

# Characterization of Navigation in the Saguenay–St. Lawrence Marine Park 2017

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# Highlights

- ✓ This report is an update of the first available characterization of navigation in the Saguenay–St. Lawrence Marine Park, which focused on the period from May to October 2007. The present document covers January to December 2017.
- ✓ 4 545 transits (See Section 2.1 “Definitions and Abbreviations”) were carried out by merchant vessels in the Marine Park in 2017, including 342 in the Saguenay Fjord. The daily average of merchant vessel transits in the Marine Park is 12.5 (min=2, max=24), of which one is in the Saguenay Fjord (min=0, max=5). Winter (January through March) is the season with the fewest merchant vessel transits in the Marine Park, while autumn (October and November) has the most (See Section 3.1.1).
- ✓ 225 transits of domestic or international cruise ships were carried out in the Marine Park in 2017, including 105 in the Saguenay Fjord. In all, 69.4% of these transits took place in September and October (See Section 3.1.2).
- ✓ Three ferry routes were in operation in the Marine Park in 2017. The ferry that runs between Baie-Sainte-Catherine and Tadoussac completed the most crossings with 41 653. For the year studied, the ferry between Trois-Pistoles and Les Escoumins completed 552 crossings and the Rivière-du-Loup and Saint-Siméon ferry completed 1 580 crossings. Thus, the ferry between Baie-Sainte-Catherine and Tadoussac represented 95.1% of all crossings carried out in the Marine Park. However, since this crossing is very short, it represented approximately 73% of all navigation time of ferries in the study area (See Section 3.1.3).
- ✓ In 2017, Parks Canada issued 53 Class 1 permits (Marine Mammal Watching at Sea) to nine different companies. Over the course of the year, 37 permit holding vessels operated from 12 different boarding locations with a total capacity of 2 780 passengers. The operational season was from April 29 to November 4 (See Section 3.1.4).
- ✓ In 2017, 6 658 excursions were conducted by Class 1 permit holders in the Marine Park and 287 180 passengers were aboard these excursions. Most excursions took place in August and July, with 2 447 (36.8%) and 1 940 (29.1%) respectively (See Section 3.1.4).
- ✓ Data available for the Marine Park allows us to estimate that the number of offshore excursions to observe marine mammals decreased by 44.3% (min=39.6%, max=48.1%) between 2007 and 2017 (See Section 3.3.1).

- ✓ As for the offering of offshore excursions to observe marine mammals, there were fewer boats in service in 2017 than in 2007. Vessels were on average larger and divided among a smaller number of companies. The demand (number of visitors) was, according to available numbers, relatively stable (See Section 3.3.1).
- ✓ In 2017, a total of 659 excursions were carried out by Class 2 permit holders (other commercial activities at sea) in the Marine Park and 4 206 passengers took part in these outings. The highest number of excursions occurred in the months of July and August with 205 (31.1%) and 204 (31.0%) respectively (See Section 3.1.5).
- ✓ In 2017, 2 024 excursions were carried out by Class 3 permit holders (human-powered activities) in the Marine Park and 16 167 passengers took part in these excursions. Most excursions took place in July and August with 691 (34.1 %) and 671 (33.2 %) respectively (See Section 3.1.6).
- ✓ Ten marinas were situated within the study area in 2017, five of which have direct access to the Marine Park. Half of the marinas were located in the Saguenay Fjord. The number of seasonal members varies between 0 and 78 (with an average of 29). In 2017, the Carrefour Maritime de Tadoussac was the marina that hosted the most visitors with 1 346 overnight stays and 650 boats, including 45% in July and 35% in August (See Section 3.1.7).
- ✓ Of the other navigation components, pilot vessels from Les Escoumins occupy the largest portion of traffic with 4 732 transits. Boats used for research, maritime safety, tugboats and barges carried out between 200 and 300 transits each in 2017 (See Section 3.1.8).
- ✓ There were 91 commercial fishing days in the Marine Park in 2017, 87 of which are attributable to the sea urchin fishery and four to the Atlantic halibut fishery (See Section 3.1.8). Furthermore, we estimate that there were approximately 240 transits of crab boats per year between Anse aux Basques and the South Shore Plateau (personal communication, Pierre Léonard).
- ✓ August was the most active month for navigation in the Marine Park (See Section 3.2).
- ✓ There was a significant drop in marine traffic at the mouth of the Saguenay Fjord between 2007 and 2017. This can be explained mainly by major changes in the fleet of tour boats departing from Tadoussac–Baie-Sainte-Catherine. The frequency of use of the Baie-Sainte-Catherine Wharf dropped by 40.2% (55.9% for large vessels and 25.6% for small vessels). The mouth of the Saguenay remains the area where marine traffic is the most intense (See Section 3.4).

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# 1. Introduction

Management of navigation activities is an important element in attaining Saguenay–St. Lawrence Marine Park objectives to limit impacts on marine and coastal ecosystems, prevent utilization conflicts and promote a rewarding visitor experience. The evaluation of risks associated with these activities on ecosystems or on a particular species requires a characterization of the spatial and temporal structures of maritime traffic. This information is essential to Marine Spatial Planning so as to assist with decisions aimed at ensuring the long-term use of marine ecosystems. In depth characterization of navigation activities and its regular updating are essential to the management of a marine protected area.

In 2009, Chion *et al.* completed the first portrait of navigation in the Saguenay–St. Lawrence Marine Park using 2007 as their reference year. It looked at the characterization of activities without resource extraction between May 1 and October 31. An update of the portrait of navigation was required, within the framework of Parks Canada’s Conservation and Restoration Program (CoRe) entitled *Sharing the waters with Belugas*, in order to support the implementation of new protection measures for endangered whale habitat. Mainly, the objective of this program is to establish concrete measures to attenuate the risks that navigation activities pose to whales. The present report provides an overview of the navigation in the Saguenay–St. Lawrence Marine Park for the year 2017, from January to December. A comparison with the 2007 portrait will also be presented (Section 3.3).

The characterization of navigation presented in this report is based on four types of complementary analyses:

1. **Descriptive analysis:** detail of the fleet (number of boats, types of boats, capacity, etc.).
2. **Quantitative analysis:** number of transits, excursions, crossings, overnight stays or passages by component and by sector (See below for definitions).
3. **Temporal analysis:** several monthly analyses were broken down to visualize the seasonality of activities.
4. **Spatial analysis:** the densities of navigation activities by component (See below) were calculated on grids using a resolution of 500 and 1000 m (UTM projection zone 19N). Spatial analyses were also carried out according to four sectors: the Lower Estuary (downstream from Tadoussac), the Upper Estuary (upstream from Tadoussac), the mouth of the Saguenay Fjord (downstream from the ferries to buoys S7 and S8) and the Saguenay Fjord (upstream of the ferry crossing line). One section will deal specifically with the mouth of the Saguenay Fjord (Section 3.4) due to the intensity of traffic and for management purposes specific to this sector.

Maritime traffic was broken down into eight distinct components (Table 1). Each of these components was individually characterized according to available data. These individual analyses (Section 3.1) were then combined to provide an overview of navigation activities in the Marine Park (Section 3.2).

*Table 1. Maritime traffic components retained for this report and their definitions.*

<b>Maritime Traffic Components</b>	<b>Definitions</b>
<b>Merchant Shipping</b>	Commercial vessels used to transport merchandise, including bulk carriers, container ships, tanker vessels, freighters and roll-on/roll-off (ro-ro) ships. Barges and passenger ships are not included in this component.
<b>Domestic and International Cruises</b>	Passenger ships offering overnight accommodation for at least 100 people.
<b>Ferries</b>	Boat used to transport passengers and vehicles between two points situated on either side of a body of water and on which no overnight stay is included.
<b>Marine Mammal Watching at Sea (Class 1 Permit)</b>	Marine tour business whose activities take place on a vessel, other than a human-powered vessel, and include directed marine mammal watching tours in the Marine Park.
<b>Other Commercial Activities at Sea (Class 2 Permit)</b>	Marine tour business whose activities take place on a vessel, other than a human-powered vessel, and consist of activities other than directed marine mammal watching tours in the Marine Park.
<b>Human-powered Activities (Class 3 and Recreational)</b>	Marine tour business whose activities take place on a human-powered vessel in the Marine Park. Also includes non-commercial pleasure boating on a human-powered vessel.
<b>Pleasure Boating</b>	Includes non-commercial pleasure boating carried out on a private motor or sailing vessel. Includes recreational fishers, excludes non-commercial pleasure boating on a human-powered vessel.
<b>Maritime Operations and Other Activities</b>	Includes barges, tugboats, commercial fishing vessels, service vessels (research boats, government boats, pilot boats, etc.), military vessels and other types of boats.

For the spatial analysis, the study area is slightly larger than the Marine Park territory (Figure 1). It includes the south shore portion of the St. Lawrence Estuary and parts of the Estuary upstream and downstream of the Marine Park. A portion of the Saguenay Fjord upstream of the limits of the Marine Park is also included in the study area. For the descriptive, quantitative and temporal analysis the numbers reported are restraint to its limits.

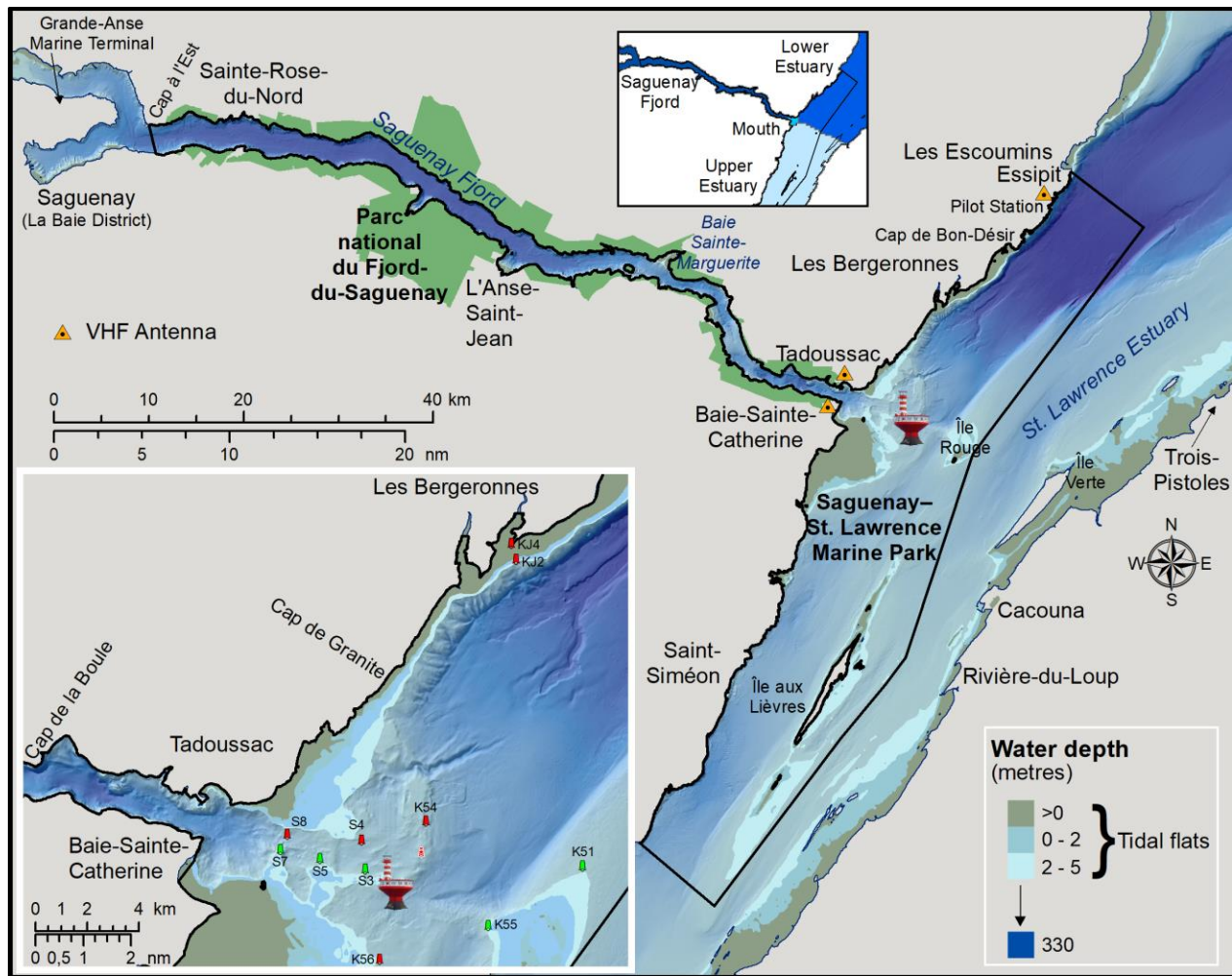


Figure 1. Study area, Saguenay–St. Lawrence Marine Park limits and location of VHF antennae enabling the reception of AIS signals. The insert at the bottom is an enlargement of the sector that includes the mouth of the Saguenay Fjord and the head of the Laurentian Channel. The insert at the top illustrates the four sectors analysed.

## 2. Definitions, data and methodology

### 2.1. Definitions and abbreviations

AIS: Automatic Identification System

Class 1 (Permit): Defines a marine tour business whose activities take place on a vessel, other than a human-powered vessel, and include directed marine mammal watching tours. This permit is issued in accordance with the Marine Activities in the Saguenay–St. Lawrence Marine Park Regulations.

Class 2 (Permit): Defines a marine tour business whose activities take place on a vessel, other than a human-powered vessel, and consist of activities other than directed marine mammal watching tours. This permit is issued in accordance with the Marine Activities in the Saguenay–St. Lawrence Marine Park Regulations.

Class 3 (Permit): Defines a marine tour business whose activities take place on a human-powered vessel. This permit is issued in accordance with the Marine Activities in the Saguenay–St. Lawrence Marine Park Regulations.

Excursion\*: an excursion refers to an offshore tour aboard a vessel operated by a private company (Class 1, Class 2 or Class 3), defined as the route taken between leaving from and arriving at the boarding point. A given vessel may undertake more than one excursion per day. In the Marine Park, only vessels with a Parks Canada permit have the right to carry out commercial excursions.

INNAV: marine traffic management information system. This system is mainly used by Marine Communications and Traffic Service (MCTS) centres. These centres are located all across Canada and cover all navigable waterways.

Passage: a passage is an incursion into a sector or a cell of the analysis grid. A transit or an excursion can correspond to more than one passage in a given sector or cell of the analysis grid. For example, an excursion leaving Tadoussac will carry out at least two passages through the mouth of the Saguenay, heading out and returning.

Marina: in this report marina is used as a generic term to refer to yacht clubs, boat launches, maritime crossroads, recreation and tourism associations or ports of refuge.

Transit\*: route followed by a vessel between two successive stops at a port, a marina or a wharf. This term applies, among other things, to vessels passing through the Marine Park, such as a transit between an overseas destination and Montreal. For certain components, such as research vessels, a transit corresponds to a day of work at sea.

Crossing\*: route followed by a ferry between two wharves situated on either side of a waterway. Thus, a return trip corresponds to two crossings.

\* The terms *excursion*, *transit* and *crossing* denote essentially the same thing, but they apply to different navigation components. They can therefore be compared and added. The generic term *movement* includes all three of these terms.

## 2.2. Data

Several data sources were used to produce the present report. The following sections serve to describe the different data used. When not specified, it is assumed that the data are from the year 2017.

### 2.2.1. Automatic Identification System (AIS) data

AIS is an automated continuous exchange system of messages between ships and land-based stations using VHF (Very High Frequency) radio. This system was implemented and developed for maritime safety, (*e.g.*, to avoid collisions between vessels) and for traffic management (*e.g.*, by port authorities). AIS transmits messages containing dynamic data that include the ship's GPS position, its speed over the ground, its route over the ground, its true heading and its rate of turn. AIS also transmits static data such as a ship's Maritime Mobile Service Identity number, its International Maritime Organization registration number, its radio call sign, its name, its class and its dimensions. AIS can also send data manually inputted by the operator, such as the state of navigation, the destination, the estimated time of arrival and the ship's draft.

Parks Canada installed a network of three VHF antennae and an archival site in 2011 in order to receive and record AIS messages transmitted in Marine Park territory, with the exception of a major portion of the Saguenay Fjord; the morphology of the Fjord renders the transmission of VHF waves difficult. The antennae are located at the Pointe-Noire Interpretation and Observation Centre, at the Parks Canada administrative office in Tadoussac and at the Marine Environment Discovery Centre (Figure 1). Information for each ship is recorded at one-minute intervals in order to limit the amount of data recorded.

In accordance with Canada's Navigation Safety Regulations:

- Every vessel of 150 gross tonnage or more that is carrying more than 12 passengers and engaged on an international voyage shall be fitted with an AIS.
- Every vessel, other than a fishing vessel, of 300 gross tonnage or more that is engaged on an international voyage shall be fitted with an AIS.
- Every vessel, other than a fishing vessel, of 500 gross tonnage or more that is not engaged on an international voyage shall be fitted with an AIS.

In addition to all vessels on which it is mandatory, AIS constitutes a significant, though incomplete, data source for other navigation components. For example, in the summer of 2011, Parks Canada installed AIS systems on eight vessels conducting observation activities at sea in the Marine Park. In 2017, on a voluntary basis, a whale watching company operating within the limits of the Marine Park outfitted its entire fleet of inflatable vessels with the AIS system.

### **2.2.2. INNAV data**

Canada uses the Vessel Traffic Management Information System (INNAV) to manage marine information. The INNAV system collects, processes, displays, distributes and records a large quantity of data. The INNAV database is compiled using information gathered by the Canadian Coast Guard's Marine Communications and Traffic Services (MCTS).

Pursuant to the *Vessel Traffic Services Zones Regulations* of the *Canada Shipping Act, 2001*, every ship 20 metres or more in length and every ship towing or pushing any vessel or object other than fishing gear must declare itself to the INNAV system. However, these regulations do not apply to pleasure yachts less than 30 m in length or fishing vessels less than 24 m in length and not more than 150 tons gross tonnage.

As soon as a ship arrives in Canadian waters, or when leaving a berth, an entry is added to the INNAV system, including information on the vessel, its point of origin, its destination, the date and the time. Conversely, the movement is closed, using the same recorded information, when a ship leaves Canadian waters or when it arrives at a berth. In addition to these "origin-destination" data, ships report at several calling-in points all along their transit. To a certain extent, the list of calling-in points to which a ship has reported can be used to reconstitute its trajectory, and learn more about the exact route it has taken, rather than could be derived from a simple "origin-destination" entry.

In order to document each of the transits undertaken in the study area in 2017 in a unique manner, data on all movements reported at the calling-in points in the Les Escoumins area (*Les Escoumins Point 5A Upstream, Les Escoumins Point 5B Downstream, Les Escoumins Direction East Pilot Stn, Les Escoumins Southeast Shore, Les Escoumins Southwest Shore, Les Escoumins Direction West Pilot Stn*) or in the Saguenay (*St. Louis Island Upstream, St. Louis Island Downstream*) were used. In addition to these data, those from all movements carried out from or to a wharf in the study area were also used. For vessels that were not required to report (*e.g.*, certain research vessels), results must be interpreted as minimal values due to the fact that these users may report in only for security reasons and not systematically.

### ***2.2.3. Whale watching activities monitoring (WWAM)***

Every summer since 1994, technicians have boarded different tour boats from various homeports in the Marine Park area in order to characterize marine mammals watching at sea activity. Among other things, the whale watching activities monitoring (WWAM) data have allowed managers to document the use of the territory for marine mammal watching at sea. During a sampled excursion, several variables are noted at ten-minute intervals, such as the boat's activity (search and displacement, whale observation, observation of other species such as birds and seals or scenery observation), observation conditions (visibility and waves), species and numbers of individuals observed as well as the types of boats within a 2 000 m radius of the boat being sampled (Michaud et al., 2010). The GPS route is recorded with positions every minute. The data source used in this report is from Parks Canada and the Marine Mammal Observation Network (MMON) from 2015 to 2017. The *Société des établissements de plein air du Québec* (Sépaq) has participated to WWAM data collection for excursions in the Saguenay in 2017. Annex 1 describes the spatial analysis methodology of these data.

### ***2.2.4. Marine activities permit register at the Marine Park***

Any company wishing to carry out marine activities offering directed marine mammal watching tours, marine activities not offering directed marine mammal watching tours or marine activities on a human-powered vessel must obtain a Class 1, 2 or 3 Permit, respectively. The register contains the list of current annual permits by class. These data were used to obtain the number of permits by class, details on companies and the fleet.

### 2.2.5. Data from the register of marine activities for permit holders

With the 2017 review of the Marine Activities in the Saguenay–St. Lawrence Marine Park Regulations, every year Class 1, 2 or 3 Permit holders must, according to the conditions of their permit, provide their number of outings completed per month and their number of passengers per month (Figure 2).


 <b>Register of Marine Activities— 2017</b>								
Company Name:								
	April	May	June	July	August	September	October	November
Number of Outings								
Number of Passengers								

Figure 2. Model of the register of marine activities that commercial tour companies must relay annually under the terms of their permit.

### 2.2.6. Land-based observation data

#### 2.2.6.1. Land-based observation data at the mouth of the Saguenay Fjord and at Sainte-Marguerite Bay

Systematic visual scanning has been carried out on average every 5 to 10 minutes, six hours per day, five days per week every summer since 2003 at the mouth of the Saguenay Fjord from the lookout area of the Pointe-Noire Observation and Interpretation Centre, and at Sainte-Marguerite Bay from the lookout area of the *parc national du Fjord-du-Saguenay* (Figure 1). Two time slots were alternated on an equal basis every week, one from 6:00 a.m. to 2:00 p.m. and the other from 1:00 p.m. to 8:00 p.m. Each visual scan consisted of a point sampling (PS) during which observations were noted as quickly as possible so as to give an instant representation of the moment when the scan was carried out. When beluga whales were present, the sampling pace was every five minutes. When beluga whales were absent, the PS was carried out every 10 minutes. Data was collected using Bushnell 7x50 binoculars with telemetric reticles and integrated compasses. Information noted for each PS included date, time, visibility, position (distance given from the telemetric reticle and azimuth reading of the compass) and number of individuals in each group of beluga whales observed, their age classification and their behaviour (activity, orientation, dynamism, group cohesion). The number and type of vessels and other cetacean species, as well as their positions and activities, were also noted. Further details concerning methodology are available in Conversano (2013) and Conversano et al. (2017).

#### *2.2.6.2. Land-based observation data of pleasure boating*

Complementary to the data described above, and for the purposes of this report, a protocol was developed in order to measure the passage of pleasure craft from four land-based sites situated throughout the Marine Park territory. These sites are: L'Anse-Saint-Jean, Cap à l'Est, Cap-à-l'Aigle and Cap-de-Bon-Désir (Figure 1). This simple protocol was used to record pleasure craft that entered the Marine Park by sea or from marinas situated in the study area. Sites were selected for the vantage point they offered onto the Fjord, the Estuary or the main marinas of the Marine Park.

For each site, four to six observation days were established in July and August. Two observation days were conducted on weekends and two during the busy period between July 20 and August 10. A total of 28 observation days were carried out over the summer. Various time slots were defined to observe pleasure boaters at different times of the day from 9:00 a.m. to 2:00 p.m., from 10:00 a.m. to 2:00 p.m. and from 2:00 p.m. to 6:00 p.m. A total of 121 observation hours were carried out. Each observation slot was divided into 30-minute periods.

An adaptation of the protocol described in the preceding section was used to collate this same information in 30-minute periods for the same period of the season for the mouth of the Saguenay Fjord and Sainte-Marguerite Bay.

#### *2.2.7. Data on marina usage*

To characterize pleasure boating in the Saguenay–St. Lawrence Marine Park, the marinas of the region were contacted in order to obtain different data of the usage in 2017. The 10 marinas were contacted and usage data was collected (Table 2). It should be noted that the marinas at Cap-à-l'Aigle, Sainte-Rose-du-Nord and Rivière-du-Loup expressed concern about the frequency of usage for 2017 due to various problems they encountered with their installations (dredging or problems with the wharves and floating docks). The marinas supplied the actual number of seasonal visitors, overnight stays and visiting boats. When actual numbers were not available, an estimate was supplied.

Table 2. List of marinas and types of information collected.

Marinas	Number of seasonal visitors	Number of overnight stays	Number of visiting boats	Other available data/comments
Carrefour Maritime de Tadoussac	yes	yes	yes	Percentage of overnight stays in July and August. Proportion of sailboats to motorboats. Origin of boats (2013 only).
Halte nautique de Sainte-Rose-du-Nord	yes	yes	no	The number of overnight stays is an estimate.
Club nautique de Bergeronnes	yes	yes	no	no
Marina de Trois-Pistoles	yes	no	no	no
Association récréotouristique de L'Anse-de-Roche	yes	yes	no	Number of boats launched.
Marina de la ville de La Baie	yes	yes	yes	The number of overnight stays and visitors are estimates.
Club nautique de Rivière-du-Loup	yes	yes	no	Data from 2015
Port de refuge de Cap-à-l'Aigle	yes	yes	no	no
Club nautique de L'Anse-Saint-Jean	yes	yes	yes	Data from 2016. Proportion of sailboats to motorboats.
Marina du Gros Cap (Notre-Dame-des-Sept-Douleurs)	yes	no	no	no

### 2.2.8. Departure schedules, service offerings and fleet details

Departure schedules, service offerings and fleet details were consulted online for marine activities at sea, ferries and international cruises. Information gathered for observation activities at sea include departure schedules, periods of operation and excursions duration. Details concerning boats and transits duration were compiled for ferries. Finally, for international cruises, the list and schedule of arrivals and departures from cruise ship terminals in Saguenay and Québec City were used to validate INNAV data for this navigation component.

### 2.2.9. Participant-specific data

Several participants were contacted to obtain information on the movements of their fleets. Among the participants contacted were the operators of different ferries that navigate in the Marine Park, the *Société des traversiers du Québec*, the Group for Research and Education on Marine Mammals (GREMM) and Fisheries and Oceans Canada officers. When possible, this information was broken down by month.

### ***2.2.10. Probable itinerary***

In cases where no spatial data were available, or to cover sectors that were not covered, probable partial or complete itineraries were constructed using available information (origin, destination, product offered, excursion duration or schedule). For example, due to the fact that AIS is not available in the Saguenay, probable itineraries were plotted for this sector.

### ***2.2.11. Baie-Sainte-Catherine wharf usage data***

Parks Canada manages the Baie-Sainte-Catherine Wharf. Docking or usage numbers (arrival and departure) have been compiled for each boat at the Baie-Sainte-Catherine Wharf on a daily basis throughout the summer since 2006. While these data do not represent a complete portrait of traffic at the mouth of the Saguenay, they are a good indicator.

### ***2.2.12. Kayak-camping site visits for the parc national du Fjord-du-Saguenay (Sépaq)***

Data on overnight reservations for kayak-camping sites in the *parc national du Fjord-du-Saguenay* (Sépaq) were used as a source of data for recreational kayakers. One overnight stay may equate to more than one person and, consequently, more than one kayak. An overnight stay corresponds instead to a site. However, these data may also include reservations made by companies operating kayak excursions of more than one day.

### ***2.2.13. Data used by component***

Table 3 below lists the sources of data used to analyse the various maritime traffic components. Several data sources were used for the entire set of components. Generally speaking, one data source was used for the quantitative and temporal segment (dark blue in Table 3), one for the spatial segment (light blue in Table 3) and one source for the descriptive segment of the analyses (red in Table 3).

Table 3. Data sources used depending on each component. Light blue corresponds to the use of spatial data, dark blue corresponds to quantitative and temporal data and red corresponds to descriptive data.

Maritime traffic component	Data sources											
	Automatic Identification System (AIS) (Section 2.2.1)	INNAV data (Section 2.2.2)	Whale watching activities monitoring (WWAM) (Section 2.2.3)	Marine Park marine activities permits Register (Section 2.2.4.)	Register of marine activities (Section 2.2.5)	Land-based observation data (Section 2.2.6)	Marina usage (Section 2.2.7)	Departure schedules, service offerings and fleet details (Section 2.2.8)	Participant specific data (Section 2.2.9)	Probable itinerary (Section 2.2.10)	Baie-Sainte-Catherine wharf usage (Section 2.2.11)	Kayak-camping site visits (Section 2.2.12)
Merchant shipping (Section 3.3.1)												
Domestic and international cruises (Section 3.3.2)												
Ferries (Section 3.3.3)												
Marine mammal watching at sea (Class 1 Permit) (Section 3.3.4)												
Other commercial activities at sea (Class 2 Permit) (Section 3.3.5)												
Human-powered activities (Class 3 and Recreational) (Section 3.3.6)												
Pleasure boating (Section 3.3.7)												
Maritime operations and other activities (Section 3.3.8)												

## 3. Results

### 3.1. Characterization by component

#### 3.1.1. Merchant shipping



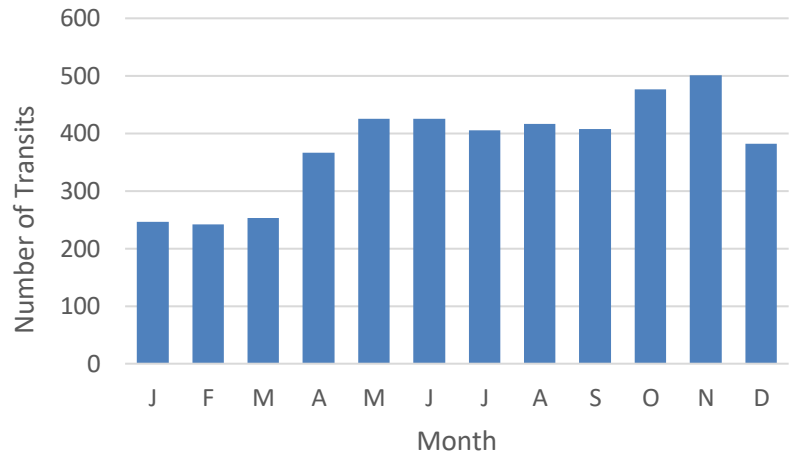
*Figure 3. Container Ship © Jean-Louis Provencher, Parks Canada.*

All merchant vessels are included in this category. This category does not include tugboats, barges or cruise ships transporting passengers.

In 2017, 4 545 merchant vessel transits were carried out within the limits of the Marine Park. There are fewer transits in winter, during the ice period (January to March). The number of transits is relatively stable the rest of the year, with the exception of the months of October and November when there are a few more transits. The monthly portrait is outlined in Table 4 and in Figure 4. The daily average of merchant vessel transits in the Marine Park is 12.5 (min=2, max=24).

*Table 4. Number and percentage of monthly merchant vessel transits in the Marine Park in 2017.*

Month	Number of transits	%
January	246	5.4
February	242	5.3
March	253	5.6
April	366	8.1
May	426	9.4
June	426	9.4
July	405	8.9
August	417	9.2
September	408	9.0
October	477	10.5
November	501	11.0
December	382	8.4
<b>Total</b>	<b>4 545</b>	<b>100</b>



*Figure 4. Number of monthly merchant vessel transits in the Marine Park in 2017.*

Figure 5 illustrates the density of the number of merchant vessel transits in the study area in 2017. Navigation corridors (upstream and downstream directions) are the main locations used by this component. The pilot boarding zone is the area with the highest number of transits. Approximately 95% of transits are carried out north of Rouge Island. Only 5% take place in the channel south of Rouge Island. In 2017, 342 transits were carried out in the Saguenay Fjord. Of these transits, 29.5% had the Grande-Anse Maritime Terminal as a destination or point of origin and 70.5% had Port-Alfred (La Baie) as a destination or point of origin. Figure 6 illustrates the number of transits carried out in the Saguenay Fjord by vessel category. There was approximately one ship navigating in the Fjord every day (min=0, max=5). The monthly average of transits in the Fjord was 28.5 (min=21, max=41). In 2017, the month of August was the busiest. Winter months (January to April) saw lower than average number of transits.

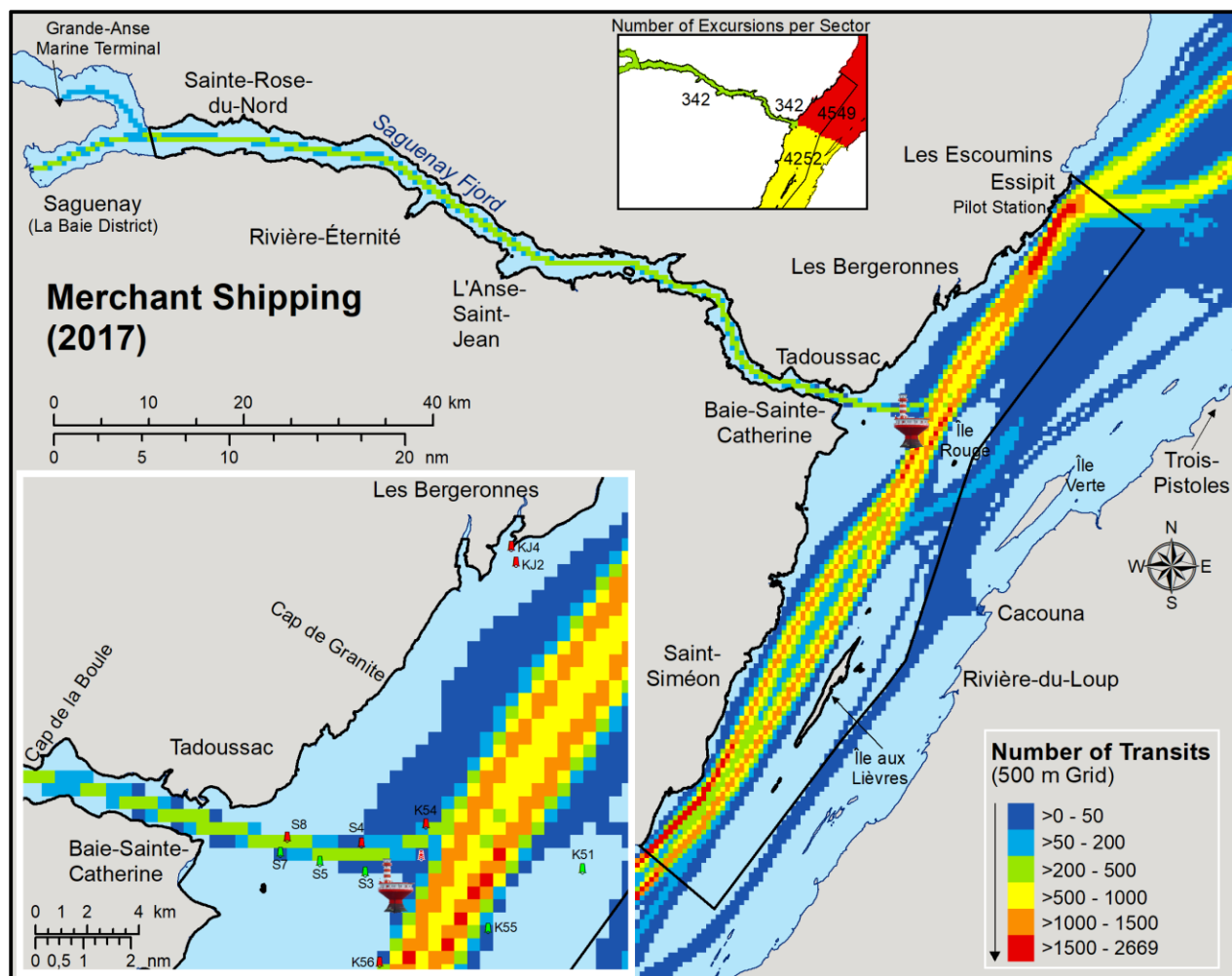


Figure 5. Number of merchant vessel transits in 2017 in a 500 m resolution grid.

Figure 6 illustrates the number of transits carried out in 2017 in the Marine Park per merchant vessel category. The bulk carrier category performed the highest number of transits with 40.7% followed by tankers (26.2%), container ships (20.2%), freighters (12.3%) and ro-ro ships (1%) (Figure 7).

In 2017, a total of 860 different merchant vessels made transits. These ships carried out an average of 5.3 transits (min=1, max=99). Among these ships, 7.6% were registered in Canada representing 24.9% of transits. The two ships that carried out the most transits in the Marine Park in 2017 were the *Oceanex Avalon* and the *Oceanex Connaigra* with slightly more than 4% of registered transits and an average of one transit per week each. The various registered ships have an average length of 187 m (min=53, max=294).

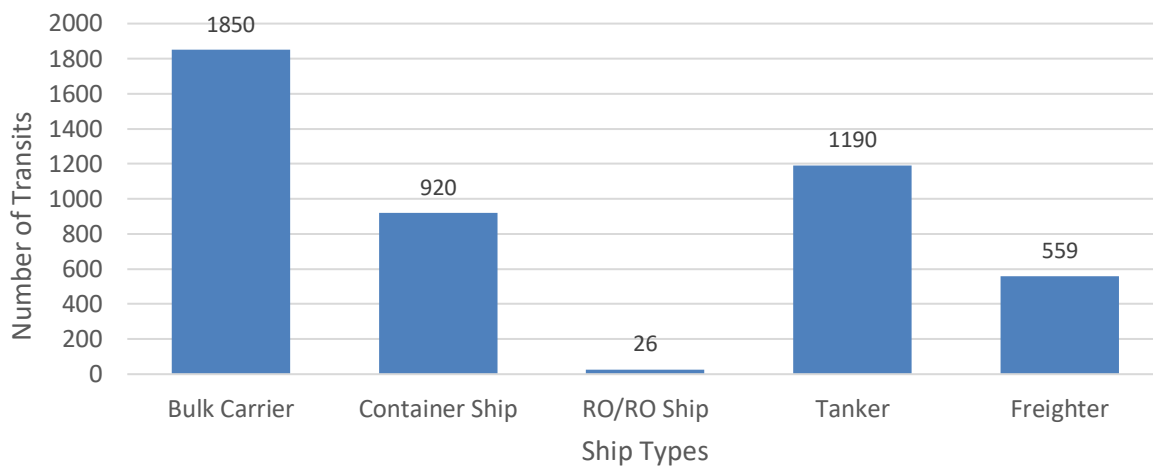


Figure 6. Number of transits in the Marine Park per merchant vessel type in 2017.

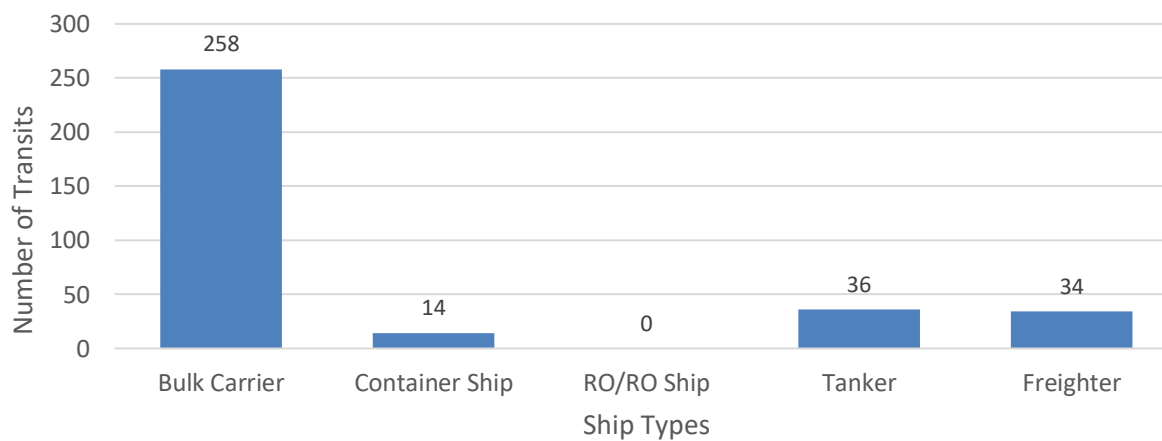


Figure 7. Number of transits in the Saguenay Fjord per merchant vessel type in 2017.

### 3.1.2. Domestic and international cruise ships



Figure 8. Cruise ship leaving the Saguenay Fjord © Samuel Turgeon, Parks Canada.

In 2017, domestic or international cruise ships carried out 225 transits within the limits of the Marine Park. Among these, 105 transits were carried out in the Saguenay Fjord and 120 transits were carried out exclusively in the Estuary portion of the Marine Park. Table 5 details the routes used by cruised ships in 2017. It should be noted that during a voyage in the St. Lawrence waterway, a cruise ship may perform as many as three and even four transits in the Marine Park. For example, 1) from the Gulf of St. Lawrence to the cruise ship terminal in the city of Saguenay, 2) from the cruise ship terminal to Québec City, 3) from Québec City to the Gulf.

Table 5. Number of transits (percentage) per main routes used by cruise ships.

Number of transits (percentage)	To	Upstream of the Marine Park (for example Quebec City)	Downstream of the Marine Park (for example the Gulf of St. Lawrence)	Saguenay Cruise Ship Terminal (La Baie District)	Tadoussac
From					
Upstream of the Marine Park (for example Quebec City)			62 (28 %)**	24 (11 %)	
Downstream of the Marine Park (for example the Gulf of St. Lawrence)		55 (24 %)*		26 (12 %)	2 (<1 %)
Saguenay Cruise Ship Terminal (La Baie District)		26 (12 %)	22 (10 %)		3 (1 %)
Tadoussac		2 (<1 %)	2 (<1 %)	1 (<1 %)	

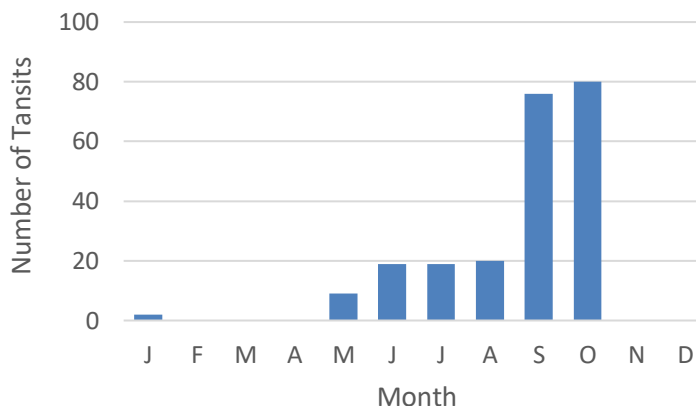
\* Two transits also followed the Saguenay Fjord up to Baie Éternité sector.

\*\* One transit also followed the Saguenay Fjord up to Baie Éternité sector.

In 2017, the months of September and October saw the most transits: nearly 70% (Table 6, Figure 9). Only two transits took place in winter, both in January, by the *CTMA Vacancier*.

*Table 6. Number and percentage of monthly cruise ship transits in the Marine Park in 2017.*

Month	Number of Transits	%
January	2	0.9
February	0	0
March	0	0
April	0	0
May	9	4.0
June	19	8.4
July	19	8.4
August	20	8.9
September	76	33.8
October	80	35.6
November	0	0
December	0	0
<b>Total</b>	<b>225</b>	<b>100</b>



*Figure 9. Number of monthly cruise ship transits in the Marine Park in 2017.*

Figure 10 illustrates cruise ship transit density in the study area in 2017. The Saguenay and the upstream and downstream navigation corridors are the main areas used by this component. Approximately 9% of transits corresponding to cruise ships used the channel south of Rouge Island in 2017. In preceding years, almost no transits of this component had been registered in this sector. This change was probably motivated to avoid the speed reduction zone that is in place in the north channel from May to October, and which might be a consequence of the measure in place to slow shipping traffic in the Gulf of St. Lawrence for right whales (Carl Robitaille, president of the *Corporation des pilotes du Bas Saint-Laurent*, personal communication).

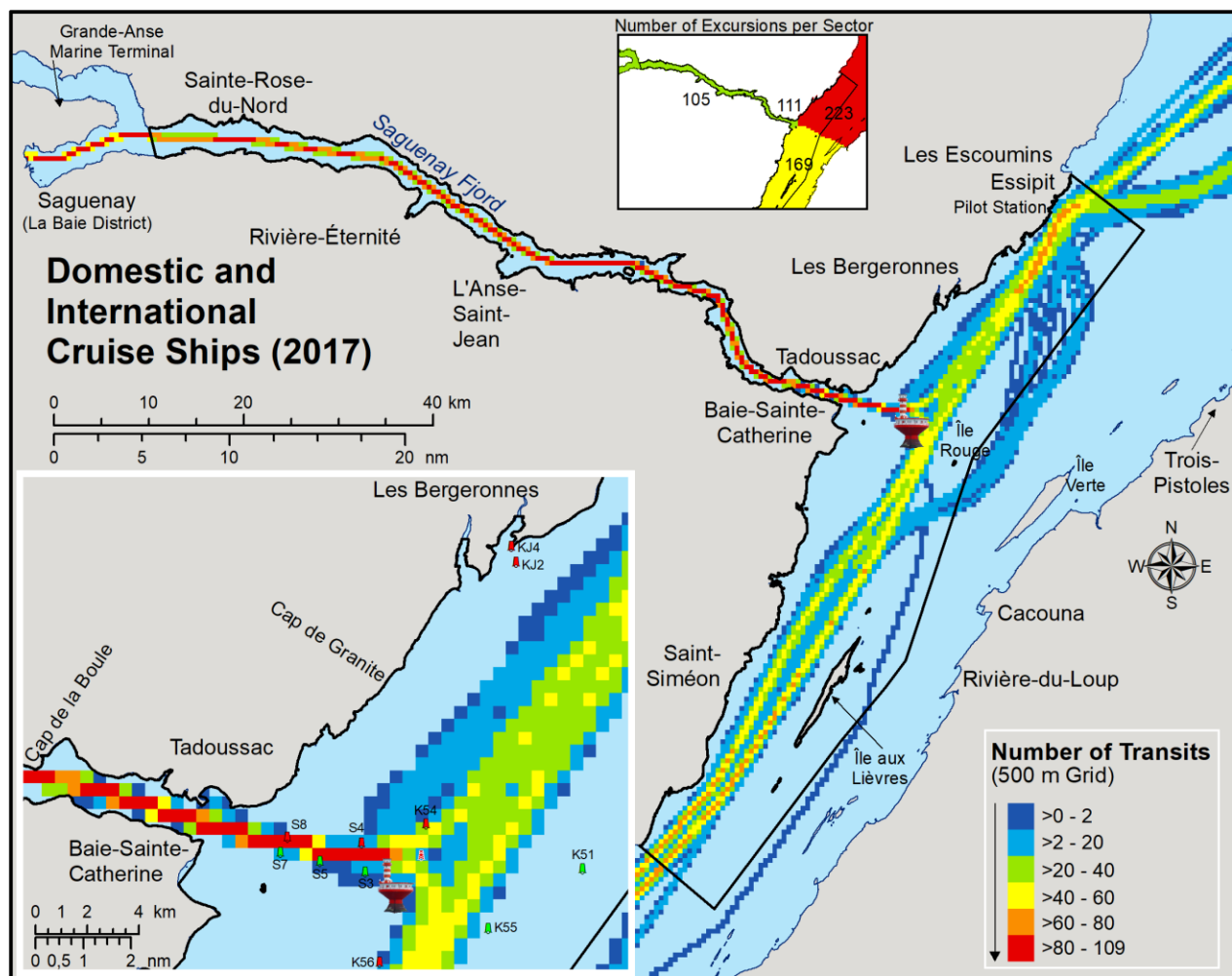


Figure 10. Number of national and international cruise ship transits in 2017 in a 500 m resolution grid.

A total of 33 different cruise ships entered the Marine Park in 2017. The *CTMA Vacancier* (domestic cruise ship) recorded the highest number of transits with 36. It is followed by the *Veendam* and the *Maasdam* with 19 and 16 transits respectively. Multiplying the number of transits carried out by each ship, their maximum passenger capacity and number of crew members, represents a potential of 244 133 passengers (344 366 including crew) who navigated the Marine Park aboard a cruise ship in 2017. However, it should be noted that these passengers or crew are not all necessarily different each time as a certain proportion may be aboard for two transits or more.

### 3.1.3. Ferries

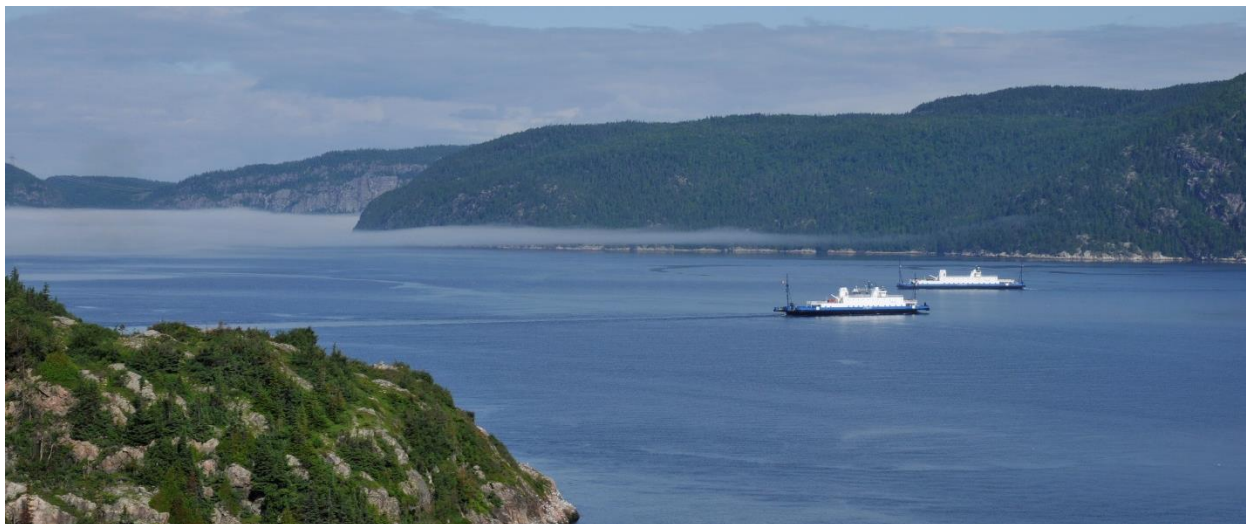


Figure 11. Ferries between Baie-Sainte-Catherine and Tadoussac © Parks Canada.

Three ferry services were in operation in 2017 in the Marine Park, one at the mouth of the Saguenay Fjord, one in the Upper Estuary and one in the Lower Estuary.

The first, which travels between Tadoussac and Baie-Sainte-Catherine, is operated as a year-round service by the *Société des traversiers du Québec*. The crossing is 1.6 km wide and takes approximately 10 minutes to complete. Crossings occurred every 20 minutes during the day and every hour at night, supported by two ferries. In summer and on the Thanksgiving weekend, a third ferry was used to increase the rate of departures to once every 13 minutes during the day. The ferries that were in service were the *NM Armand-Imbeau* (capacity of 367 passengers and 75 vehicles), the *NM Jos-Deschênes* (capacity of 367 passengers and 75 vehicles) and the *NM Félix-Antoine-Savard* (in summer, capacity of 376 passengers and 70 vehicles).

A second ferry service links Trois-Pistoles and Les Escoumins. One to three crossings per day were offered from each shore from May 25 to October 11, 2017. One particularity of this ferry service is that the schedule varies according to the tide, which is a limitation on the Trois-Pistoles side. The service is operated by the *Compagnie de navigation des Basques* and is maintained by *L'Héritage 1* (capacity of 195 passengers and 42 vehicles). The 28 km crossing takes approximately 90 minutes.

The third and final ferry service operating within the Marine Park operates between Saint-Siméon and Rivière-du-Loup. The 27 km crossing takes approximately 65 minutes and is carried out by the *NM Trans-St-Laurent* (capacity of 400 passengers and 100 vehicles). In 2017, from May 13 to January 2, 2018, one to four crossings per day were offered from each shore.

Another ferry operates in the study area from the end of April to mid-November, depending on the freeze-up period, between Notre-Dame-des-Sept-Douleurs and L'Île-Verte, outside of the Marine Park. Its numbers are therefore not compiled in the present report. The service is offered in partnership between *Société des traversiers du Québec* and the *Société Inter-Rives de l'Île-Verte*. The 7 km crossing takes approximately 30 minutes to complete and is provided by the *NM Peter-Fraser* (capacity of 70 passengers and 2 vehicles).

Table 7, below, lists the number of crossings per month by all three ferry services operating in the Marine Park. The highest number of crossings occurred during the months of July and August (Figure 12). The ferry between Baie-Sainte-Catherine and Tadoussac performed the most crossings in 2017 with a total of 41 653. In 2017, the ferry between Trois-Pistoles and Les Escoumins completed 552 crossings, the ferry between Rivière-du-Loup and Saint-Siméon, 1 580. Consequently, the ferry between Baie-Sainte-Catherine and Tadoussac represents 95% of all crossings in the Marine Park. However, since the crossing is very short, it represents approximately 73% of sailing time for these ferries.

*Table 7. Total number of monthly crossings and sailing times of the three ferry services in operation in the Marine Park in 2017.*

Month	Number of Crossings			Total
	Tadoussac– Baie-Sainte- Catherine	Trois-Pistoles– Les Escoumins	Rivière-du- Loup–Saint- Siméon	
January	3241	0	2	3243
February	3012	0	0	3012
March	3217	0	0	3217
April	3222	0	108	3330
May	3330	18	170	3518
June	3570	110	192	3872
July	4084	138	248	4470
August	4175	144	240	4559
September	3740	104	184	4028
October	3486	38	180	3704
November	3262	0	163	3425
December	3314	0	93	3407
Sub-total (May to October)	22 385	552	1214	24 151
<b>Total</b>	<b>41 653</b>	<b>552</b>	<b>1 580</b>	<b>43 785</b>
Crossing Duration (min)	10	90	65	
Sailing Time (May to October)	3731 h	828 h	1315 h	5874 h
<b>Total Sailing Time</b>	<b>6942 h</b>	<b>828 h</b>	<b>1712 h</b>	<b>9482 h</b>

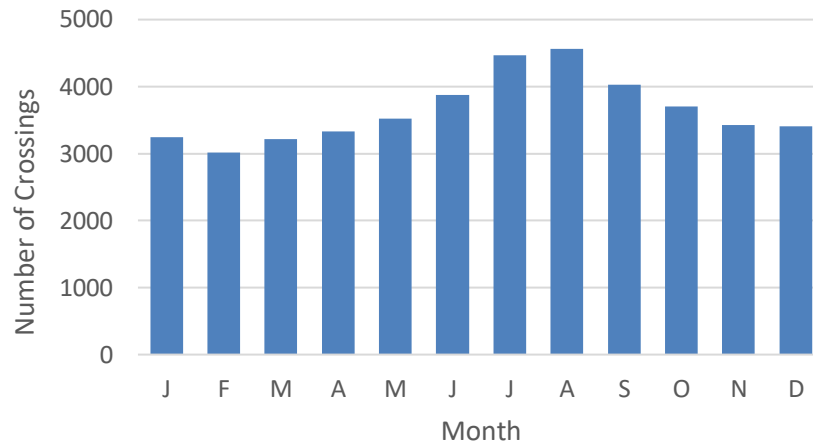


Figure 12. Number of monthly crossings completed in the Marine Park in 2017 for all three ferries combined.

Figure 13 illustrates the routes used by the three ferry services as well as density values in order to visualize variability in the corridors used.

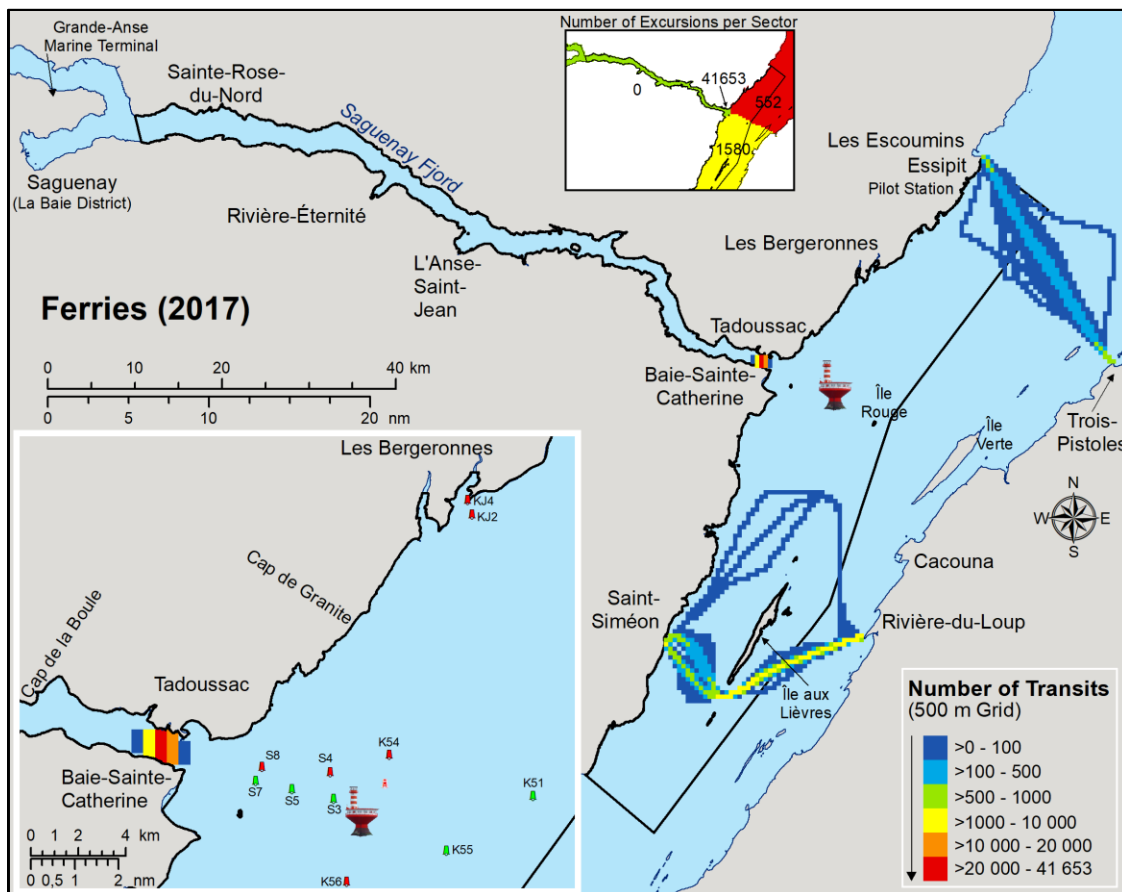


Figure 13. Number of ferry transits in 2017 in a 500 m resolution grid.

#### 3.1.4. Marine mammal watching at sea (Class 1 permit)



*Figure 14. Observation of a marine mammal at sea © Laurence Lévesque, Parks Canada.*

In 2017, the 53 Class 1 permits available under the Marine Activities in the Saguenay–St. Lawrence Marine Park Regulations were issued to nine different companies (Table 8). The majority of these companies were located on the North Shore of the Lower Estuary in Tadoussac, Les Bergeronnes and Les Escoumins (Anse-aux-Basques and Baie des Anémones) (Table 8). Excursions also took place in the Saguenay Fjord and on the South Shore departing from Rivière-du-Loup (Table 8). Out of the 12 boarding locations, nine are located in the Marine Park. Departure schedules and cruise durations are variable from one company to the next. Boats offering tours in 2017 included inflatable vessels, large vessels, bateaux-mouches, a cruise launch and a schooner. Out of the 53 possible vessels, 37 were in service in the Marine Park in 2017 and their total capacity was 2 780 passengers. Thus, 16 of the 53 permits issued in 2017 were inactive. Capacity of the different boats varied between 11 and 690 passengers (Table 8).

In 2017, 6 658 excursions were performed by Class 1 Permit holders in the Marine Park and 287 180 passengers took part in these excursions (Table 9). The month of August held the most excursions, with 2 447, and the most passengers, with 103 072. The second busiest month was the month of July with 1 940 excursions and 81 595 passengers (Figure 15 and Table 9). Very few excursions occurred in April (<1 %), May (2.4%) and November (<1 %). The operating season began on April 29 and ended on November 4. Only one company was in service for the entire period. Most companies started their operations at the beginning of June and ended them in the first half of October.

Table 8. List of companies with Class 1 permits, details of their fleets, boarding locations, tour schedules and periods of operation in 2017 (source: internet sites of each company).

Company name	Number of permits*	Fleet** Vessel type, number of boats and capacity	Boarding location	Tour duration	Departure schedule**	Operating period
Les Croisières Essipit inc.	8	<b>Inflatables</b> 6 x 12 + 1 x 40	Les Bergeronnes	2 h	8:30, 9:30, 10:00, and 11:00 a.m., 12:30, 2:00, 3:00 and 4:30 p.m.	June 9 to October 9
Promotion Saguenay inc.	3	<b>Bateaux-mouches</b> 1 x 72 + 1 x 125 <b>Large Vessel</b> 1 x 330	La Baie, Sainte-Rose-du-Nord, Baie-Éternité, L'Anse-Saint-Jean, Tadoussac	Variable	Variable	July 1 To September 4
OrganisAction	3	<b>Inflatables</b> 1 x 25 + 2 x 12 <sup>†</sup>	L'Anse-Saint-Jean, Baie-Éternité, Anse-Saint-Étienne, Cap Jaseux	Between 2 h and 4 h	8:30 a.m. and 1:30 p.m. 10:00 a.m., 2:00 p.m. and 5:00 p.m.	June 10 to October 9
Croisières AML	28	<b>Inflatables</b> 1 x 40*** + 2 * 60*** + 8 x 24 + 1 x 11 <b>Large Vessels</b> 1 x 557 + 1 x 243 + 1 x 690	Tadoussac, Baie-Sainte-Catherine, Rivière-du-Loup	I: 2 h and 2 h 30, LV: 2 h, 3 h and 3 h 30	I: 8:00, 10:15 a.m., 1:30, 4:30 p.m. LV: 9:00, 9:30 a.m. 1:00, 1:30 and 4:00 p.m.	April 29 to November 4
Croisières Neptune	5	<b>Inflatables</b> 1 x 48 + 1 x 40 + 1 x 49	Anse aux Basques (Les Escoumins)	2 h	6:30, 9:00, and 11:30 a.m., 2:00, 4:30 p.m.	
Croisières Escoumins	2	<b>Inflatables</b> 1 x 12 + 1 x 42	Baie des Anémones (Les Escoumins)	2 h	7:30, 9:00, 10:00 and 11:30 a.m., 1:00, 2:00, 3:30 and 4:00 p.m.	May 27 to October 22
Tadoussac autrement	1	<b>Schooner***</b> 1 x 45 <b>Inflatables***</b> 1 x 12	Tadoussac	2 h 30	9:00 a.m., 12:00 p.m. and 3:00 p.m.	July - October
Écumeurs du Saint-Laurent	2	<b>Inflatables</b> 2 x 12	Anse aux Basques (Les Escoumins)	2 h-2 h30	7:00, 9:30 a.m., 12:00, 2:30 and 5:00 p.m.	June 2 to October 2
Duvenor	1	<b>Cruise Launch</b> 1 x 12	Rivière-du-Loup	1 h 30 and 3 h	12:30 p.m. and 2:00 p.m.	June 2 to October 1
9 Companies	53	<b>37 Vessels, maximum total capacity 2780 passengers</b>	<b>12 Different boarding locations</b>			<b>April 29 to November 4</b>

\* Number of permits including loans

\*\* Only includes boats that actually operated in the Marine Park in 2017

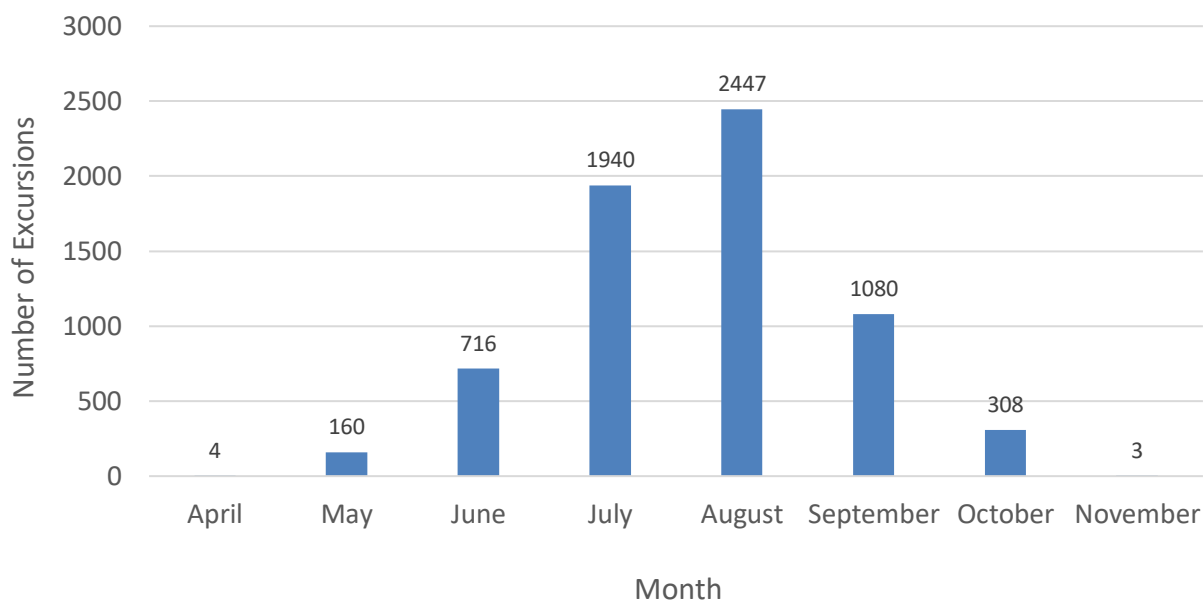
\*\*\* Both vessels were not in use at the same time

<sup>†</sup> One of these vessels was mostly in service outside the park

<sup>††</sup> High season schedule

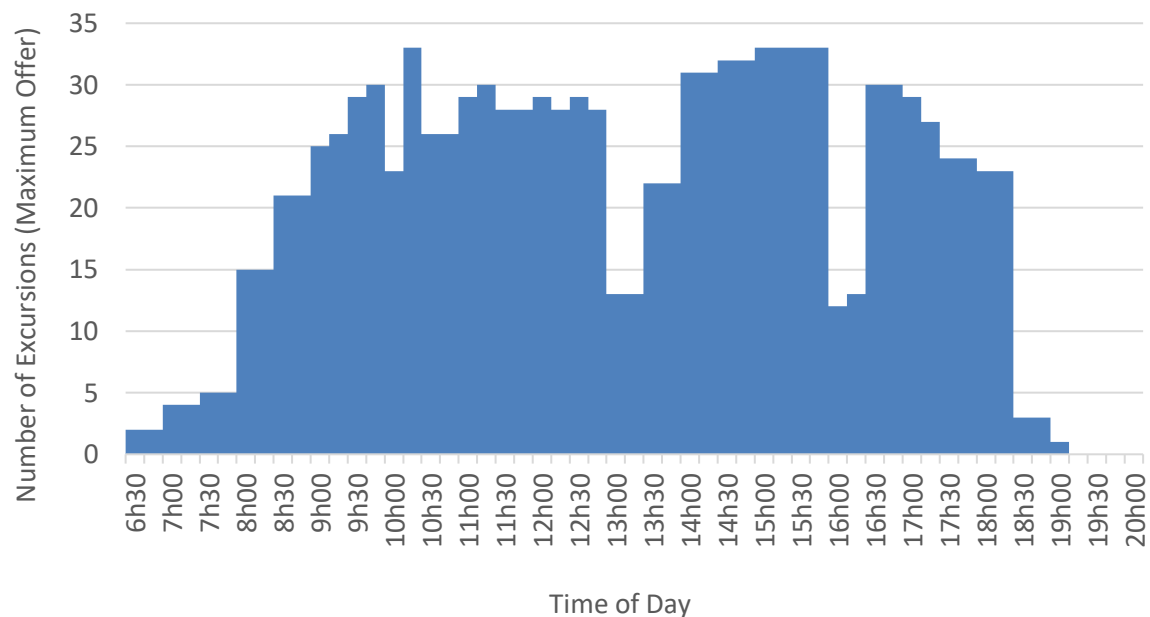
*Table 9. Number and percentage of excursions and passengers by month per Class 1 permit holder in the Marine Park in 2017.*

Month	Number of excursions	%	Number of passengers	%
April	4	0.1	72	0.0
May	160	2.4	8651	3.0
June	716	10.8	26 831	9.3
July	1 940	29.1	81 595	28.4
August	2 447	36.8	103 072	35.9
September	1 080	16.2	45 856	16.0
October	308	4.6	20 810	7.2
November	3	0.0	221	0.1
<b>Total</b>	<b>6 658</b>	<b>100</b>	<b>287 108</b>	<b>100</b>



*Figure 15. Number of excursions per month carried out by Class 1 permit holders in the Marine Park in 2017.*

Figure 16 shows the maximum number of excursions that could be at sea depending on the time of day. It is based on the schedule of proposed excursions, their duration and the fleet of the different companies. The highest potential ridership was between 2:00 p.m. and 3:45 p.m.



*Figure 16. Maximum offer of the number of excursions by Class 1 permit holders in the Marine Park per 15-minute period all day long in high season in 2017.*

Figure 17 shows the number of passages of excursion vessels (Class 1) on a spatial analysis grid. Annex 1 describes the methodology used. The highest densities of passages could be found between Tadoussac and Baie-Sainte-Catherine, between buoys S7 and S8 and at the exit of the Les Bergeronnes marina. Subsequently, the sectors from the mouth of the Saguenay to Cap de la Boule in the Saguenay Fjord, between Cap de Granite and the Prince Shoal Lighthouse, along the shore between Les Bergeronnes and Les Escoumins and the area between L'Anse-Saint-Jean and Rivière-Éternité presents the highest number of passages of vessels with a Class 1 permit which include directed marine mammal watching tours. It should be mentioned that not all Class 1 permit holders offered directed marine mammal watching tours. This is notably the case for certain permit holders operating in the Saguenay Fjord and the Upper Estuary. The Upper Estuary, upstream baie des Rochers, is the only sector of the Marine Park that is not used by this navigation component. The Class 1 permit in operation between Rivière-du-Loup and Île aux Lièvres mostly concentrates its activities on the observation of birds and island scenery, as well as passenger transportation.

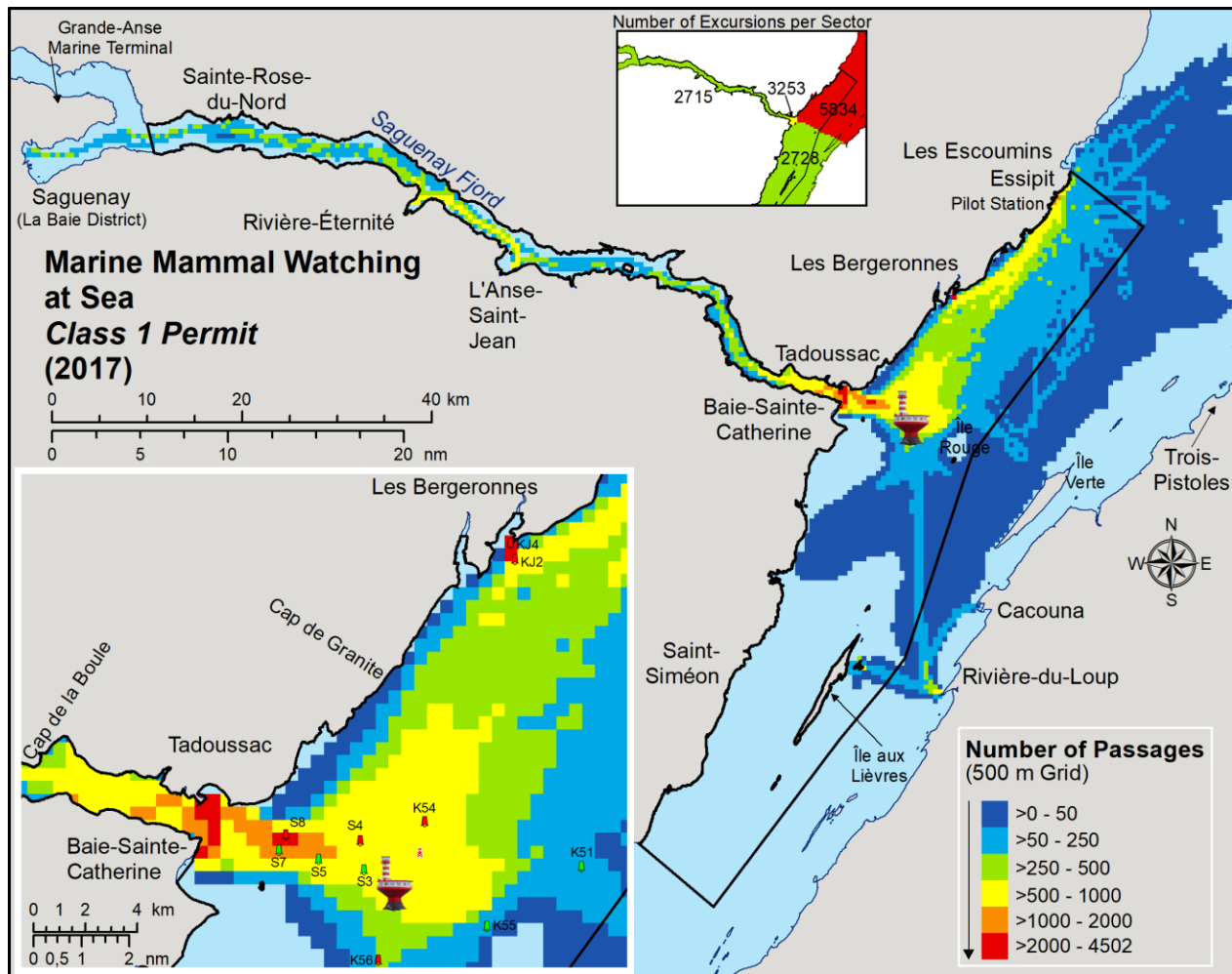


Figure 17. Number of passages of tour boats (Class 1) in a 500 m resolution grid.

Figure 18 depicts the main sectors used by tour boats, taking into account their speed and, consequently, their time of residence in the various sectors. Red areas denote territories where 30% of the activity takes place. This is the equivalent of approximately 39 km<sup>2</sup> (3.1% of the park's surface area). Orange signifies territories where 50% of the activity takes place, representing 96 km<sup>2</sup> (7.7% of the park's surface area). The 95% zone can be interpreted as the territory used by this navigation component, representing approximately 653 km<sup>2</sup>, 512 km<sup>2</sup> of which are within the Marine Park boundary (41.1% of the park's surface area). The other 5% can be considered as extreme values, sectors that are rarely used.

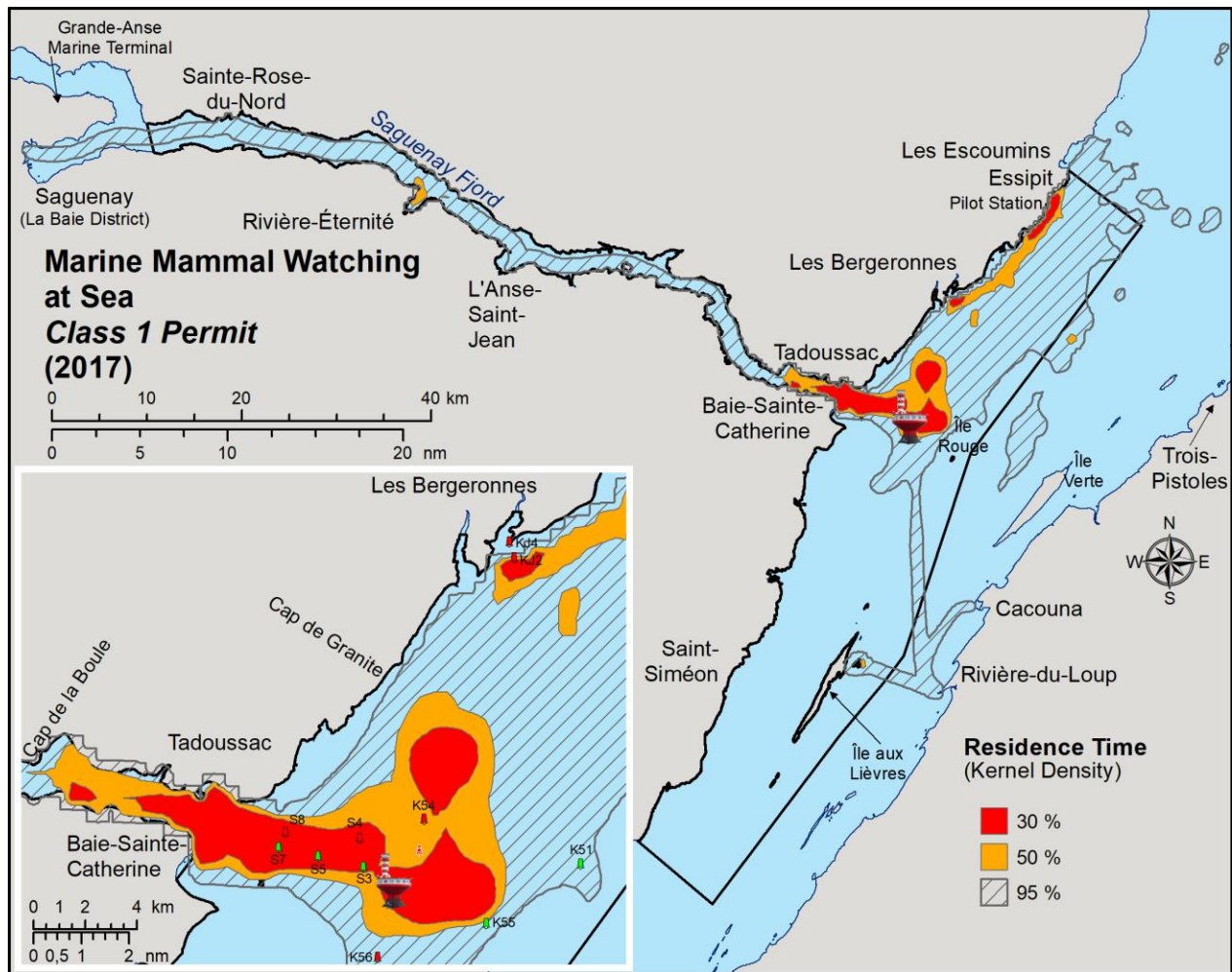
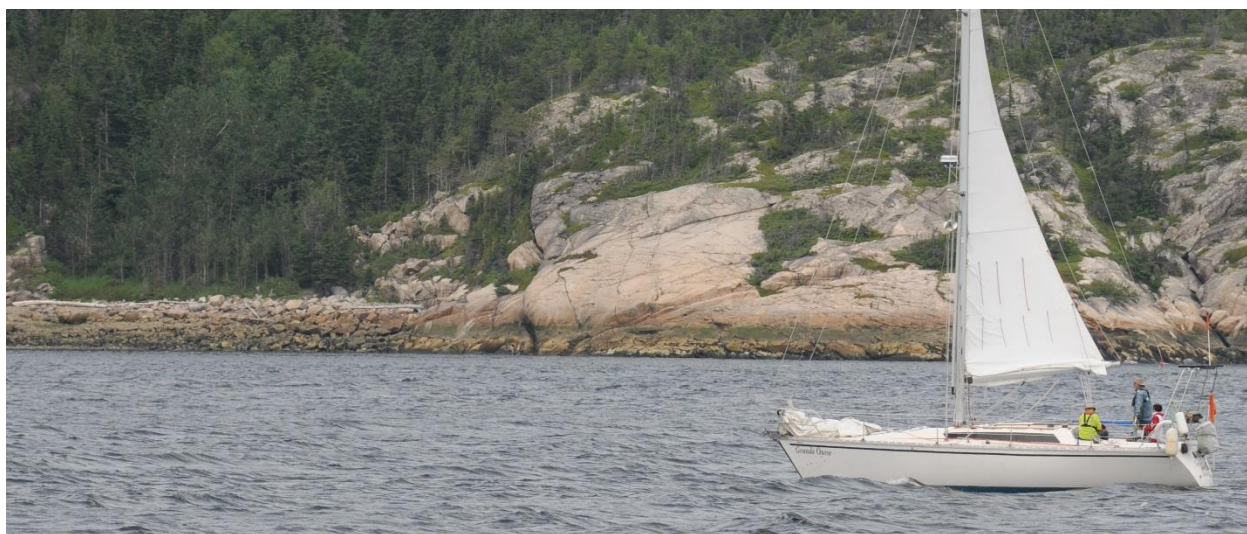


Figure 18. Main sectors used (time of residence) by tour boats (Class 1). Kernel type density analysis performed using GPS points and AIS to the weighted minute using data from the activities at sea register (See Annex 1).

### 3.1.5. Other commercial activities at sea (Class 2 permit)



*Figure 19. Sailing school © Laurence Lévesque, Parks Canada.*

In 2017, 16 permits were issued for activities covered by the Class 2 Permit, which refers to marine tour businesses whose activities take place on a vessel, other than a human-powered vessel, and consist of activities other than directed marine mammal watching tours. These permits were issued to eight companies (Table 10). These companies operated a total of 15 boats, offered different services and had a varied fleet (Table 10). Half of these companies were sailing schools.

In 2017, 659 excursions were carried out by Class 2 permit holders in the Marine Park and 4 206 passengers took part in these excursions (Figure 20, Table 11). It should be noted that some of these excursions lasted more than one day. The months of July and August saw the most excursions with 205 and 204, and the most passengers with 1 404 and 1 352. Very few excursions took place during the months of May (<1 %), October (1,4 %) and November (<1 %) (Figure 20).

The sector mostly used by vessels of this component is situated between Rivière-du-Loup, Île aux Lièvres and Île du Pot à l'Eau-de-Vie. The three boats in service in this sector offered shuttle services between the shore and the islands to transport passengers and material, along with other diverse operations (research, eiderdown harvesting, island infrastructure maintenance work).

Table 10. List of companies with Class 2 permits, details of their fleets, types of products offered and boarding locations in 2017.

Company Name	Product offered	Number of permits	Fleet	Boarding or mooring locations
<b>Tadoussac autrement</b>	Schooner tour offering geographical, historical and ecological interpretation of Tadoussac	1	<b>Schooner</b> 1 * 45	Tadoussac
<b>ÉcoMaris</b>	Sailing School	1	<b>Sailboats</b> 1 * 29	Outside the Marine Park, Tadoussac and other
<b>Accès Plongée Saguenay</b>	Scuba Diving	1	<b>Small Boat</b> 1 * 12	
<b>Voile Mercator</b>	Sailing School	5	<b>Sailboats</b> 1 * 11 + 2 * 8 + 1 * 10	Tadoussac, L'Anse-Saint-Jean, other
<b>Damacha Yachting</b>	Sailing School	2	<b>Sailboats</b> 1 * 6 + 1 * 8	Tadoussac, other, outside the Marine Park
<b>Otis Aventures inc.</b>	Transport of passengers and divers	1	<b>Inflatables</b> 1 * 12	Tadoussac
<b>Formation nautique Québec</b>	Sailing School	2	<b>Sailboats</b> 1 * 6 + 1 * 7	Outside the Marine Park, Tadoussac and other
<b>Duvelnor</b>	Shuttle	3	<b>Cabin Cruiser</b> 3 * 12	Rivière-du-Loup, Île aux Lièvres, Île du Pot à l'Eau-de-Vie
<b>8 Companies</b>		<b>16</b>	<b>15 Boats, maximum capacity 198 passengers</b>	<b>12 Different boarding locations</b>

Table 11. Number and percentage of monthly excursions and passengers by Class 2 permit holders in the Marine Park in 2017.

Month	Number of excursions (Number of excursions of two to eight days in length)	%	Number of passengers	%
May	4 (3)	0.6	11	0.3
June	122 (18)	18.5	732	17.4
July	205 (18)	31.1	1404	33.4
August	204 (17)	31.0	1352	32.1
September	111 (9)	16.8	638	15.2
October	11	1.7	59	1.4
November	2	0.3	10	0.2
Total	659	100	4 206	100

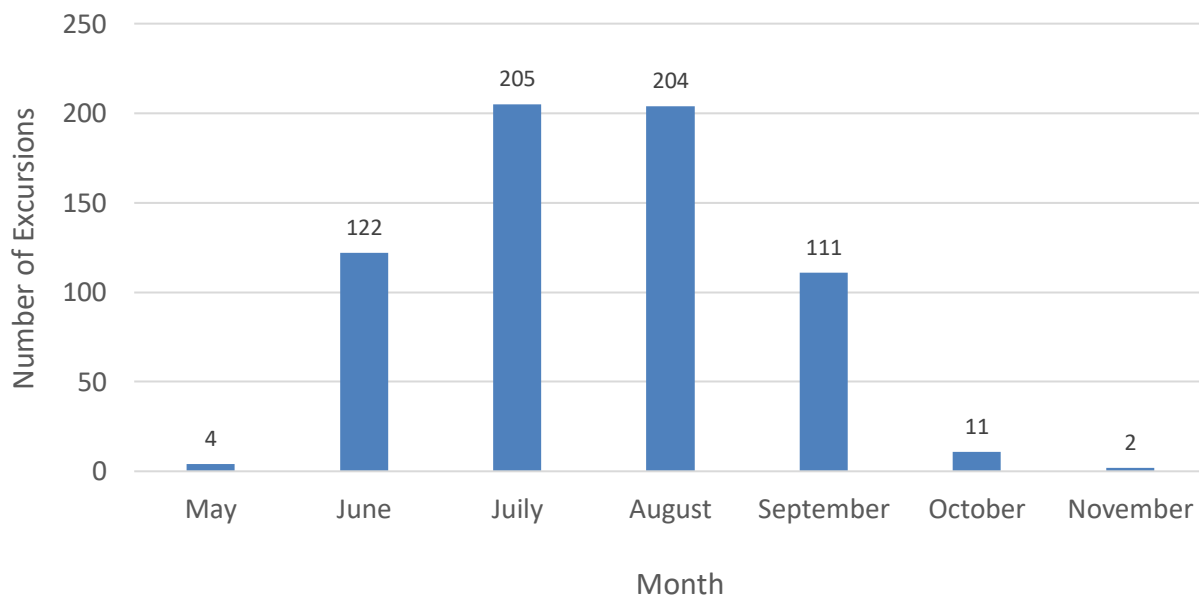


Figure 20. Number of monthly excursions carried out by Class 2 permit holders in the Marine Park in 2017.

### 3.1.6. Human-powered activities (Class 3 and recreational)

#### 3.1.6.1. Commercial (Class 3 permit)



Figure 21. Kayak Excursion © Jean-Louis Provencher, Parks Canada.

In 2017, 13 companies held permits for marine tours whose activities took place on a human-powered vessel (Class 3) (Table 12). Of these companies, three were not in service in 2017 and four did not operate on a regular basis in the Marine Park, but were instead based outside of the park and offered long duration expeditions during the summer.

Table 12. List of companies with Class 3 permits and departure locations for their activities in 2017.

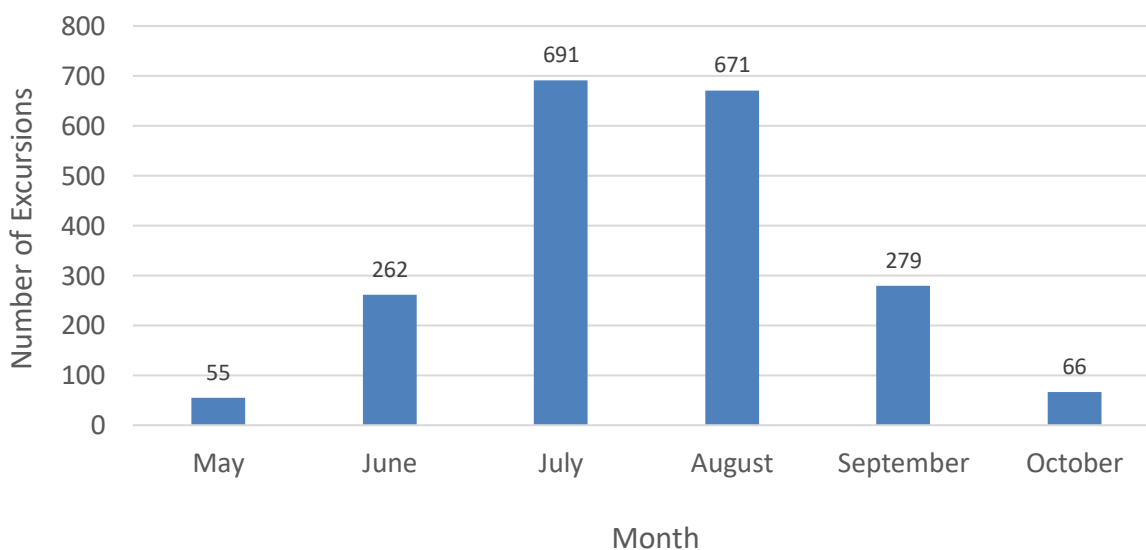
Company Name	Location
<b>Maikan Aventure</b>	Saguenay Fjord, Les Bergeronnes
<b>Les kayaks du Paradis</b>	Les Bergeronnes
<b>Mer et monde écotours</b>	Les Bergeronnes
<b>OrganisAction</b>	Saguenay Fjord
<b>Parc national du Fjord-du-Saguenay</b>	Baie-Éternité, Saguenay Fjord
<b>Fjord en kayak</b>	L'Anse-Saint-Jean, Saguenay Fjord
<b>Aventure Rose-des-Vents</b>	Sainte-Rose-du-Nord
<b>Katabatik-Aventure dans Charlevoix</b>	Charlevoix, Cap-à-l'Aigle, Saint-Siméon
<b>Centre de vacances Ferme 5 étoiles</b>	L'Anse-de-Roche, Saguenay Fjord
<b>Quatre Natures</b>	Saguenay Fjord
<b>Otis Aventures inc.</b>	Tadoussac
<b>Écho Aventures Tadoussac</b>	Tadoussac
<b>Kayak Latins du Nord</b>	Saguenay Fjord

In 2017, 2 024 excursions were carried out by Class 3 Permit holders in the Marine Park and 16 167 passengers took part in these excursions (Table 13). It should be noted that 35 of these excursions lasted over a day. The month of July held the most excursions with 691 (34.1%) and the most passengers with 5 943 (36.8%). The second busiest month was August with 671 excursions (33.2%) and 5 665 passengers (35.0%). Very few excursions occurred in May (<2.7 %) and October (<3.3 %) (Figure 22). These excursions essentially took place in the Saguenay Fjord, at the mouth of the Saguenay and in the Les Bergeronnes sector (Figure 23).

*Table 13. Number and percentage of monthly excursions and passengers by Class 3 permit holders in the Marine Park in 2017.*

Month	Number of excursions	%	Number of passengers	%
May	55	2.7	258	1.6
June	262	12.9	1 477	9.1
July	691	34.1	5 943	36.8
August	671	33.2	5 665	35.0
September	279	13.8	2 377	14.7
October	66	3.3	447	2.8
<b>Total</b>	<b>2 024*</b>	<b>100</b>	<b>16 167</b>	<b>100</b>

\* Including 35 excursions lasting two to seven days



*Figure 22. Number of monthly excursions carried out by Class 3 permit holders in the Marine Park in 2017.*

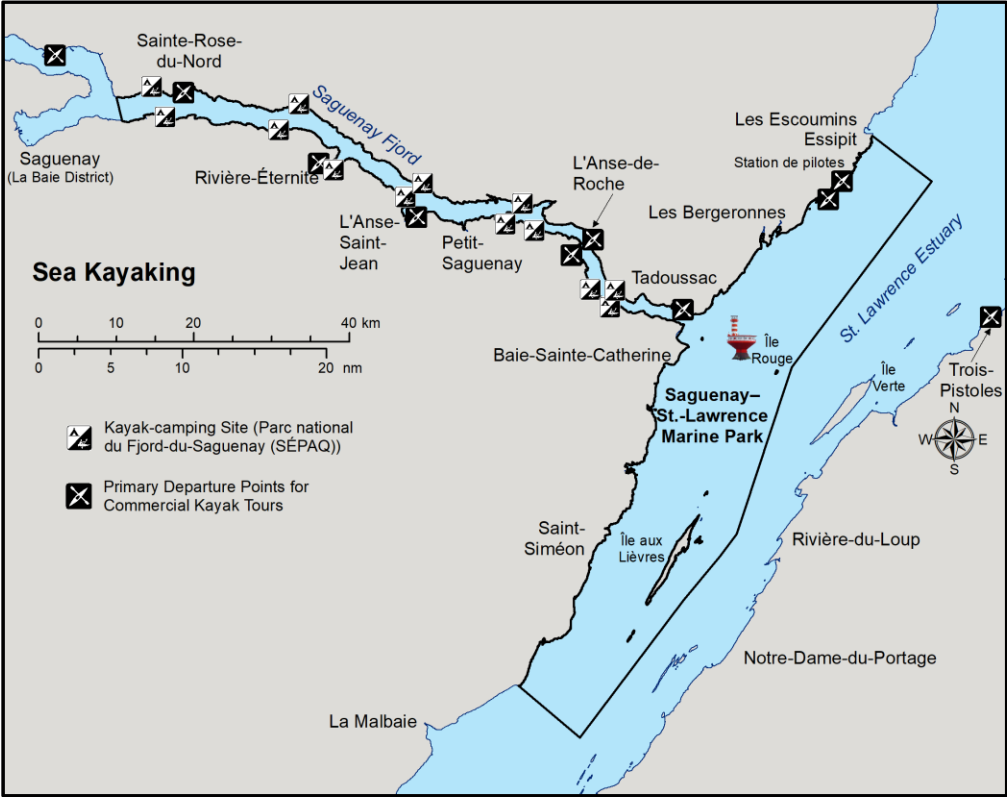
### *3.1.6.2. Human-powered recreational activities*

According to attendance data for kayak-camping sites in the *parc national du Fjord-du-Saguenay*, there were 270 overnight stays in 2017 (Table 14). The month of July was the busiest, with nearly 50% of all overnight stays. These

data are the only data available to quantify recreational kayaking activities in the Marine Park. Figure 23 indicates the location of kayak-camping sites. It is important to mention that owners of human-powered vessels can launch practically anywhere in the Marine Park. Nonetheless, the *Paradis Marin* and *Mer et monde écotours* sites, both located in Les Bergeronnes, as well as the *Village-Vacances Petit-Saguenay* situated at Anse-Sainte-Étienne, are recognized as important launch sites for kayaks due to the presence of private camp sites.

*Table 14. Number of overnight stays reserved on kayak-camping sites in the parc national du Fjord-du-Saguenay in 2017.*

Month	Number of nights	%
June	38	14.1
July	130	48.1
August	94	34.8
September	8	3.0
Total	270	100



*Figure 23. Location of kayak camping sites in the parc national du Fjord-du-Saguenay (Sépaq) and primary departure points of commercial tours for Class 3 permit holders in the Marine Park in 2017.*

### 3.1.7. Pleasure boating



*Figure 24. Pleasure craft in the Saguenay Fjord © Laurence Lévesque, Parks Canada.*

Table 15 presents the marinas situated in the study area along with the number of seasonal pleasure boats and the number of overnight stays booked by visiting pleasure boaters in 2017. A seasonal pleasure boater corresponds to a pleasure boater whose vessel is based in a marina located in the study area for the summer season. A visiting pleasure boater corresponds to a pleasure boater visiting for a limited time. Of the 10 marinas, five are located on the perimeter of the Marine Park and the other five are situated nearby, either on the South Shore of the St. Lawrence or upstream of the Marine Park in the Saguenay Fjord and in the Upper Estuary (Figure 25). The La Baie marina has the highest number of seasonal pleasure boaters (78), followed by Tadoussac (41), Rivière-du-Loup (40) and Cap-à-l'Aigle (40). The Tadoussac marina accommodates the highest number of seasonal pleasure boaters in the Marine Park, followed by the marina at L'Anse-Saint-Jean (30). As for overnight stays by visitors, the Tadoussac marina recorded the highest number in 2017 with 1 346. These overnight stays were registered to 650 boats, which translates to approximately two nights per boat. The second marina with the most overnight stays in 2017 was Cap-à-l'Aigle with 915. For two marinas, no visitor numbers were available. However, they represent few overnight stays due to difficult access or size. Furthermore, they are located outside the Marine Park. Other marinas are near the region, but were not considered as they are outside the study area. These include Chicoutimi, Bic, Rimouski, Rivière-Ouelle and Rivière-Portneuf.

According to visitor data for the Carrefour Maritime de Tadoussac in 2017 and the Club nautique de L'Anse-Saint-Jean in 2016, 68% of visiting boats were sailboats, while motorized vessels represented 32%. According to visitor

data from the Carrefour Maritime de Tadoussac in 2017, 80% of overnight stays in the region occurred in July (45%) and August (35%).

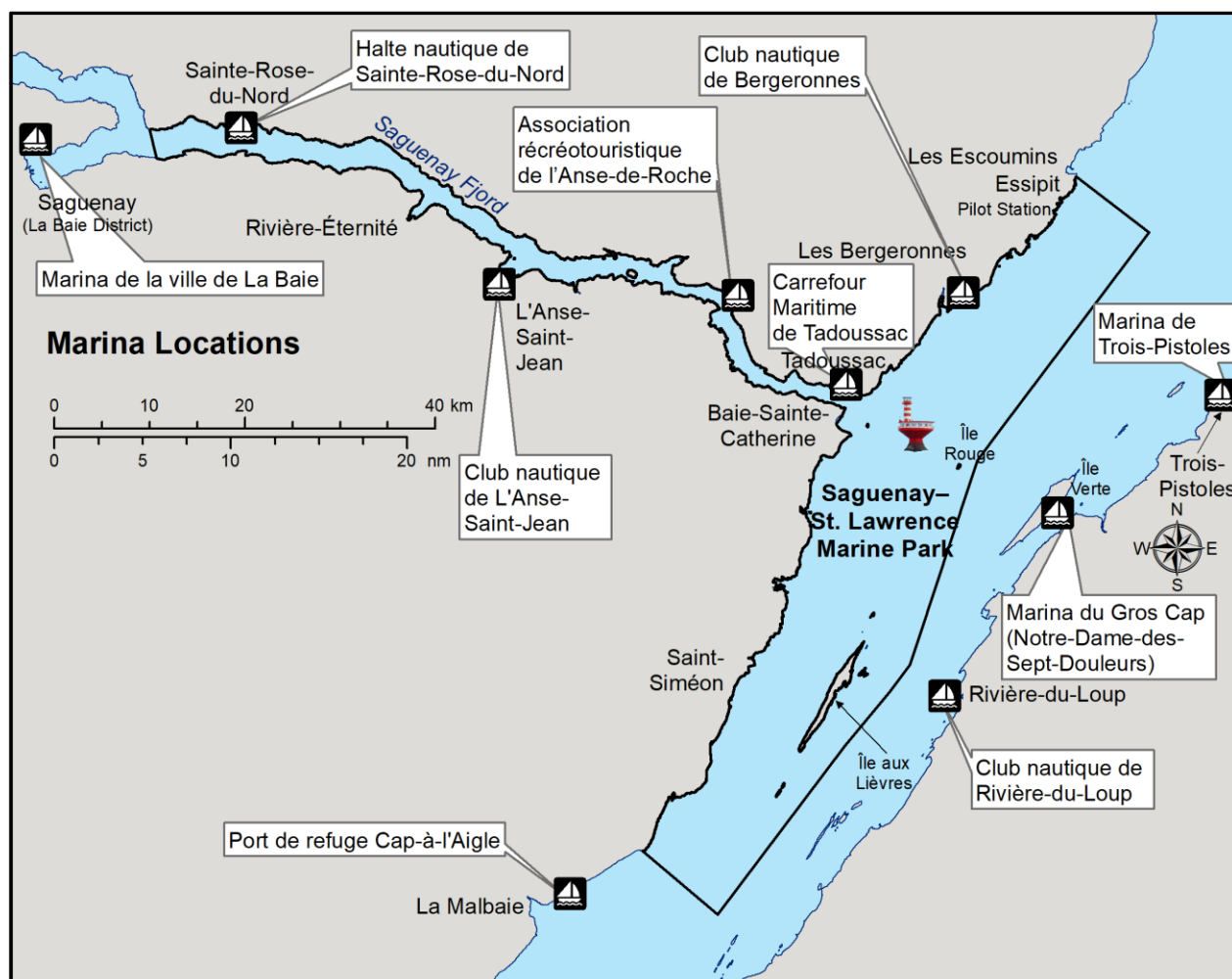


Figure 25. Location of marinas in the Saguenay–St. Lawrence Marine Park area.

*Table 15. List of Marinas Included in the analysis and number of seasonal and overnight stays recorded by visiting boats in 2017. Maximum values are in bold type. † Approximate data, \* 2015 Season data, \*\* 2016 Season data, nd= non-determined.*

Marina	Number of seasonal pleasure boats	Number of overnight stays by visiting pleasure boats
Carrefour Maritime de Tadoussac	41	<b>1 346</b>
Halte nautique de Sainte-Rose-du-Nord	0	100†
Club nautique de Bergeronnes	6	139
Association récréotouristique de L'Anse-de-Roche	28	79
Marina de La Baie	<b>78</b>	150†
Club nautique de Rivière-du-Loup	40	74*
Port de refuge Cap-à-l'Aigle	40	915
Club nautique de L'Anse-Saint-Jean	30	411**
Marina de Trois-Pistoles	12	nd
Marina du Gros Cap (Notre-Dame-des-Sept-Douleurs)	18	nd

The table 16 presents the place of origin of boats visiting the Tadoussac marina in 2013. The majority (57.4%) of visiting boats came from upstream of the Marine Park in the St. Lawrence, namely Québec City (32.4%), Montreal (18.5%), Ontario (4,5 %) and Charlevoix (2,0 %). Approximately one third (29.1%) came from marinas upstream of Tadoussac in the Saguenay. The remaining percentage (6%) of visiting boats came from downstream of the Marine Park, either the North Shore, the Gaspé Peninsula, the Maritimes or overseas.

*Table 16. Place of origin of visitors to the Tadoussac marina in 2013.*

Place of origin	Number of visiting boats	%
<b>Quebec City</b>	224	32.4
<b>Saguenay</b>	201	29.1
<b>Montreal</b>	128	18.5
<b>Lower St. Lawrence</b>	38	5.5
<b>Ontario</b>	31	4.5
<b>North Shore</b>	24	3.5
<b>United States</b>	14	2.0
<b>Charlevoix</b>	14	2.0
<b>Gaspé</b>	6	0.9
<b>France</b>	6	0.9
<b>Maritimes</b>	5	0.7
<b>Total</b>	<b>691</b>	<b>100</b>

The joint analysis of marina user data and the place of origin of visiting boats identifies the Upper Estuary, the North Shore and especially the Saguenay Fjord and its mouth as the areas most frequently used by pleasure boaters in the Marine Park (Figure 26).

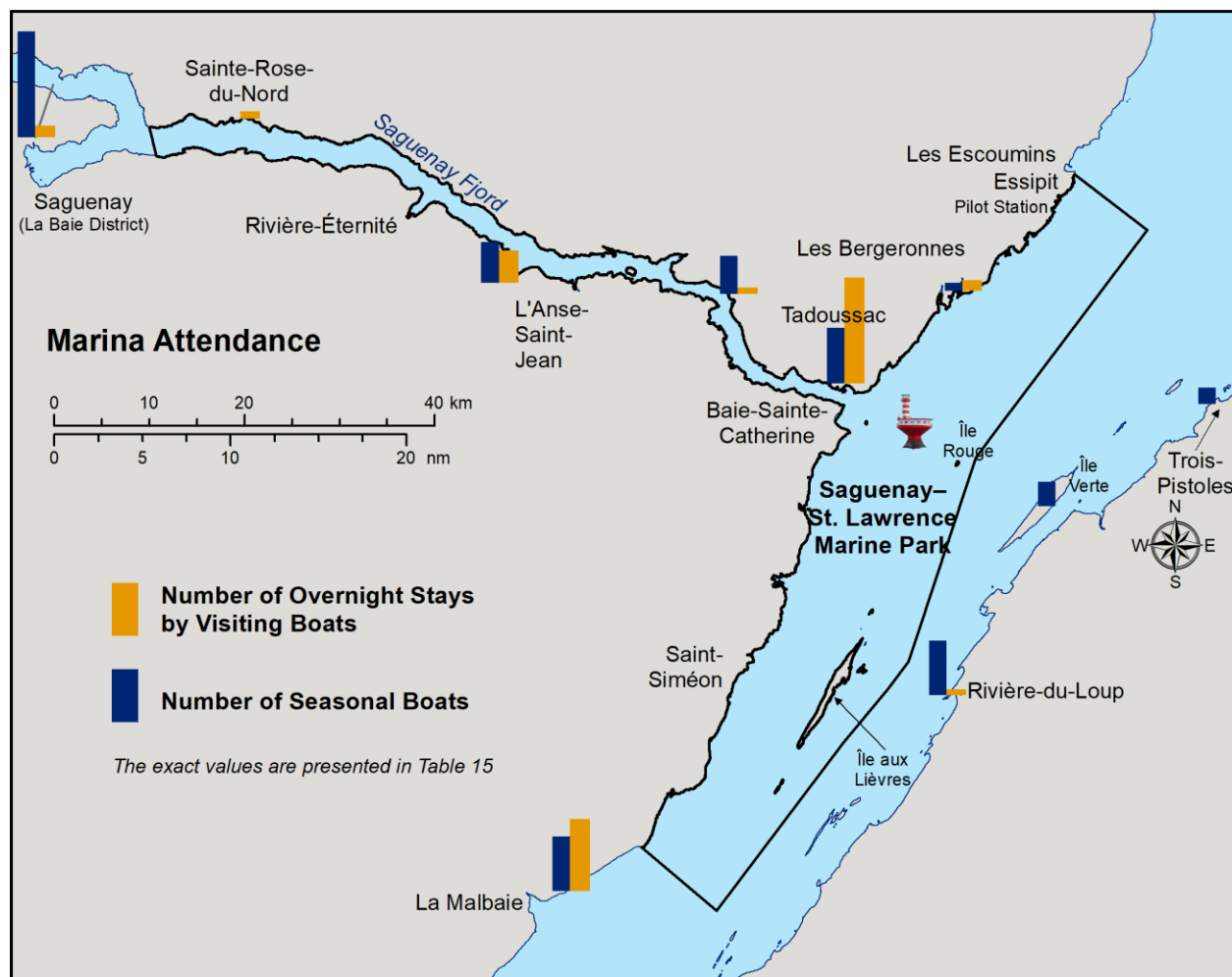


Figure 26. Map illustrating marina usage in the study area in terms of the number of overnight stays by visiting boats and the number of seasonal boats.

A preliminary analysis of pleasure boating carried out in various sectors based on data exposed in section 2.2.6.2 is contained in Annex 2. This analysis is presented essentially for its methodology and its potential for the continued monitoring of this navigation component of the Marine Park.

### 3.1.8. Maritime operations and other activities



*Figure 27. Transhipment of a pilot near Les Escoumins © Mélissa St-Onge, Parks Canada.*

This section includes barges, tugboats, commercial fishing vessels, research vessels, government vessels, vessels used for the transhipment of St. Lawrence pilots (pilot boats), military vessels and others. A total of 5619 transits were carried out by boats of this component (Table 17).

The pilot boat subcategory contributed the most to this navigation component with a total of 4 762 transits. The number of transits carried out is in the same order of magnitude as the sum of merchant vessels (4 545 transits) and cruise ships (225 transits) which nearly all embark or disembark one or two pilots. Pilots may also embark on other types of boats (for example on pleasure yachts).

In 2017, 91 commercial fishing days were carried out in the Marine Park (*Fisheries Agent from Fisheries and Oceans Canada, personal communication*). Only two species were commercially fished in the Marine Park in 2017, namely Atlantic halibuts and green sea urchins. It should be noted that in certain years, fishing vessels are used for other species, including sea snails and scallops, however this was not the case in 2017. For the sea urchin, 58 fishing days in spring (end of March to mid-May) were carried out by three boats and 29 fishing days in autumn (September to the end of October) were carried out by one boat. The areas targeted for sea-urchin fishing were essentially around Lark Reef, but also in the Île aux Lièvres area. Two vessels carried out four fishing days for Atlantic halibut in May. This species is fished in the Les Bergeronnes area. It should be noted that snow-crab fishing boats from Les Escoumins, although they conduct their activities beyond the limits of the Marine Park, navigate within the limits of the Marine Park as they travel to and from the wharf of Anse aux Basques.

We estimate that there are approximately 240 transits of crab-fishing vessels per year between Anse aux Basques and the South Shore plateau (*Pierre Léonard, personal communication*). In 2017, the crab-fishing season began on March 29.

*Table 17. Number and percentage of transits according to the subcategory of boats in the maritime operations and other activities component.*

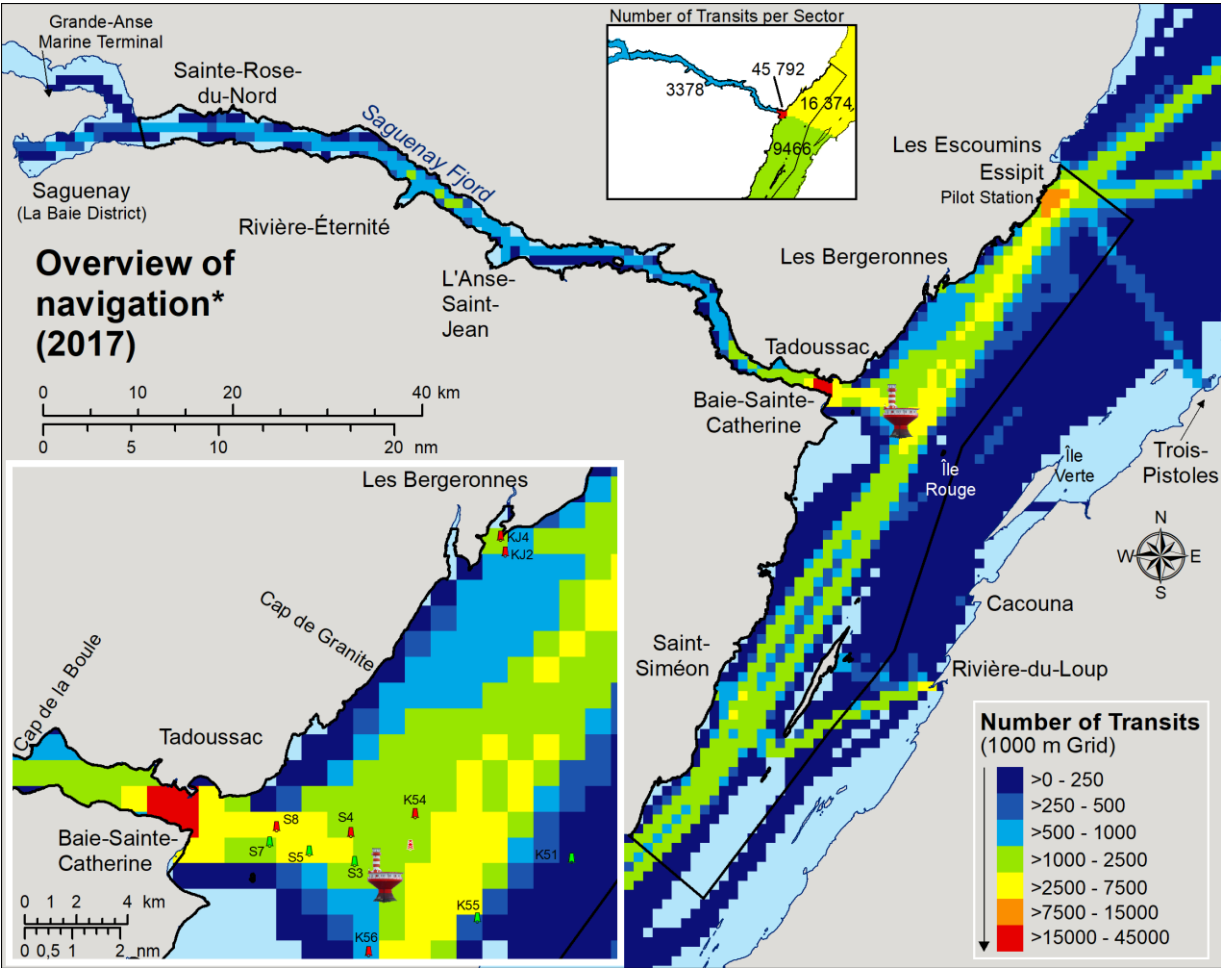
Month	Pilot Boat	Research	Tugboat, Dredge, Barge	Maritime Security	Fishing*	Other	Total	%	Sub-total (without pilot boat)	%
January	268	0	4	17	0	0	<b>289</b>	5.1	21	2.5
February	238	0	2	18	0	0	<b>258</b>	4.6	20	2.3
March	258	0	2	18	7	0	<b>285</b>	5.1	27	3.2
April	374	0	29	10	34	0	<b>447</b>	8.0	73	8.5
May	433	18	53	25	21	6	<b>556</b>	9.9	123	14.4
June	450	61	16	39	0	5	<b>571</b>	10.2	121	14.1
July	450	59	15	26	0	13	<b>563</b>	10.0	113	13.2
August	428	58	10	32	0	0	<b>528</b>	9.4	100	11.7
September	457	37	32	25	14	0	<b>565</b>	10.1	108	12.6
October	520	33	25	14	15	0	<b>607</b>	10.8	87	10.2
November	498	4	16	13	0	3	<b>534</b>	9.5	36	4.2
December	388	0	12	16	0	0	<b>416</b>	7.4	28	3.3
<b>Total</b>	<b>4 762</b>	<b>270</b>	<b>216</b>	<b>253</b>	<b>91</b>	<b>27</b>	<b>5 619</b>	<b>100</b>	<b>857</b>	<b>100</b>

\* Excludes snow-crab fishing

## 3.2. Overview

In this section, data presented by navigation component are grouped together to provide an overview of navigation activities in the Marine Park. This characterization is presented in a spatial format (Figure 28) and a quantitative format (Table 18).

As mentioned in previous sections, spatial data are limited for certain components. Thus, the map in Figure 28 excludes kayaking activities (commercial and recreational), fishing vessels, pleasure boating and a major portion of activities carried out by Class 2 permit holders. It is worth mentioning that contrary to the other maps, resolution of the analysis grid is 1000 m. Despite these limitations, the areas mostly used for navigation are easily identifiable, particularly the mouth of the Saguenay Fjord, the Pilot Station area, as well as the head of the Laurentian Channel, near the Prince Shoal Lighthouse.



\* With the exception of pleasure boating activities, human-powered vessels, commercial fishing vessels and a portion of commercial activities (Class 2)

Figure 28. Overview of navigation in the Saguenay–St. Lawrence Marine Park.

Table 18. Summary of the number of transits, excursions or overnight stays and percentage by component of navigation by month in 2017. Maximum values are in bold type. The level of confidence in these values is grouped into three categories (weak, average and excellent) for result interpretation.

Navigation component		Number of movements or overnight stays	Number of passengers	Number of transits, crossings, excursions or overnight stays*(and percentage) by month											Level of confidence	
				J	F	M	A	M	J	J	A	S	O	N		D
Merchant shipping		4 545	na	246 (5.4)	242 (5.3)	253 (5.6)	366 (8.1)	426 (9.4)	426 (9.4)	405 (8.9)	417 (9.2)	408 (9.0)	477 (10.5)	<b>501 (11.0)</b>	382 (8.4)	Excellent
Domestic and international cruises		225	na	2 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)	9 (4.0)	19 (8.4)	19 (8.4)	20 (8.9)	76 (33.8)	<b>80 (35.6)</b>	0 (0.0)	0 (0.0)	Excellent
Ferries		43 785	na	3 243 (7.4)	3 012 (6.9)	3 217 (7.3)	3 330 (7.6)	3 518 (8.0)	3 872 (8.8)	4 470 (10.2)	<b>4 559 (10.4)</b>	4 028 (9.2)	3 704 (8.5)	3 425 (7.8)	3 407 (7.8)	Excellent
Marine Mammal Watching at Sea (Class 1)		6 658	287 108	0 (0.0)	0 (0.0)	0 (0.0)	4 (0.1)	160 (2.4)	716 (10.8)	1 940 (29.1)	<b>2 447 (36.8)</b>	1 080 (16.2)	308 (4.6)	3 (0.0)	0 (0.0)	Excellent
Other Commercial Activities at Sea (Class 2)		659	4 206	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (0.6)	122 (18.5)	<b>205 (31.1)</b>	204 (31.0)	111 (16.8)	11 (1.7)	2 (0.3)	0 (0.0)	Excellent
Human-powered Activities	Class 3	2 024	16 167	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	55 (2.7)	262 (12.9)	<b>691 (34.1)</b>	671 (33.2)	279 (13.8)	66 (3.3)	0 (0.0)	0 (0.0)	Excellent
	Kayak-camping (Overnight)*	270	na	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	38 (14.1)	<b>130 (48.1)</b>	94 (34.8)	8 (3.0)	0 (0.0)	0 (0.0)	0 (0.0)	Excellent
Pleasure boating (Overnight)**		3 214	na	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	21 (0.6)	264 (8.2)	<b>1 435 (44.7)</b>	1 132 (35.2)	362 (11.3)	0 (0.0)	0 (0.0)	0 (0.0)	Average
Maritime operations and other activities***		5 619	na	289 (5.1)	258 (4.6)	285 (5.1)	447 (8.0)	556 (9.9)	571 (10.2)	563 (10.0)	528 (9.4)	565 (10.1)	<b>607 (10.8)</b>	534 (9.5)	416 (7.4)	Average
Subtotal (Class 1, 2 and 3 Permits)		9 341	307 481	0 (0.0)	0 (0.0)	0 (0.0)	4 (0.0)	219 (2.3)	1 100 (11.8)	2 836 (30.4)	<b>3 322 (35.6)</b>	1 470 (15.7)	385 (4.1)	5 (0.1)	0 (0.0)	Excellent

\* Here an overnight stay corresponds to a platform reserved on the kayak-camping sites in the *parc national du Fjord-du-Saguenay*.

\*\* The percentages in July and August correspond to those identified by the Tadoussac marina. The remaining percentage was divided among the other months according to those derived from Chion et al. (2009).

\*\*\* Excluding snow-crab fishing

### 3.3. Comparison of navigation in the Marine Park from 2007 to 2017

The present report is the second characterization of navigation activities in the Saguenay–St. Lawrence Marine Park. The first one, achieved by Chion *et al.* (2009), focused on the period from May to October 2007. Table 19 is a comparison between numbers presented in the two reports, when possible. Whenever applicable, methodological differences between the two reports will be presented to ensure a better interpretation of the results. Section 3.3.1 will deal specifically with the comparison of marine mammal watching at sea.

For the merchant shipping component, the portrait from 2007 included barges and tugboats. In the present report, barges and tugboats were included in the component “Maritime Operations and Other Activities” in order to conform to the methodology of the Maritime Information System (MIS), developed by the *St. Lawrence Economic Development Council* and *Innovation maritime*. From May to October 2007, the volume of merchant vessel transits (including barges and tugboats) was 3 135. In 2017, when adding the number of transits carried out by barges and tugboats, 2 707 transits were completed, representing a drop of 13.7% for this period. For the entire year, the numbers are 4 450 for 2007 and 4 757 for 2017, representing an increase of 6.9%. There was therefore a slight increase in the number of transits by merchant vessels in 2017 when compared to the 2007 report. According to MIS, there was also a slight increase in shipping traffic in 2017 as compared to the 2012-2016 period (SIM, 2017).

The number of domestic and international cruises more than doubled in the Marine Park from 2007 to 2017. This component of maritime traffic has been experiencing strong growth over the last decade, however the number of transits is low (5.0%) in comparison to merchant shipping. This activity is nevertheless very concentrated in time and in space. Nearly 70% of all cruises take place in September and October and represent approximately 30% of all large vessel transits in the Saguenay Fjord.

The number of crossings carried out by ferries in the Marine Park from May to October increased by 13.7% in 2017 in comparison to 2007. The main difference between 2007 and 2017 for this component can be explained by the inactivity of the Trois-Pistoles–Les Escoumins ferry in 2007. However, the number of crossings (552) is low compared to that of the Tadoussac and Baie-Sainte-Catherine ferry.

With the exception of commercial activities at sea (Class 1 and 2 permits) for which a more detailed analysis will be presented in the following subsection, it is not possible to make a valid comparison of the other components of maritime traffic between the characterizations of 2007 and 2017 given the methodological differences or the level of confidence in the data.

Table 19. Summary comparison of navigation activities according to the 2007 portrait (Chion et al.,2009, main values) and the present characterization.

Navigation Component	2007		2017		Variation (%)	
	May to October	Full Year	May to October	Full Year	May to October	Full Year
<b>Merchant shipping</b>	3 135	4 450	2 559 + 148* = 2 707	4 545 + 212* = 4 757	-13.7 %	6.9 %
<b>Domestic and international cruises</b>	108	nd	223	225	106.5 %	na
<b>Ferries</b>	21 247	nd	24 151	43 785	13.7 %	na
<b>Marine Mammal Watching at Sea (Class 1 Permit) + Other Commercial Activities at Sea (Class 2 Permit)**</b>	13 070	13 070	6 651 (Class 1) + 653 (Class 2) = 7 304	6 658 (Class 1) + 659 (Class 2) = 7 317	See Section 3.3.1	
<b>Human-powered Activities (Class 3 and Recreational)</b>	nd	nd	2 024	2 024	na	na
<b>Pleasure boating</b>	9 277	nd	na	na	na	na
<b>Maritime operations and other activities</b>	3 662	nd	3 189***	5 312***	-12.9 %	na

na: Not applicable

nd: No data

\*: Data on the number of transits carried out by tugboats and barges were added in order to compare with the 2007 estimate.

\*\* : In 2007, the category “excursions at sea of more than 10 days” included Class 1 and 2 that exist since 2017. In 2007, the value was an estimate, while in 2017 the number originates from a register completed by each permit holder.

\*\*\* Data on the number of transits carried out by tugboats, barges and commercial fishing vessels were removed in order to compare with the 2007 estimate.

### ***3.3.1. Changes in the number of marine mammal watching at sea excursions between 2007 and 2017 in the Saguenay–St. Lawrence Marine Park***

Marine mammal watching at sea are a management priority for the Marine Park (APC and MDDEP, 2010; SSLMP, 2011). The number of excursions and details of the fleet (number of boats, capacities, types of vessels, etc.) constitute essential information for the sustainable management of this activity, for the evaluation and modelling of impacts on marine mammals as well as on Marine Park ecosystems. A new permit classification has been introduced as the result of modifications to the Marine Activities in the Saguenay–St. Lawrence Marine Park Regulations, implemented on January 1, 2017. Prior to these changes, companies offering marine mammal watching at sea excursions were issued with an *Excursions at Sea of More Than 10 Days* permit, along with companies offering other activities, such as sailing schools. Since 2017, two distinct classes of permit were created, Class 1 and Class 2. The estimated number of excursions, 13 070 (lower limit = 12 131; upper limit = 14 015), for the period from May to October 2007 thus included excursions that did not target marine mammals (Chion *et al.*, 2009). In order to compare those numbers with the present report, it is essential to combine the values for permits of Class 1 and 2 (See Table 19). However, this summary comparison has its limitations. In order to have a more representative comparison, two companies must be excluded from the equation. As for the first one, Croisières Marjolaine, which has since become Promotion Saguenay, the numbers are not comparable given the difference in the definition of an excursion in 2007 and 2017. In 2017, their number of excursions was reported as days of operation, while in 2007 they were estimated according to the definition of an excursion (from departure to docking at the wharf). For the second, Société Duvetnor, which held Class 1 and 2 permits in 2017, the numbers available for 2007 do not make a distinction between activity categories (observation at sea and shuttle to Île aux Lièvres). Among those holding a Class 1 Permit, these two companies conduct the lowest numbers of marine mammal watching at sea. Therefore, their removal from the comparative analysis between 2007 and 2017 does not limit the comparison of the total number of marine mammal watching at sea excursions. Table 20 presents the results of the comparison between 2007 (Chion *et al.*, 2009) and 2017, while taking into account the elements mentioned above. Data on the frequency of use of the Baie-Sainte-Catherine Wharf are also presented. As a reminder, the data from 2007 were estimated (central value) with a confidence interval (lower and upper limits) and those presented in the present report are real numbers obtained from a register of activities at sea completed by each permit holder.

Table 20. Variation in the number of marine mammal watching at sea excursions and frequency of use of the Baie-Sainte-Catherine wharf from 2007 to 2017 for small and large vessels.

	Number of excursions			Frequency of use of the Baie-Sainte-Catherine wharf
	2007 <sup>†</sup> (Estimated values, Chion <i>et al.</i> , 2009)		2017 (Reported values)	Variation (%)
<b>Large Vessels*</b>	Lower Limit	1 827	<b>759</b>	-58.5
	Central Value	<b>2 042</b>		-62.8
	Upper Limit	2 326		-67.4
<b>Small Vessels**</b>	Lower Limit	8 331	<b>5 372</b>	-35.5
	Central Value	<b>8 959</b>		-40.0
	Upper Limit	9 486		-43.4
<b>Total ***</b>	Lower Limit	10 158	<b>6 131</b>	-39.6
	Central Value	<b>11 001</b>		-44.3
	Upper Limit	11 812		-48.1

\* Data from Croisières Marjolaine (2007) and Promotion Saguenay (2017) have been excluded.

\*\* Data from Société Duvetnor (2007 and 2017) have been excluded. Furthermore, new inflatable vessels with a capacity of 60 people operating in the Marine Park have been included in the Small Vessels category since 2017.

\*\*\* Data from Croisières Marjolaine (2007), Promotion Saguenay (2017) and data from Société Duvetnor (2007 and 2017) have been excluded.

<sup>†</sup> Data from companies holding an Excursion at Sea of More Than 10 Days Permit not targeting marine mammals have been excluded.

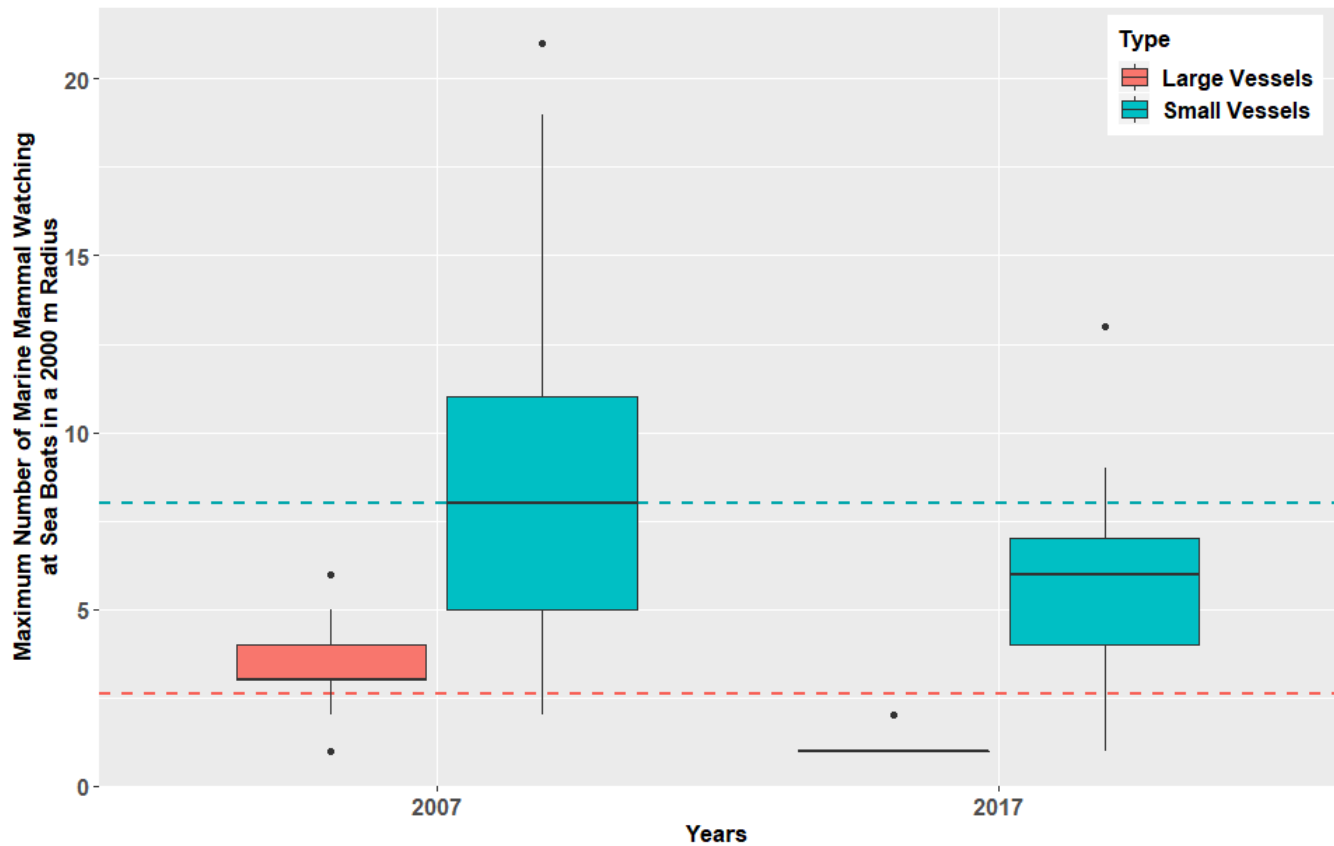
The number of marine mammal watching tours at sea decreased significantly between 2007 and 2017. However, methodological differences (estimated values as opposed to reported values) are not conducive to precisely quantifying the observed decline. Available data allow us to estimate that the number of marine mammal watching tours at sea in the Marine Park appear to have dropped by 44.3% (min=39.6, max=48.1) between 2007 and 2017 (Table 20). These values have a similar order of magnitude as the drop observed in the use of the Baie-Sainte-Catherine Wharf over the same period (40.2%). The drop is much more significant for large vessels (between 58.5% and 67.4%) than for small vessels (between 35.5% and 43.4%) (Table 20). Tours departing from Tadoussac and Baie-Sainte-Catherine showed the most significant drop. In 2007, according to estimates of Chion *et al.* (2009), approximately 53% of tours used Tadoussac and Baie-Sainte-Catherine as boarding locations. Four companies were based at these locations with a total of 21 vessels, including four large vessels. In 2017, there were two companies with 15 vessels and these boarding locations accounted for 41.6% of tours carried out in the Marine Park. Part of the drop observed from 2007 to 2017 may also be attributable to the cessation of operations departing from Saint-Siméon in 2015. The number of tours estimated and reported for departures from Rivière-du-Loup, Les Bergeronnes, Les Escoumins and in the Saguenay remains relatively stable between 2007 and 2017.

The consolidation of tour companies and the rationalization of offered excursions, mainly in Tadoussac–Baie-Sainte-Catherine, led to a decrease in the number of excursions. The following table presents changes observed to the fleet of large and small vessels between 2007 and 2017 (Table 21). First finding: there were four fewer companies in 2017 than in 2007, representing a drop of 30.1%. There were fewer large vessels in 2017 (-33.3%) and the total maximum capacity for passengers of these vessels was lower (-22.1%). However, the average capacity per vessel was higher. There were also fewer small vessels in 2017, but the difference is less marked than it is for large vessels, at 11.4%. Yet, the maximum and average capacity of small vessels was greatly superior in 2017 (29.5% and 56.3%). As for the offer, there were therefore fewer vessels in 2017 than in 2007, these vessels were on average larger and apportioned through a smaller number of companies.

*Table 21. Number of companies, vessels and maximum capacity in 2007 and in 2017 for marine mammal watching at sea.*

		2007	2017	Variation (%)
<b>Number of companies</b>		13	9	-30.1
<b>Large Vessels</b>	Number of boats	9	6	-33.3
	Maximum capacity (number of passengers)	2 588	2 017	-22.1
	Average capacity (maximum capacity/number of boats)	288	336	16.7
<b>Small Vessels</b>	Number of boats	35	31	-11.4
	Maximum capacity (number of passengers)	547	763	39.5
	Average capacity (maximum capacity/number of boats)	16	25	56.3
<b>Total</b>	Number of boats	44	37	-15.9
	Maximum capacity (number of passengers)	3 135	2 780	-11.3
	Average capacity (maximum capacity/number of boats)	71	75	5.6

The decline in the number of whale watching tours can also be observed through the analysis of the maximum concentrations of boats by excursion on observation sites (the number of tour boats in a 2 km radius). Figure 29 illustrates the distribution of maximum concentrations of tour boats by excursion sampled on large boats departing from Tadoussac in July and August 2007 and 2017 in the WWAM database.



*Figure 29. Distribution of maximum concentrations of large and small tour vessels per excursion sampled aboard large vessels from Tadoussac in July and August from 2007 to 2017 as part of the whale watching activities monitoring program. The pointed lines represent averages for the period from 2007 to 2017.*

Available numbers indicate a certain stability or a very slight increase in recent years of the number of visitors (demand). From May 1 to October 31 2005, a period deemed representative of the situation in 2007, the total number of visits of the maritime discovery circuit (which includes marine mammal observation activities at sea and excursions into the Fjord) carried out by tourists is estimated at 274 036 (SOM, 2006). In 2017, according to the activity registers of Class 1 Permit holders, a total of 287 180 passengers participated in these activities. According to these numbers, there was a slight increase (4.8%) of visitors partaking in marine mammal observation activities at sea between 2005 and 2017. Yet, since the comparison is based on estimated and reported values, it is difficult to confirm such a trend. However, it is possible to conclude that the number of visitors either increased slightly or remained relatively stable, while the number of boats and excursions did drop. This stability or slight

increase in the demand, paired with the consolidation of the offer and larger vessels has led to a decrease in the number of excursions and the optimisation of movements.

### 3.4. Characterisation of navigation at the mouth of the Saguenay Fjord

The mouth of the Saguenay fjord is the sector where maritime traffic is the most intense in the Marine Park. The mouth of the Saguenay Fjord is also an area of high residence for the St. Lawrence beluga whales (Lemieux Lefebvre *et al.*, 2012). From 2003 to 2016, beluga whales were present at the mouth of the Saguenay fjord on an average of 86% of the surveyed days and 48% of the observation time from June to August (Conversano *et al.*, 2017). This is why the Saguenay–St. Lawrence Marine Park Management Plan (APC and MDDEP, 2010) identified the intensity and growth of maritime traffic in the St. Lawrence Estuary, especially at the mouth of the Saguenay, constituted major issues for public safety, the environment and conflicts of use. The monitoring and the characterization of navigation activities specific to the mouth of the Saguenay Fjord are therefore important. Here are a few key facts related to navigation in this geographically limited sector:

- In 2017, nearly 3 000 excursions left from Tadoussac or Baie-Sainte-Catherine. Several shuttles operated between these two homeports to board or disembark passengers. In certain years and at certain periods, the mouth of the Saguenay is used as a marine mammal observation sector (Martins *et al.*, 2018).
- In 2017, over 40 000 crossings were carried out on a continual basis and year round.
- Mandatory transit area to enter or leave the Saguenay Fjord.
- In the study area, approximately 40% of pleasure boater overnight stays were registered in Tadoussac.
- Launching ramps are situated on either side of the mouth of the Saguenay fjord, namely in Tadoussac and Baie-Sainte-Catherine.
- Several government vessels (*e.g.*, Parks Canada, Canadian Coast Guard) or research vessels (*e.g.*, GREMM) are based in Tadoussac.
- Sea urchin landings are based in Tadoussac and the fishing sectors are partially situated in the mouth of the Saguenay (notably the rim of Lark Reef).

The following figures draw up a summary of maritime traffic at the mouth of the Saguenay from 2007 to 2017. Figure 30 illustrates the decrease in the use of the Baie-Sainte-Catherine Wharf by small and large marine mammal observation at sea tour boats and the average number of these boats observed through visual scans from Pointe-Noire in 2007 and 2017. This result has already been discussed in the preceding section.

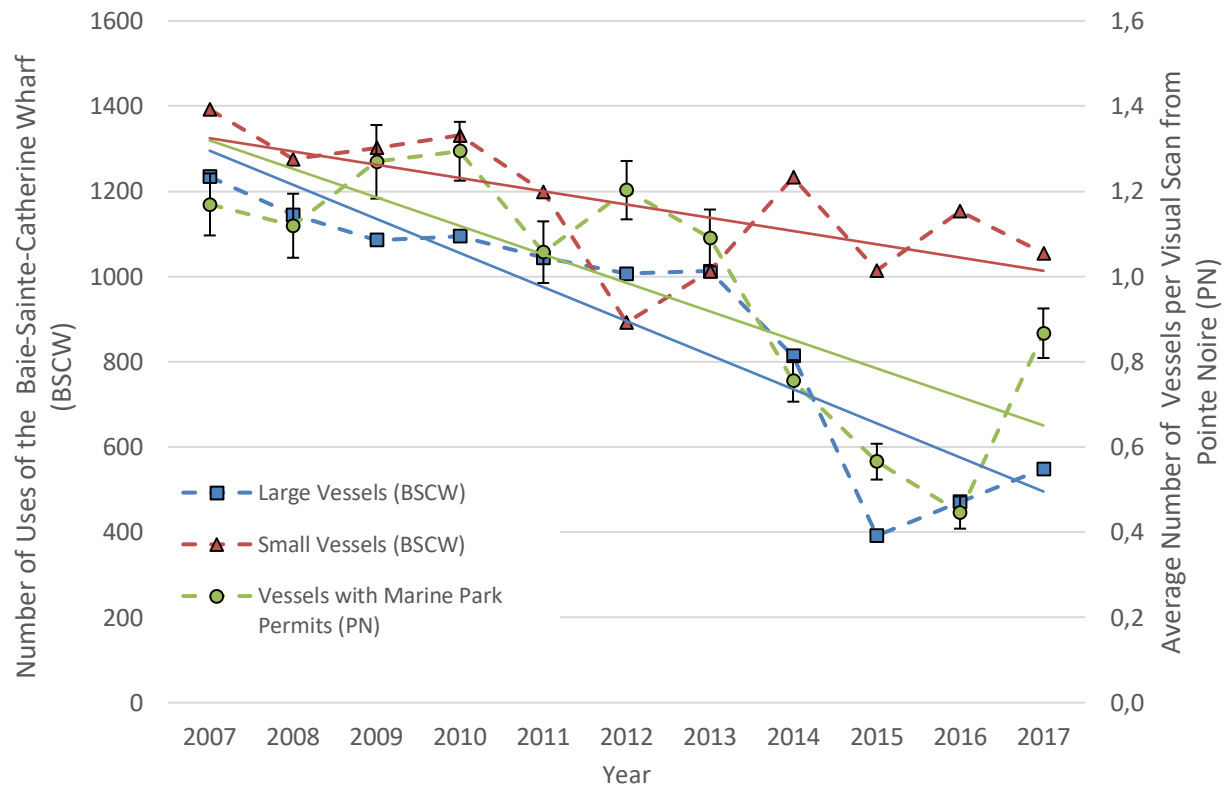


Figure 30. Number of uses of the Baie-Sainte-Catherine wharf (BSCW) by large tour vessels (in blue) and by small tour vessels (in red) and average number of vessels possessing Marine Park Activity at sea permits per visual scan from Pointe-Noire (PN) (in green, modified from Ménard et al., 2018) for the months of June to August 2007 to 2017. The solid lines represent simple linear regression lines and the whiskers, 95% confidence intervals.

As for pleasure boating, the trend is not as clear as that of tour boats at sea observing marine mammals. However, available data indicates a slight decline in the use of the mouth of the Saguenay by pleasure boaters (Figure 31). Pleasure boating activity was at its peak in 2010 and 2012 at the mouth of the Saguenay.

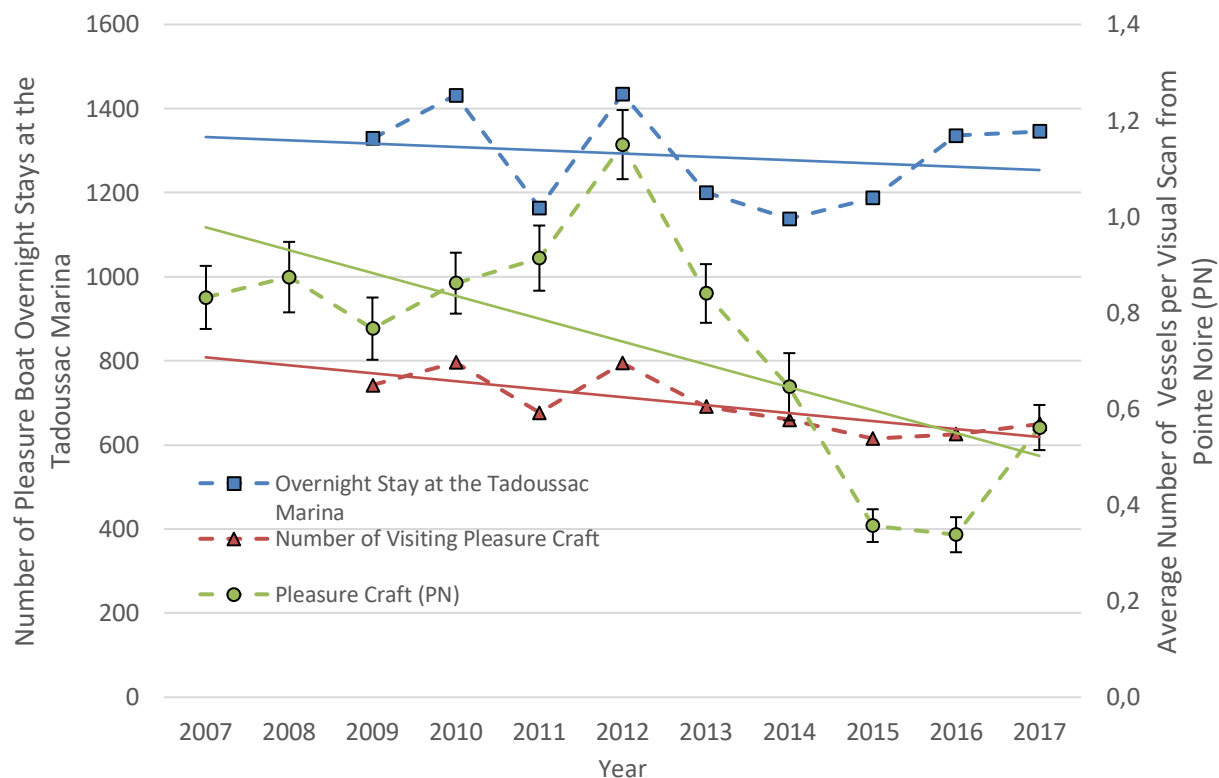


Figure 31. Number of overnight stays (in blue) and of visiting pleasure craft (in red) at the Tadoussac marina from 2009 to 2017 according to data supplied by the marina and average number of pleasure craft per visual scan from Pointe-Noire (PN) (in green, modified from Ménard et al., 2018) for the months of June to August 2007 to 2017. The solid lines represent simple linear regression lines.

Use of the mouth of the Saguenay Fjord by kayakers diminished from 2007 to 2017 (Figure 32). This drop can be largely explained by the closure in 2013 of a kayak company that was operating from Baie-Sainte-Catherine. It is also possible that this activity became less popular in recent years, thus witnessing a trend change.

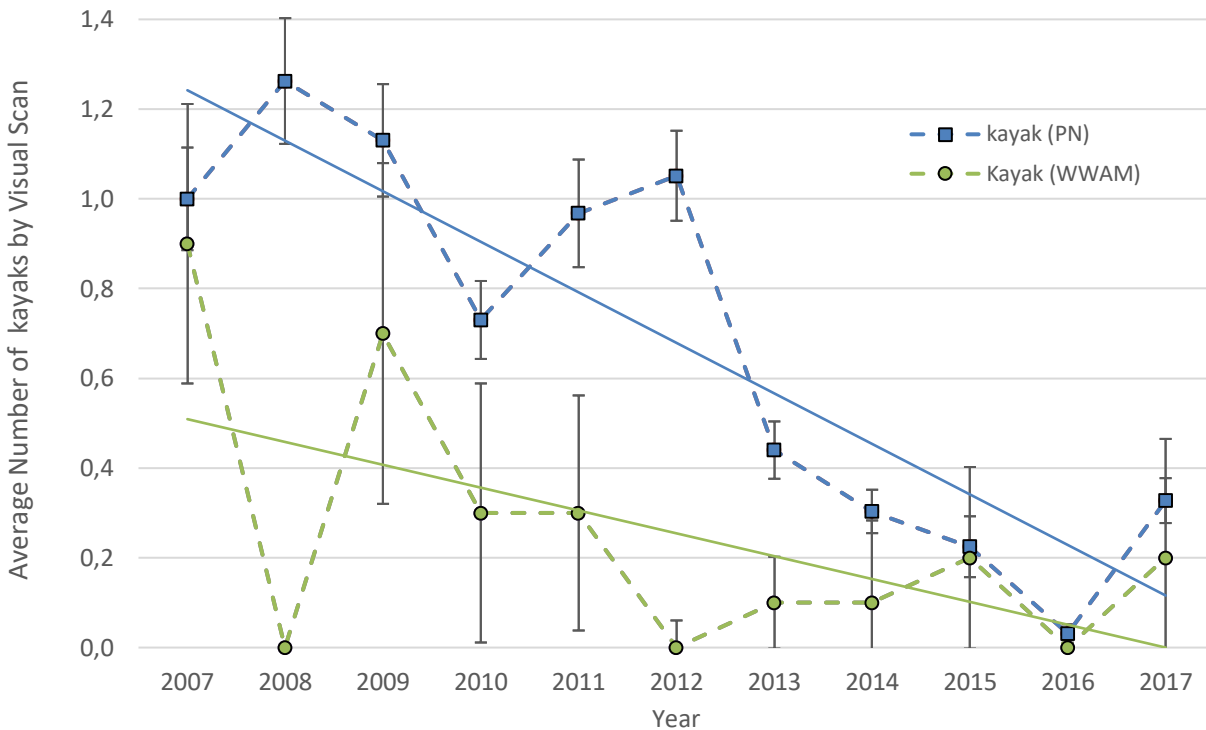


Figure 32. Average number of kayaks per visual scan from Pointe-Noire (PN) (in blue, modified from Ménard et al., 2018) and derived from the whale watching activities monitoring (WWAM) at the mouth of the Saguenay for the Months of June to August 2007 to 2017. The solid lines represent simple linear regression lines.

The number of merchant vessels that made their way to one of the wharves upstream of the Saguenay Fjord fluctuates from year to year and shows no trend (Figure 33). It should be noted that the change observed between 2015 and 2017 may be methodological in nature since the data source is different. For domestic and international cruises, the trend is constant and increasing, from eight ships in 2007 to 51 in 2017 (Figure 33). It is also worth mentioning that the values presented in Figure 33 do not represent the number of passages at the mouth of the Saguenay but rather that of docking operations. Therefore, the number of docking operations must be multiplied by two to obtain the number of passages. Also, it is important to consider that certain ships of domestic and international cruises only make an incursion into the Fjord (two passages through the mouth of the Saguenay Fjord without any docking operations) while transiting through the St. Lawrence, and some may also anchor in Tadoussac. Thus, in 2017, domestic and international cruise ships completed 114 passages through the mouth of the Saguenay.

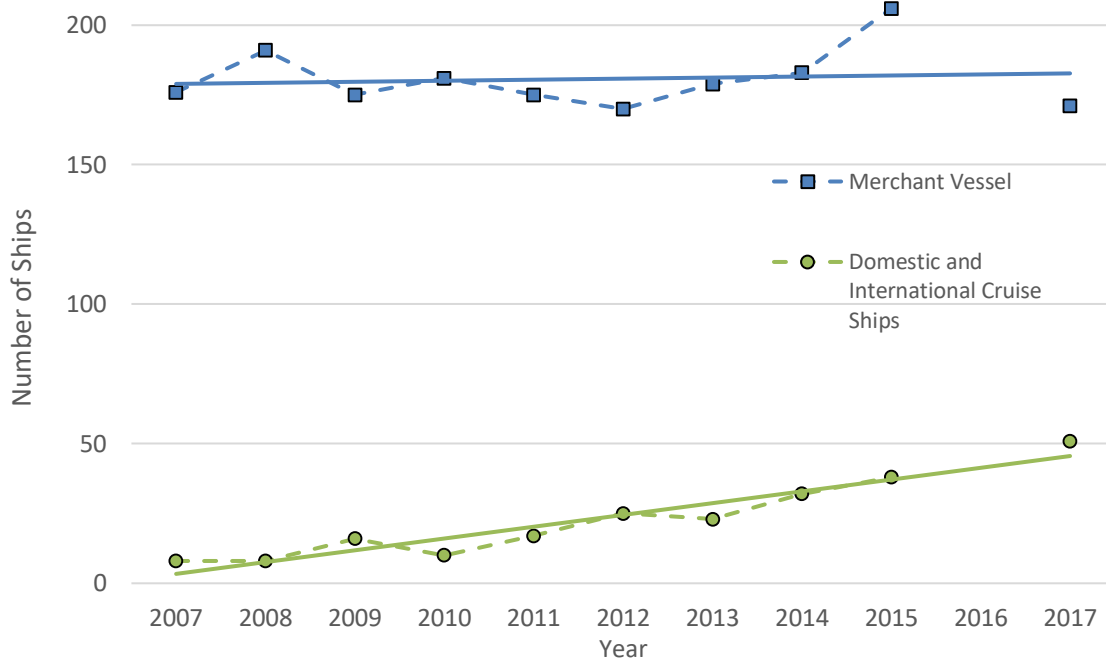


Figure 33. Number of merchant vessels (blue) and domestic and international cruise ships (in green) that docked at one of the wharves upstream of the Saguenay Fjord (Grande-Anse, La Baie and the ville de Saguenay cruise ship terminal) from 2007 to 2017. The solid lines represent simple linear regression lines. Numbers from 2007 to 2016 come from WSP/GCNN (2016). The numbers for 2017 are from the present report.

The intensity of navigation activities varied differently from 2007 to 2017 for the various components. For marine mammal watching tours and kayaks, the drop is significant. For pleasure craft, ferries and merchant vessels, the situation is relatively stable. For domestic and international cruise ships, the trend is clearly rising. Globally, there were fewer passages through the mouth of the Saguenay in 2017 than in 2007, but maritime traffic remains intense and this is by far the most used sector of the Marine Park. Changes in the fleet of marine mammal activities at sea tour boats are the main reason behind this decline. Changes are expected in the upcoming years if development projects that are presently in the planning stages become reality. The sum of these projects will change the navigation portrait for this sector. Projects that are presently under development include domestic and international cruise ships at Ville de Saguenay and Tadoussac, the North Shore Saguenay Marine Terminal, development projects put forward by various industrial promoters for the Grande-Anse Wharf and the new ferries between Tadoussac and Baie-Sainte-Catherine.

## 4. Conclusion

The present report characterizes navigation activities in the Marine Park for 2017. The different navigation components were characterized in quantitative, descriptive, spatial and temporal terms. The analysis highlighted a considerable heterogeneity between the components, sectors and periods of the year. The mouth of the Saguenay Fjord and the head of the Laurentian Channel are sectors where navigation is the most intense. During the summer, particularly in August, navigation activity is at its peak due to tourism activities that include pleasure boating and marine mammal watching at sea.

An important result of this report is the decline in the number of marine mammal watching at sea excursions that was detected when comparing numbers from 2017 with those from 2007 (Chion *et al.*, 2009). Despite methodological differences in data acquisition for these two years, this reduction is considered real. The consolidation of various companies, the increase in vessel capacity and the stability of the demand resulted in the decrease of the number of marine mammal watching at sea excursions in the Marine Park. These major changes in the industry translate into gains in conservation by a reduction of disturbance and a reduction in underwater noise associated with this navigation component. These changes also translate into an improvement of the visitor experience. Indeed, the decrease of the concentration of vessels on marine mammal observation sites can enhance the conservation of marine mammals and contribute to improving the experience on the water.

The continued monitoring of navigation activities in the Saguenay–St. Lawrence Marine Park is essential in order to provide a better framework for the management of these activities and to limit their effects on ecosystems. A series of recommendations is proposed in the following section to improve the monitoring of navigation activities in the Marine Park and to follow the evolution of these activities.

# 5. Recommendations

It is recommended that the characterization of navigation in the Marine Park be updated at least every five years. Due to the fact that navigation is a major issue and is not limited to one administrative jurisdiction, such as the Marine Park, it is recommended that the work and effort (analysis and data acquisition) be harmonized with other federal ministries (Fisheries and Oceans Canada and Transport Canada) in order to cover a larger territory than solely the Marine Park. A characterization of navigation covering the St. Lawrence Estuary or the critical habitat of the St. Lawrence beluga whale population should be considered. Parks Canada’s contribution could focus more on components subjected to the permit system that stems from Marine Activities in the Saguenay–St. Lawrence Marine Park Regulations. Such an approach would avoid effort duplication.

The following table lists recommendations for the continued monitoring of navigation activities in the Marine Park, by component (Table 22). It is recommended that the same categories be maintained in order to facilitate comparisons from one report to the next.

Table 22. Recommendations for the continued monitoring of maritime traffic in the Saguenay–St. Lawrence Marine Park.

Maritime Traffic Component	Recommendations
<b>Merchant Shipping</b>	Continue AIS logging and data storage as it is presently done and consider a partnership with the Canadian Coast Guard in order to obtain AIS data for the Saguenay Fjord and other areas that are not well covered. Continue the use of INNAV to obtain transit numbers.
<b>Domestic and International Cruises</b>	Continue AIS logging and data storage as it is presently done and consider a partnership with the Canadian Coast Guard in order to obtain AIS data for the Saguenay Fjord and other areas that are not well covered. Continue the use of INNAV to obtain transit numbers.
<b>Ferries</b>	Continue AIS logging and data storage as it is presently done and ensure follow up with representatives of the various ferry companies in order to obtain their annual statistics.
<b>Marine Mammal Watching Activities at Sea (Class 1 permit)</b>	Maintain the activities at sea register and promote the installation of an AIS system on the various boats. Pursue monitoring of marine mammal watching activities at sea.
<b>Other Commercial Activities at Sea (Class 2 permit)</b>	Maintain the activities at sea register and promote the installation of an AIS system on the various boats.
<b>Human-powered Activities (Class 3 and Recreational)</b>	Maintain the activities at sea register. Include a section for recreational kayaking in the survey proposed below for pleasure boating. Reservations for kayak-camping sites in the <i>parc national du Fjord-du-Saguenay</i> are a good indicator of the volume of recreational kayakers in the Fjord, so retain this type of monitoring with the Sépaq.
<b>Pleasure Boating</b>	Conduct a survey in the various marinas in order to obtain an up-to-date profile of visiting and seasonal pleasure boaters. See the proposition in Annex III. The number of overnight stays and the number of seasonal visitors, which are relatively easy to obtain, could be an interesting and constant way of monitoring pleasure boating in terms of total volume. In years when a report on navigation is produced, set up a land-based observation project dedicated to pleasure boating in the different key sectors (Section 2.2.6.2) and ensure that there is a sufficient sample to repeat the analysis proposed in Annex II.
<b>Maritime Operations and Other Activities</b>	Continue to use INNAV data to obtain the number of transits. Establish a partnership agreement with Fisheries and Oceans Canada agents in order to obtain a yearly summary of the number of fishing days for each type of fishery in the Marine Park and data from the Vessel Monitoring System (VMS). Request that all fishing vessels that carry out their activities in the Marine Park have a functioning VMS aboard.

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# ANNEX I: Methodological details for the spatial analysis of the *Marine Mammal Watching at Sea (Class 1 Permit)* Component

Use of the territory by vessels conducting marine mammal watching at sea is variable from one year to the next (Martins *et al.*, 2018). However, the activity takes place essentially in the Lower Estuary and at the mouth of the Saguenay fjord and fluctuates depending on the abundance and distribution of marine mammals. In order to provide a representative characterisation of the territory used by marine mammal watching at sea excursions in the Marine Park and not specific to the year 2017, a decision was made to use data from the period of 2015 to 2017. The purpose of this strategy was also to increase the size of the spatial dataset.

AIS and WWAM data (GPS tracks recorded at one-minute interval) were used for the spatial analysis of this maritime traffic component. For AIS data, only excursions with complete trajectories and with positions at one-minute intervals were used. An initial data selection was made in order to ensure a representative number of positions per excursion. This number was variable depending on the duration of the excursion and the reception frequency of the data (AIS class A or B). Positions were then interpolated in a linear fashion at a pace of one minute between all continuous positions with a maximum gap of two minutes. It was also validated that the first and last position of each excursion were at the wharf. The positions (point format) of a given excursion were transformed into a trajectory (line format). For excursions carried out by *Promotion Saguenay*, as no spatial data were available, trajectories were created and minute-by-minute points were generated from the departure schedules to better represent true trajectory. Then the entire set of positions ( $n = 508\ 610$ ) and trajectories ( $n = 3881$ ) of complete excursions were adjusted ( $p$ ) by the values ( $N$ ) of the activity logs of the companies ( $i$ ) using the formula:

$$p_i = N_i/n_i$$

The adjustment has the effect of correlating the sample with the real number. Spatial analyses were carried out using the position in order to illustrate the residence time (kernel-type analysis), and using the trajectories in order to calculate the number of passages or excursions in a 500 m resolution grid.

## ANNEX II: Overview of an exploratory and preliminary analysis of pleasure boating in different sectors

A linear mixed-effects model was used with data described in sections 2.2.6.1 and 2.2.6.2 in order to observe the variation in the number of pleasure craft per 30-minute interval (response variable) according to the different sectors (explicative variable). The analysis was conducted with the *lmer* function of the *lme4* library (Bates *et al.*, 2015). These sectors are the mouth of the Saguenay Fjord (Pointe-Noire), Sainte-Marguerite Bay, L'Anse-Saint-Jean, Cap-de-Bon-Désir, Cap à l'Est and Cap-à-l'Aigle. The time of day (morning or afternoon) and time of the week (weekday or weekend) were also included as explicative values. The sampling day (date) was included as a random effect.

According to data from the study period, results are near 2.81 [2.00 – 3.63] pleasure craft per 30-minute interval for the sector at the mouth of the Saguenay Fjord, which is the busiest sector for pleasure boaters. Next, in decreasing order of usage, are Cap-à-l'Aigle and Cap à l'Est, Cap-de-Bon-Désir, L'Anse-Saint-Jean and Sainte-Marguerite Bay. There were also more pleasure craft in the afternoon (+ 0.42) and on the weekend (+ 0.30). However, most results are not significant due to the sampling effort which was very low for certain sectors, namely those covered by the methodology described in section 2.2.6.2. The inference of these results is thus limited. The methodology may be used in upcoming years with a larger volume of data in order to compare the intensity of maritime traffic by pleasure craft in different areas of the Marine Park.

*Table 23. Result of the analysis by linear mixed-effects model on the number of passages of pleasure craft per 30 minutes period in different sectors. Bold type values are significant at the threshold  $\alpha=0.05$ .*

Fixed Effects	Pleasure Boating (number of pleasure craft per 30 minute interval)		
	Estimate	Confidence Range	p-value
<b><i>y-intercept</i></b> <b>(Pointe-Noire, Morning, Week)</b>	2.81	2.00 – 3.63	<b>&lt;0.001</b>
<b>Afternoon</b>	0.42	-0.13 – 0.96	0.13
<b>Weekend</b>	0.30	-0.83 – 1.43	0.60
<b>Sainte-Marguerite Bay</b>	-1.61	-2.23 – -0.99	<b>&lt;0.001</b>
<b>L'Anse-Saint-Jean</b>	-1.47	-2.81 – -0.13	<b>0.04</b>
<b>Cap-de-Bon-Désir</b>	-1.02	-2.39 – 0.35	0.14
<b>Cap à l'Est</b>	-0.77	-2.14 – 0.61	0.28
<b>Cap-à-l'Aigle</b>	-0.72	-1.91 – 0.47	0.22

# ANNEX III: Proposed model of survey for a study of pleasure boat usage of the Saguenay–St. Lawrence Marine Park

## Update of the study of pleasure boat usage of the Saguenay–St. Lawrence Marine Park

All types of maritime vessels (cargo ships, sailboats, kayaks) represent a potential impact on Saguenay–St. Lawrence Marine Park ecosystems. A portrait of navigation in the Marine Park was carried out in 2007 for the Parks Canada Agency to guide management objectives according to the various activities at sea. This year, the Parks Canada Agency proceeded with an update of these data, along with an enhancement of data related to pleasure boating, which represents a major component of maritime traffic that is on the rise in the Marine Park.

In order to better understand your activity and to factor it into our work at Parks Canada, we require your collaboration to characterize your visit of the Marine Park. The information that you provide is crucial in establishing the most realistic portrait possible of pleasure boating activity in the park. This information will enable us to later improve the quality of the visitor experience, thanks to a better understanding of your fields of interest. We will be able to make the information that you require concerning the Marine Park more readily available. Finally, we will also be able to improve marine mammal protection.

Data collected will be handled in total confidentiality. On another note, we would like to apologize if certain questions appear repetitive.

Date:	Time:	Place:
<b>Pleasure Boater Profile</b>		
<b>1. What is your place of residence?</b> ..... (city, state country) <b>2. What type of vessel are you using?</b> <input type="checkbox"/> Cruiser <input type="checkbox"/> Former Fishing Vessel <input type="checkbox"/> Inflatable Vessel <input type="checkbox"/> Sailboat <input type="checkbox"/> Launch <input type="checkbox"/> Human-powered Vessel <input type="checkbox"/> Other: ..... <b>3. What is the homeport of your vessel?</b> ..... <input type="checkbox"/> <u>Seasonal</u> : your place of residence, at least for the summer, is in the Marine Park region. <input type="checkbox"/> <u>Visitor</u> : you are passing through the Marine Park region.	<b>4. Do you know that you are near or in a marine protected area?</b> <input type="checkbox"/> YES <input type="checkbox"/> NO <b>5. Do you know the boundaries of the Marine Park?</b> <input type="checkbox"/> YES <input type="checkbox"/> NO <b>6. Do you know that there exist regulations for activities at sea while navigating in this zone?</b> <input type="checkbox"/> YES <input type="checkbox"/> NO	
<b>Recurrence</b>		
<b>7. Is this your first time navigating in the Marine Park region?</b> <input type="checkbox"/> YES <input type="checkbox"/> NO <b>8. How long will you be staying (visitors)/season (residents) in the Marine Park?</b> From ..... to .....		

(if you answered YES to question 7, skip directly to question 13)

9. How long have you been navigating in the park?

.....

10. During which period(s) (indicate the month(s)) of the year do you navigate the most in Marine Park waters?

.....

11. On average, how many outings per year do you undertake in the Marine Park?

.....

12. On average, how long does an outing in the Marine Park last?

- ☐ Less than an hour
- ☐ Between one and two hours
- ☐ Between two and five hours
- ☐ An entire day
- ☐ Several days: ..... days

**Spatial Usage**

***For Visitors:***

13. Where did you leave from at the beginning of your voyage? What is your final destination?

From..... To.....

14. What are the stages (marinas) of your visit in the Marine Park?

.....

15. On the adjacent maps, draw your visit of the Marine Park using the following key:

- Route
- Stop Areas (anchoring or holding a position)
- Sites that were particularly appreciated or that you would like to visit with your boat.

***For Residents:***

13. Where do you launch and haul out your boat?

From..... To.....

14. Where do you normally leave from and return to when you head out on the water?

From ..... To .....

16. On the adjacent maps, draw your visit of the Marine Park using the following key:

- Route
- Stop Areas (anchoring or holding a position)
- Sites that you particularly appreciate visiting in the Marine Park.

17. Why did you choose those sites (*several possible answers*)

- ☐ Beauty of the Scenery
- ☐ Tranquillity
- ☐ Marine Mammal Observation
- ☐ Pleasant to navigate
- ☐ Fishing
- ☐ Dive Site
- ☐ Other (specify) : .....

18. Other comments: