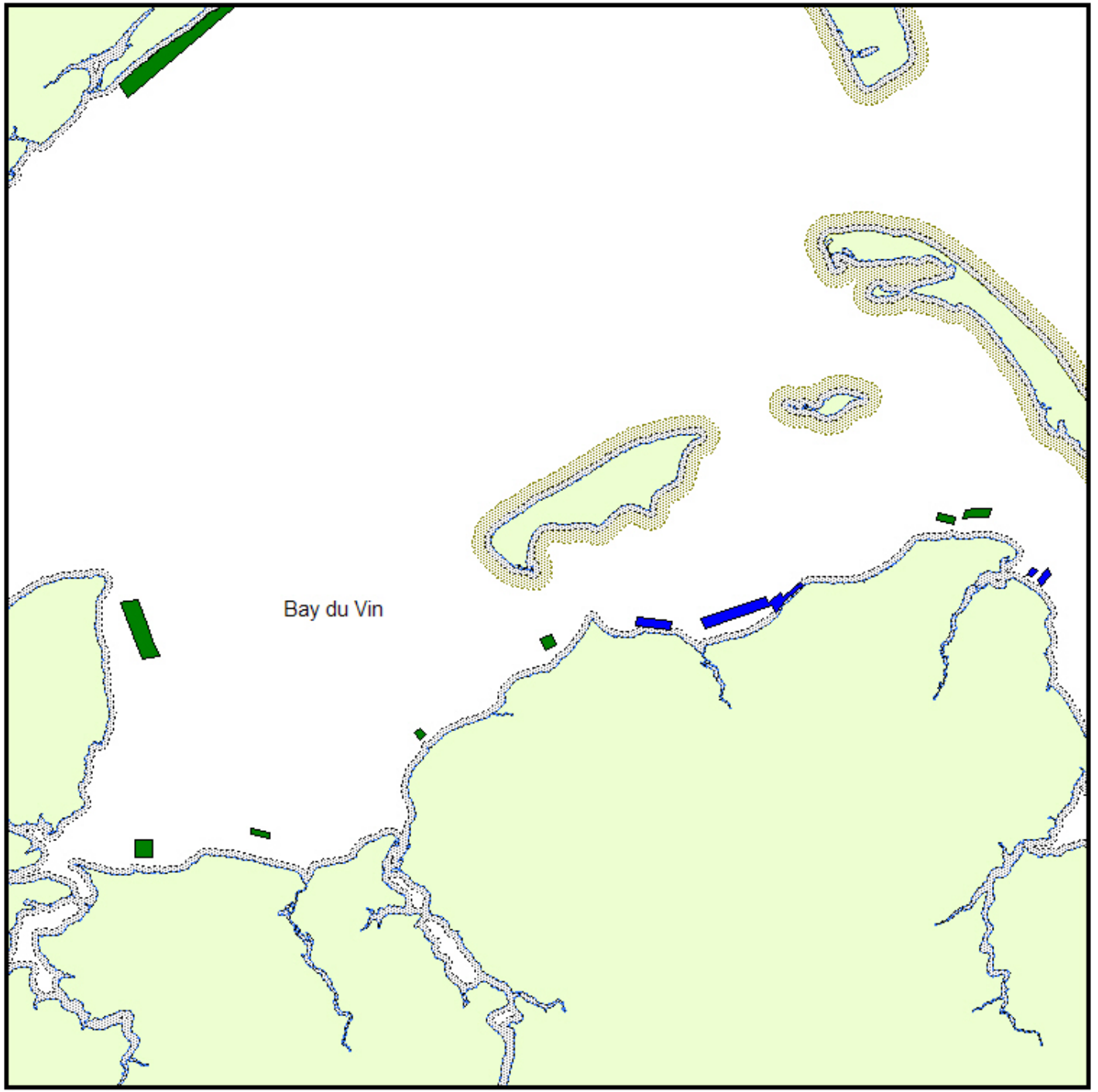
For more specific information refer to: Section 5.1.1

January 25, 2007



Legend

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- Class C bottom culture
- Class D no regular water column oyster aquaculture activities

For more specific information refer to: Section 5.1.1

January 25, 2007

7 Environmental Setting: Richibucto

Approximate Boundaries of Environmental Setting:

Major embayment of Richibucto River as well as smaller bays, inlets and harbours, including:

- Richibucto estuary
- Rivière St-Charles
- Le Barachois
- Petite Aldouane River
- Anse à Fidèle
- Richibucto Harbour
- Richibucto River
- Passe de l'Ile
- Baie du Village

Note: The tidal waters of Kouchibouquac National Park are specifically excluded from this area for the purposes of this RCSR.

Marine Environment:

The Richibucto estuary is a coastal lagoon protected from the Gulf of St. Lawrence by barrier island systems. Tidal waters enter the bays through one main channel located between the North and South Richibucto dunes. Freshwater flows into the estuary from the Richibucto River and its main tributaries, the St. Charles and St. Nicholas Rivers. The total watershed area is 1088.5 km^2. The estuarine portion includes subtidal and intertidal waters and flats bordered by salt marshes, dunes, peat bogs and forested areas. Marine water depths average 1-2 m, with a maximum depth of 12 m in the channels. Tides are semi-diurnal and average approximately 0.1 to 1.4 m (low to high tidal range) [76].

Fish and Fish Habitat:

The following inshore commercial fish and marine invertebrate species have been identified within this study area:

Fish

- Alewife (*Alosa pseudoharengus*)
- American eel (*Anguilla rostrata*)
- Atlantic herring (*Clupea harengus harengus*)
- Atlantic mackerel (*Scomber scombrus*)
- Atlantic salmon (*Salmo salar*)
- Sea-run trout (*Salvelinus fontinalis*)
- Rainbow smelt (*Osmerus mordax*)
- Striped bass (*Morone saxatilis*)
- Smooth flounder (*Pleuronectes putnami*)
- Winter flounder (*Pseudopleuronectes americanus*)
- White hake (*Urophysis tenuis*)

Mollusc and crustaceans

- American lobster (*Homarus americanus*)
- American oyster (*Crassostrea virginica*)
- Bar clam (*Spisula solidissima*)
- Blue mussel (*Mytilus edulis*)
- Quahog (*Mercenaria mercenaria*)
- Razor clam (*Ensis directus*)
- Rock crab (*Cancer irroratus*)
- Softshell clam (*Mya arenaria*)

Marine Mammals:

Harbour seals (*Phoca vitulina*) are listed as occurring in the area [81].

Migratory Birds, Seabirds, Shorebirds, and Waterfowl:

The following marine bird species have been identified as being in the study area:

- American Black Duck (*Anas rubripes*)
- American Widgeon (*Anas americana*)
- Bald Eagle (*Haliaeetus leucocephalus*)
- Killdeer (*Charadrius vociferus*)
- Osprey (*Pandion haliaetus*)
- Piping Plover (*Chardrius melodus*)
- Savannah Sparrow (*Passerculus sandwichensis*)
- Swamp Sparrow (*Melospiza georgiana*)
- Upland Sandpiper (*Bartramia longicauda*)

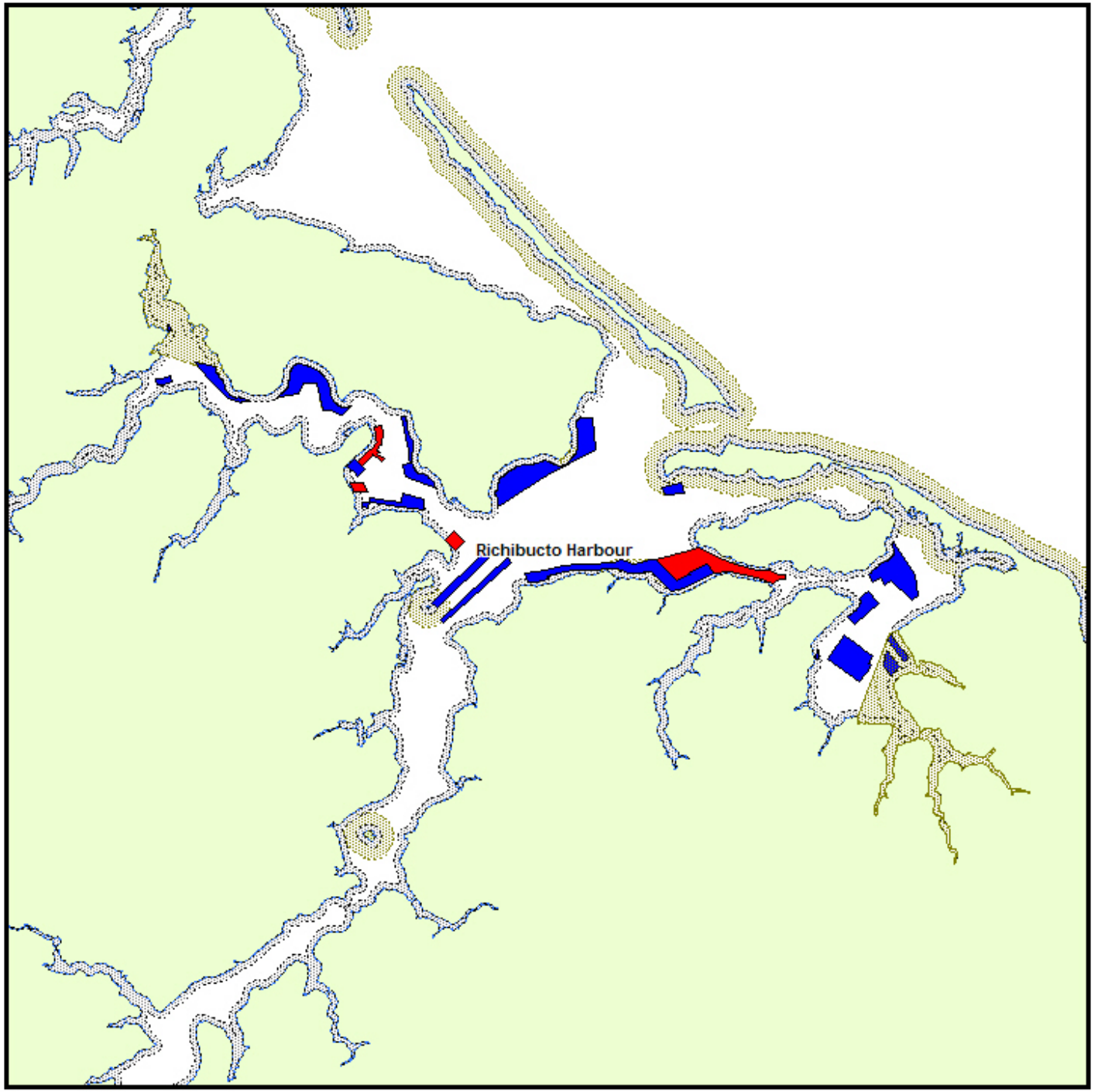
Designated Areas:

The following ESA's can be found in this area [77]:

- Richibucto Estuary ESA
- Richibucto-Village Estuary ESA
- South Richibucto Dune ESA
- York Point Island ESA
- Kouchibouguac NP sand islands are designated Important Bird Areas.

Transportation and Navigation:

The main source of transportation in this area is by commercial fishing vessels and recreational boating. The area generally is ice free from Mar. 15 to Jan. 1 [76].



Legend

- Buffer zone
- Extended buffer zone
- Class A bottom, near-bottom and water column culture
- Class B bottom and near-bottom culture
- Class C bottom culture
- Class D no regular water column oyster aquaculture activities

For more specific information refer to: Section 5.1.1

January 25, 2007

8 Environmental Setting: Buctouche, Cocagne

Approximate Boundaries of Environmental Setting:

Major embayments of Buctouche and Cocagne Bays as well as smaller inlets and Harbours:

- Cocagne Bay
- Cocagne Harbour
- Cocagne River
- La Passe
- Buctouche Bay
- Buctouche Harbour
- Buctouche River
- Little Buctouche River
- Babineau Brook
- Smelt Brook
- Murray Brook

Marine Environment:

This area includes small bays and several small inlets and harbours, the most important being Buctouche Bay and Cocagne Bay. Buctouche Bay is protected from the Northumberland Strait by a large dune system (Dune de Buctouche). Freshwater flows from two rivers, Cocagne River and Buctouche River, into the Northumberland Strait.

Cocagne Bay is protected by Cocagne Island which lies between two gullies that permit the exchange of waters between the Northumberland Strait and Cocagne Harbour.

The depth of marine waters in the area ranges from approximately 0.3 to 7.9 m (DFO, 2004). The tides are semi-diurnal with a mean tidal range of approximately 0.1 to 1.1 m (low to high tidal range), [76].

Fish and Fish Habitat:

The following inshore commercial fish and marine invertebrate species are indicated as occurring within this study area:

Fish

- American eel (*Anguilla rostrata*)
- Alewife (*Alosa pseudoharengus*)
- Atlantic herring (*Clupea harengus harengus*)
- Atlantic mackerel (*Scomber scombrus*)
- Rainbow smelt (*Osmerus mordax*)
- Sea-run trout (*Salvelinus fontinalis*)
- Striped bass (*Morone saxatilis*)
- Tomcod (*Microgadus tomcod*)
- Winter flounder (*Pseudopleuronectes americanus*)

Molluscs and crustaceans

- American lobster (*Homarus americanus*)
- American oyster (*Crassostrea virginica*)
- Bar clam (*Spisula solidissima*)
- Blue mussel (*Mytilus edulis*)
- Quahog (*Mercenaria mercenaria*)
- Razor clam (*Ensis directus*)
- Rock crab (*Cancer irroratus*)
- Softshell clam (*Mya arenaria*)

Atlantic herring, Atlantic lobster and rock crab spawning areas

are indicated as occurring within the bounds of this study area.

Migratory Birds, Seabirds, Shorebirds, and Waterfowl:

The following marine and coastal bird species have been identified as being in the study area:

- American Black Duck (*Anas rubripes*)
- American Widgeon (*Anas americana*)
- Belted Kingfisher (*Ceryle alcyon*)
- Common Tern (*Sterna hirundo*)
- Great Blue Heron (*Ardea herodias*)
- Green-winged Teal (*Anas crecca*)
- Horned Lark (*Eremophila alpestris*)
- Killdeer (*Charadrius vociferus*)
- Osprey (*Pandion haliaetus*)
- Piping Plover (*Chardrius melodus*)
- Savannah Sparrow (*Passerculus sandwichensis*)
- Spotted Sandpiper (*Actitis macularia*)
- Willet (*Catoptrophorus semipalmatus*)

Marine Mammals:

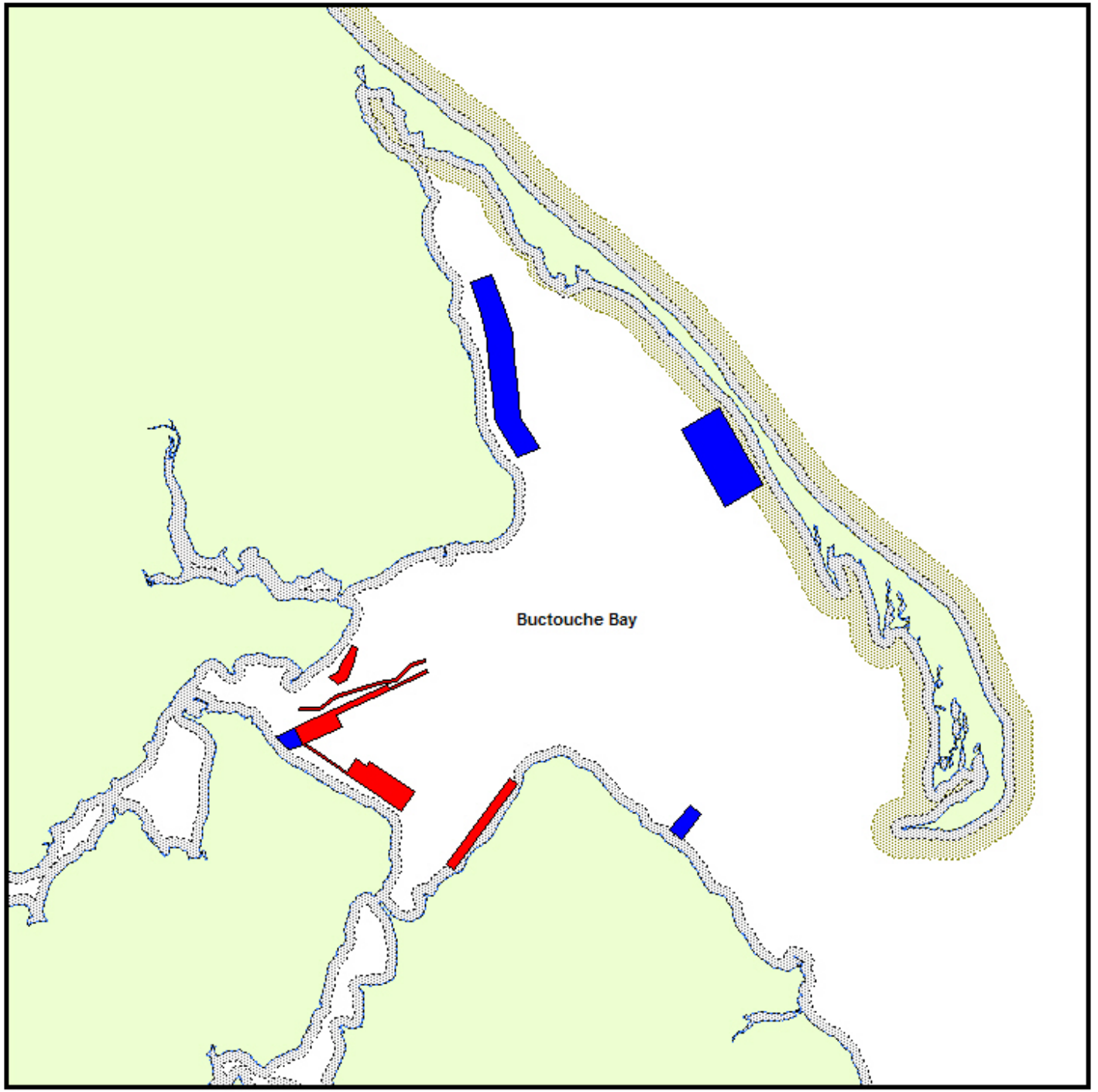
Harbour seals (*Phoca vitulina*) are indicated as occurring in the area [81].

Designated Areas:

- Buctouche Bar ESA
- Chockpish Dune ESA
- Black River Estuary ESA
- Buctouche River ESA
- Cocagne Bar ESA
- Cocagne Island ESA
- Cocagne River ESA
- Little Buctouche River ESA
- Mill Creek ESA
- Buctouche Bar is designated Important Bird Area.

Transportation and Navigation:

The main sources of transportation in this area are by commercial fishing vessels and recreational boating. The area generally is ice free from Apr. 1 to Jan. 1 [78].

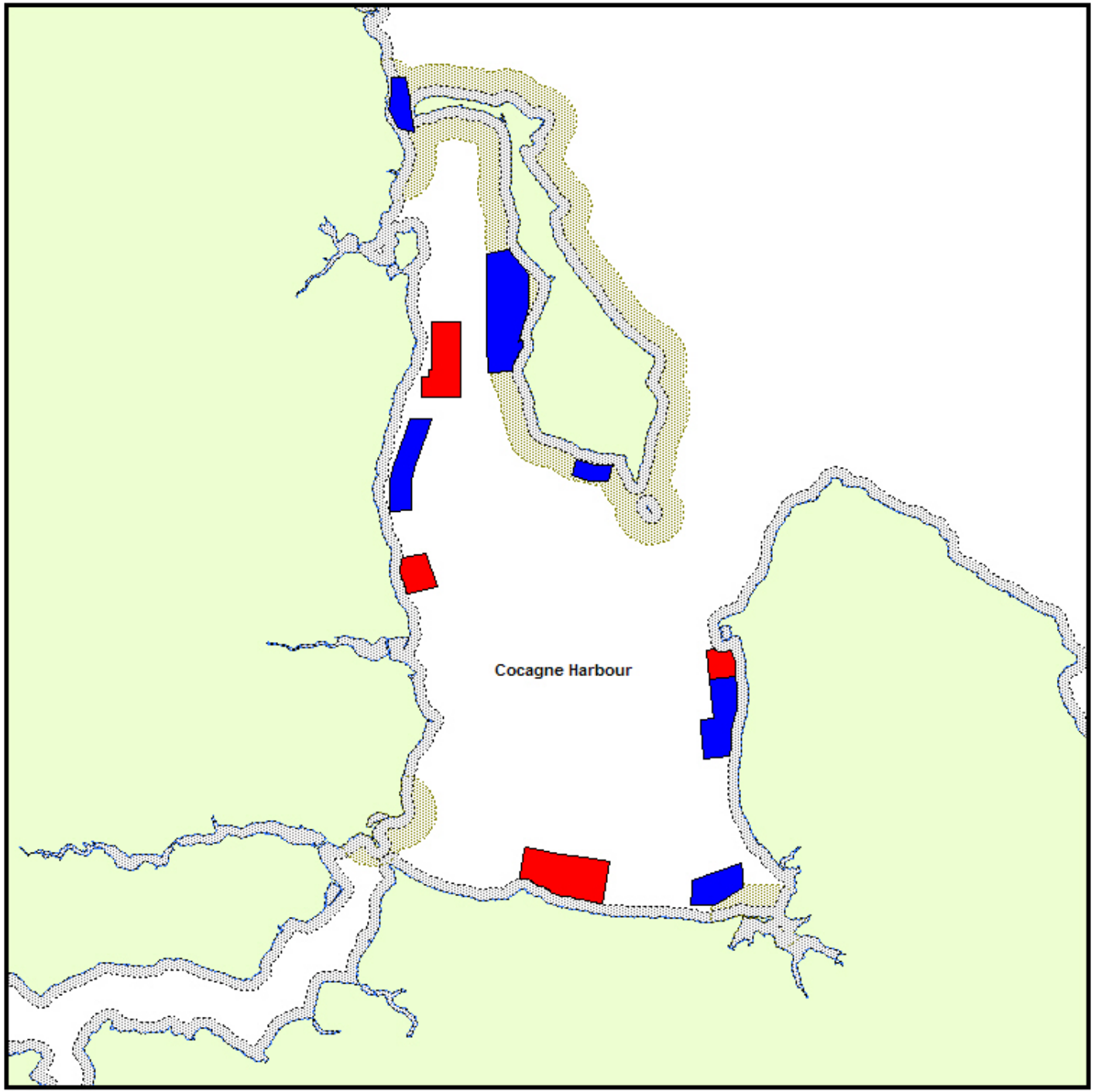


Legend

- Buffer zone
- Extended buffer zone
- Class A bottom, near-bottom and water column culture
- Class B bottom and near-bottom culture
- Class C bottom culture
- Class D no regular water column oyster aquaculture activities

For more specific information refer to: Section 5.1.1

January 25, 2007



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- Class C bottom culture
- Class D no regular water column oyster aquaculture activities

For more specific information refer to: Section 5.1.1

January 25, 2007

9 Environmental Setting: Shediac, Petit Barachois, Shemogue Harbour and Spence Cove

Approximate Boundaries of Environmental Setting:

Major embayment of Shediac Bay, Petit Barachois, Shemogue and Spence Cove as well as smaller inlets and Harbours:

- Shediac Bay
- Shediac Harbour
- Petit Barachois
- Shemogue Harbour
- Little Shemogue Harbour
- Spence Cove
- Peacock Cove
- Baie Verte
- Big Cove
- Anse Big Cove

Marine Environment:

This area includes several bays, harbours and estuaries, the most important being Shediac Bay, Petit Barachois, Little Shemogue Harbour and Spence Cove.

Shediac Bay is fairly open and separated from the Northumberland Strait by Shediac Island. Fresh water flows into the bay from two main rivers, the Scoudouc River and Shediac River.

Petit Barachois is a shallow enclosed bay which is protected by barrier beaches and is open to Northumberland Strait through small gullies. A small freshwater tributary flows into the bay.

The Shemogue watershed (including Little Shemogue Harbour and Shemogue Harbour) runs parallel to the shore of the Northumberland Strait and is supplied with freshwater from several small tributaries. Depths within the harbours are quite shallow (less than 5m) and much of Little Shemogue Harbour is exposed at low tide. There are no oyster aquaculture activities in Shemogue Harbour.

The Spence Cove watershed opens on the Northumberland Strait and is supplied with freshwater by a small tributary. Depths within the Cove are quite shallow (less than 5m) and much of it is exposed at low tide.

Baie Verte is a large open bay on that lies on the border between New Brunswick and Nova Scotia. To the north it is open to Northumberland Strait. Freshwater flows into the bay from two main rivers and several smaller tributaries. There are no oyster aquaculture activities in Baie Verte.

The depth of marine waters in the area ranges from approximately 0.3 to 10.19 m. The tides are semi-diurnal with a mean tidal range of approximately 0.2 to 2.8 m (low to high tidal range), [76].

Fish and Fish Habitat:

The following inshore commercial fish and marine invertebrate species are indicated as occurring within this study area:

Fish

- Alewife (*Alosa pseudoharengus*)
- American eel (*Anguilla rostrata*)
- Atlantic salmon (*Salmo salar*)
- Atlantic herring (*Clupea harengus harengus*)
- Atlantic mackerel (*Scomber scombrus*)
- Hake (*Urophycis tenuis*)
- Rainbow smelt (*Osmerus mordax*)
- Striped bass (*Morone saxatilis*)
- Winter flounder (*Pseudopleuronectes americanus*)

Molluscs and crustaceans

- American lobster (*Homarus americanus*)
- American oyster (*Crassostrea virginica*)
- Bar clam (*Spisula solidissima*)
- Blue mussel *(Mytilus edulis*)
- Quahog (*Mercenaria mercenaria*)
- Razor clam (*Ensis directus*)
- Rock crab (*Cancer irroratus*)
- Softshell clam (*Mya arenaria*)

Atlantic herring and rock crab spawning areas have been identified within the bounds of this study area

Migratory Birds, Seabirds, Shorebirds, and Waterfowl:

The following marine and coastal bird species have been identified as being in the study area:

- American Bittern (*Botaurus lentiginosus*)
- American Black Duck (*Anas rubripes*)
- American Widgeon (*Anas americana*)
- Belted Kingfisher (*Ceryle alcyon*)
- Blue-winged Teal (*Anas discors*)
- Great Blue Heron (*Ardea herodias*)
- Green-winged Teal (*Anas crecca*)
- Killdeer (*Charadrius vociferus*)
- Northern Harrier (*Circus cyaneus*)
- Northern Pintail (*Anas acuta*)
- Osprey (*Pandion haliaetus*)
- Pied-billed Grebe (*Podilymbus podiceps*)
- Piping Plover (*Chardrius melodus*)
- Red-breasted Merganser (*Mergus serrator*)
- Ring-necked Duck (*Aythya collaris*)
- Savannah Sparrow (*Passerculus sandwichensis*)
- Sharp-tailed sparrow (*Ammodramus caudacutus*)
- Spotted Sandpiper (*Actitis macularia*)
- Swamp Sparrow (*Melospiza georgiana*)
- Willet (*Catoptrophorus semipalmatus*)
- Wood duck (*Aix sponsa*)

Marine Mammals:

No sensitive marine mammal species were identified as occurring within the study area [81].

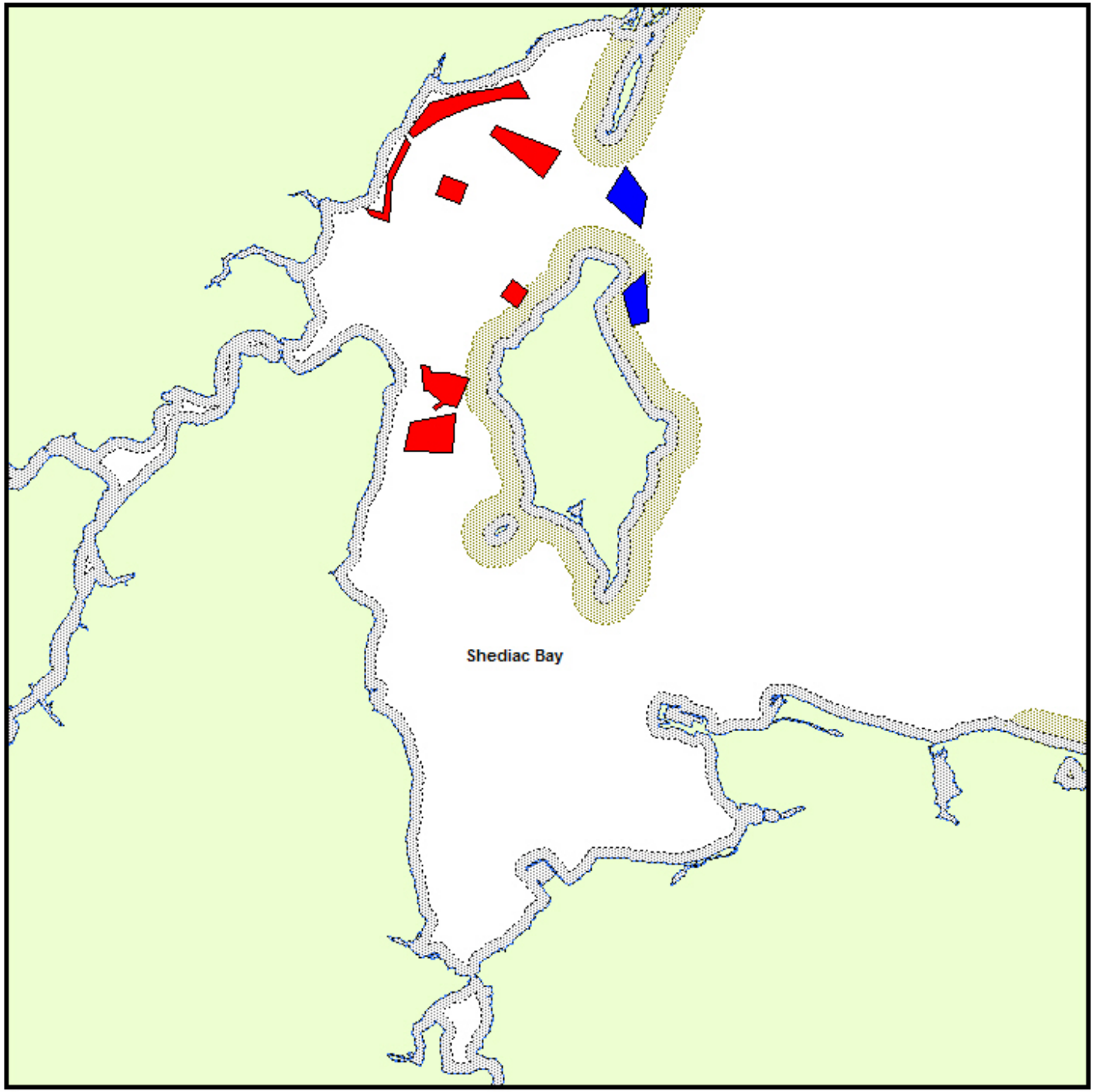
Designated Areas:

- Shediac Island ESA
- Grant Point ESA
- Johnson's Point ESA
- Little Cape ESA
- Petit Barachois ESA

- Cape Jourimain National Wildlife Area ESA
- Upper Cape Coast ESA
- Baie Verte ESA

Transportation and Navigation:

The main sources of transportation in this area are by commercial fishing vessels and recreational boating. The area is generally ice free from Apr. 1 to Jan. 1 [78].

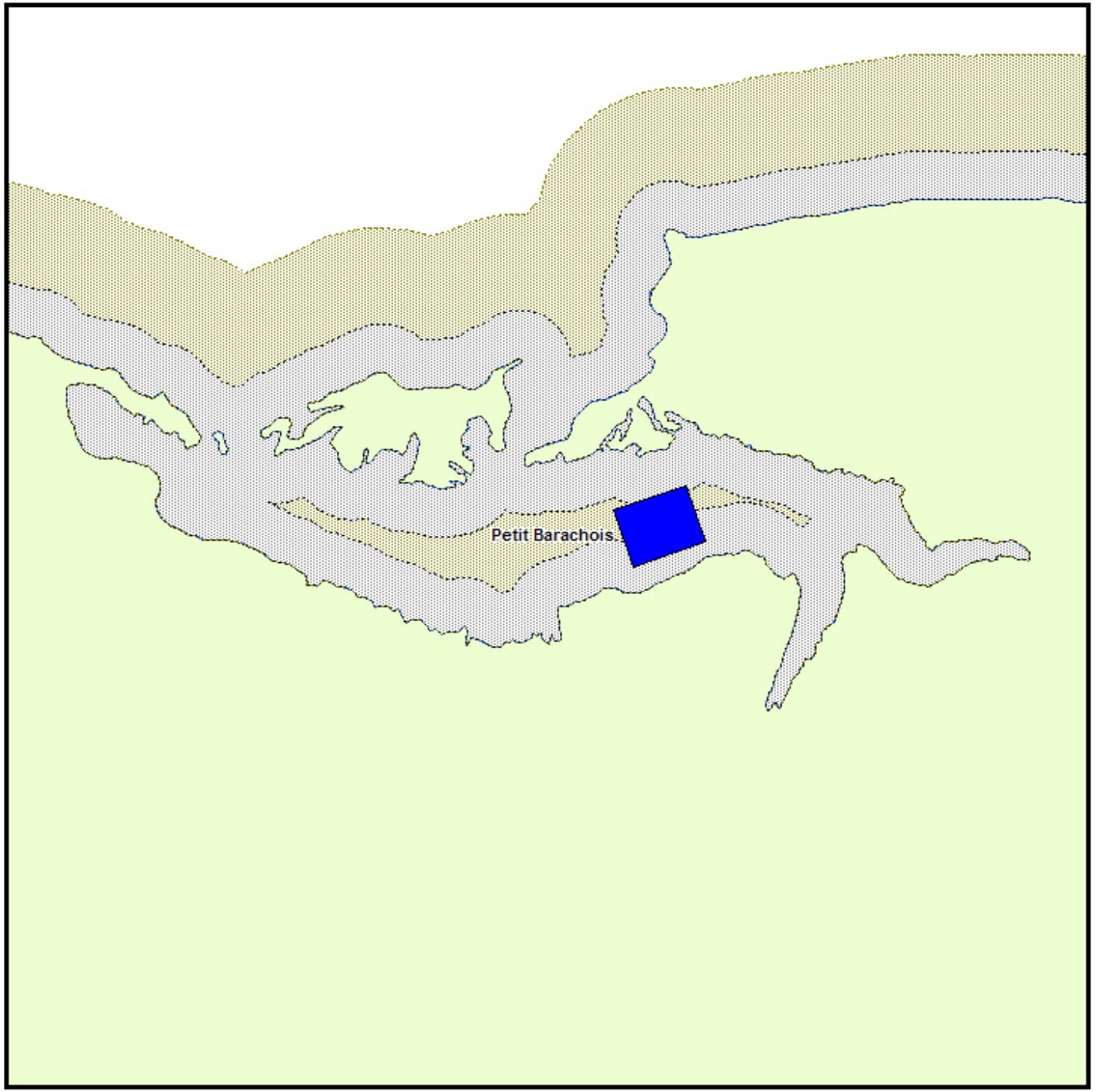


Legend

- Buffer zone
- Extended buffer zone
- Class A bottom, near-bottom and water column culture
- Class B bottom and near-bottom culture
- Class C bottom culture
- Class D no regular water column oyster aquaculture activities

For more specific information refer to: Section 5.1.1

January 25, 2007



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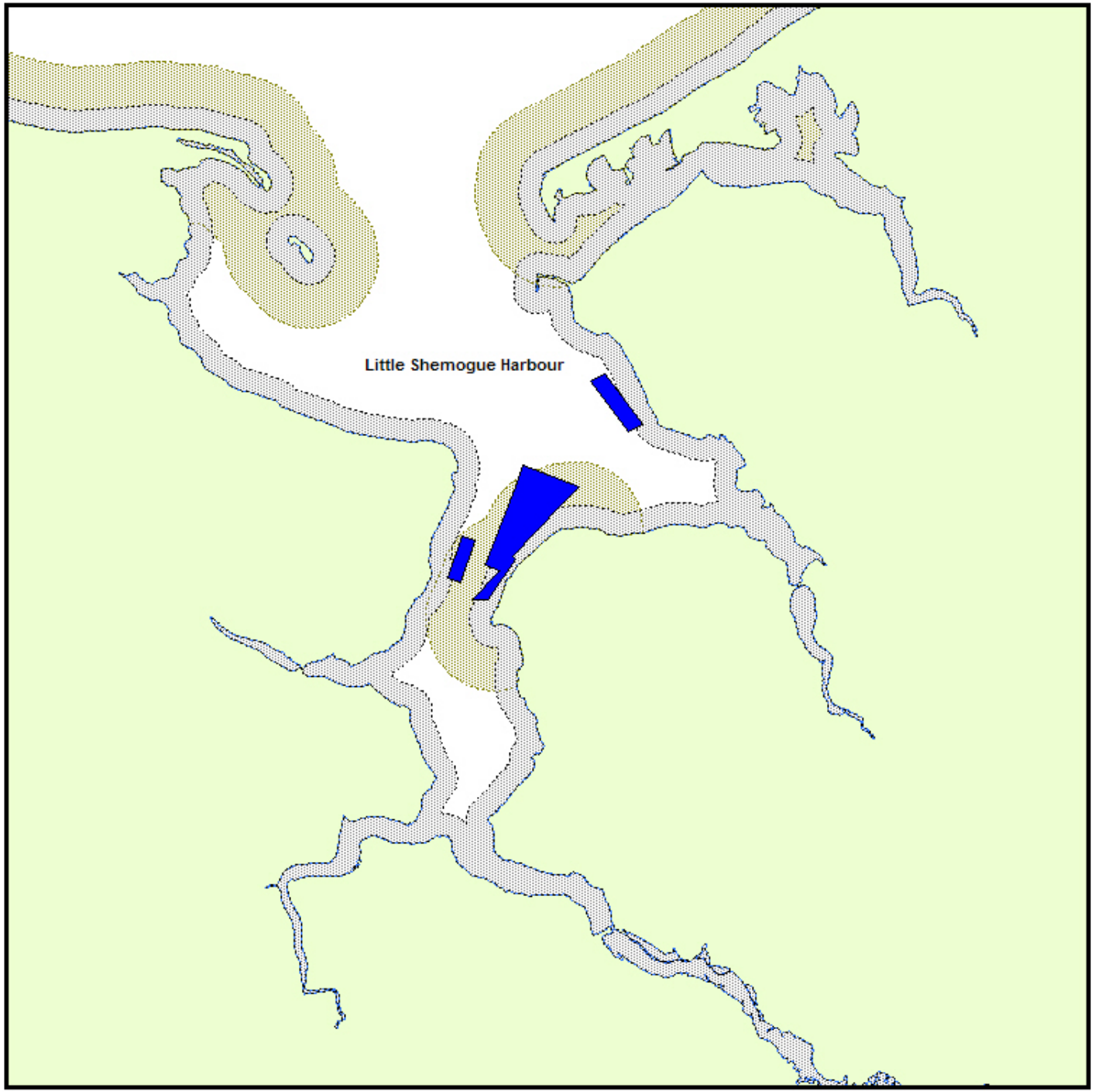

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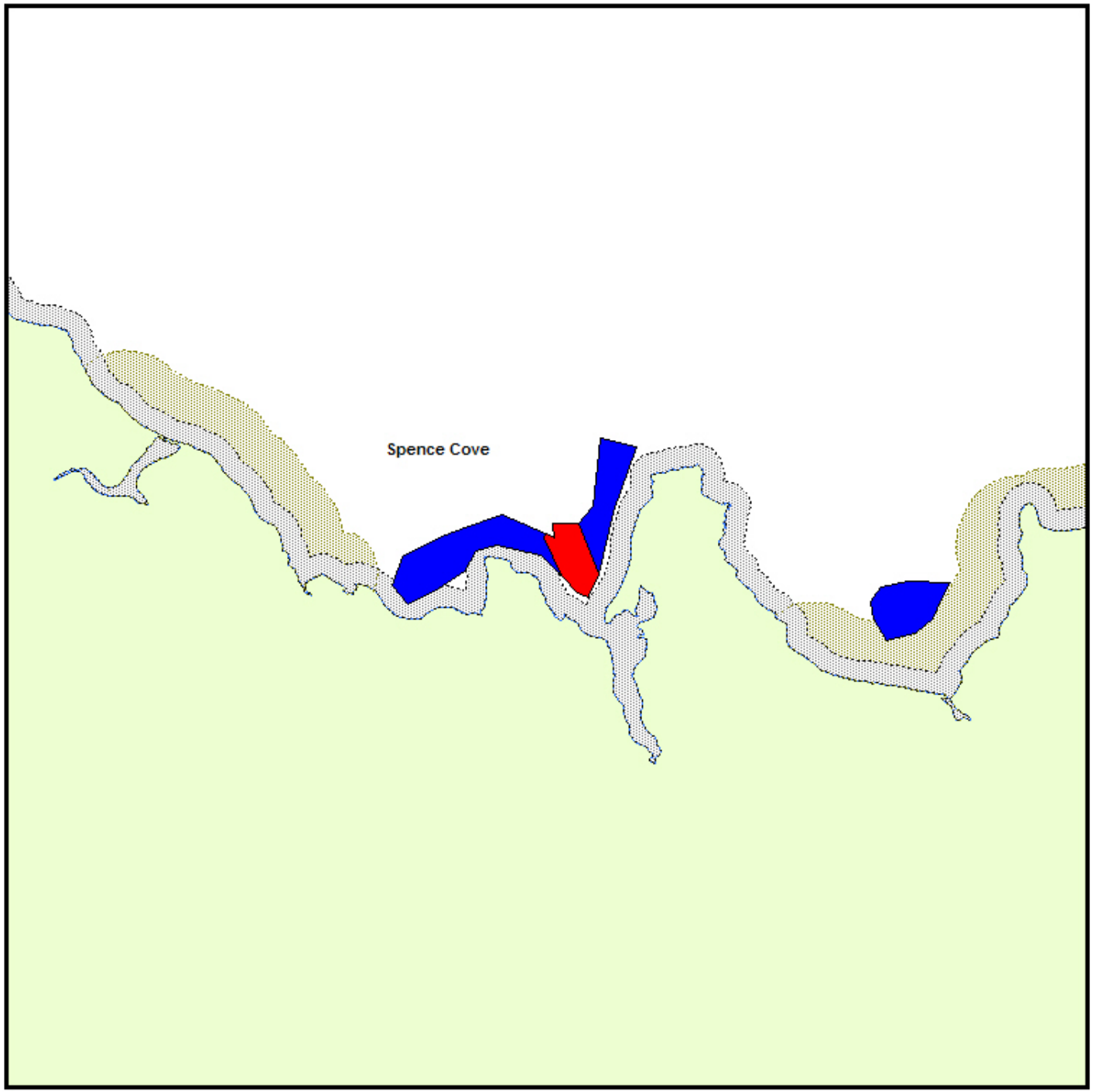

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- Class C bottom culture
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For more specific information refer to: Section 5.1.1

January 25, 2007

APPENDIX 4 – ENVIRONMENT CANADA LEGISLATION APPLICABLE TO SHELLFISH AQUACULTURE

REGULATORY INSTRUMENT	INTENT
Fisheries Act - Pollution Prevention Provisions Prohibits the deposit of remains or offal or fish or marine animals on the shore, beach or bank of any water or on the beach between the high and low water marks, or leaving decayed or decaying fish in any net or other fishing apparatus. Prohibits the deposition of deleterious substances into waters frequented by fish.	Promotes pollution prevention and sustainable management practices, including provisions for contingency planning, to ensure that water quality is maintained for healthy ecosystems.
Migratory Birds Convention Act and associated regulations (Migratory Birds Regulations, Migratory Bird Sanctuary Regulations) Prohibits the hunting of migratory bird except under authority of a permit, and ""hunt" means chase, pursue, worry, follow after or on the trail of, lie in wait for, or attempt in any manner to capture, kill, injure or harass a migratory bird, whether or not the migratory bird is captured, killed or injured". (s 5(1)) Prohibits the disturbance, destruction or taking of a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird, or have in his possession a live migratory bird, or a carcass, skin, nest or egg of a migratory bird except under authority of a permit. States that : – "No person or vessel shall deposit a substance that is harmful to migratory birds, or permit such a substance to be deposited, in waters or an area frequented by migratory birds or in a place from which the substance may enter such waters or such an area" (s.5.1(1)), and – "No person or vessel shall deposit a substance or permit a substance to be deposited in any place if the substance, in combination with one or more substances, results in a substance — in waters or an area frequented by migratory birds or in a place from which it may enter such waters or such an area — that is harmful to migratory birds." (s.5.1(2)).	Sustainable siting is to ensure that migratory birds are not killed, harmed or harassed as result of activities associated with shellfish aquaculture facilities. Promotes pollution prevention and sustainable management practices, including provisions for contingency planning, to ensure that water quality is maintained for healthy ecosystems.
Wildlife Area Regulations In National Wildlife Areas, it is prohibited to (a) hunt or fish, (b) be in possession of any firearm, slingshot, bow and arrow, shot other than non-toxic shot or any instrument that could be used for the purpose of hunting, or be in possession of, while fishing, any lead sinkers or lead jigs that weigh less than	

REGULATORY INSTRUMENT	INTENT
50 grams, (c) have in his possession any animal, carcass, nest, egg or a part of any of those things, (d) damage, destroy or remove a plant, (e) carry on any agricultural activity, graze livestock or harvest any natural or cultivated crop, (f) allow any domestic animal to run at large, (g) swim, picnic, camp or carry on any other recreational activity or light or maintain a fire, (h) operate a conveyance, (i) destroy or molest animals or carcasses, nests or eggs thereof, (j) remove, deface, damage or destroy any artifact, natural object, building, fence, poster, sign or other structure, (k) carry on any commercial or industrial activity, (l) disturb or remove any soil, sand, gravel or other material, or (m) dump or deposit any rubbish, waste material or substance that would degrade or alter the quality of the environment, unless one does so under and in accordance with a permit issued by the Minister pursuant to section 4." (s3(1)) (2) Where the Minister has published a notice in a local newspaper or posted a notice at the entrance of any wildlife area or on the boundary of any part thereof permitting an activity described in subsection (1), any person may carry on the activity described in the notice if the activity is carried on in accordance with the notice.	
Species at Risk Act The Minister of Environment's responsibilities under the Act include the protection and recovery of migratory birds and species at risk on federal lands other than those under the responsibility of the Minister of Fisheries and Oceans or those individuals under the responsibility of Parks Canada Agency. However, there are no federal lands affected by this project. Under the Accord for the protection of Species at Risk, it is understood that the provinces and territories will undertake actions and enforce prohibitions for the conservation of species at risk that come under their management authority. SARA allows the federal government to enact protective prohibitions in cases where a province	Sustainable siting is to ensure that species at risk, are not killed, harmed or harassed as result of activities associated with shellfish aquaculture facilities.

REGULATORY INSTRUMENT	INTENT
or territory fails to provide effective protection for a species. SARA makes it an offence in sections 32 and 33 to: – kill, harm, harass, capture or take an individual of a listed species that is extirpated, endangered or threatened; – possess, collect, buy, sell or trade an individual of a listed species that is extirpated, endangered or threatened, or its part or derivative; – damage or destroy the residence of one or more individuals of a listed endangered or threatened species or of a listed extirpated species if a recovery strategy has recommended its reintroduction.	
Canadian Environmental Protection Act (1999) Enables the control of toxic substances. Disposal at Sea Regulations: Substances listed in the Act may be permitted for disposal at sea, including dredged material, fisheries waste, ships, inert matter, uncontaminated organic matter and bulky substances. New Substances Notification Regulations: Specifies notification requirements for substances not on the Domestic Substances List which can include chemicals, polymers, micro-organisms or organisms (this would include genetically modified animals, bacteria, etc.)	Toxic substances listed under the Act may be controlled and regulated. A substance is toxic if it is entering or may enter the environment in a quantity or concentration or under conditions that may have a harmful or dangerous effect on the environment or its biological diversity or on human life/health. The disposal of fish offal or shellfish waste into the ocean requires a Disposal at Sea permit. Harrowing of the seafloor to manage waste accumulation also requires a Permit. The import or manufacture of substances not listed on the Domestic Substances List (e.g. new products, genetically modified organisms) must be assessed. Importers and manufacturers of substances not listed are required to notify Environment Canada pursuant to the New Substances Notification Regulations.