

Saguenay–St. Lawrence Marine Park

# SCIENTIFIC RESEARCH PROGRAM

Research and Monitoring Needs and Priorities

Developed by the Saguenay–St. Lawrence Marine  
Park Ecosystem Management and Research  
Advisory Committee  
2017



Parc Québec / A. Jobin-Piché



L'Alliance  
Parks Canada / S. Duquette



SAGUENAY-ST. LAWRENCE  
**MARINE PARK**

Canada

Québec

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## Foreword

Scientific research is of paramount importance in Marine Protected Areas considering the limited availability of knowledge pertaining to marine ecosystems when compared to the terrestrial environment. Therefore, encouraging scientific research is a clearly defined objective of the legal mandate of the Marine Park, one of the first Marine Protected Areas in Canada. The Marine Park is an area as well known for its impressive biological diversity as for the profusion of human activities that take place within its boundaries. In this respect it is important to identify and understand the territory's ecological and human components and their interactions in order to evaluate the effects of anthropogenic activities, the effectiveness of management measures and the outcomes of actions that have been implemented to reach the objectives of the protected area. Science has a major role to play in identifying threats, managing risks, evaluating the effectiveness of management measures and encouraging the appreciation of the visiting public. Furthermore, the acquisition of fresh knowledge leads to the development of applied innovative management measures at the Marine Park.

The purpose of this scientific research program is to present ongoing monitoring and scientific research projects and to identify gaps. It has been organised into four themes: 1) Ecology and Biodiversity; 2) Human Activities; 3) Environmental Quality and Risk Assessment; 4) Governance and Social, Economic and Cultural Features. An overview of research and monitoring projects that have already been completed or initiated (See Annex 3) has been integrated into this program to apprise and promote the implementation of new, complementary projects. With this in mind, this research program may be used as a lever to establish new partnerships and to pursue funding. To a large extent, science-based activities within the Marine Park are achieved in partnership with research institutions (universities, ministries, non-governmental organisations). The projects identified in this scientific research program are implemented in this spirit of collaboration.

The needs and priorities with regards to scientific research must respond to emergent ecological, economic or social issues and be able to seize new opportunities that may arise. The orientations defined in this document will guide Marine Park management in its selection of projects to be retained and put forward. This exercise is in response to commitments identified in the Saguenay-St. Lawrence Marine Park's Management Plan (2010), such as: 1) to maintain and develop monitoring programs for ecosystems and human activities and; 2) set up a research program adapted to the needs of the Marine Park and implement it in partnership with relevant organisations.

**Scientific research is at the heart of the Park's mandate, substantiating the importance of science in the achievement of its goals:**

**'The purpose of the Saguenay-St. Lawrence Marine Park is to increase, for the benefit of the present and future generations, the level of protection of the ecosystems of a representative portion of the Saguenay River and the St. Lawrence Estuary for conservation purposes, while encouraging its use for educational, recreational and scientific purposes.'**

CTD type probe deployment to measure temperature, salinity and dissolved oxygen through the water column



Parks Canada / S. Duquette



## Understanding for Greater Action

Since its creation, scientific knowledge has played a key role in the achievement of Marine Park goals that were defined during the creation of one of the first Marine Protected Areas in Canada. Initially, scientific knowledge was used for the planning and establishment of the protected area. Scientific knowledge was also used to implement conservation measures, activity management measures and educational programs.

The Saguenay-St. Lawrence Marine Park Ecosystem Conservation Plan (2001) long served as the reference document to guide the actions and investments of Marine Park managers and their partners in the field of science. Several actions set out in the Ecosystem Conservation Plan have been carried out, in whole or in part, while others have since become obsolete.

The State of the Marine Park Report (Ménard *and al.*, 2008) prepared by Parks Canada identifies several knowledge gaps required to evaluate the state of the Marine Park in various fields, such as governance and the socio-economic characteristics of the region, ecosystems, ecologically sustainable use, landscape and cultural heritage, visitor experience, education and awareness. Supplementing the research and monitoring program established several years ago by Parks Canada, Parcs Québec's Ecological Integrity Monitoring Program, initiated in 2013, contributes to the understanding of the state of ecological preservation in the Marine Park using indicators that measure changes in ecosystems. These research and monitoring operations carried out jointly with researchers from diverse backgrounds will be used in the production of the next State of the Marine Park report.

As part of the implementation of the Management Plan (2010), the Coordinating Committee mandated the Ecosystem Management and Research Advisory Committee to identify needs and priorities related to the acquisition of scientific knowledge in the Marine Park. Through the elaboration of this scientific research program, the advisory committee proposes a flexible and achievable medium-term plan adapted to the knowledge requirements that are indispensable for the management of this marine protected area.

### **The Ecosystem Management and Research Advisory Committee**

Implemented by the Coordination Committee as support for its recommendations, the Ecosystem Management and Research Advisory Committee is made up of representatives from the field of scientific research, from a non-governmental organisation with an environmental mission, from ministries involved with the Marine Park, from First Nations and from regional municipalities (see committee composition in Annex I).

Stomach contents identification in Cod fished in the Saguenay



## The Management Plan: The Objectives Guiding Scientific Planning

The result of work carried out by a multidisciplinary team and having been submitted to extensive public consultations, the Saguenay-St. Lawrence Marine Park Management Plan (2010) presents the Marine Park's vision and the actions to be carried out over the course of the coming years (See Annex 2). The present planning of research activities aims to fulfil the objectives and actions identified in the Management Plan.

### Management Plan Objectives Regarding Ecosystem and Biodiversity Conservation

*Ensure the protection of the key components of the ecosystem, as well as other fragile, unique or highly representative elements:*

- ◆ *Protect rare, declining, threatened or vulnerable species and populations and, in particular, ensure the protection, restoration or improvement of essential habits for the survival of species;*
- ◆ *Foster the development of a conservation culture in residents living in the coordination area;*
- ◆ *Set up environmental monitoring mechanisms in order to better understand and measure the evolution of Marine Park ecosystems and the efficiency of management methods;*
- ◆ *Promote the work of research centres and generate interest in academic spheres for the production of theses and research in the fields of natural and cultural heritage.*

### Management Plan Objectives Regarding Ecologically Sustainable Use

- ◆ *Manage resource harvesting in accordance with the principle of ecologically sustainable use with due regard for ecosystems;*
- ◆ *Foster collaboration through agreements that contribute to the achievement of Marine Park protection and showcase its values, particularly in the fields of fisheries and shipping traffic;*
- ◆ *Acquire the necessary expertise to evaluate the repercussions of commercial, recreational and tourism activities on ecosystems.*

### **The actions identified in the Management Plan (2010) related scientific research**

*Maintain and develop monitoring programs for ecosystems and activities;*

*Set up a research program adapted to the needs of the Marine Park and implement it in partnership with the organizations concerned;  
Pursue the implementation of the conservation plan and identify priorities for action;*

*Raise the awareness of residents of the coordination zone and great watershed as well as of municipal authorities in regard to the importance of protecting coastal environments and how such action is linked to the health of the Marine Park;*

*Define protection and restoration needs in the Marine Park (wetlands, spawning grounds, etc.) other than those set out in the zoning plan, and implement appropriate measures.*

# General Principals for Scientific Research in the Marine Park

## 1. Foster multidisciplinary scientific research which takes into account the Marine Park's conservation and education missions

- Advocate for an applied approach to scientific research that enables informed decision-making and effectiveness evaluation of measures implemented;
- Foster a transdisciplinary approach to research that touches expressly on certain ecological, economic and social issues tied to marine protected area management;
- Contribute to the transfer of knowledge to the general public.

## 2. Stimulate partnerships

- Be proactive to encourage partnerships with scientific researchers and clients in a variety of disciplines;
- Share available resources in order to facilitate research (goods and services, funding).

## 3. Be proactive regarding current or emerging issues

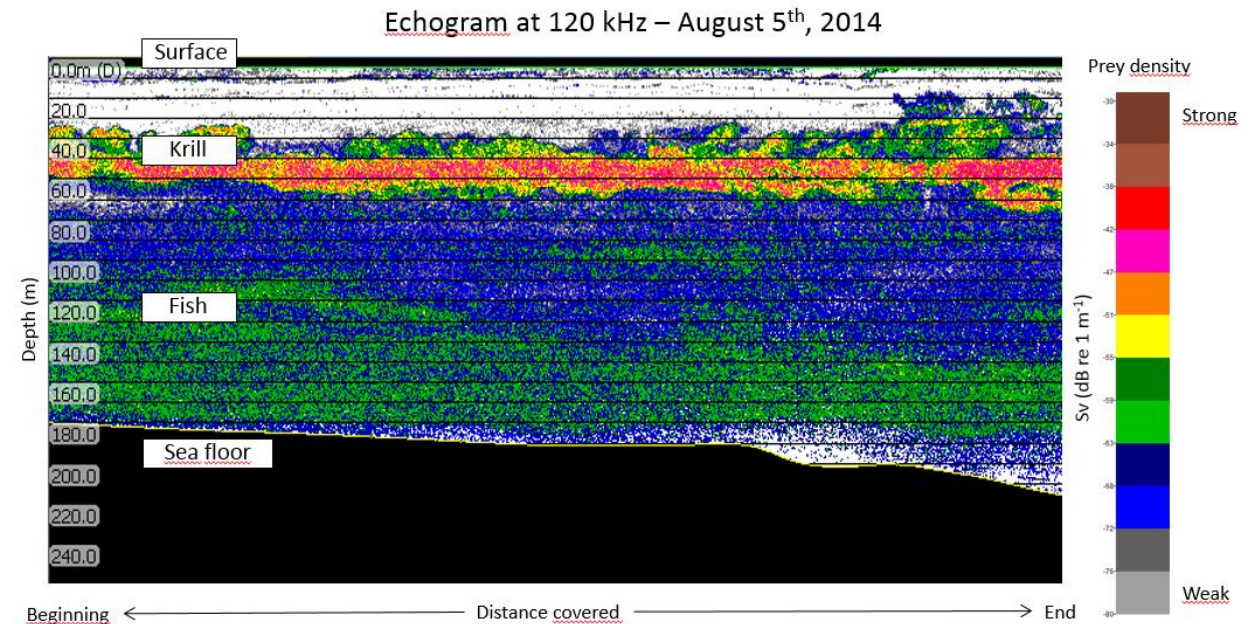
- Collect and update data on species and their habitats in order to contribute to biodiversity conservation and promote the recovery of species at risk;
- Rapidly react to emerging issues that arise by documenting events in order to enable various stakeholders to take the necessary steps to reduce impacts on ecosystems and on coastal communities of the coordination area of the Marine Park.

## 4. Make accessible and disseminate scientific data collected in the area

- Become a forum for exchanges, knowledge and experience and create publication opportunities;
- Foster a culture of scientific rigour in the popularisation and dissemination of information, both internally and externally;
- Ensure sound data management.

## 5. Respect the principles of best practices and ethics in science

- Exercise a rigorous approach in data collection and analysis and encourage peer review procedures;
- Undertake projects in keeping with laws and regulations that are in effect in the Saguenay-St. Lawrence Marine Park;
- Ensure minimal impact on ecosystems;
- Exercise respect and consult local communities prior to undertaking any project that may affect them.



## Research Themes

The Marine Park Scientific Research Program proposes four main themes. Knowledge requirements have been identified for each of these. In the majority of cases, knowledge acquisition will take place in partnership with research partners and relevant stakeholders. Results will be shared with organisations having responsibilities in matters of conservation and management of ecosystem components and human activities within the Marine Park in order to collectively attain Marine Park objectives.

### 1. Ecology and Biodiversity

#### Promote research related to:

- 1.1 the life cycles of Marine Park species and habitats;
- 1.2 forage species and predator-prey relationships;
- 1.3 benthic, pelagic and coastal biodiversity;
- 1.4 the circulation of water masses in the Fjord and at the confluence of the Saguenay and the St. Lawrence Estuary.

### 2. Human Activities

#### Encourage the acquisition of knowledge pertaining to:

- 2.1 ecosystem management approaches for commercial and recreational activities with and without harvesting;
- 2.2 the environmental performance of the commercial and recreational practices of marine activities;
- 2.3 environmentally responsible whale-watching practices at sea.

### 3. Environmental Quality and Risk Assessment

#### Maintain and pursue the acquisition of knowledge concerning:

- 3.1 contaminant levels and sources in the Marine Park;

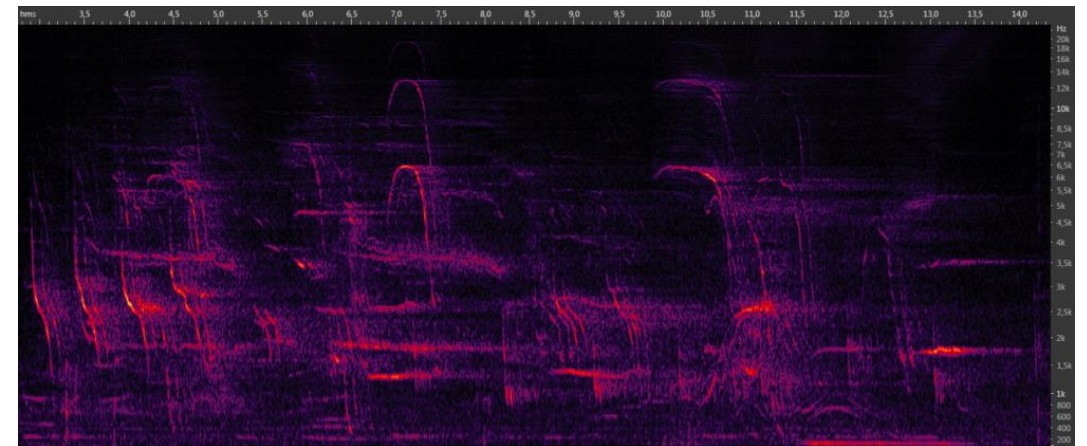
3.2 direct and indirect environmental risks in the Marine Park and its zone of influence;

3.3 elements sensitive to human activities and environmental accidents.

### 4. Governance and Social, Economic and Cultural Features

#### Facilitate knowledge acquisition to evaluate:

- 4.1 the level of support of coastal communities for the Marine Park;
- 4.2 the effectiveness of the Marine Park's governance model;
- 4.3 the efficiency of management measures;
- 4.4 ecosystem goods and services in the coordination area.



Spectrogram showing beluga whale noises recorded by a series of hydrophones along the coast deployed from Pointe-Noire at the mouth of the Saguenay River in May 2009 (data source: Yvan Simard, DFO)



## Research and Monitoring Projects in the Marine Park: Two Complementary Needs

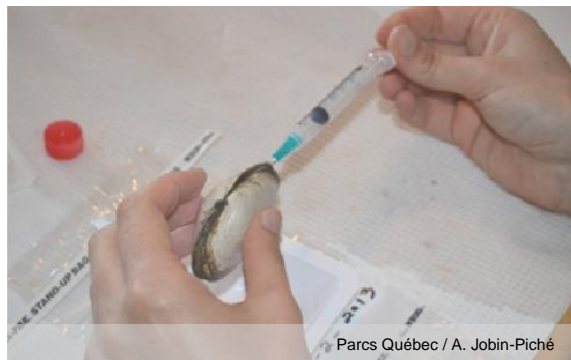
**A research project is** a scientific project that strives to gain knowledge and to answer to hypotheses on a given subject.

**Monitoring is** a scientific process that tracks parameters over a given period of time for the purpose of the management of natural, human or cultural environments.

Fin sample for a caplin genetic project



Health indicator measures in the softshell clam in the Saguenay Fjord



Barrow Goldeneye winter survey



### Criteria to consider when prioritising research projects for the Marine Park:

- ◆ Conform to the principles, themes and orientations of the present research program;
- ◆ Be identified in the recovery program or action plan of a species designated under Canada's Species at Risk Act (SARA) or Quebec's threatened or vulnerable species act;
- ◆ Be identified in the Marine Park's Plan for Marine Activities, in the State of the Marine Park Report, in the Parks Canada Monitoring and Reporting Plan for the Marine Park or in the Marine Park's ecological health monitoring program (PSSE);
- ◆ Have a minimal impact on ecosystems and cultural heritage;
- ◆ Have the ability to be completed or the potential to draw significant conclusions within five years;
- ◆ Allow free access to data after publication;
- ◆ Consider the resource availability and have a level of engagement from partners;

## List of Projects: A Dynamic Portrait

The following section lists research or scientific monitoring projects that are ongoing or in development, or that may be implemented to fulfil knowledge gaps. Studies or projects are organised into the four main themes identified in this program.

### The table presented on the following pages incorporates:

- Monitoring and research projects that are ongoing or in development in the Marine Park and that should be continued;
- Projects that could be carried out by various partners that have the resources, expertise and interest;
- Subjects that touch upon areas of interest of specific researchers or university research chairs and that could be applied to the management of a marine protected area.

### ORGANISATION ACRONYMS

AMQ: Association Maritime du Québec  
CCG: Canadian Coast Guard  
CHS: Canadian Hydrographic Service  
CIDCO: Interdisciplinary Centre for the Development of Ocean Mapping  
CIRSA: Centre interuniversitaire de recherche sur le saumon atlantique  
CWS: Canadian Wildlife Service  
DFO: Fisheries and Oceans Canada  
EC: Environment Canada  
EWA: Eco-Whale Alliance  
FEB: Fonds Éco-Baleine  
GREMM: Group for Research and Education on Marine Mammals  
INRS: National Institute of Scientific Research  
ISMER/UQAR: Institut des Sciences de la mer, Université du Québec à Rimouski  
MAMROT: Ministère des Affaires municipales et de l'Occupation du territoire  
MAPAQ: Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec  
MDDELCC: Ministère du Développement durable, de l'Environnement, et de la Lutte contre les changements climatiques.  
MFFP: Ministère des Forêts, de la Faune et des Parcs (Québec)  
MLI: Maurice Lamontagne Institute  
NRC: Natural Resources Canada  
MRC: Municipalité régionale de comté  
OBV: Organismes de bassins versants  
OOT: Observatoire d'oiseaux de Tadoussac  
PC: Parks Canada  
SSLMP: Saguenay-St. Lawrence Marine Park

PNFS: Parc national du Fjord-du-Saguenay  
RQUMM: Quebec Marine Mammal Emergency Response Network  
ROMM: Réseau d'observation de mammifères marins  
RTA: Rio Tinto Alcan  
Sépaq: Société des établissements de plein air du Québec  
SLNIE: St Lawrence National Institute of Ecotoxicology  
TC: Transport Canada  
U de M: Université de Montréal  
U Laval: Université Laval  
UQAC: Université du Québec à Chicoutimi  
UQAM: Université du Québec à Montréal  
UQAR: Université du Québec à Rimouski  
UQTR: Université du Québec à Trois-Rivières  
ZIP: Comité de zone d'intervention prioritaire

### MANAGEMENT PROGRAM ACRONYMS

AOM: Whale-watching Activities at Sea  
MAR: Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations  
MPA: Marine Protected Areas MPA: Marine Protected Area  
PMA: Plan for Marine Activities in the Saguenay-St. Lawrence Marine Park  
PSSE: Marine Park Ecological Health Monitoring Program  
SARA: Species at Risk Act

## 1. Ecology and Biodiversity

### ORIENTATIONS

**Promote research related to:**

I.1 the life cycles of Marine Park species and habitats;

I.2 forage species and predator-prey relationships;

I.3 benthic, pelagic and coastal biodiversity;

I.4 the circulation of water masses in the Fjord and at the confluence of the Saguenay and the St. Lawrence Estuary.

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
I	I.1, 2.1	Collection and post-mortem examination of beluga whale carcasses	Ongoing follow-up (1982 - )	U de M School of Veterinary Medicine at St. Hyacinthe, SLNIE, PC, RQUMM	<ul style="list-style-type: none"> <li>✓ Monitor the health of the St. Lawrence beluga whale population;</li> <li>✓ Determine the cause of death of beluga whales in the St. Lawrence Estuary;</li> <li>✓ Identify contaminants and threats.</li> </ul> <p><b>Main management and publication contributions:</b> many, see Proceedings of the workshop on the St. Lawrence Estuary beluga – review of carcass program (DFO, 2007a; 2014a); Lebeuf (2009); Lebeuf <i>et al.</i> (2014); Lesage <i>et al.</i> (2014); recovery strategy (identifying threats) and many actions managing actions from this plan (ex: contaminants reduction in the St-Lawrence river) (DFO, 2012a, 2014).</p>

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
2	1.1, 1.2, 1.3	State of the St. Lawrence beluga whale population	To be developed to bridge gaps identified in the population recovery program	DFO, GREMM. PC	<ul style="list-style-type: none"> <li>✓ Increase knowledge related to the St. Lawrence beluga whale population, its dynamics and factors limiting population growth;</li> <li>✓ Quantify the some effects of navigation on beluga whales;</li> </ul> <p>Biology and ecology:</p> <ul style="list-style-type: none"> <li>✓ Population dynamics (particularly the survival of juveniles);</li> <li>✓ Seasonal distribution and behaviour (particularly beyond the summer season);</li> <li>✓ Social structure and reproductive strategies;</li> <li>✓ Diet and energy requirements.</li> </ul> <p>Habitat :</p> <ul style="list-style-type: none"> <li>✓ Distribution, abundance, quality, habitat, biology and threats to key beluga whale prey species.</li> </ul> <p>Threats:</p> <ul style="list-style-type: none"> <li>✓ Full range of anthropogenic environmental contaminants to which beluga whales and their prey are exposed over time and space; particular attention is placed on the determination of sources, notably of new compounds and their effects on beluga whales, their prey and their habitat;</li> <li>✓ Short and long-term effects of disturbance, as much related to noise as to the physical proximity of human activities;</li> <li>✓ Original source of anthropogenic pathogens;</li> <li>✓ Frequency and intensity of ship strikes;</li> <li>✓ Threat mitigation measures;</li> <li>✓ Other obstacles to recovery;</li> <li>✓ Effects of climate change on the impact of threats to recovery;</li> <li>✓ Entanglement.</li> </ul> <p><b>Main management and publication contributions:</b> Recovery Strategy for the beluga whale (DFO, 2012a), Status of Beluga (DFO, 2014a); Temporal trends of PBDEs in adult and newborn beluga (Lebeuf <i>et al.</i>, 2014); Documentation of Maritime Traffic and Navigational Interactions with St. Lawrence Estuary Beluga in Calving Areas (Ménard <i>and al.</i>, 2014); aires de haute résidence (Lemieux-Lefebvre 2009, Lemieux-Lefebvre <i>et al.</i> 2012); characterization, use and quality of the habitat (Mosnier <i>et al.</i>, 2010, 2016 et Gautier, 2012); population abundance (Gosselin <i>et al.</i> 2014).</p>



No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
3	1.1, 2.1	Monitoring of beluga whale use of St. Marguerite Bay and documentation of nautical activities	Ongoing monitoring (2003 - 2008; 2014, 2015)	Sépaq, PC	<ul style="list-style-type: none"> <li>✓ Define adequate protection measures (ex: zoning) as this sector represents an important area used by females and young;</li> <li>✓ Continuation of this project in combination with the project dealing with prey (2009-2010).</li> </ul> <p><b>Main management and publication contributions:</b> Decision support tool for the activities allowed in the area (ex. kayak launching); Site managing plan to be completed (PNFS et SSLMP); Busque, 2006; Turgeon (2008; 2012; Ménard <i>and al.</i>, 2014).</p>
4	1.1, 2.1, 2.3	Monitoring of beluga whale use of the mouth of the Saguenay and documentation of nautical activities	Ongoing monitoring (1998 - )	PC	<ul style="list-style-type: none"> <li>✓ Define adequate protection measures (ex: zoning) since this sector represents an important area used by females and young;</li> <li>✓ Continuation of this project in combination with the project dealing with prey;</li> <li>✓ Understand the potential effect of vessel traffic on the presence of beluga whales attributing a decline in attendance to increased traffic; withdrawal of beluga whales from Tadoussac Bay.</li> </ul> <p><b>Main management and publication contributions:</b> Zoning plan (SSLMP, 2009); contribution to the Plan for marine activities in the Saguenay-St. Lawrence marine park (SSLMP, 2011) and to the review of the Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations; Cloutier (2004); Turgeon <i>et al.</i> (2008), Turgeon (2010, 2012); Simard <i>et al.</i> (2010), Roy <i>et al.</i> (2010); Conversano (2013); implementation of the recovery strategy (2012). See also these studies: Pippard <i>et Malcom</i> (1978), Laurin (1982), Caron <i>et Sergent</i> (1988), Pippard (1985a, 1985b).</p>
5	1.1	Determine the fertility of female beluga whales in their summer habitat	Ongoing research (2013 -2018)	DFO, GREMM, Saint Mary's University (N-É.), Florida Atlantic University	<ul style="list-style-type: none"> <li>✓ Determine if the proportion of gestating female beluga whales is comparable to what could be expected in a healthy population.</li> </ul> <p><b>Main management and publication contributions:</b> Implementation of the SLE beluga recovery strategy (DFO, 2012a).</p>

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
6	I.1	Tagging and satellite monitoring of male beluga whales on their winter habitat	Inconclusive attempt undertaken in winter 2016	GREMM, DFO, WWF, Donner Canadian Foundation	<p>✓ Document the behaviour and movement of St. Lawrence beluga whales during winter.</p> <p><b>Main management and publication contributions:</b> Critical habitat determination of the SLE beluga population, implementation of the SLE beluga recovery strategy (DFO, 2012a).</p>
7	I.1, I.2, 2.1, 2.3	Monitoring cetaceans at the head of the Laurentian Channel	Ongoing monitoring (2006 - )	GREMM, PC, Sépaq, FEB	<p>✓ Improve knowledge of St. Lawrence cetaceans in order to increase their protection.</p> <p><b>Main management and publication contributions:</b> Michaud <i>et al.</i> (2007-2010); Ph.D. Martins C. C. A. (2012); pooling of the number of cetaceans/preys (to be completed); Management Plan for the fin whale (DFO, 2017); implementation of the Recovery Strategy for the blue whale (Beauchamp <i>and al.</i>, 2009); identifying high risk areas for ship strikes on cetaceans (2012) in order to define des voluntary protection measures for commercial shipping (2013 et 2014); Chion <i>et al.</i> (2012), Chion (2014), Chion et Turgeon (2015), Parrott <i>et al.</i> (2011, 2016), GREMM and Parks Canada (2015).</p>
8	I.1	Systematic visual and photographic inventory of large rorqual whales	Ongoing monitoring	GREMM, PC, Sépaq	<p>✓ Obtain information on the abundance and composition of the population;</p> <p>✓ Acquire knowledge on the number of migratory cetaceans observed in the Marine Park and their residency periods;</p> <p>✓ Be able to monitor the evolution of whale populations in connection with other indicators of the state of Marine Park ecosystems (Ex: prey monitoring, AOM monitoring, etc.).</p> <p><b>Main management and publication contributions:</b> Recovery strategies and management plans of several species (beluga; blue whale; fin whale: listed on SARA).</p>

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
9	1.1, 1.2, 2.1	Behavioural ecology of large rorqual whales in the Marine Park	Ongoing monitoring	DFO, GREMM, PC, ISMER	<ul style="list-style-type: none"> <li>✓ Document, by means of telemetric monitoring, the activity patterns and use of the territory by large rorqual whales;</li> <li>✓ Understand dive patterns in relation to prey monitoring data.</li> </ul> <p><b>Main management and publication contributions:</b> Recovery Strategy for the blue whale (Beauchamp <i>and al.</i>, 2009); Management Plan for the fin whale (DFO, 2017), Ph.D. Guilpin (ongoing); Understanding of the uses of the habitat (McQuinn et al., 2016, Lesage et al. 2016).</p>
10	1.1	Monitoring harbour seals in the Saguenay Fjord	Ongoing monitoring (1993 - ) and to be developed	ROMM, PC, Sépaq, Whale-watching companies	<ul style="list-style-type: none"> <li>✓ Acquire knowledge on the distribution of harbour seals along the Saguenay Fjord;</li> <li>✓ Acquire knowledge to estimate the population trend in the Saguenay Fjord;</li> <li>✓ Determine the annual number of pups present on haul out sites.</li> </ul> <p>To be developed:</p> <ul style="list-style-type: none"> <li>✓ Determine the population's reproductive success;</li> <li>✓ Study disturbance levels on haul out sites.</li> </ul> <p><b>Main management and publication contributions:</b> Lavigneur (1993); Zoning (SSLMP, 2009); Plan de gestion du phoque commun de l'estuaire du Saint-Laurent (ROMM, 2004); PSSE (SÉPAQ, 2013); State of the Saguenay St. Lawrence Marine Park (Ménard <i>and al.</i>, 2008).</p>

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
11	1.2	Study of the influence of the variability of pelagic prey on the retention of marine fauna biodiversity in the SSLMP	Ongoing monitoring (2009 - )	PC, DFO, GREMM, Sépaq, CWS	<ul style="list-style-type: none"> <li>✓ Document the distribution and abundance of prey and predators (birds and mammals) and better understand the processes at the root of marine biodiversity retention;</li> <li>✓ Gain better understanding of the ecological conditions sought out by species at risk that regularly visit the area in order to contribute to the identification of, and ecological function of, their essential habitats;</li> <li>✓ Implement recovery programs;</li> <li>✓ Understand the ecological importance of sand lance, a seldom-studied forage species that may play a key role in the Marine Park's ecosystem.</li> </ul> <p><b>Main management and publication contributions:</b> Recovery strategies and management plans of several species (beluga; blue whale; fin whale: listed on SARA); identifying high risk areas for ship strikes on cetaceans (2012) in order to define des voluntary protection measures for commercial shipping (2013 and 2014), GREMM and Parks Canada (2015).</p>
12	1.1, 1.2	Production and consumption of krill in the St. Lawrence Estuary and Gulf, ecosystem evaluation of the state of stocks	Ongoing research	DFO, ISMER, U Laval, PC, GREMM, Stanford University (É.-U.), Neptune Technologies & Bioresources Inc.	<ul style="list-style-type: none"> <li>✓ Understand the roles of physical processes (currents, temperature, fresh water inflow, etc.) and biological processes (food availability, survival, recruitment, etc.) on krill production;</li> <li>✓ Identify focal points for krill production and retention in the St. Lawrence Estuary and Gulf;</li> <li>✓ Examine the ecological resilience of krill populations in the St. Lawrence Estuary and Gulf;</li> <li>✓ Evaluate the role of krill as a forage species;</li> <li>✓ Understand the population dynamics of Nordic and Arctic krill populations;</li> <li>✓ Supply an integrated management tool based on digital modelling of these krill species including population dynamics and productivity, 3D dynamics of the physical environment and krill biomass.</li> </ul> <p><b>Main management and publication contributions:</b> Ph.D. Guilpin (ongoing): bilan énergétique de l'activité d'alimentation et consommation de krill par les rorquals dans l'estuaire et le golfe du Saint-Laurent.</p>



No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
13	1.1, 1.2	Study of the spawning and larval retention of herring in the Upper Estuary and identification of populations that come to spawn in the St. Lawrence Estuary using microchemical markers	Ongoing research / to be developed	ISMER, DFO, PC, UQAC	<ul style="list-style-type: none"> <li>✓ Verify if Atlantic herring spawning activity in the Upper St. Lawrence Estuary is still similar to what is presented in the literature: general localisation of spawning sites and the moment of larval hatching;</li> <li>✓ Explore the role of the Upper St. Lawrence Estuary in the retention and growth of herring larvae: identification and localisation of retention areas in the Upper Estuary, evaluation of environmental conditions for larval development inside and outside of retention areas and evaluate the growth and condition of larvae inside and outside of these areas.</li> </ul> <p><b>Main management and publication contributions:</b> Recovery Strategy for the beluga whale (DFO, 2014); M.Sc. Lévesque, L. (in preparation).</p>
14	1.1, 1.2, 2.1	Smelt and capelin	To be developed	MFFP, UQAC, ZIP-Saguenay, Sépaq, PC, DFO	<ul style="list-style-type: none"> <li>✓ Locate smelt and capelin spawning sites in the Saguenay River and St. Lawrence Estuary;</li> <li>✓ Study the dynamics of larval deviation and retention of these key forage species in the Marine Park's ecosystem;</li> <li>✓ Evaluate the vulnerability of spawning sites with respect to anthropogenic activities carried out in their vicinity;</li> <li>✓ Heighten awareness and educate the local residents and various users of the waterway to the fragility and uniqueness of these spawning habitats.</li> </ul> <p><b>Main management and publication contributions:</b> ZIP Saguenay, «Plan de protection des frayères à éperlan (Cloutier 2010) » to ensure the protection and the sustainability smelt spawning sites of the Saguenay river.</p>
15	1.2, 1.3	Monitoring of the stomach contents of pelagic and ground fish	Ongoing monitoring	PC	<ul style="list-style-type: none"> <li>✓ Analyse the stomach contents of specimens captured in an opportunistic manner to document the food web of the Estuary and Saguenay Fjord;</li> <li>✓ Document the presence of species that are hard to capture in classic fishing gear (ex: small redfish).</li> </ul>

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
16	1.1, 2.1	Striped bass	To be developed	MFFP, UQAC	<ul style="list-style-type: none"> <li>✓ Determine the origin, diet and age structure of individuals that frequent the Saguenay;</li> <li>✓ Understand the effects of striped bass population expansion on the Marine Park's food web.</li> </ul>
17	1.1, 1.3	Determine the distributional range of mature striped bass of the St. Lawrence Estuary population	Ongoing monitoring (2010 - )	MFFP, DFO	<ul style="list-style-type: none"> <li>✓ Determine the distributional range of striped bass in the St. Lawrence.</li> </ul> <p><b>Main management and publication contributions:</b> Suivi de la réintroduction du bar rayé (<i>Morone saxatilis</i>) dans le Saint-Laurent (MFFP 2012); COSEWIC assessment and status report on the Striped Bass (2012).</p>
18	1.3, 2.1	Inventory wolffish between Les Escoumins and Cap de Bon-Désir	To be developed	PC, Explos-Nature, recreational divers	<ul style="list-style-type: none"> <li>✓ Develop a method to document the abundance and the habitats of wolffish species that frequent the Marine Park area.</li> </ul> <p><b>Main management and publication contributions:</b> Recovery Strategy for Northern Wolffish and Spotted Wolffish and Management Plan for Atlantic Wolffish (Kulka <i>et al.</i>, 2007; DFO, 2013b); Dutil <i>et al.</i> (2011).</p>
19	1.3	Update the list of known species in the Marine Park	Follow-up every five years	PC	<ul style="list-style-type: none"> <li>✓ Refresh the list of Marine Park species on a periodic basis. The last update was completed in 2016.</li> </ul>

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
20	I.1, 2.1	Monitor Barrow's goldeneyes in their winter habitat (Baie des Rochers)	Ongoing monitoring (2013 - )	EC, Sépaq, PC	<ul style="list-style-type: none"> <li>✓ Determine the long-term trend of the population of Barrow's goldeneyes that use the Baie des Rochers area in winter;</li> <li>✓ Discern the presence of anthropogenic disturbance on the population.</li> </ul> <p><b>Main management and publication contributions:</b> Plan de gestion du garrot d'Islande (EC, 2013); PSSE (SÉPAQ, 2013); Zoning plan (SSLMP, 2009). See also these studies : Savard (2009) ; Laforge (2010) etc.</p>
21	I.1	Monitoring of sea birds (inventory of sea bird colonies in the Estuary)	Ongoing monitoring (1971 - )	EC, PC, Sépaq	<ul style="list-style-type: none"> <li>✓ Calculate the number of nesting birds, notably within the limits of the Saguenay-St. Lawrence Marine Park, on islands situated between La Malbaie and Les Escoumins;</li> <li>✓ Acquire additional information on the islands within the Marine Park.</li> </ul> <p><b>Main management and publication contributions:</b> Rail <i>et al.</i> (1996); Chapdeleine <i>et al.</i> (2004); PSSE (SÉPAQ, 2013).</p>
22	I.1	Inventory black-legged kittiwakes and Bonaparte's gulls	Pilot project (2005 - 2006)  To be developed	CWS, OOT, PC	<ul style="list-style-type: none"> <li>✓ Determine population trends;</li> <li>✓ To be developed: time of residence of Bonaparte's gulls in the Marine Park.</li> </ul> <p><b>Main management and publication contributions:</b> The marine park is an important migratory stopover for gulls, which make the SSLMP a strategic place for monitoring these two Quebec population of gulls; Berthiaume et Drolet (2007).</p>
23	I.1	Monitoring of soft-shell clams as an ecosystem health indicator	Ongoing monitoring (2013 - )	Sépaq, MLI et EC	<ul style="list-style-type: none"> <li>✓ Determine and monitor over time the state of health of soft-shell clam populations;</li> <li>✓ Estimate the bacteriological and physicochemical quality of the water.</li> </ul> <p><b>Main management and publication contributions:</b> Gagné <i>et al.</i>, (2009); Pellerin <i>et al.</i> (2009); Lacaze <i>et al.</i> (2014); PSSE (SÉPAQ, 2013).</p>

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
24	I.1	Monitoring of herbaceous zones (marshes, meadows)	To be followed up every 10 years (2000 - )	Sépaq, PC	<ul style="list-style-type: none"> <li>✓ Assign a representative value of the ecological capacity of herbaceous zones in order to monitor their state of health over time;</li> <li>✓ Detect changes in the quality and integrity of these ecosystems sensitive to coastal development, erosion and oil spills.</li> </ul> <p><b>Main management and publication contributions:</b> Gilbert (2004); information available for environmental emergencies (Système de gestion des urgences environnementales, E2MS); contribution for the State of the Saguenay St. Lawrence marine Park (Ménard <i>and al.</i>, 2008) and the PSSE (SÉPAQ, 2013).</p>
25	I.1	Acquisition of high-resolution bathymetric data of coastal zones (0-30 metres)	To be maintained depending on opportunities	CHC, ULaval, CIDCO, PC	<ul style="list-style-type: none"> <li>✓ Better understand and better map coastal habitats.</li> </ul> <p><b>Main management and publication contributions:</b> Patte (2013), Joyal (2015), Joyal <i>et al.</i> (2016).</p>
26	I.4	Physical oceanography of the Saguenay Fjord	Ongoing research	ISMER	<ul style="list-style-type: none"> <li>✓ Simulate the currents of the Saguenay Fjord in three dimensions.</li> </ul> <p><b>Main management and publication contributions:</b> Study of the larval drifting and retention in the Saguenay fjord (to be developed); Response planning to environmental emergencies; Drainville (1968), Saucier <i>et al.</i> (1997a, 1997b), Bourgault (2001), Bélanger (2003), Cloutier (2009), Saucier <i>et al.</i> (2009), Janes (2009), Bourgault <i>et al.</i> (2012), Belzile (2015), Belzile <i>et al.</i> (2016), M.Sc. Livernoche, A. (ongoing).</p>



## 2. Human Activities

### **ORIENTATIONS**

#### **Encourage the acquisition of knowledge pertaining to:**

- 2.1 ecosystem management approaches for commercial and recreational activities with and without harvesting;
- 2.2 the environmental performance of the commercial and recreational practices of marine activities;
- 2.3 environmentally responsible whale-watching practices at sea.

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
27	2.1	Ground fish and smelt ice fishing	Ongoing monitoring (1994 - )	DFO, MFFP, PC, Sépaq, fisheries associations, UQAC	<ul style="list-style-type: none"> <li>✓ Define management measures required to ensure a sustainable fishery;</li> <li>✓ Elaborate an accurate assessment per unit-effort.</li> </ul> <p><b>Main management and publication contributions:</b> Recovery strategies and management plans of several species (redfish etc.); DFO (2011b, 2013a); Sirois <i>et al.</i> (2009); Sévigny <i>et al.</i> (2009); Campana <i>et al.</i> (2007); Lambert et Bérubé (2002); Plan de rétablissement de l'éperlan arc-en-ciel (Équipe de rétablissement de l'éperlan arc-en-ciel, 2008); Tremblay (2008); Autef (2009); MRN (2012); Valentine (2014).</p>
28	2.1, 1.2	Summer fishing	To be developed	MFFP, PC, DFO, Saguenay fishermen's association	<ul style="list-style-type: none"> <li>✓ Complement the monitoring of winter fishing to better understand the pressure from fishing Fjord populations, with a view to sustainable fishing.</li> </ul> <p><b>Main management and publication contributions:</b> Lesueur et Archer (1996), Duchêne (2011).</p>

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
29	2.1	Anadromous brook trout	Ongoing monitoring (2013 - )	MFFP, Committee for action to safeguard sea trout (CAST)	<ul style="list-style-type: none"> <li>✓ Develop tools to carry out rigorous monitoring of anadromous brook trout both in rivers and in open waters;</li> <li>✓ Evaluate population distribution and habitat use in the saltwater environment;</li> <li>✓ Obtain a more comprehensive overview of dynamics, distribution and trends for the Saguenay population of anadromous brook trout;</li> <li>✓ Facilitate fish management.</li> </ul> <p><b>Main management and publication contributions:</b> Valentine (2014).</p>
30	2.1	Improvement of monitoring methodology for clams and their recreational harvesting (Petites-Bergeronnes)	To be developed	DFO, PC, recreational Fishermen	<ul style="list-style-type: none"> <li>✓ Encourage sustainable recreational harvesting by communities in the coordination area.</li> </ul> <p><b>Main management and publication contributions:</b> Duchêne (2008).</p>
31	2.1, 1.1	Evaluate green urchin stocks	Ongoing monitoring (2007 - ) and to be developed	DFO, PC, Fishermen	<ul style="list-style-type: none"> <li>✓ Define the fishing effort and other management measures for a sustainable fishery.</li> </ul> <p>To be developed:</p> <ul style="list-style-type: none"> <li>✓ Improve knowledge pertaining to the biology, the state and the dynamics of the population of green sea urchins in the St. Lawrence;</li> <li>✓ Evaluate the impact of harvesting on ecosystems;</li> <li>✓ Evaluate the regenerative capacity of harvested species.</li> </ul> <p><b>Main management and publication contributions:</b> Assessment of the Green Sea Urchin Fishery (DFO, 2012b, 2016); PSSE (SÉPAQ, 2013). State of the Saguenay St. Lawrence Marine Park (Ménard <i>and al.</i>, 2008).</p>

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
32	2.2	Impact of divers on the undersea landscape through the use of frilled anemone ( <i>Metridium senile</i> ) as an indicator species	Existing methodology, discontinued (2001 - )	PC, Explos-Nature	<ul style="list-style-type: none"> <li>✓ Conserve undersea landscapes for the quality of the experience of divers and other visitors (ex: Live, from Beneath the St. Lawrence River!);</li> <li>✓ Engage in better site management;</li> <li>✓ Acquire a knowledge base for the study of the impact of undersea cables and diving activities at the Marine Environment Discovery Centre (MEDC).</li> </ul> <p><b>Main management and publication contributions:</b> Management of diving activities at the Marine Environment Discovery Centre.</p>
33	2.2	Monitoring of ship strikes on whales	Ongoing monitoring (1992 - )	PC, RQUMM,, Users: obligation to report collisions (REG-2002; REG-2012)	<ul style="list-style-type: none"> <li>✓ Define marine activities regulations;</li> <li>✓ Establish of a working group on shipping (reduce collision priority);</li> <li>✓ Determine risk factors in order to reduce them.</li> </ul> <p><b>Main management and publication contributions:</b> Obligation to report strikes with marine mammals (REG-2002; REG-2012); Implementation of the Working Group for Maritime Transportation and Marine Mammal Protection (priority to reduce ship strikes); Laist <i>et al.</i> (2001); Recovery Strategy for the blue whale (Beauchamp <i>and al.</i>, 2009) and Management Plan for the fin whale (DFO, 2017)</p>
34	2.2	Boater activity in the Marine Park	Monitoring partially ongoing (2013 - )	AMQ, marine managers, Sépaq, PC	<ul style="list-style-type: none"> <li>✓ Document the visitor rate of boaters in marinas as an estimate of presence in the Marine Park;</li> <li>✓ Plan public awareness activities for boaters;</li> <li>✓ Document the passage of pleasure boats, with a view to reduce impacts they may have on species at risk and ecosystems;</li> <li>✓ Foster an environmentally friendly attitude in Marine Park marinas;</li> <li>✓ Research and develop new methods to reduce noise pollution.</li> </ul> <p><b>Main management and publication contributions:</b> Recovery Strategy for the beluga whale (DFO, 2012a), Status of Beluga (DFO, 2014a); Documentation of Maritime Traffic and Navigational Interactions with St. Lawrence Estuary Beluga in Calving Areas (Ménard <i>et al.</i>, 2014).</p>

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
35	2.2, 4.3	Monitoring compliance with collision risk reduction measures for rorqual whales in the Marine Park	Ongoing and/or to be developed	PC, DFO, Working Group for Maritime Transportation and Marine Mammal Protection	<ul style="list-style-type: none"> <li>✓ Reduce collision risks in Marine Park rorqual whale feeding zones and blue whale feeding zones downstream from the Marine Park while reducing the acoustical footprint of vessels in the beluga whale habitat south of Rouge Island.</li> </ul> <p><b>Main management and publication contributions:</b> Notices to Mariners published by the CGC (2013, 2014); Recovery Strategy for the blue whale (Beauchamp <i>and al.</i>, 2009) et Management Plan for the fin whale (DFO, 2017); Chion <i>et al.</i> (2012); Chion (2014); Chion et Turgeon (2015); Parrott <i>et al.</i> (2016).</p>
36	2.3	Monitoring Whale-watching Activities at Sea (AOM)	Ongoing monitoring (1994 - )	PC, GREMM (1994-2011); DFO (2005-2010); U de M	<ul style="list-style-type: none"> <li>✓ Determine the interannual trend of average whale-watching and pleasure boat concentrations on cetacean observations sites;</li> <li>✓ Ensure the sustainable continuation of the activity;</li> <li>✓ Evaluate the effectiveness of management measures.</li> </ul> <p><b>Main management and publication contributions:</b> Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations (REG-2002); Modelling marine traffic in the SSLMP (3MTSim); Evaluation of the efficiency of the regulations and review (REG-2012) ; PSSE (SÉPAQ, 2013); AEB (2011); Michaud <i>et al.</i> (2012); Working Group for Maritime Transportation and Marine Mammal Protection (scenario to avoid strikes) etc.; Parrott <i>et al.</i> (2011); Chion <i>et al.</i> (2009); Chion <i>et al.</i> (2014); Lamontagne (2009); Michaud <i>et al.</i> (1997-2010), Ménard <i>et al.</i> (2014); Guide for environmentally responsible practices for various users.</p>
37	2.3	Monitor vessel traffic using AIS	Ongoing monitoring (2011 - )	PC, TC	<ul style="list-style-type: none"> <li>✓ Monitor the main activity that is carried out in the Marine Park: navigation (merchant shipping and AOM)</li> </ul> <p><b>Main management and publication contributions:</b> Environmental emergency response plan and visitor safety; PGAM; Compliance tracking of the voluntary measures implemented with the shipping industry to protect marine mammals; Chion <i>et al.</i> (2009, 2012), Chion (2014), Chion et Turgeon (2015), Parrott <i>et al.</i> (2011, sous presse), Ménard <i>et al.</i> (2014), Lesage <i>et al.</i> (2014), DFO (2014b).</p>



### 3. Environmental quality and risk evaluation

**Maintain and pursue the acquisition of knowledge concerning:**

**3.1** contaminant levels and sources in the Marine Park;

**3.2** direct and indirect environmental risks in the Marine Park and its zone of influence;

**3.3** elements that are sensitive to human activities and environmental accidents

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
38	3.1	Concentrations of deep water dissolved oxygen	Ongoing monitoring	DFO, ISMER, PC	<ul style="list-style-type: none"> <li>✓ Monitor concentration of dissolved oxygen in deep waters as an indicator of the degradation of benthic habitats and ground fish habitats.</li> </ul> <p><b>Main management and publication contributions:</b> Results available on the St. Lawrence Global Observatory website (<a href="http://ogsl.ca">http://ogsl.ca</a>).</p>
39	3.1	Wastewater treatment systems quality	Ongoing monitoring	MAMROT, municipalities within the coordination area	<ul style="list-style-type: none"> <li>✓ Monitor the quality of municipal wastewater effluent in municipalities with wastewater treatment systems;</li> <li>✓ Conduct more detailed physicochemical and bacteriological studies in municipalities with wastewater treatment systems.</li> </ul> <p><b>Main management and publication contributions:</b> PSSE (SÉPAQ, 2013), State of the Saguenay St. Lawrence Marine Park (Ménard <i>et al.</i>, 2008) ; MAMROT (2012).</p>
40	3.1	Chemical contamination	To be developed		<ul style="list-style-type: none"> <li>✓ Develop a monitoring program for chemical contamination, such as trace metals, in order to track long-term trends in the state of the Lower Estuary.</li> </ul>

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
41	3.1	Water quality in smelt spawning areas	Under development and/or to be developed	MDDELCC, MFFP, RTA	<ul style="list-style-type: none"> <li>✓ Document and monitor water quality parameters to protect smelt spawning areas.</li> </ul>
42	3.1	Monitoring of the quantity of fertilizer used in the agricultural sector	Under development and/or to be developed	MAPAQ, Sépaq	<ul style="list-style-type: none"> <li>✓ Elaborate a monitoring program for the nitrogen balance in areas receiving fertilizer (surplus mineral equivalent sampled on receptive crops) in certain Marine Park watersheds.</li> <li>✓ Study phosphorus, nitrogen and nitrite contamination in Marine Park watersheds.</li> </ul> <p><b>Main management and publication contributions:</b> PSSE (SÉPAQ, 2013).</p>
43	3.2	Monitor toxic algae	Ongoing monitoring	DFO, PC	<ul style="list-style-type: none"> <li>✓ Monitor on a weekly basis during summer the abundance of toxic phytoplankton species near the Tadoussac wharf;</li> <li>✓ Reduce domestic, agricultural and industrial nutrient enrichment of water in Marine Park watersheds.</li> </ul> <p><b>Main management and publication contributions:</b> PSSE (SÉPAQ, 2013); State of the Saguenay St. Lawrence Marine Park (Ménard <i>and al.</i>, 2008); emergency measures follow-up. Data available on the St. Lawrence Global Observatory website (<a href="http://ogsl.ca">http://ogsl.ca</a>); Starr <i>et al.</i> (ongoing).</p>

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
44	3.2	Monitor primary productivity	Ongoing monitoring (1994 - )	DFO, PC	<ul style="list-style-type: none"> <li>✓ Measure the chlorophyll level at the Rimouski station using a fluorometer available at the Marine Park (CTD) in order to track the state of eutrophication of the marine environment;</li> <li>✓ To be developed: Increase our knowledge of the effect of the use of fertilizers and other nutritive elements on the eutrophication of the marine environment.</li> </ul> <p><b>Main management and publication contributions:</b> PSSE (SÉPAQ, 2013); State if the Saguenay St. Lawrence Marine Park (Ménard <i>and al.</i>, 2008); Data available on the St. Lawrence Global Observatory website (<a href="http://ogsl.ca">http://ogsl.ca</a>)</p>
45	3.2, 3.3	Marine Park risk management model	Study completed(2011); implementation to be developed	ISMER/UQAR, PC, Sépaq	<ul style="list-style-type: none"> <li>✓ Develop a decision aid tool that is both simple and scalable for the evaluation and management of environmental risks in the Saguenay-St. Lawrence Marine Park;</li> <li>✓ Integrate the multifaceted nature of anthropogenic sources of stress and their potential targets, the spatial variability of relationships between these various elements and the heterogeneity of data available in an interactive process that allows for park management;</li> <li>✓ Be in a position to apply the relative risk model to the Saguenay-St. Lawrence Marine Park for the purpose of environmental management and ecosystem protection.</li> </ul> <p><b>Main management and publication contributions:</b> Lemaire (2012). Test the management options with this model within the park sectors with higher risks, in order to determine the possible benefits. Know the parks region with higher risks and the the sources of environmental stressors associated with these regions.</p>
46	3.2	Characterization of noise in the marine environment and identification of mitigation measures	To be developed		<ul style="list-style-type: none"> <li>✓ Characterize noise in the critical habitats of marine mammals in the Marine Park;</li> <li>✓ Develop marine environment noise mitigation measures, particularly for vessels that operate on a regular basis in the Marine Park (whale-watching boats, search and rescue boats, ferries).</li> </ul> <p><b>Main management and publication contributions:</b> Gervaise <i>et al.</i> (2012); Noise reduction emitted by the new Tadoussac-Baie-Ste-Catherine ferries; See also : Lesage (1993), Lesage <i>et al.</i> (1999), McQuinn <i>et al.</i> (2011), Lesage <i>et al.</i> (2014), Roy et Simard (2015).</p>

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
47	3.2	Monitor the evolution of the shoreline(erosion, rock fill, development)	Ongoing	MRC, Municipalities, UQAR	<ul style="list-style-type: none"> <li>✓ Map the shoreline in order to target areas susceptible to erosion, for the purposes of habitat protection;</li> <li>✓ Define and circumscribe types of coastal and shoreline usage.</li> </ul>
48	3.2	Invasive exotic species	To be developed	OBV Saguenay	<ul style="list-style-type: none"> <li>✓ Detect the disappearance or appearance of new species and, if necessary, document their proliferation.</li> </ul>
49	3.2	Oceanographic conditions of the Saguenay Fjord and the Lower St. Lawrence Estuary	Ongoing (1994 - )	DFO, ISMER, PC	<ul style="list-style-type: none"> <li>✓ Monitor oceanographic parameters;</li> <li>✓ Model currents in 3-D.</li> </ul> <p><b>Main management and publication contributions:</b> Environmental emergencies plan; Data partially available on the St. Lawrence Global Observatory website (<a href="http://ogsl.ca">http://ogsl.ca</a>). Saucier <i>et al.</i> (1997a, 1997b), Saucier et Chassé (2000), Bourgault (2001), Bélanger (2003), Cloutier (2009), Saucier <i>et al.</i> (2009), Janes (2009), Bourgault <i>et al.</i> (2012), Belzile (2015), Belzile <i>et al.</i> (2016), M.Sc. Livernoche, A. (en préparation), Galbraith <i>et al.</i> (2010, 2011, 2012, 2013, 2014, 2015).</p>
50	3.3	Development of an electronic atlas for the Marine Park using a geographic information system	Under development and/or to be developed	PC	<ul style="list-style-type: none"> <li>✓ Elaborate a geographic information system using available data on habitats, marine resources, etc.</li> </ul>

#### 4. Governance and Social, Economic and Cultural Features

##### **ORIENTATIONS**

##### **Facilitate knowledge acquisition to evaluate:**

- 4.1 the level of support of coastal communities for the Marine Park;
- 4.2 the effectiveness of the Marine Park's governance model;
- 4.3 the efficiency of management measures;
- 4.4 ecosystem goods and services in the coordination area.

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
51	4.1	Level of involvement of local organizations in the achievement of Marine Park objectives	To be developed		✓ Develop a relevant collaboration strategy in order to foster agreements that allow organizations to present a request for collaboration.
52	4.1	Understanding of Marine Park goals and objectives by residents of the coordination area and of their sense of approval	To be developed		<ul style="list-style-type: none"> <li>✓ Measure the level of approval of Marine Park objectives by coastal community residents;</li> <li>✓ Measure the level of support of coastal communities for the practice of activities at sea.</li> </ul>
53	4.1	Social and economic aspects	To be developed		✓ Evaluate the social and economic effects of activities with or without harvesting in the Marine Park coordination area.

No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
54	4.1	Communication with the regional community	To be developed		✓ Improve and develop communication strategies with the regional community.
55	4.2	Effectiveness of the Management Plan	To be developed		✓ Develop performance indicators in order to ensure a better evaluation of the status of the upcoming Management Plan.
56	4.4	Summary monitoring of SSLMP activities with park wardens and other field staff	Ongoing study	Sépaq, PC	<ul style="list-style-type: none"> <li>✓ Understanding of activities occurring in the Marine Park;</li> <li>✓ Observance of management measures.</li> </ul>
57	4.5	Implementation of monitoring of progress of the Eco-Whale Alliance	Under development	Sépaq, PC, GREMM, member organisations of the Eco-Whale Alliance	<ul style="list-style-type: none"> <li>✓ Measure progress towards the achievement of Alliance objectives;</li> <li>✓ Improve practices at sea;</li> <li>✓ Obtain more information concerning the customers and the image projected by the whale-watching industry;</li> <li>✓ Undertake an adaptive and strategic management of the resource.</li> </ul>
58	4.4	Estimate the non-market value of SSLMP ecosystem services	Ongoing study (2014 - )	UQAR, PC	<ul style="list-style-type: none"> <li>✓ Define ecosystem services and the relative importance of the key significant characteristics of the ecosystem.</li> </ul> <p><b>Main management and publication contributions:</b> M.Sc. Bouquet, R. (in preparation).</p>



No	Orientation(s)	Research Subject	Status	Promoter(s) and Partner(s)	Research Objectives and Results
59	4.2, 4.3	Assessment and monitoring index of the performance of Marine Protected Areas	Ongoing study (2014 - )	PC, ISMER, UQAR	<ul style="list-style-type: none"> <li>✓ Determine the operating efficiency of MPAs in accordance with their objectives;</li> <li>✓ Develop an aggregate indicator to measure the performance of MPAs for all fundamental themes (environment, society and governance);</li> <li>✓ Implement a case study: the SSLMP</li> </ul> <p><b>Main management and publication contributions:</b> M.Sc. Patte, L. (ongoing).</p>

## Annex 1: Members of the Advisory Committee on Ecosystem Management and Research (GÉR)

### **Committee President — Substitute representative from the field of scientific research on the Coordination Committee**

Dr Pascal Sirois, Professor Université du Québec à Chicoutimi

### **Regional representative:**

Mr. Kévin Bédard, MRC Haute-Côte-Nord

### **Representative from the Council of the Innu First Nation of Essipit:**

Mr. Bernard Chamberland, Council of the Innu First Nation of Essipit

### **Environmental representative:**

Mr. Robert Patenaude, Société Provencher

### **Representatives from the Ministère du Développement durable, de l'Environnement, et de la Lutte contre les changements climatiques:**

Mrs. Véronique Tremblay, Regional board of analysis and appraisal for the Saguenay-Lac-Saint-Jean

Mr. Rodolph Balej, Environmental heritage and parks board

Mr. Marc Valentine, Saguenay-Lac-Saint-Jean Territorial board of energy-wildlife-forest-mines appraisal

### **Environment Canada representative:**

Mr. Jean-François Rail, Canadian Wildlife Service (CWS)

### **Fisheries and Oceans Canada representative (DFO):**

Mr. Guy Cantin, Oceans Management Board

### **Parks Canada representative:**

Mrs Nadia Ménard, Saguenay-St. Lawrence Marine Park

### **Sépaq representative:**

Mrs. Yana Desautels, Saguenay Fjord National Park

### **Ad hoc member:**

Mrs. Suzan Dionne, Parks Canada

### **Committee secretary:**

Mrs. Chloé Bonnette, Saguenay-St. Lawrence Marine Park (Sépaq)

## Annex 2

### A vision for the Marine Park:

### A Protected Area for the Benefit of Riverside Communities and the General Public

The vision of the Marine Park forms the basis of orientations and actions recommended in its Management Plan. Consequently, it underpins Marine Park management by setting forth medium-term, 15-year goals.

Several statements of this vision refer directly or indirectly to scientific research. The present scientific research orientation strategy contributes to achieving this vision.

Deployment of a drifting buoy with hydrophones to measure sound propagation in the Saguenay Fjord



Parcs Canada /N. Ménard

**We hope that in fifteen years and with the support of surrounding populations, the Saguenay–Saint. Lawrence Marine Park will :**

- ✔ *Protect the unique marine ecosystems, fauna and flora of a section of the St. Lawrence Estuary and Saguenay Fjord;*
- ✔ *Use scientific research for the improved management, protection and presentation of the area's resources;*
- ✔ *Resort, in the absence of scientific certitude, to the precautionary principle in the management of activities capable of modifying the biological diversity and marine environment of the estuary and fjord;*
- ✔ *Serve as a model of the environmentally sustainable use of renewable natural resources generating positive effects on the environment, the economy and regional jobs;*
- ✔ *Respect the principles of sustainable development, where conservation interventions and the use of resources are environmentally viable, socially acceptable and economically profitable;*
- ✔ *Significantly contribute to the preservation of the estuary and fjord, in particular by taking action to protect habitats to promote the restoration of endangered species, including the St. Lawrence beluga;*
- ✔ *Remain one of the best places in Canada to see marine mammals and a place of residence for the St. Lawrence beluga;*
- ✔ *Perpetuate a harmonious relationship between man and sea and the contribution of local and First Nations communities;*
- ✔ *Be recognized as a model of cooperation and participation with local and regional communities while exerting an influence extending well beyond its territorial boundaries;*
- ✔ *Be a place for exchanges of knowledge and experiences giving rise to the discovery, understanding, appreciation and protection of the natural and cultural heritage of the marine environment;*
- ✔ *Provide the framework for the safe practice of discovery and recreational activities in line with ecosystem conservation objectives;*
- ✔ *Still comprise striking marine and coastal landscapes;*
- ✔ *Become a potential candidate for designation as a UNESCO world heritage site.*

## Annex 3: Summary Assessment of Scientific Research Projects (as of 2015)

### Theme 1: Ecology and Biodiversity

Year(s)	Research Subject	Status	Promoter(s) and Partner(s)	Main management and publication contributions
1971 - 2015	Seabird monitoring (Inventory of seabird colonies in the Estuary)	Monitoring (ongoing)	EC, PC, Sépaq	Rail <i>et al.</i> (1996); Chapdeleine et Rail (2004); Cotter <i>et al.</i> (2012). PSSE (SÉPAQ, 2013). Database on bird colonies available on the St. Lawrence Global Observatory website ( <a href="http://ogsl.ca">http://ogsl.ca</a> ).
1982 - 2015	Collection and post-mortem examination of beluga whale carcasses	Monitoring (ongoing)	DFO, U de M School of Veterinary Medicine at St. Hyacinthe, PC, RQUUMM	Many, see «Proceedings of the workshop on the St. Lawrence Estuary beluga – review of carcass program» (DFO, 2007a; 2014a); recovery strategy (identifying threats) and many actions managing actions from this plan (ex. : contaminants reduction in the St-Lawrence river) (DFO, 2012a); Lebeuf (2009).
1984 - 2002	Behavioural study of fin whales using VHF transmitters in the St. Lawrence Estuary	Study	GREMM, PC, DFO, MFFP	Giard (1996); Giard et Michaud (1995); Mingelbier <i>et al.</i> (1995); Michaud et Giard (1997, 1998).
1986 - 1993	Evaluation of the composition of the St. Lawrence beluga whale population	Study	DFO, SLNIE, PC, McMaster University, U de M, U Laval	Lesage (1990); Michaud et Chadenet (1990a et 1990b); Kingsley et Hammill (1991); Michaud (1993a, 1993b et 1994).
1991	Study of ice cover in the SSLMP	Study	PC	Demers (1991).
1991 - 1993	Distribution and biology of seals and other marine mammals in the SSLMP area	Study	PC, DFO	Lavigueur <i>et al.</i> (1993).

Summary Assessment of Scientific Research Projects - Ecology and Biodiversity

Year(s)	Research Subject	Status	Promoter(s) and Partner(s)	Main management and publication contributions
1991 - 1993	Presence of St. Lawrence beluga whales in St. Marguerite Bay	Study	SLNIE, DFO, PC	Michaud (1992).
1991 - 2015	Monitoring of harbour seals in the Saguenay Fjord	Monitoring (ongoing)	ROMM, PC, Sépaq, Whale-watching companies	Lavigueur (1993); Zoning (SSLMP, 2009); plan de gestion du phoque commun de l'estuaire du Saint-Laurent (ROMM, 2004); PSSE (SÉPAQ, 2013); State of the Saguenay St. Lawrence Marine Park (Ménard <i>and al.</i> , 2008).
1993 - 1994	Ascertain the visitation pattern of seabirds and coastal birds in a portion of the SSLMP	Study	PC, EC	Savard et Falardeau (1997); Savard <i>et al.</i> (1997).
1993 - 1995	Mussel Watch at Laval Island and Cap de Bon-Désir	Monitoring	EC	Project interrupted
1993 - 1996	Terrestrial communities of islands in the St. Lawrence Estuary: birds and forest plants	Study	PC, EC	Bédard <i>et al.</i> (1997).
1993 - 1997	Presence and activity report of St. Lawrence beluga whales in St. Marguerite Bay	Study	U Laval, DFO, PC, Ministère de l'Environnement et de la Faune du Québec, SLNIE, Centre for Northern Studies, GREMM, Municipality of Sacré-Cœur, ORES Coastal Research Centre, Mrs. Jean Blane	Chadenet (1997).

Summary Assessment of Scientific Research Projects - Ecology and Biodiversity

Year(s)	Research Subject	Status	Promoter(s) and Partner(s)	Main management and publication contributions
1994 - 1995	Comparative study of the condition and reproductive state of cod ( <i>Gadus morhua</i> ) in the Saguenay Fjord and Gulf of St. Lawrence	Study	UQAC, PC	Richard (1997).
1994 - 2006	Study of the distribution and social organisation of St. Lawrence beluga whales	Study	GREMM, Dalhousie University, PC, MFFP, SLNIE, WWF Canada, DFO, Fondation de la Faune du Québec	Michaud (1994, 1995a, 1995b, 1995c, 1996, 1997, 2002).
1995 - 1996	Identification of spring moulting and resting sites of scoters and common eiders in the St. Lawrence Gulf and Estuary	Study	PC, EC, Société Duvetnor	Savard et Falardeau (1997); Rail et Savard (2003).
1995 - 1996	Amphidromous and freshwater fish populations in the Saguenay	Study	DFO, PC, MFFP, Zip-Saguenay Committee	Lesueur (1996, 1998a, 1998b et 1998c).
1995 - 1996	Characterisation of benthic resources in St. Marguerite Bay	Study	DFO, PC	Lemieux (1996).
1995 - 1997	Spatial distribution and structure of pelagic schooling fish in a St. Lawrence cetacean feeding area	Study	PC, DFO, U Laval	Ménard (1998).
1995 - 1996 2012 - 2015	High-resolution coastal zone bathymetry	Study	CHS, U Laval, CIDCO, PC	Patte (2013), Joyal (2015).
1996 - 1997	Characterisation of young stages of fish in St. Marguerite Bay	Study	DFO, MFFP, CIRSA, PC	Mousseau et Dodson (1996).
1996 - 1997	Study of surface current circulation at the mouth of the Saguenay	Study	DFO, PC	Saucier <i>et al.</i> (1997a, 1997b)



Year(s)	Research Subject	Status	Promoter(s) and Partner(s)	Main management and publication contributions
1996 - 1998	Study of the diet of beluga whales and harbour seals of the St. Lawrence Estuary	Study	DFO, PC	Hammill et Lesage (1996, résultats préliminaires); Hammill (1998).
1996 - 1998	The Île aux Lièvres passage; Strategic importance for marine fauna and the Estuary	Study	PC, EC, Société Duvetnor, DFO	Bédard <i>et al.</i> (1997); Falardeau <i>et al.</i> (2000).
1997 - 1998	Description of a herring spawning ground at Île aux Lièvres in the Upper St. Lawrence Estuary	Study	DFO, PC	Munro <i>et al.</i> (1998).
1997 - 2000	Monitoring waterfowl and land birds that visit the Tadoussac marine terraces, 'dunes'	Monitoring	OOT, CWS	
1997, 2000, 2009	Modelling water flow in the St. Lawrence Gulf and Estuary	Study	ISMER, DFO, CHS, EC, University of Reading, Université du Sud Toulon-Var	Saucier <i>et al.</i> (1997a; 2009); Saucier et Chassé (2000).
1998 - 2002	Determining the biological characteristics of sea trout from the St. Marguerite River, Saguenay	Study	CIRSA, PC, MFFP	Dodson (2002).
1998 - 2002	Distribution, ecology and behaviour of Barrow's goldeneyes ( <i>Bucephala islandica</i> ) in the St. Lawrence Estuary in winter	Study	PC, EC	Benoît <i>et al.</i> (2001); Robert <i>et al.</i> (2003).
1998 - 2015	Characterisation of the use of the mouth of the Saguenay by beluga whales and documentation of nautical activities	Monitoring (ongoing)	PC	Zoning plan (SSLMP, 2009) ; Contribution to the Plan for marine activities in the Saguenay-St. Lawrence marine park (SSLMP, 2011) and to the review of the Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations (REG-2012, REG-2015 nd); Cloutier (2004); Turgeon <i>et al.</i> (2008); Turgeon (2012); Simard <i>et al.</i> (2010), Roy <i>et al.</i> (2010); Conversano (2013); Implementation of the recovery strategy (DFO,

Summary Assessment of Scientific Research Projects - Ecology and Biodiversity

Year(s)	Research Subject	Status	Promoter(s) and Partner(s)	Main management and publication contributions
				2012a). See also these studies: Pippard et Malcom (1978), Laurin (1982), Caron et Sergent (1988), Pippard (1985a, 1985b).
1999 - 2009	Prey aggregation and oceanographic processes at the base of the whale feeding site at the head of the Laurentian Channel	Study	DFO, ISMER, INRS	Marchand <i>et al.</i> (1999); Simard et Lavoie (1999); Lavoie <i>et al.</i> (2000); Simard <i>et al.</i> (2002; 2003); Simard (2009).
1999 - 2001 2005 - 2006 2011 - 2015	Characterisation of the winter habitat of Barrow's goldeneye in the St. Lawrence Estuary (Baie des Rochers)	Monitoring	EC, PC, Sépaq	Savard (2009); Laforge (2010); PSSE (SÉPAQ, 2013); Plan de gestion du garrot d'Islande (EC, 2013).
2000 - 2003	Research project on the Rouge Island scallop bed	Study	PC, DFO	Arseneau <i>et al.</i> (2002, 2003); Hartog <i>et al.</i> (2001).
2001 - 2002	The Baie des Rochers benthic community	Study	PC, U de M	Brunel (2002, draft report)
2001 - 2002	Evaluation of the significance of waterfowl habitat in winter in the SSLMP	Study	PC, EC	Savard et Falardeau (1997); Savard <i>et al.</i> (1997); Savard (2009).
2001 - 2002	Analysis of the stomach contents of Greenland sharks captured in the Saguenay	Study	DFO, PC	Marcil <i>et al.</i> (2002).
2001 - 2003	Study of the biodiversity of stickleback parasites in the SSLMP	Study	EC, PC	Marcogliese (2002).
2001 - 2004	Localisation project for smelt spawning grounds in the Saguenay River	Study	PC, Zip-Saguenay Committee, Sépaq, DFO, NRC	Lesueur (2001, 2002 et 2004); Cloutier (2010).

Summary Assessment of Scientific Research Projects - Ecology and Biodiversity

Year(s)	Research Subject	Status	Promoter(s) and Partner(s)	Main management and publication contributions
2002 - 2003	Characterisation of potential underwater dumping grounds and identification of grasslands in the Saguenay Fjord	Study	PC, Sépaq, Zip-Saguenay Committee	ZIP-Saguenay (2004).
2002 - 2003	Recruitment of Saguenay Fjord fish populations: review of knowledge and description of a research strategy	Study	UQAC, PC	Fortin et Sirois (2003).
2002 - 2004	Characterisation of the Baie du Moulin à Baude benthic community and evaluation of shellfish beds	Study	DFO, PC, Sépaq	Roy <i>et al.</i> (2005).
2002 - 2009	Presence of polycyclic aromatic hydrocarbons (PAH) in living and non-living segments of the Saguenay Fjord and River	Study	ISMER	Pelletier <i>et al.</i> (2009).
2003 - 2004	Shorebird inventory for the SSLMP territory	Monitoring	CWS	Define park zoning, contribution of the implementation of the management plan of the Barrow Goldeneye (SARA listed); Robert <i>et al.</i> (2003); Buidin <i>et al.</i> (2005); Savard (2009).
2003 - 2004	Monitoring of the grasslands (marsh, meadows) of the SSLMP	Monitoring (to be carried out every 10 years)	Sépaq ,PC	Information available for environmental emergencies (Système de gestion des urgences environnementales, E2MS); contribution to the State of the Saguenay St. Lawrence Marine Park (Ménard <i>and al.</i> , 2008) et le PSSE (SÉPAQ, 2013); Gilbert (2004).
2003 - 2006	Analysis of ichthyoplankton and zooplankton in the Saguenay Fjord	Study	DFO, UQAC, Sépaq, PC	Fortin <i>et al.</i> (2006).
2003 - 2006	Analysis of redfish and Atlantic cod otoliths from the Saguenay	Study	PC, DFO, UQAQ	Campana <i>et al.</i> (2007), Sévigny <i>et al.</i> (2009), Sirois <i>et al.</i> (2009).
2003 - 2008; 2013 - 2015	Characterisation of the use of St. Marguerite Bay by beluga whales and documentation of nautical activities	Monitoring (ongoing)	Sépaq (PNFS), PC	Decision support tool for the allowed activities in the area (ex. kayak launching); Site managing plan to be

Summary Assessment of Scientific Research Projects - Ecology and Biodiversity

Year(s)	Research Subject	Status	Promoter(s) and Partner(s)	Main management and publication contributions
				completed (PNFS et SSLMP); Busque (2006); Turgeon (2008).
2005 - 2006	Inventory of black-legged kittiwakes and Bonaparte's gulls		CWS, OOT, PC	Berthiaume et Drolet (2007).
2005 - 2007	Cartography of the St. Lawrence Estuary seabed	Study	Geological Survey of Canada (NRC), DFO	Découverte de mégadunes dans l'estuaire moyen du Saint-Laurent (Bolduc et Duchesne 2009).
2005 - 2009	Saguenay Fjord: currentology and dynamic structures at the mouth	Study	ISMER, PC	Cloutier (2009).
2006 - 2015	Monitoring of cetaceans at the head of the Laurentian Channel	Monitoring (ongoing)	GREMM, PC, Sépaq FEB	Michaud <i>et al.</i> (2007-2010) ; Ph.D. Martins, C.C.A. (2012); pooling of the number of cetaceans/preys (to be completed); Management Plan for the fin whale (DFO, 2017); implementation of the Recovery Strategy for the blue whale (Beauchamp <i>and al.</i> , 2009); identifying high risk areas for ship strikes on cetaceans (2012) in order to define des voluntary protection measures for commercial shipping (2013 and 2014)
2006 - 2015	Visual and systematic photographic survey of large rorqual whales	Monitoring (ongoing)	GREMM, PC, Sépaq	Recovery strategies and management plans of several species (blue whale and fin whale: listed on SARA)
2007 - 2012	Use of a specific habitat by St. Lawrence beluga whales: interannual, seasonal, circadian and tidal visitation of the mouth of the Saguenay	Study	PC, ISMER, DFO	Conversano (2013).
2008 - 2010	Sustainability of winter fishing for Atlantic cod in the Saguenay Fjord: analysis of cod population structure and evaluation of management measures	Study	UQAR, PC, MDDELCC, Sépaq	Autef (2010).

Year(s)	Research Subject	Status	Promoter(s) and Partner(s)	Main management and publication contributions
2009	Physiography and log of the Saguenay Fjord	Study	U Laval, Jacques Whitford Stantec Limited	Locat et Levesque (2009).
2009 - 2012	Use of stable isotopes for the evaluation of the origins of zooplankton populations in the SSLMP: the case of <i>Calanus</i> spp.	Study	ISMER, DFO, UQAC, PC	Perrin (2012).
2009 - 2012	Modelling of the use of St. Lawrence beluga whale habitat according to its prey at the mouth of the Saguenay River and in St. Marguerite Bay	Study	U de M, PC	Turgeon (2012).
2009 - 2015	Study of the influence of pelagic prey variability on the retention of marine fauna biodiversity in the SSLMP	Monitoring (ongoing)	PC, DFO, GREMM, Sépaq, CWS(EC)	Recovery strategies and management plans of several species (beluga; blue whale; fin whale: listed on SARA); identifying high risk areas for ship strikes on cetaceans (2012) in order to define des voluntary protection measures for commercial shipping (2013 and 2014), Ménard <i>et al.</i> (in preparation).
2010 - 2015	Determine the distributional range of the St. Lawrence Estuary population of mature striped bass	Monitoring (ongoing)	MFFP, MPO	Suivi de la réintroduction du bar rayé ( <i>Morone saxatilis</i> ) dans le Saint-Laurent (MFFP 2012); COSEWIC assessment and status report on the Striped Bass (2012).
2012 - 2015	Feeding and behavioural ecology of large rorqual whales in the Marine Park	Ongoing study	DFO, GREMM, PC, ISMER	Recovery Strategy for the blue whale (Beauchamp <i>and al.</i> , 2009) et Management Plan for the fin whale (DFO, 2017), Ph.D. Guilpin, M. (in preparation).
2013 - 2015	Origin, gathering areas, growth and survival of Atlantic herring larvae in the Upper St. Lawrence Estuary	Ongoing study	PC, ISMER, DFO	M.Sc. Lévesque, L. (in preparation).
2013 - 2015	Monitoring of soft-shelled clams as a health indicator	Monitoring (ongoing)	Sépaq, INRS et EC	Gagné <i>et al.</i> (2009); Pellerin <i>et al.</i> (2009); Lacaze <i>et al.</i> (2014); PSSE (SÉPAQ, 2013).

### Theme 2: Human Activities

Year(s)	Research Subject	Status	Promoter(s) and Partner(s)	Main management and publication contributions
1984 - 2002	Evaluation of the effect of whale-watching activities at sea on the fin whales of the St. Lawrence Estuary	Study	GREMM, PC, DFO, MFFP	GREMM (1993); Giard (1996); Giard et Michaud (1995); Mingelbier <i>et al.</i> (1995); Michaud et Giard (1997 et 1999).
1988 - 1994	Consequences of ecotourism boats on the behaviour of St. Lawrence beluga whales	Study	University of Toronto	Blane (1990), Blane et Jaakson (1994).
1991 - 1993	Winter sport fishing of Greenland halibut and Atlantic cod in the Saguenay Fjord	Study	PC, DFO, UQAC	Talbot (1992 et 1993).
1992	Characterisation of the seal hunt within the proposed limits of the SSLMP	Study	PC, Naturam	Naturam Environnement (1992).
1992 - 2015	Monitoring of collisions between vessels and whales	Monitoring (ongoing)	PC, RQUMM. Users: obligation to report collisions (REG-2002; REG-2012)	Obligation to report strikes with marine mammals (REG-2002; REG-2012); Implementation of the Working Group for Maritime Transportation and Marine Mammal Protection (priority to reduce ship strikes); Laist <i>et al.</i> , 2001 (revue mondiale); Recovery Strategy for the blue whale (Beauchamp <i>and al.</i> , 2009) et Management Plan for the fin whale (DFO, 2017).
1992 - 2015	Monitoring whale-watching activities at sea (AOM)	Monitoring (ongoing)	PC, GREMM, DFO, U de M	Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations (REG-2002); Modelling marine traffic in the SSLMP (3MTSim); Evaluation of the efficiency of the regulations and review (REG-2012) ; PSSE (SÉPAQ, 2013); AEB (2011); Michaud <i>et al.</i> (2012); Working Group for Maritime Transportation and



Year(s)	Research Subject	Status	Promoter(s) and Partner(s)	Main management and publication contributions
				Marine Mammal Protection (scenario to avoid strikes) etc.; Parrott <i>et al.</i> (2011); Chion <i>et al.</i> (2009); Chion <i>et al.</i> (2014); Lamontagne (2009); Michaud <i>et al.</i> (1997-2010), Ménard <i>et al.</i> (2014); Guide for environmentally responsible practices for various users.
1992 - 2015	Monitoring of ice fishing activity on the Saguenay River	Monitoring (ongoing)	DFO, MFFP, PC, Sépaq, Fishermen associations, Promotion Saguenay, UQAC	Talbot (1992, 1993); Lambert et Bérubé (2002) ; Recovery strategies and management plans of several species (redfish etc.); DFO (2004, 2005, 2007b, 2008, 2011a, 2013a, 2015); Sirois <i>et al.</i> (2009); Sévigny <i>et al.</i> (2009); Campana <i>et al.</i> (2007); Valentine (2006); Valentine <i>et al.</i> (2006). Plan de rétablissement de l'éperlan arc-en-ciel (Équipe de rétablissement de l'éperlan arc-en-ciel, 2008); Tremblay (2008); Autef (2009); MRN (2012).
1996	Characterisation of sea kayaking activity on the territory of the SSLMP	Study	PC, Québec Off the beaten path!	Michaud, H. (1996).
1996	Description of summer recreational fishing on the Saguenay River	Study	DFO, MFFP	Lesueur et Archer (1996).
1996 - 2001	Effect of underwater activities on the benthic landscape in the Cap Bon-Désir and Les Escoumins area	Study	PC, MFFP, Jeunes Explos, Ass. intervenants en plongée sous-marine des Escoumins, Université Laval, CRD de la Côte-Nord	Cusson et Guichard (2000).
1998	The effects of scuba diving on the benthic landscape of the Saguenay-St. Lawrence Marine Park	Study	PC, MFFP, DFO, École de la mer, Association des Intervenants en Plongée	Archambault <i>et al.</i> (1998).

Summary Assessment of Scientific Research Projects - Human Activities

Year(s)	Research Subject	Status	Promoter(s) and Partner(s)	Main management and publication contributions
			Sous-marine de Les Escoumins	
2001 - 2015	Use of <i>Metridium senile</i> (frilled anemone) as an indicator species of the deterioration of benthic communities	Monitoring	PC, Explos-Nature	Management of diving activities at the Marine Environment Discovery Centre.
2002 - 2006	Effect of whale-watching activities at sea, commercial, recreational and tourism traffic on activity patterns and residency periods of blue whales in the St. Lawrence Estuary	Study	DFO, PC, GREMM	M.Sc. Omrane, A. (in preparation)
2003 - 2004	Characterisation of fishing in the middle Saguenay, fishing from docks and the implementation of various projects regarding winter fishing in the SSLMP	Study	PC, Sépaq, MFFP, Zip-Saguenay Committee	Busque (2004); Lefebvre (2004).
2006 - 2015	Modelling of maritime traffic in the SSLMP	Study	U de M, PC	Parrott <i>et al.</i> (2011); Chion <i>et al.</i> (2009); Chion <i>et al.</i> (2014).
2007 - 2015	Evaluation of green sea urchin stocks	Monitoring (ongoing)	DFO, PC, fishermen	Assessment of the Green Sea Urchin Fishery (DFO, 2012b, 2016); PSSE (SÉPAQ, 2013). State of the Saguenay St. Lawrence Marine Park (Ménard <i>et al.</i> , 2008).
2009 - 2015	Improvement of a method to monitor clams and recreational harvesting (Petites Bergeronnes)	Monitoring (to be developed)	DFO, PC, sport fishermen	Duchêne (2008).
2011	Summer recreational fishing in the Saguenay-St. Lawrence Marine Park (downstream portion of the Saguenay)	Study	PC	Duchesne (2011).
2011 - 2012	Evaluation of the ecological degradation of the benthic community in relation to scuba diving in the SSLMP	Study	PC	Bourgeois (2012).

Summary Assessment of Scientific Research Projects - Human Activities

Year(s)	Research Subject	Status	Promoter(s) and Partner(s)	Main management and publication contributions
2011 - 2015	Monitoring of shipping traffic using AIS	Monitoring (ongoing)	PC, TC	Environmental emergencies and Visitor safety plan; Plan for marine activities in the Saguenay-St. Lawrence marine park.
2012 - 2013	Public access to the Saguenay River	Study	ZIP-Saguenay	ZIP-Saguenay (2013a, 2013b).
2013 - 2015	Pleasure boating activity in the Marine Park	Monitoring (ongoing)	AMQ, marina management, Sépaq, PC	Recovery Strategy for the beluga whale (DFO, 2012a), Status of Beluga (DFO, 2014a); Documentation of Maritime Traffic and Navigational Interactions with St. Lawrence Estuary Beluga in Calving Areas (Ménard <i>et al.</i> , 2014).
2013 - 2015	Anadromous brook trout	Monitoring (ongoing)	MFFP, Committee for action to safeguard sea trout (CAST)	Valentine (2014).

**Theme 3: Environmental Quality and Risk Assessment**

Year(s)	Research Subject	Status	Promoter(s) and Partner(s)	Main management and publication contributions
1990 - 1993	Sediment contamination in the St. Lawrence Estuary	Study	DFO, PC	Gobeil (1991); Gobeil et Lebeuf (1992).
1991 - 1993	Contaminants and toxicity in fish and benthic invertebrates in the St. Lawrence Estuary and Saguenay Fjord	Study	DFO, PC	Hodson <i>et al.</i> (1992).
1994 - 2015	Monitoring of primary production	Monitoring (ongoing)	DFO, PC	PSSE (SÉPAQ, 2013); State of the Saguenay-St. Lawrence Marine Park (Ménard <i>et al.</i> , 2008); Results available on the St. Lawrence Global Observatory website ( <a href="http://ogsl.ca">http://ogsl.ca</a> ).
1994 - 2015	Oceanographic conditions of the Saguenay Fjord and the Lower St. Lawrence Estuary (CTD station for researchers)	Monitoring (ongoing)	DFO, ISMER, PC	Environmental emergencies plan: Results partially available on the St. Lawrence Global Observatory website ( <a href="http://ogsl.ca">http://ogsl.ca</a> ).
1996 - 1997	Evaluation of noise pollution and its effect on St. Lawrence beluga whales	Study	SLNIE, PC, University of Connecticut	Sheifele <i>et al.</i> (1997); Sheifele (1997).
1999 - 2000	Study of pollution in St. Catherine Bay	Study	PC, ISMER	Roy et Pelletier (2000).
2001 - 2002	Environmental characterisation of contaminated sites	Study	PC, DFO	Technisol Environnement (2002).
2002 - 2011	Exposure of St. Lawrence beluga whales to noise in their critical habitats	Study	DFO, PC, GREMM	McQuinn <i>et al.</i> (2011).
2003 - 2008	Detection and localisation of whales using passive acoustics: effects of navigational noise in the SSLMP	Study	DFO, École nationale supérieure de techniques	Simard <i>et al.</i> (2008).

Year(s)	Research Subject	Status	Promoter(s) and Partner(s)	Main management and publication contributions
			avancées Bretagne (ENSTA)	
2005 - 2006	Environmental evaluation (sediment contamination) in St. Catherine Bay	Study	PC, ISMER	Roy et Pelletier (2000), Lemaire <i>et al.</i> (2005).
2006 - 2011	Evaluation of environmental risks in the SSLMP; Marine Park risk management model	Study	ISMER/UQAR, PC, Sépaq	Lemaire (2012).
2006 - 2015	Deep water dissolved oxygen levels	Monitoring (ongoing)	DFO, ISMER, PC	Results available on the St. Lawrence Global Observatory website ( <a href="http://ogsl.ca">http://ogsl.ca</a> ).
2014 - 2015	Monitoring of fertilizers quantities used in agriculture	Monitoring (under development)	MAPAQ, Sépaq	PSSE (SÉPAQ, 2013).
2009 - 2015	Monitoring of toxic algae	Monitoring (ongoing)	DFO, PC	PSSE (SÉPAQ, 2013); State of the Saguenay St. Lawrence Marine Park (Ménard <i>and al.</i> , 2008); Follow up of emergencies mesures; Results available on the St. Lawrence Global Observatory website ( <a href="http://ogsl.ca">http://ogsl.ca</a> ).
2008 - 2012	Characterisation, sources and assessment of vessel noise at the mouth of the Saguenay and impacts on beluga whales in the SSLMP	Study	DFO, GIPSA-Lab Grenoble, École nationale supérieure de techniques avancées Bretagne (ENSTA), PC	Gervaise <i>et al.</i> (2012)
2009	Use of fish to evaluate the biological effects of contaminants in the St. Lawrence Estuary and Saguenay Fjord	Study	DFO, ISMER, PC	Couillard (2009, revue).

**Theme 4: Governance and Social, Economic and Cultural Features**

Year(s)	Research Subject	Status	Promoter(s) and Partner(s)	Main management and publication contributions
1992 - 1997	Cultural components and historical documents of the SSLMP sector	Study	PC	Bernard (1992, 1996a, 1996b, 1997).
1996 - 2000	Ecotourism governance: sustainable development, regional development and participative democracy	Study	UQAM, INRS-Urbanisation	Lequin (2000).
1998 - 2002	Study of the perception and utilisation of the marine environment and of whales of the St. Lawrence	Study	PC	Bernard (1998 et 2002).
1999 - 2002	Maritime memoir: knowledge and practices in the marine environment by coastal residents of the SSLMP	Study	PC	Goupil (2002).
2000	Study of the expectations and satisfaction of whale-watching clients in the SSLMP sector	Study	UQTR	Giroul (2000).
2002	Definition of the desirable visitor experience allowing for the transmission of SSLMP conservation and educational values and objectives	Study	PC, UQAM	Degrandpré <i>et al.</i> (2002).
2003	Summary monitoring of activities in the SSLMP with park wardens and other field staff	Study	Sépaq, PC	Archambault (2003).
2004 - 2008	Estimated economic impacts of Parks Canada in Quebec	Study	PC	Gosselin et Germain (2007); Gosselin et Poitras-Gosselin (2011).
2005 - 2007	Study of SSLMP visitation by coastal residents, visitors and pleasure boaters	Study	PC	SOM (2006a, 2006b, 2006c, 2007).



Year(s)	Research Subject	Status	Promoter(s) and Partner(s)	Main management and publication contributions
2006	Contribution to governance of the oceans: studies of two cases of Marine Protected Areas created for the protection of marine mammals	Study	UQAR	George (2006).
2007	Estimation of the economic benefits of the recovery of marine mammals of the St. Lawrence Estuary	Study	DFO, U Laval, University of Alberta	MPO (2007).
2008	Inventory of submerged cultural resources in the SSLMP	Study	PC	Bernier <i>et al.</i> (2008).
2009	Science in the service of conservation in the SSLMP: how better understanding leads to better protection	Review	PC	Ménard (2009).
2009 - 2014	The governance of Marine Protected Areas in Quebec: a comparative analysis	Study	Concordia University	Layton-Cartier (2014).
2010 - 2011	Information program on visitors to the SSLMP	Study	PC	Parcs Canada (2011).
2012 - 2013	Valorisation of the MEDC's diving area through geomatic sciences, 3D animation and education about benthic communities	Study	CIDCO, ISMER, UQAR, PC, Laurentian Pilotage Authority, CCG	Patte (2013).
2013	Evaluation of Marine Protected Area governance: an applied discovery process in the SSLMP	Study	UQAR, ISMER	Desrochers (2013).
2013 - 2015	Ecological health monitoring program	Monitoring (ongoing)	Sépaq, PC	PSSE (SÉPAQ, 2013).
2013 - 2015	Study of the compliance to mortal merchant ship collision risk reduction measures for large rorqual whales in the St. Lawrence Estuary	Monitoring (ongoing and/or to be developed)	PC, DFO, Working Group on Marine Traffic	Notices to Mariners published by the CGC (2013, 2014); Recovery Strategy for the blue whale (Beauchamp <i>and al.</i> , 2009) et Management Plan for the

Summary Assessment of Scientific Research Projects - Governance and Social, Economic and Cultural Features

Year(s)	Research Subject	Status	Promoter(s) and Partner(s)	Main management and publication contributions
			and Protection of Marine Mammals	fin whale (DFO, 2017); Chion (2014); Chion et Turgeon (2015).
2013 - 2015	Evaluation index and monitoring of the performance of Marine Protected Areas	Study (ongoing)	PC, ISMER, UQAR	M.Sc. Patte, L. (in preparation)
2014 - 2015	Conservation gains stemming from voluntary protection measures for marine mammals by the merchant shipping industry	Study	PC, DFO, Working Group on Marine Traffic and Protection of Marine Mammals	Chion (2014), Chion et Turgeon (2015), Parrot <i>et al.</i> (2016).

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