Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

MARINE INVESTIGATION REPORT M16C0137

Collision

Passenger vessel C03097QC
Les Bergeronnes, Quebec
29 August 2016

Canada

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The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

Marine Investigation Report M16C0137

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Summary

On 29 August 2016, at approximately 1223 Eastern Daylight Time, the rigid-hull inflatable passenger vessel C03097QC known as the *Aventure 6*, with 9 people on board, collided with an unidentified object while conducting a marine mammal observation tour off Les Bergeronnes, Quebec. One passenger and the operator were thrown overboard, subsequently recovered, and later treated for hypothermia. Another passenger was treated for injuries caused by the impact. The 3 injured persons were taken by ambulance from the dock in Les Bergeronnes to Les Escoumins, Quebec. The vessel's outboard engines were damaged.

Le présent rapport est également disponible en français.

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1.0 Factual information

1.1 Particulars of the vessel

Table 1. Particulars of the vessel

Common name of vessel	*Aventure 6*
Official number	C03097QC
Province of registry	Quebec
Flag	Canada
Type	Passenger
Materials	Fibreglass, aluminum, neoprene / Hypalon (chlorosulfonated polyethylene synthetic rubber)
Gross tonnage	5.00 tons
Length, registered	8.46 m
Built	2002, Polaris Inflatable Boats Canada Ltd., Surrey, BC, Canada
Model (hull number)	Neptune PRH 840 ZYP (ZYPDR24PH202)
Propulsion	Two 225-horsepower outboard 4-stroke gasoline engines
Passengers	8 (maximum of 12)
Crew	1
Registered owner/operator	Croisières Essipit, Les Escoumins, Quebec, Canada

1.2 Description of the vessel

The C03097QC (*Aventure 6*) is a rigid-hull inflatable passenger boat designed to carry a maximum capacity of 9500 pounds, or 28 persons. The hull and deck of the vessel are made of fibreglass while the all-around, 60 cm (24-inch) diameter pneumatic tube is made of mixed synthetic materials and is segregated into 5 independent air chambers.

An aluminum and fibreglass conning station stands just ahead of the stern and includes a seat, the helm, engine controls and surveillance displays, a very high frequency (VHF) radiotelephone equipped with digital selective calling (DSC) and dual-watch capabilities, a global positioning system (GPS), an electronic chart display, a radar, instrument controls and short-circuit breakers, and a lifebuoy on the roof. The conning station is also fitted with a safety lanyard that can be attached to the operator while the vessel is in operation: if the lanyard is pulled from its connector switch, the vessel's propulsion plant will shut down.

The passenger seating area is located ahead of the conning station, occupying approximately two-thirds of the vessel. When the vessel operator is seated at the conning station, visibility ahead of the vessel is reduced by the seated passengers. For this reason, the operator of the *Aventure 6* would typically stand while operating the vessel.

Twin outboard engines, providing a combined 450 horsepower, propel the vessel (Figures 1 and 2). Depending on its various loading conditions, the vessel has a freeboard of 67 to 78 cm in salt water.

Figure 1. Stern and conning station of the *Aventure 6*

Figure 2. Starboard side and bow of the *Aventure 6*

1.3 Vessel modifications

When the *Aventure 6* was delivered to the owner in 2002, it was fitted with a single inboard engine driving a single propeller. A stability verification was subsequently performed by an independent marine expert under the supervision of a marine safety inspector from Transport Canada (TC).

In 2008, the owner contracted a naval architecture firm to evaluate the feasibility of carrying out various modifications to its fleet of rigid-hull inflatable passenger boats, during which an initial inclining experiment was conducted. These modifications mainly included replacing the single inboard engine with twin outboard engines. This freed up space behind the console, which was moved back by 0.838 m (33 inches). With the extra space made ahead of the console, an additional bench was installed to enable the carrying of additional passengers.

The naval architecture firm confirmed that the modifications were viable in terms of both vessel stability and safety. The entire fleet, including the *Aventure 6* and its sister vessels, was modified in accordance with the firm's evaluation but no subsequent stability verification was conducted. Although TC was provided with a copy of the feasibility study and acknowledged the initial inclining experiment documents by establishing operational limits for a capacity of 12 passengers,[1] it remained unaware that the modifications had in fact been done. TC did not oversee the work carried out and did not confirm that the modifications were made in accordance with the pertinent rules, standards, and regulations.

In the past, the *Aventure 6* and its sister vessels had lost a few lifebuoys at sea; the yacht-type holding straps used to secure the lifebuoys to the vessel were not suitable for withstanding the winds, vibrations, and bouncing that occur during excursions at sea. In order to prevent any further loss of lifebuoys, the stowage arrangements throughout the fleet were modified to include a combination of nylon self-locking cable ties and synthetic rope (Figure 3).

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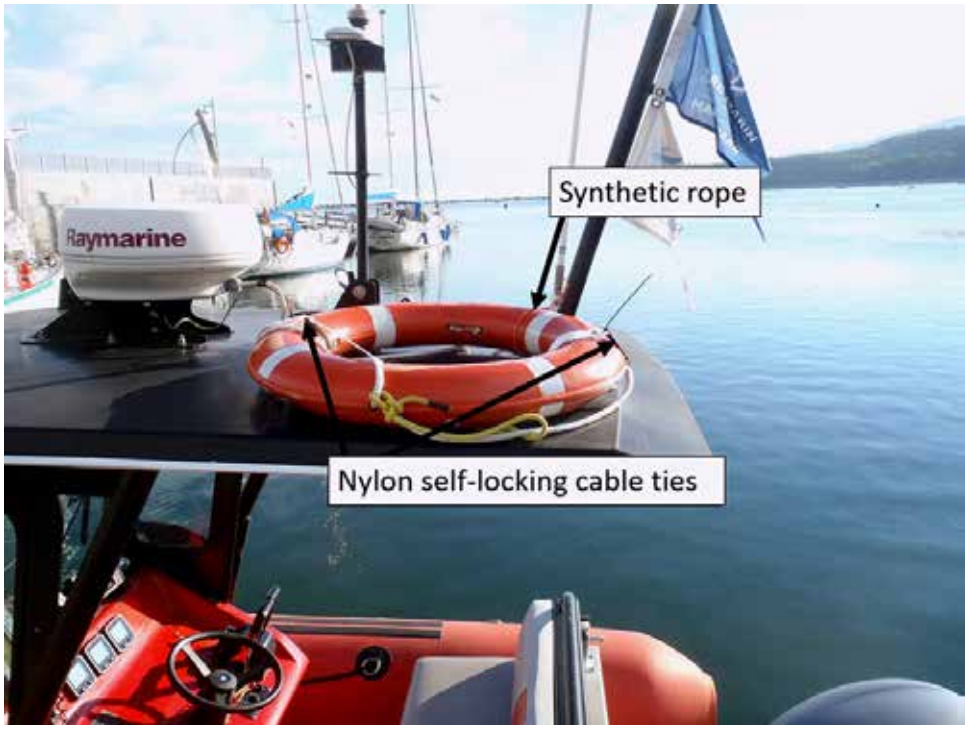
1 For the *Aventure 6*, the operational limits consisted of maximum wind speeds with gusts of 25 knots and maximum wave heights of 1 m.

Figure 3. Lifebuoy stowage arrangement



1.4 History of the voyage

On 29 August 2016, at 0859,[2] the *Aventure 6* departed the dock in Les Bergeronnes, Quebec, for its first marine mammal observation tour of the day. The vessel returned to port at 1104 and the passengers disembarked.

Shortly thereafter, the operator supervised the boarding of a new group of 8 passengers. Each passenger was wearing a Mustang flotation jacket and water-resistant pants. After the passengers were seated, the operator delivered the mandatory pre-departure safety briefing. At 1125, the vessel left the dock for its 2nd tour of the day. The engine's safety cut-off lanyard remained wrapped around the helm and the engine ignition keys.

From 1140 to 1219, the *Aventure 6* idled in a marine mammal observation zone near multiple blue whales, approximately 3 nautical miles (nm)[3] off Les Bergeronnes (Appendix A).

At 1219, the operator left the observation zone and piloted the *Aventure 6* toward Buoy S3, located off Tadoussac, Quebec, 5.3 nm to the southwest, because a herd of seals had been reported in that area. The vessel departed at a speed of 11.88 knots.[4] As the distance to the nearest vessel was 0.8 nm, the operator began to increase speed while standing behind the helm. The water depth was about 150 m. At this time, some passengers observed a whale

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2 All times are Eastern Daylight Time (Coordinated Universal Time minus 4 hours).

3 One nautical mile is equal to 1852 m, or 6080 feet.

4 All speeds are speed over the ground, unless otherwise stated.

breaking the water's surface about 100 m ahead and crossing the bow of the vessel, moving from port to starboard. None of the passengers informed the operator of this observation.

At 1223:24,[5] as the *Aventure 6* accelerated through 21.6 knots, the bow of the vessel hit an unidentified object, causing a sudden hard deceleration and jump of the bow. The impact and rapid change of speed threw 1 passenger overboard, while the operator's head hit the conning station's windshield. Almost simultaneously, the engines' skegs[6] collided with the same object, inducing a jump of the stern that threw the operator against the port side of the conning station and then overboard. At the same time, the collision triggered the automatic shutdown of both outboard engines.[7] The engines' throttle handles remained in the clutched-in position, at about half of their range in the ahead direction. The 7 passengers remaining on board were thrown against the vessel's deck, seats, and structures. Shortly afterward, some passengers heard a loud blowing sound close to the vessel, similar to the typical noise made by an exhaling whale.

Following the collision, the *Aventure 6* continued ahead on its inertia (without propulsion), gradually slowed over a distance of about 100 m, and eventually became adrift. The passengers on board attempted to use the VHF radio to call for help and pressed the red "distress" key on the VHF unit.

By 1225:44, because no response had been received on the VHF radio, one passenger used a cellphone to dial 911, while another tried to restart the engines. The 911 dispatch centre in Rimouski, Quebec, took the call and, at 1227, the 911 operator alerted the Canadian Coast Guard (CCG) Maritime Rescue Sub-Centre Québec, Quebec. A search-and-rescue cutter was dispatched from Tadoussac. Meanwhile, the passenger and operator in the water attempted to swim toward the vessel.

At 1228, one of the passengers brought the engines' throttle handles back into neutral and managed to restart the starboard engine. The passenger then manoeuvered the *Aventure 6* beside the 2 persons in the water. At 1229:30, the passenger was brought back on board. At 1230:35, the operator was brought on board with some difficulty, sustaining arm and shoulder injuries in the process.

With the assistance of the passengers on board, the operator resumed his position at the conning station. At 1232, he restarted the port engine. After unsuccessful attempts to contact the company's shoreside personnel via VHF channel 11, the operator succeeded in contacting the Saguenay–St. Lawrence Marine Park authorities on VHF channel 8. The operator told the

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5 All times that include seconds were sourced from the vessel's GPS and from 911 call recordings.

6 The skeg of each engine consisted of a small aluminum fin protruding under the engine's lower unit, or gearbox (Figure 1).

7 The outboard engines on the *Aventure 6* are designed to automatically turn off the spark ignition upon detection of a high-velocity horizontal impact, in order to stall the propeller and prevent any injury to the occupants of the vessel (should an engine flip over and inside the vessel). For this type of engine to be restarted following an automatic shutdown, the throttle handles must first be put in the neutral position.

responding park warden that he intended to bring the *Aventure 6* back to the dock at Les Bergeronnes. The park warden then relayed the information to a 911 operator, and first responders (police, ambulance, and fire department) were routed accordingly.

By 1244, the operator had managed to pilot the *Aventure 6* (at a speed of up to 31.86 knots) back to port, where all injured persons received first aid treatment and were subsequently taken by ambulance to the hospital in Les Escoumins, Quebec.

1.5 Injuries to persons

The vessel operator received medical treatment for hypothermia, minor head injuries, and serious arm and shoulder injuries, and was later diagnosed with post-traumatic stress disorder. The passenger who was thrown overboard received medical treatment for hypothermia and minor back injuries. Another passenger sustained serious knee injuries. Additionally, some passengers sustained minor injuries. Those who had been brought to the hospital were released later that day.

1.6 Damage to the vessel

Both outboard engines sustained minor damage as the holding-down bolts for the skegs and gearboxes were fractured. Upon impact, the on-board fire extinguisher broke free of its rack and was lost at sea.

1.7 Environmental conditions

On 29 August, at 1200, the wind off Les Bergeronnes was 13.5 knots from the north (350°). The air temperature was 14 °C, the relative humidity was 73%, and the seawater temperature was 6 °C.

1.8 Saguenay–St. Lawrence Marine Park industry

The Saguenay–St. Lawrence Marine Park was established in June 1998 by the Government of Canada[8] and the Government of Quebec,[9] after the 1st St. Lawrence Action Plan[10] was developed and the International Forum for the Future of the Beluga took place, in 1988. The governments had also observed growth of the marine mammal–watching industry in the Fjord du Saguenay and St. Lawrence River estuary throughout the 1990s.

The park covers a total area of 1245 km^2, and its mission is to "increase [the area's] ecosystem protection levels for conservation purposes, […] while encouraging its use for educational,

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8 Government of Canada, *Saguenay-St. Lawrence Marine Park Act* (S.C. 1997, c. 37).

9 Government of Quebec, *Act respecting the Saguenay – St. Lawrence Marine Park* (L.R.Q., c. P-8.1).

10 The St. Lawrence Action Plan is a partnership and collaborative effort to conserve, restore, protect, and enhance the St. Lawrence River. The participants include the governments of Canada and Quebec as well as Stratégies Saint-Laurent. There have been 5 action plans since 1988.

recreational and scientific purposes."[11] The park is co-managed by Parks Canada and Parcs Québec (Société des établissements de plein air du Québec [Sépaq]).

In 2000, Parks Canada conducted an internal public safety risk analysis study within the Saguenay–St. Lawrence Marine Park to help create intervention strategies and prioritize actions to minimize the risk of accidents.[12] The study established that from 1991 to 1996, the number of passengers taking part in "at-sea observation cruises" had increased from 100 000 to 300 000 per year. The study also highlighted that local resources are insufficient to handle a major search-and-rescue operation in the park.

According to data compiled in 2007,[13] an estimated 13 073 marine mammal observation tours take place annually within the Saguenay–St. Lawrence Marine Park, and mainly from May to October. Between 01 May and 31 October 2007, merchant vessels, cruise vessels, and ferries represented 6.1%, 0.2%, and 43.5%, respectively, of all marine traffic in the Saguenay–St. Lawrence Marine Park, and 25.4% of traffic was attributable to the local marine mammal observation touring industry. In 2009, the number of persons visiting the Saguenay–St. Lawrence Marine Park increased by 12% compared to 2005, and 35% of these visitors were passengers of cruise vessels on international voyages.

The most up-to-date data, from 2009, indicated that an estimated 274 000 persons went on marine mammal observation tours, a total increase of 5% since 2005. In 2017, Parks Canada concluded its revision of the Saguenay–St. Lawrence Marine Park's regulations, and the total number of commercial marine mammal observation licences (Class 1 permits) decreased from 59 to 53 (each licence is individually assigned to a passenger vessel).

The passenger vessels that hold these 53 licences are subject to different regulations depending on their class, tonnage, size, capacity, type of voyage, etc. Passenger vessels of not more than 15 tons (gross tonnage) that carry not more than 12 passengers must comply with the *Small Vessel Regulations*.[14]

1.9 Pre-departure briefing

As per the *Small Vessel Regulations*,[15] the operator of a small passenger vessel must brief the passengers on relevant safety and emergency procedures. These procedures include the

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11 Saguenay–St. Lawrence Marine Park, "Mandate of the Marine Park," at http://parcmarin.qc.ca/get-to-know/#mandat (last accessed 22 March 2018).

12 CJB Environnement inc., *Analyse de risques en sécurité publique : Parc marin du Saguenay – Saint-Laurent* (February 2000). This risk analysis revisited a similar study conducted in 1992.

13 Saguenay–St. Lawrence Marine Park, *Plan for Marine Activities in the Saguenay-St. Lawrence Marine Park (2011-2017)* (May 2011), at http://parcmarin.qc.ca/wp-content/uploads/2016/04/Parc_marin_2011_Plan_de_gestion_des_actvites_en_mer_anglais-1.pdf (last accessed 05 March 2018).

14 Transport Canada, SOR/2010-91, *Small Vessel Regulations*.

15 Ibid., Part 4: Passenger-Carrying Vessels of Not More than 15 Gross Tonnage that Carry Not More than 12 Passengers, subsections 401(1) and (2).

location and use of the different types of lifejackets and other life-saving appliances, visual distress signals (such as pyrotechnics), and the vessel's safety equipment. The operator must explain any pertinent safety measures to be taken, including fire and explosion prevention, and demonstrate the correct way to don each type of lifejacket on board. The location of any onboard survival craft must be shown to the passengers as well. The *Aventure 6* did not carry a survival craft, nor was it required to.

The investigation determined that, before the *Aventure 6* left the dock for the tour, the operator conducted a pre-departure briefing. This briefing did not include a demonstration of donning lifejackets. The location and use of the lifebuoy was not explained to passengers, and they were unaware that a lifebuoy was stowed on the roof of the conning station. The briefing did not include the location and use of the pyrotechnics located under the operator's seat.

The investigation also determined that, although the company provided guidelines on pre-departure briefings for its operators, the guidelines were incomplete and thus did not provide all the information laid out in the regulatory requirements. The content of the pre-departure briefings also varied from vessel to vessel, depending on each vessel operator's knowledge. The company did not conduct oversight of the pre-departure briefings given by its operators.

1.10 Commission des transports du Québec

The Commission des transports du Québec (CTQ) is one of the Province's administrative tribunals. The CTQ's mission is to

> increase safe conduct by carriers, […] promot[e] a transportation supply that meets the public's expectations and to support equity in the transportation industry, all from a sustainable development perspective.[16]

All vessels operating in the passenger transportation industry in the province of Quebec must have an annual permit from the CTQ.

For a vessel to be issued an initial permit from the CTQ and have it renewed annually, the owner must provide a certificate of insurance with proof of protection concerning maritime civil liability, protection, and indemnity. The owner must also provide a written statement that the vessel and its crew satisfy all federal regulatory requirements, with regard to the crew's competency and the vessel's inspection, capacity, and safety.[17]

The CTQ's jurisdiction is limited to verifying the written statement received from the person requesting for the permit. When a written statement is received and found to be acceptable, the CTQ issues the permit.

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16 Commission des transports du Québec, "The Commission," at https://www.ctq.gouv.qc.ca/en/the-commission.html (last accessed 01 March 2018).

17 These requirements are pursuant to sections 3 and 6 of Quebec's *Regulation respecting the transport of passengers by water* (c. T-12, r. 15) made under the *Transport Act* (c. T-12, s. 5).

Quebec's *Regulation respecting the transport of passengers by water* does not provide the CTQ with the power to request further proof with respect to regulatory compliance other than the provisions of sections 3 and 6.

1.11 Small Vessel Compliance Program

As is the case for the *Aventure 6*, passenger vessels with a gross tonnage of not more than 15 tons, and carrying not more than 12 passengers, are defined as "small vessels" and are thus subject to the *Small Vessel Regulations*. Although these vessels are not required to be inspected or certified by TC to operate, they must comply with regulatory requirements[18,19] at all times. TC conducts risk-based inspections for small commercial vessels as part of its National Oversight Plan, and in the Quebec region from 2012 to 2017, they have conducted 387 risk-based inspections of small commercial vessels, including an estimated 11 inspections in the area of occurrence.

The Small Vessel Compliance Program (SVCP) is available to owners of small commercial vessels. This voluntary TC program is intended to help vessel owners and operators understand and meet their legal obligations.[20] Small vessel enrollment in the program is voluntary; it is the sole responsibility of the owner or authorized representative (AR)[21] of the vessel to ensure compliance with regulatory requirements.[22]

TC estimates that approximately 852 small commercial vessels are enrolled in the SVCP in Quebec. This represents about 15% of the province's small commercial fleet. The owner of the *Aventure 6*, who was also the AR, chose to enroll all of the admissible vessels in the fleet in the SVCP.

The SVCP process is outlined in Figure 4. Before a vessel enrolls in the SVCP, the AR must provide proof of vessel registration as required under the *Canada Shipping Act, 2001*; this Certificate of Registry is mandatory for all non-pleasure vessels.[23] Subsequently, the AR submits a comprehensive report[24] to the TC regional office. The report may be completed with the assistance of TC or an independent marine consultant, if requested by the AR.[25]

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18 Government of Canada, *Canada Shipping Act, 2001* (S.C. 2001, c. 26).

19 Transport Canada, SOR/2010-91, *Small Vessel Regulations*.

20 Transport Canada, "Participating in the Small Vessel Compliance Program for commercial vessels under 15 gross tonnage," at https://www.tc.gc.ca/eng/marinesafety/svcp-menu-3633.htm (last accessed 05 March 2018).

21 Government of Canada, *Canada Shipping Act, 2001* (S.C. 2001, c. 26), section 14.

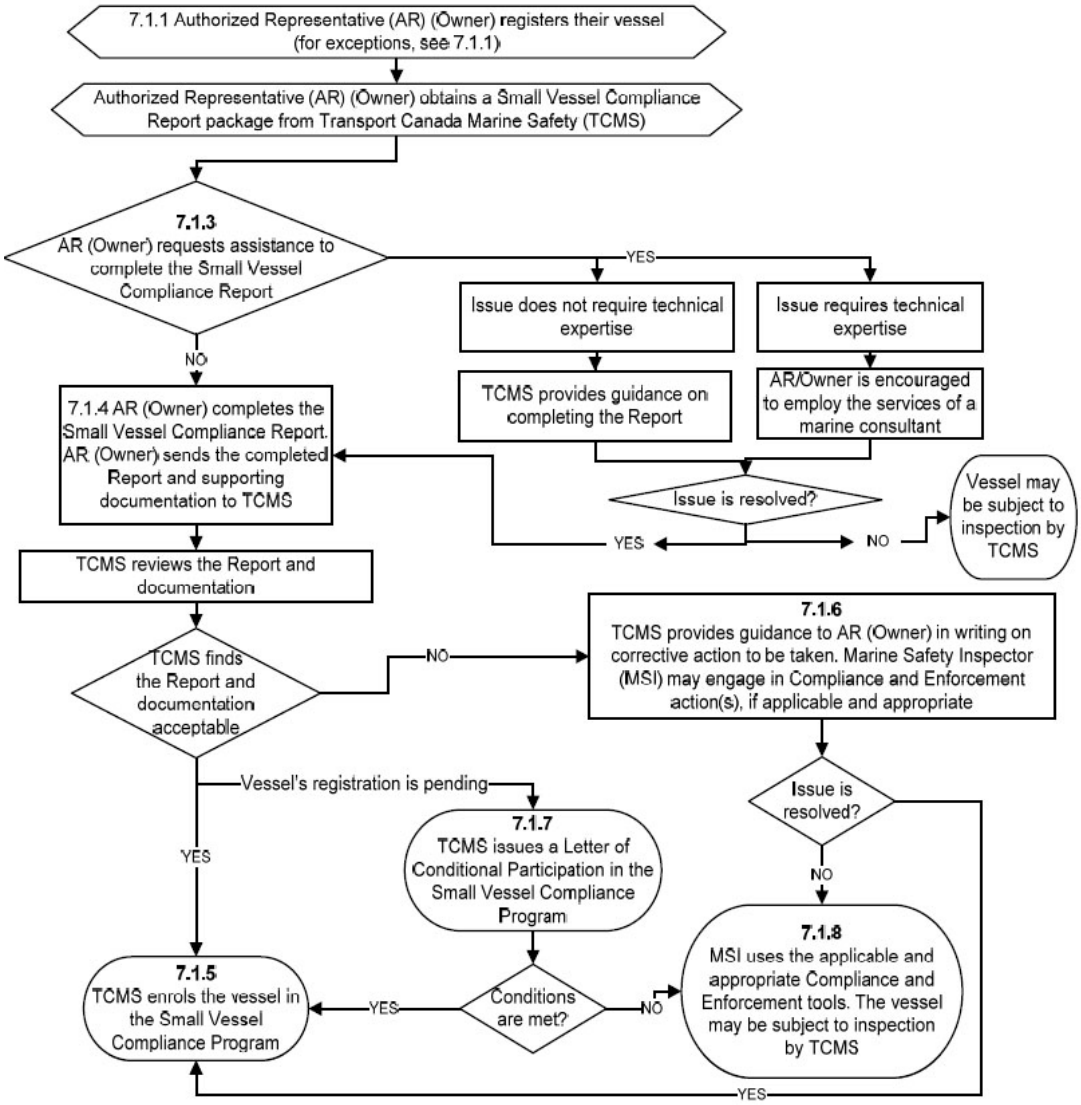
22 Ibid., section 106.

23 Ibid., section 46.

24 Transport Canada, 85-0475E, "Small Vessel Detailed Compliance Report," at http://wwwapps.tc.gc.ca/Corp-Serv-Gen/5/forms-formulaires/download/85-0475_BO_PX (last accessed 05 March 2018).

25 Guidance notes are available online in the Transport Canada publication TP 15111E, *Small Vessel Compliance Program (SVCP) Detailed Compliance Report and Guidance Notes* (2012), at

Figure 4. Small Vessel Compliance Program process flowchart in effect at time of occurrence (Source: Transport Canada, TP 13585E, *Marine Safety Management System*, Tier II – Procedures: Enrolment of Vessels in the Small Vessel Compliance Program (SVCP), at https://www.tc.gc.ca/eng/marinesafety/tp-tp13585-procedures-enrolment-vessels-3964.htm [last accessed 07 March 2018])



Once TC has reviewed the submission and concluded that its content is satisfactory administratively and technically, it enrolls the vessel in the SVCP and sends a confirmation letter[26] to the AR. It also issues a blue decal,[27] which the AR must place on the vessel in a

https://www.tc.gc.ca/eng/marinesafety/tp-tp15111-menu-3955.htm (last accessed 05 March 2018).

26 Transport Canada, TP 13585E, *Marine Safety Management System*, Tier II – Procedures: Enrolment of Vessels in the Small Vessel Compliance Program (SVCP), at https://www.tc.gc.ca/eng/marinesafety/tp-tp13585-procedures-enrolment-vessels-3964.htm (last accessed 07 March 2018).

27 Ibid.

visible location. Enrollment is valid for a 5-year period, during which the AR sends an annual report[28] to TC to demonstrate the vessel's compliance with all regulatory requirements.

On 11 May 2014, the AR of the *Aventure 6* applied to enroll the vessel in the SVCP.

On 26 May 2015, TC confirmed the vessel's enrollment and specified in the confirmation letter that the maximum number of persons on board the *Aventure 6* is 14 and the maximum number of passengers is 12. The letter also stated that lifejackets must be worn and that a copy of the vessel's stability document must be kept on board at all times. The letter required the operator to hold a Marine Emergency Duties (MED) A3 "Small Non-Pleasure Vessel Basic Safety" training certificate.

During the *Aventure 6*'s enrollment process, TC did not carry out an inspection of the vessel; its oversight to determine the vessel's compliance was limited to auditing the documents submitted by the AR. TC issued the blue decal and the AR displayed it on board the vessel. The *Aventure 6*'s enrollment was to expire on 25 May 2020.

The SVCP's detailed and annual compliance reports both require the AR to answer various questions on specific safety-related matters. Upon enrolling in the SVCP, the AR of the *Aventure 6* declared, in the package submitted to TC, that no structural or mechanical modification had been made to the vessel since its original construction and that the vessel had not sustained any damage. The AR's annual reports also stated that the company has procedures in place for dealing with emergencies, including procedures to prevent cold-water shock and hypothermia.

The AR checked the "NA [not applicable]" box in response to the question about the requirement for a re-boarding device[29] as well as the requirement to briefly describe any accident or incident involving the vessel in the last 5 years. The AR also responded that passengers are given a compliant pre-departure briefing.

The TSB investigation determined the following:

- Since its construction in 2002, the *Aventure 6* had undergone structural and mechanical modifications and had sustained damage to both engines in a previous occurrence.
- There was no onboard procedure established for emergencies or to prevent cold-water shock and hypothermia.
- The freeboard of the *Aventure 6*, depending on the loading conditions, varies from 67 to 78 cm.

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28 Transport Canada, 85-0482, "Annual Compliance Report – Small Vessel Compliance Program (SVCP)," at http://wwwapps.tc.gc.ca/Corp-Serv-Gen/5/forms-formulaires/download/85-0482_BO_PD (last accessed 05 March 2018).

29 Section 409 of the *Small Vessel Regulations* (SOR/2010-91) requires a re-boarding device to be provided if the vessel's freeboard is more than 50 cm.

- Key information regarding emergency procedures and equipment was not relayed to the passengers during the pre-departure briefing.
- Passengers were wearing approved personal flotation devices instead of the approved lifejackets specified in the SVCP letter of confirmation.
- A copy of the vessel's stability document was not kept on board at all times, and its operational limits as set by TC (wind speeds and wave heights) were not always adhered to.
- The letter of confirmation required the vessel's operator to hold a MED A3, but regulations require a MED A2: Small Passenger-Carrying Vessel Safety for this particular vessel.[30]

The marine mammal observation industry in the Saguenay–St. Lawrence Marine Park operates in the district that falls under the Québec office's jurisdiction. The geographical distance between the park and office means that TC does not have local resources in the vicinity of the park. As a result, vessel inspections without warning are normally only conducted following complaints or reported occurrences.

1.12 Personnel experience and certification

The operator of the *Aventure 6* completed the approved Small Vessel Operator Proficiency training in June 2011 and the Small Passenger Vessel Safety (MED A2) training in June 2010. He refreshed his Marine Basic First Aid Training in June 2015 and held the required VHF radiotelephone operator's restricted certificate.

He began working in the seasonal marine mammal observation industry in the Saguenay–St. Lawrence Marine Park area for other local companies in 2009, and had been employed by Croisières Essipit since 2010. He had begun working the 2016 season on 03 June.

The operator did not hold a valid Marine Medical Certificate, nor was he required to by regulation. However, the employer requires all fleet operators to undergo an annual medical examination by the company nurse.

1.13 Parks Canada and Saguenay–St. Lawrence Marine Park

1.13.1 Particular navigational conditions

Extending from the Gulf of St. Lawrence to the estuary, the Laurentian Channel is 1200 km long and 300 m deep. The channel ends abruptly off Tadoussac, at Prince Shoal, with an average water depth of 20 m. This topographic particularity forces the deep and intermediate layers of seawater, which are colder, to swirl up to the surface, where the water meets the

[30] As per TC publication TP 4957E, *Marine Emergency Duties Training Courses*, the duration of the MED A2 training is 26 hours, which is more thorough than the MED A3 duration of 8 hours.

warmer ambient air and creates fog over the surface of the water. As a result, visibility in this area is frequently reduced to less than a nautical mile.

Additionally, the warmer fresh water exiting the Saguenay River mixes with the colder seawater in the St. Lawrence estuary, creating zones of varying water densities that are separated by "current bars" or "fronts."[31] These current bars constantly change positions depending on the effects of the rising and ebbing tides. The bars create waves, eddies, and swirls that can be treacherous and challenging for small vessel operators. The area located between Prince Shoal and Tadoussac Harbour, at the mouth of the Saguenay River near buoys S7 and S8, is known for its well-documented "very heavy tide rips on ebb."[32]

The entire area is often subject to strong winds, and the varying surface currents can reach speeds of 5 to 7 knots, depending on the effects of the tide. It is common for operators in the area to carry out marine mammal observation tours in harsh seas, where waves can reach heights of 1.5 to 2.5 m. Waves are known to be even higher near current bars, and many experienced operators and masters describe crossing them with a small passenger vessel as "climbing a wall." The most common cause of passenger injury is generally considered to be the impact of the vessel's hull against the water after crossing a current bar.

1.13.2 Regulatory requirements

The *Saguenay–St. Lawrence Marine Park Act* and the *Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations*[33] (the Regulations) empower Parks Canada to regulate all marine park activities, commercial or otherwise, to ensure the sustainable use of this area and its resources[34] by, for example, preventing collisions between vessels and marine mammals and limiting the number of vessels idling in the same marine mammal observation zone.

Parks Canada's Saguenay–St. Lawrence Marine Park Law Enforcement Branch employs 3 park wardens and 2 vessels to ensure regulatory compliance within the park's boundaries. Enforcement may take the form of warnings, permit suspensions, fines, or imprisonment. The park wardens do not have jurisdiction to enforce the *Canada Shipping Act, 2001* or its regulations; they cannot enforce marine park user compliance with marine safety regulations.

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31 Saguenay–St. Lawrence Marine Park, *Attestation visant les activités en mer - Guide de formation* (June 2013).

32 Canadian Hydrographic Service, Navigational Chart No. 1203, Tadoussac to Cap Éternité (17 June 2011).

33 Canadian Heritage, SOR/2002-76, *Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations*.

34 Saguenay–St. Lawrence Marine Park, "Mandate of the Marine Park," at http://parcmarin.qc.ca/get-to-know/#mandat (last accessed 22 March 2018).

All operators are required to undergo an annual "marine activities certification" to ensure familiarization with and understanding of the Regulations. Parks Canada also requires all operators to communicate and maintain radio-watch on VHF channel 8 during marine mammal observation tours.

The Regulations contain the following requirements for speed, vessel concentration, and time limits to protect marine wildlife:

- The maximum speed anywhere in the marine park is 25 knots.
- The maximum speed in the mouth of the Saguenay River is 15 knots.
- The maximum speed in an observation zone[35] is 10 knots.
- The minimum manoeuvring speed within a distance of 400 m of a marine mammal varies depending on the vessel size, rudder type, etc.
- The propeller(s) of a vessel must be stopped within 100 m[36] of a marine mammal.
- The number of vessels within an observation zone is limited to 10.
- The number of vessels within a radius of 400 m of a marine mammal is limited to 5.[37]
- The time limit for a vessel navigating or idling in an observation zone is 1 hour.[38]

These requirements may overlap with the existing *Collision Regulations,* but do not supersede them.[39]

The investigation found that vessel operators across the industry often do not comply with the *Collision Regulations* while transiting a marine mammal observation zone in the park.

On 11 August 2017, TC implemented a temporary mandatory slowdown for all vessels of 20 m or more in length, in order to protect North Atlantic right whales from collisions with vessels. The maximum speed of 10 knots was determined in accordance with data compiled by Fisheries and Oceans Canada and the United States Department of Commerce's National Oceanic and Atmospheric Administration. The speed reduction was enforced in the western Gulf of St. Lawrence, between the north shore of Quebec and just north of Prince Edward Island, but was not applicable to the Saguenay–St. Lawrence Marine Park.

Since June 2013, the Corporation des pilotes du Bas Saint-Laurent has had a voluntary speed limit of 10 knots (speed through the water) for all merchant vessels operating under its

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35 According to the Regulations, an observation zone is defined as the area covered by a radius of 0.5 nm around a vessel that is in marine mammal observation mode. However, the Parks Canada Agency advertises, and requests the industry to respect, a radius of 1 nm.

36 This distance is increased to 400 m in the case of a species that is identified in the *Species at Risk Act* (S.C. 2002, c. 29), Schedule 1: List of Wildlife Species at Risk.

37 Canadian Heritage, SOR/2002-76, *Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations*, sections 16 and 17.

38 Ibid., subsection 25(1).

39 Ibid., section 15.2. This section refers to the *Collision Regulations* (C.R.C., c. 1416) in case of inconsistency with the *Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations*.

conduct in particular areas of the Saguenay–St. Lawrence Marine Park, annually from May to October, at the request of the park authorities.

The maximum speed of 10 knots was determined by consensus from several scientific studies with the aim of reducing the risk of vessel–whale collisions in water where marine mammals are present.[40,41] According to one of the foundational scientific references that was used to establish the speed, "[s]low-moving vessels may provide opportunity for whales to avoid a collision or for vessel operators to avoid the whales."[42]

1.14 Training, familiarization, drills, and maintenance

Before hiring a new vessel operator, Croisières Essipit audits the candidate's certificates to ensure compliance with regulatory requirements.[43] A newly hired operator must undergo an informal, undocumented training and familiarization program provided by the employer, the length of which varies depending on the operator.

The training and familiarization program includes the following tasks:

- boarding passengers,
- the conduct of the vessel,
- the use of vessel equipment, and
- passenger entertainment, which mainly consists of showing and explaining wildlife and other local features to passengers.

The new operator participates as an observer on an average of 2 to 3 tours with passengers and a senior operator. In addition to the training and familiarization program, the new operator must undergo Parks Canada training on the regulatory requirements specific to the Saguenay–St. Lawrence Marine Park. After the new operator has observed a few tours and is considered to be ready, he or she is given the responsibility of a passenger vessel without any further competency assessment.

Section 420 of the *Small Vessel Regulations* stipulates the following:

> The owner and the operator of a passenger-carrying vessel shall ensure that

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40 P. B. Conn and G. K. Silber, "Vessel speed restrictions reduce risk of collision-related mortality for North Atlantic right whales," *Ecosphere*, Vol. 4, Issue 4 (03 April 2013), p. 43, at http://dx.doi.org/10.1890/ES13-00004.1 (last accessed 07 March 2018).

41 G. K. Silber and S. Bettridge, An Assessment of the Final Rule to Implement Vessel Speed Restrictions to Reduce the Threat of Vessel Collisions with North Atlantic Right Whales, U.S. Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum NMFS-OPR-48 (February 2012).

42 A. S. M. Vanderlaan and C. T. Taggart, "Vessel collisions with whales: the probability of lethal injury based on vessel speed," *Marine Mammal Science*, Vol. 23, Issue 1 (January 2007), pp. 144–156.

43 For a vessel of the type and class of the *Aventure 6*, the requirements are a Restricted Operator's Certificate – Maritime issued under the *Radiocommunication Act* (R.S.C., 1985, c. R-2), MED A2, Marine Basic First Aid, and Small Vessel Operator Proficiency training certificates.

> (a) procedures are established for the use of the vessel's life-saving appliances and fire extinguishing equipment in case of an emergency; and
>
> (b) the crew practises the procedures so as to be at all times proficient in carrying them out.[44]

However, the investigation determined that there was no procedure in place at the time of the occurrence to deal with emergencies, and safety drills were not carried out by vessel operators or the company. Operator proficiency in using life-saving and fire-extinguishing equipment varied in accordance with each operator's experience, competence, and previous MED training.

The company conducts fleet maintenance daily, weekly, and annually. Although the owner's mechanic performs electrical and mechanical systems maintenance on a regular basis, each vessel operator is required to inspect and maintain all other life-saving and fire-extinguishing equipment. The latter was done informally and to the best of the operator's knowledge, with no oversight from the company. There were no maintenance records kept by the operators.

1.15 Company risk assessment and safety management

The company does not have a formal safety management system (SMS), nor is it required to by regulation.[45] Most of the company's marine operations procedures are undocumented and conducted in an informal manner.

The company uses the requirements set out in the *Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations* to establish operational limits related to the safety of navigation. These include the maximum speeds for vessels and minimum distances to maintain between vessels, and between vessels and marine mammals. The company has not conducted additional risk analyses to assess whether these specific limitations are safe to follow, or to take into account the risks associated with the variables present in the business model, such as

- behaviour of different marine mammals;
- level of visibility and other meteorological conditions;
- marine traffic and density of vessels in a given area;
- the short turnaround time between observation tours;
- vessel operators' high workload;
- the type, quantity, and adequacy of onboard emergency equipment; and
- the minimum safe manning of the vessels.

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44 Transport Canada, SOR/2010-91, *Small Vessel Regulations*, paragraphs 420(a) and (b).

45 Transport Canada, SOR/98-348, *Safety Management Regulations*. Section 2 refers to Chapter IX of the International Convention for the Safety of Life at Sea, 1974.

In 2011, the non-profit corporation Alliance Éco-Baleine was created. It combines 4 industry companies (including the occurrence company), as well as the Group for Research and Education on Marine Mammals, Parks Canada, and Parcs Québec. The Alliance Éco-Baleine issued a guidance booklet[46] establishing a code of conduct for marine mammal observation tours in the Saguenay–St. Lawrence Marine Park, and distributed the booklet to vessel operators employed by its member companies. The guidance booklet emphasizes the requirement for vessel operators to comply strictly with park regulations, but does not stipulate requirements concerning topics of marine safety. It does, however, specify the requirement to maintain a radio watch over VHF channels 9 (Marine Communications and Traffic Services [MCTS]) and 16 (distress).

1.15.1 Business model of small passenger vessels

The local marine mammal observation industry's business model focuses on the passenger experience. While all vessels in this industry are operated mainly for the purpose of at-sea marine mammal observation, the larger, multi-decked vessels are capable of carrying hundreds of passengers and are meant to provide more stable, comfortable, and accessible tours at sea; they are intended for large groups of people, people who want to be more comfortable, and people with mobility issues.

The marine mammal observation tours conducted on board smaller vessels are advertised and designed for clientele seeking a more thrilling and intense ride, given the inherent proximity to marine mammals and closer contact with the environment (waves, winds, and a lower vessel freeboard).

1.15.2 Weather assessment

It is the responsibility of each vessel operator to assess weather and sea conditions prior to departure to ensure that tours can be conducted in a safe manner. The company does not have any clear guidelines or operational limits based on weather or sea conditions—such as visibility, wind forces, or wave heights—nor is it involved in weather assessments. It is the operator's responsibility to determine whether the tour would be safe and cancel the tour if needed.

1.15.3 Unsafe practices

Pursuant to regulatory requirements,[47] vessels of a gross tonnage of not more than 5 tons but carrying more than 12 passengers must carry additional life-saving appliances, such as an approved inflatable liferaft or an additional lifebuoy. Vessels with more than 12 passengers are also subject to additional TC requirements concerning the vessel's stability and minimum

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46 Alliance Éco-Baleine, Guide des pratiques écoresponsables pour les capitaines/naturalistes en mer, première édition 2011.

47 Transport Canada, *Life Saving Equipment Regulations* (C.R.C., c. 1436), section 18.

manning, as well as having mandatory general (annual) and special (every 5 years) periodic inspections.

Small passenger vessels are approved by TC for the carriage of a maximum of 12 passengers and 2 crew members. Pursuant to regulatory requirements,[48] a shoreside employee records the number of passengers and their names before the passengers board the vessel for each observation tour. Vessel operators must also complete a log sheet after each tour. Due to the high workload throughout the day, most operators complete the log sheets at the end of the work day.

Although the *Aventure 6* and its sister vessels were designed by the manufacturer to carry 28 persons, the owner limited the capacity to a maximum of 12 passengers in order to comply with the *Small Vessel Regulations* and participate in the SVCP.

The TSB investigation found the following unsafe practices at the company:

- The company occasionally permits extra passengers to be carried, above the maximum capacity of 12, for example in attempts to keep groups of customers together on the same vessel. Sometimes, these additional passengers are not charged the regular fare, and the company temporarily assigns them the role of "crew member," in order to adhere to the maximum capacity of 14 passengers and crew members.
- There are not always enough approved child-sized lifejackets for the number of children on board a voyage.
- Although its vessels frequent the Saguenay–St. Lawrence Marine Park area, the company does not adapt its operating practices in dense fog, for example by requiring lower speeds or assigning an additional crew member to assist the vessel operator in managing passenger safety and acting as a navigational lookout.
- Occasionally, operators use the in-house VHF radio frequency to obtain emergency assistance from the company's shoreside office or from other vessels within the fleet; this frequency is not monitored by MCTS.

The investigation also determined that TC assessed 3 of the local industry's companies after they ordered some of their vessels out on marine mammal observation tours, with passengers on board and in harsh weather conditions, on 11 September 2016.[49] Following its assessment, TC issued administrative monetary penalties.[50]

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48 Transport Canada, SOR/2010-91, *Small Vessel Regulations*, section 402.

49 On 11 September 2016, winds in the area were, on average, 28.8 knots from 1000 to 1700, and peaked at 34 knots from the west at 1400.

50 Pursuant to the *Canada Shipping Act, 2001* (S.C. 2001, c. 26) and the *Administrative Monetary Penalties and Notices Regulations* (SOR/2008-97).

1.16 Operator workload

1.16.1 Operator work–rest history

On the day of the occurrence, the vessel operator began his shift at 0800. By the time of the occurrence (1223), the operator was on the 2nd tour of the day and had been on duty for just over 4 hours.

The occurrence took place on the 3rd day of the operator's 6-day work schedule. After 3 days off, the operator began his work rotation on 27 August. The operator had obtained an average of 8 hours of good quality sleep per night leading up to the occurrence and had not been diagnosed with any medical condition that would have interfered with his ability to obtain quality sleep.

The investigation concluded that the operator was not fatigued at the time of the occurrence.

1.16.2 Operational tasks

A vessel operator's primary responsibility is the safe operation and navigation of the vessel, as well as the safety of the vessel's passengers. Vessel operators in the marine mammal observation industry must conn the vessel, communicate on the VHF radiotelephone,[51] and act as a naturalist tour guide, if operating a single-crew vessel.

As a naturalist guide, the operator of the *Aventure 6* performed a number of duties, including providing information about the Saguenay–St. Lawrence Marine Park's history, its various features, and its marine mammals, as well as locating and identifying those marine mammals for passengers to view. The operator also provided verbal explanations of other natural and cultural features of the park, such as cliffs and lighthouses. Due to the construction of the conning station, the operator must step to its side to be heard by the passengers over the noise of the wind and the engines, especially when the vessel is underway.

1.16.3 Marine mammal spotting

Marine mammals such as seals, whales, dolphins, and porpoises are typically spotted by a visual scan of the water's surface for the dark crescent shape of their backs as they surface and dive; their dorsal fins as they break the water's surface; whale blows or spouts; and, occasionally, the flukes of a whale's tail. Spotting whales can be difficult under even the best viewing conditions (i.e., a clear day in calm waters) because they spend much of their time hidden from view underwater and, when they do surface to breathe, they often disappear before it is possible to get a good look at them. Under good viewing conditions, a whale that

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[51] In addition to VHF channels 9 and 16, used for traffic and safety purposes, Saguenay–St. Lawrence Marine Park authorities require the operators to communicate on VHF channel 8. In addition, industry masters and operators use VHF channel 10 to communicate with vessels of different companies, and each tour company uses its own "family channel" for communications between the fleet and the shore office.

has surfaced can typically be seen beginning at a distance of 10 m from the operator located at the conning station.

Spotting whales at or just below the surface requires intense operator focus and attention: whales are particularly difficult to see, given the low contrast between them and the water, as well as the possible reflection of the sun on the water's surface. Visibility is further compromised in poor conditions, such as rain, fog, or choppy waters.

Passengers may provide the operator with both verbal and non-verbal cues to a whale's presence. Passengers sometimes spot a whale before the operator does and can call out its possible location verbally, or signal non-verbally through gestures or facial expressions.

In this occurrence, a passenger spotted a whale that surfaced about 100 m directly ahead of the *Aventure 6* and crossed the bow of the vessel, moving from port to starboard. This passenger was seated at the front of the vessel on the starboard side and facing forward. Another passenger, who was seated on the starboard side near the rear of the vessel and facing outward, spotted the blow of a whale some distance away. Neither passenger indicated to the operator what they had seen. The operator did not see a whale or other marine mammal before or after impact.

1.16.4 Attentional focus during vessel navigation

The TSB conducted an analysis of the visual and non-visual tasks involved in marine mammal observation operations. When the operator is the sole crew member conducting an observation tour on board a passenger vessel, his or her attention must be divided between the tasks involved in safely navigating the vessel (such as maintaining the vessel's speed and heading, and checking the communication and navigation equipment), scanning the water's surface for mammals and other obstacles, and monitoring the well-being of the passengers.

Attention is necessary to perceive elements in the environment and adjust actions accordingly.[52] As the speed of the vessel increases, the operator must increase the rate at which he or she scans between the surface of the water, the passengers, and the vessel instruments, thereby decreasing the amount of attention that can be given to any one task. In addition, the operator must search for, identify, and recognize surrounding landmarks (visually or by using radar, a GPS, a radiotelephone, or a compass) as the vessel moves through the water. The operator must also maintain a radio watch, which requires auditory attention at all times. While navigating the vessel, entertaining the passengers, and searching for marine mammals, the operator experiences radio noise that can be distracting.

The operator's tasks to ensure adequate passenger safety are

- maintaining visual attention on the passengers to ensure they are seated and remain seated while the vessel is underway;
- monitoring the effects of the vessel's motion on passenger safety;

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52 D. LaBerge, *Attentional Processing: The Brain's Art of Mindfulness* (Harvard University Press, 1995).

- verbally communicating safety information to passengers (for example, informing them to remain seated or warning them of an upcoming wave); and
- being ready to respond to any passenger health or safety concern and initiate an emergency response if needed.

1.17 Cold water survivability

If a person experiences prolonged and unprotected exposure to water below body temperature, he or she will lose body heat as it is transferred to the water. Table 2 classifies the degree of heat loss with its associated clinical presentations.[53]

[53] G. G. Giesbrecht and A. M. Steinman, "Immersion into cold water," in: P. S. Auerbach (ed.), *Wilderness Medicine*, 6th edition (Philadelphia, PA: Elsevier, 2012), pp. 143–170.

Table 2. Classifications of hypothermia (Source: G. G. Giesbrecht and A. M. Steinman, "Immersion into cold water," in: P. S. Auerbach [ed.], *Wilderness Medicine*, 6th edition [Philadelphia, PA: Elsevier, 2012], pp. 143–170)

Classifications	Core temperature	Patient's ability to rewarm without external heat source	Clinical presentation
Normal	Above 35 °C (95 °F)	N/A	Cold sensation; shivering
Mild	35–32 °C (95–90 °F)	Good	• Physical impairment (fine motor; gross motor) • Mental impairment (complex; simple)
Moderate	32–28 °C (90–82 °F)	Limited	Below 30 °C (86 °F), shivering stops; loss of consciousness
Severe	Below 28 °C (82 °F)	Unable	Rigidity; vital signs reduced or absent; severe risk of mechanically stimulated (rough handling) ventricular fibrillation
	Below 25 °C (77 °F)	Unable	Spontaneous ventricular fibrillation; cardiac arrest

Although cold water is commonly defined as less than 15 °C,[54,55,56] temperature loss from the body can occur at water temperatures as high as 25 °C[57,58] if immersion is prolonged.

When immersed in cold water, the human body reacts in 4 stages.[59] The 1st stage, known as cold shock response, starts as soon as a person enters cold water and can last for up to 2 minutes. In cold shock, the person's breathing is affected, normally resulting in a large gasp and subsequent hyperventilation. There is also a significant increase in heart rate and blood pressure.

The 2nd stage, known as cold incapacitation, occurs at any point between 5 and 30 minutes after continued immersion. At this stage, a person begins to lose the ability to swim. The fine muscles of the hands may be the first to be affected: within as little as 10 to 15 minutes, the ability to hang onto flotation devices is reduced. Local cooling of the limbs then occurs: the muscles and joints get stiffer and, as a result, swimming strokes get shorter and eventually become ineffective. Even strong swimmers can succumb to cold incapacitation. Cognitive impairment also occurs.

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54 Canadian Red Cross, *Drownings and Other Water-Related Injuries in Canada: 10 Years of Research* (The Canadian Red Cross Society, 2006).

55 Transport Canada, TP 13822E, *Survival in Cold Waters: Staying Alive* (2003).

56 Fisheries and Oceans Canada and Canadian Coast Guard Search and Rescue, *SAR Seamanship Reference Manual* (November 2000).

57 U.S. Search and Rescue Task Force, "Cold Water Survival," at http://www.ussartf.org/cold_water_survival.htm (last accessed 05 March 2018).

58 G. G. Giesbrecht and A. M. Steinman, "Immersion into cold water," in: P. S. Auerbach (ed.), *Wilderness Medicine*, 6th edition (Philadelphia, PA: Elsevier, 2012), pp. 143–170.

59 Ibid.

After approximately 30 minutes, the 3rd stage, hypothermia, begins to set in. Hypothermia results in a reduction of blood flow to the hands, feet, and surface of the body, as well as intense shivering in the early stages and a lack of shivering in the later stages, and can eventually lead to a loss of consciousness and heart failure. Given that stages 1 and 2 can quickly incapacitate a person, the only means of increasing survivability is ensuring that the person is wearing a flotation device prior to water entry.

A 4th stage, known as post-rescue collapse, may occur when survivors are pulled from the water and the loss of hydrostatic pressure to the body causes a sudden drop in blood pressure, resulting in heart or brain failure. As the body warms up, blood begins to flow more freely, which may result in fatal bleeding from internal or external injuries.

In water with a temperature much lower than 15 °C, the body's reactions in stages 1 and 2 can be severe as the heat transfer is more rapid. Without the assistance of a flotation device to keep the survivor's head above water, death can occur rapidly. But if, for example, a person becomes unconscious as a result of hypothermia, a flotation device that keeps the head and mouth out of the water could increase the survival time by an extra hour.[60]

When people experience a sudden catastrophic event, they can exhibit responses that vary from calm and rational, to uncontrolled screaming, to paralyzing anxiety. Most people become stunned and bewildered. The physiological responses that result from some of these psychological states include rapid heart rate, trembling, weakness, and nausea. The effects of cold water immersion can be exacerbated by the emotional response of the person overboard, particularly the 1st-stage symptom of hyperventilation. Uncontrolled hyperventilation can cause numbness, further muscle weakness, and sometimes fainting, which increases the likelihood of water intake, further panic, and drowning.

At the time of the occurrence, the seawater temperature was approximately 6 °C. The operator and the passenger who fell overboard the *Aventure 6* were soon physically unable to swim to the vessel and to pull themselves on board once it was manoeuvred alongside them. They spent 7 minutes in the water and an additional 14 minutes in wet clothes and being exposed to winds while the vessel returned to port, before receiving first aid from first responders. The operator and the passenger were both treated for hypothermia.

1.17.1 Personal protective equipment for vessel operator and passengers

The vessel operator and the passengers of the *Aventure 6* wore flotation clothing to protect themselves in adverse environmental conditions and in the event of an emergency. The vessel operator wore a Helly Hansen 1-piece flotation suit (Figure 5) and every passenger wore a Mustang flotation jacket, which is classified as marine anti-exposure apparel, and regular (non-buoyant, uninsulated) water-resistant pants (Figure 6).

60 Ibid.

Figure 5. Helly Hansen 1-piece flotation suit worn by vessel operator

Figure 6. Mustang flotation jacket and yellow water-resistant pants worn by passengers

Marine anti-exposure suits and jackets protect a person immersed in cold water by reducing thermal shock upon entry, delaying the onset of hypothermia, and providing flotation to minimize the risk of drowning. They thermally insulate the body by allowing small quantities of water into the suit that are then warmed by body heat. When properly sized and donned, the close-fitting style also prevents excessive heat loss: water that enters the suit is prevented from escaping and being replaced with cold water.

However, marine anti-exposure suits are limited in their ability to provide warmth, for 2 reasons: the wearer is still exposed to some amount of water, and the insulation is less effective than that of dry suits, because water in the suit draws body heat.

The flotation clothing worn by the 2 persons in the water effectively kept their heads and mouths out of the water, resulting in minimal ingestion of water.[61]

The companies operating in the marine mammal observation touring industry in the Saguenay–St. Lawrence Marine Park do not have a harmonized approach concerning the risk of passengers and crews being exposed to the cold water of the St. Lawrence River and estuary. The protective clothing supplied to passengers varies in suitability for each company: some provide passengers with regular, non-buoyant rain-protection suits without thermal insulation, and some provide non-buoyant winter clothing. Others provide full buoyant marine anti-exposure suits or a combination of buoyant marine anti-exposure jackets and rain-protection pants.

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61 Ibid.

1.18 Falling overboard

In Canada, falling overboard is one of the highest causes of fatalities in the marine industry.[62] There are a number of commercially available devices to facilitate re-boarding in the event of a person overboard incident, including the following:

- a removable ladder or scramble net that allows a conscious person in the water to climb back on board
- a lifting sling that can be passed under a person's arms and then used to haul the person back on board manually or by mechanical means, such as a hauler or winch
- a life net, which is used in a similar manner to a sling, but also has a net suspended underneath it for further support of the person being lifted aboard
- a Jason's Cradle, which is a stowable, net-like device that can be passed under an unconscious person in the water and used to haul the person on board
- a gaff that will help in the recovery of persons overboard

Apart from these options, some commercial fishermen have constructed their own devices, such as a buoyant ring with netting attached to the underside.

There was no re-boarding device on board the *Aventure 6*, although it was required by regulation to carry one.[63]

1.19 Reporting marine occurrences

Pursuant to regulatory requirements, marine occurrences such as a vessel's unforeseen contact with the bottom,[64] the total failure of navigation equipment,[65] the total failure of a main or auxiliary machinery,[66] and any collision,[67] including an impact between a vessel and a marine mammal,[68] must be reported to the TSB. The *Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations*[69] also require the operator of a vessel that collides with a

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62 The marine industry encompasses all commercial maritime activities such as, but not limited to, fishing, transportation of various bulk or packaged liquid and solid goods, carriage of people, tug and towing services, icebreaking, surveying, ferry services, offshore supplying, oil and gas exploration/exploitation, underwater construction, and dredging.

63 Section 409 of the *Small Vessel Regulations* requires a re-boarding device to be provided if the vessel's freeboard is more than 50 cm.

64 Transportation Safety Board of Canada, SOR/2014-37, *Transportation Safety Board Regulations*, subparagraph 3(1)(d)(v).

65 Ibid., clause 3(1)(d)(x)(A).

66 Ibid., clause 3(1)(d)(x)(B).

67 Ibid., subparagraph 3(1)(d)(ii).

68 Ibid., subsection 3(8): "'collision' means an impact, other than an impact associated with normal operating circumstances, between ships or between a ship and another object."

69 Canadian Heritage, SOR/2002-76, *Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations*, paragraph 11.3(2)(g) and subsection 14(4).

marine mammal to report the event to a park warden or enforcement officer. In addition, any vessel collision or striking at sea must be reported to MCTS,[70] and dangerous occurrences and accidents on board all vessels in Canadian waters must be reported to TC.[71]

Parks Canada statistics and records show that 50 collisions within the boundaries of the Saguenay–St. Lawrence Marine Park were reported from 1992 to 2016. These collisions involved various marine mammals and vessels engaged in commercial activities (either cargo vessels or marine mammal observation tour vessels). Sixteen of these collisions occurred from 2006 to 2016.

The following is a list of some of the collisions from 1992 to 2016, involving vessels on marine mammal observation tours and circumstances that were similar to those of this occurrence, though not limited to the occurrence company:

- On 15 September 2006, a small passenger vessel collided with a fin whale in dense fog while underway at a speed of 10 to 15 knots. The vessel sustained damage to its engine skeg.
- In August 2008, a small passenger vessel collided with a beluga.
- On 24 July 2010, a small passenger vessel collided with a minke whale off Buoy K55.
- On 29 July 2013, a small passenger vessel collided with a fin whale while departing a whale observation zone at the speed of 4 knots. The whale reportedly surfaced on the port side of the vessel, just ahead of the bow.
- On 09 August 2014, a small passenger vessel collided with a blue whale while underway at a speed of 15 to 20 knots. The whale made contact with the vessel's bow and port engine skeg.

With the exception of the occurrence involving the *Aventure 6*, none of the 50 known occurrences since 1992 were reported to the TSB.

The owning company of the *Aventure 6* does not have an internal policy or a standing order requiring its employees to report a marine occurrence to the relevant authorities.

The investigation established that 4 reportable marine occurrences happened in August 2016, all involving another company operating in the park's marine mammal observation industry. None of these 4 occurrences were reported to the relevant authorities. The involved vessels did not request the assistance of the CCG, nor did they broadcast a distress call on the appropriate frequencies.[72] The 4 occurrences were as follows:

- A passenger vessel with 20 passengers on board collided with Buoy S7 at a speed of 12 knots in dense fog during a marine mammal observation tour in the Saguenay–

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70 Transport Canada, SOR/89-98, *Vessel Traffic Services Zones Regulations*, paragraph 7(1)(b).

71 Transport Canada, SOR/85-514, *Shipping Casualties Reporting Regulations*, subsection 4(1).

72 VHF channel 16 (156.8 MHz), the international distress frequency, and VHF channel 9, the local marine traffic frequency, are constantly monitored by MCTS; all vessels are required to maintain watch over these frequencies.

St. Lawrence Marine Park. One passenger was injured and the vessel's hull was damaged. All VHF communications were made on the company's in-house frequency.[73]

- A passenger vessel touched bottom at Cap de Granite during a marine mammal observation tour in the Saguenay–St. Lawrence Marine Park, damaging the vessel's propellers.
- A passenger vessel continued its daily marine mammal observation tours with a non-functional radar for 13 consecutive days. On 6 of those days, the tours were carried out in restricted visibility due to the presence of fog.
- A passenger vessel sustained a mechanical failure and became disabled at sea during a marine mammal observation tour. While the vessel was still offshore, all passengers were evacuated to another vessel from the same company. All radio communications were made on the company's in-house frequency.

The policy in the training manual of company that owns the vessels in these occurrences indicates that the only reporting requirement for accidents involving crew members and passengers is to the owning company itself via its in-house VHF frequency. As stipulated in the manual, this accident-reporting policy is intended to collect information about the incident and to protect the owning company against any potential civil litigation filed by passengers. This company stipulates in its "requirements booklet" that reporting requirements apply only to passenger injuries. The TSB's investigation has also established that this directive is not followed systematically.

The same training manual does not mention any of the reporting requirements set out in the applicable federal legislation or regulations.[74]

The CCG has a protocol in place to advise all relevant stakeholders of an occurrence through its Alerting and Warning Network. Once an occurrence is reported to the local MCTS traffic controller, regulatory requirements to report marine occurrences are properly met.

Alliance Éco-Baleine states in its guidelines[75] that a "captain" who witnesses a dangerous situation must report it to MCTS at Les Escoumins, using VHF channel 9, which echoes the regulatory requirement. These guidelines further explain that such reporting eases search-and-rescue mission coordination and provides valuable information on all marine occurrences to help address issues with appropriate stakeholders. The investigation determined that not all vessel operators adhere to these guidelines.

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73 The company uses VHF channel 73 as the in-house frequency, which is not monitored by the Canadian Coast Guard's MCTS station in Les Escoumins.

74 The *Transportation Safety Board Regulations*, the *Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations*, the *Canada Shipping Act, 2001*, the *Maritime Occupational Health and Safety Regulations*, the *Vessel Traffic Services Zones Regulations*, and the *Shipping Casualties Reporting Regulations*.

75 Alliance Éco-Baleine, *Guide des pratiques écoresponsables pour les capitaines/naturalistes en mer, première édition 2011*, p. 24.

1.20 Post-occurrence examination of vessel

Following the occurrence, the TSB conducted an examination of the *Aventure 6* and inspected other vessels within the company's fleet.

On all of the company vessels of a similar size and design, lifebuoy stowage arrangements required users to remove the nylon self-locking cable ties and synthetic ropes that secured the lifebuoys to their cradles before they could be deployed. The cable ties and ropes could not easily be undone by hand and needed to be cut. Furthermore, cutting devices were not kept readily available near the lifebuoy cradles.

Additionally, all examined vessels were issued a Mobile Maritime Service Identity number from Innovation, Science and Economic Development Canada, and none of the shipborne VHF radiotelephones examined were configured to enable the operators to use the DSC function in case of an emergency, although they all had DSC capability.[76]

It was common practice for operators not to use the engine safety cut-off lanyards. The lanyards were found coiled tightly and permanently around the helm, engine throttles, and engine ignition keys on all the vessels examined.

1.21 Previous occurrences

In Canada, from 2006 to 2016, 61 collisions between 2 or more vessels and 26 allisions between vessels and floating or underwater objects were reported to the TSB across the entire marine industry. As well, 127 occurrences involving persons overboard and 76 occurrences involving persons sustaining serious injuries were reported to the TSB. Additionally, during this period, 28 crew members and passengers were fatally injured. The majority (89.3%) of these fatalities were caused by persons falling overboard or being in the water for prolonged periods (hypothermia and drowning).

During the same period, 8 occurrences that took place during marine mammal observation tours in the Saguenay–St. Lawrence Marine Park were reported to the TSB (Appendix B).

Additionally, 9 events were reported to the TSB during the same period involving close-quarters situations between cargo vessels and passenger vessels involved in marine mammal observation tours in the Saguenay–St. Lawrence Marine Park.

Multiple TSB marine investigations have highlighted the risks posed by the lack of an effective regulatory oversight regime including inspection, the lack of emergency preparedness, and the lack of effective safety management and risk assessment.

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[76] The DSC function of a VHF radiotelephone transmits digital messages on channel 70. When an operator presses the distress button on a VHF unit with a configured DSC function, the Mobile Maritime Service Identification number and the GPS position of the vessel are sent to the nearest MCTS station.

The TSB investigation into the flooding of the self-propelled barge *Lasqueti Daughters* on 14 March 2015, while it was carrying passengers and motor vehicles, found that

> If comprehensive surveys or mandatory inspections are not conducted, critical areas of a vessel may go uninspected, and masters and owners will have incomplete information about the condition and safety of their vessels, increasing the risk of accidents.[77]

The TSB investigations into the falling overboard and fatalities of crew members on the fishing vessels *Four Ladies 2003* (09 March 2015[78]) and *Cock-a-Wit Lady* (30 November 2015[79]) established a common risk: when crews do not assess their vessels for emergency preparedness or conduct drills that provide an opportunity to practise their emergency response and to identify shortcomings, such as in a person-overboard situation, there is a risk that their response to an emergency will be ineffective.

The investigation into the *Cock-a-Wit Lady* occurrence also concluded that if vessels do not have a system for on-board risk management, there is a risk that crews will not mitigate onboard hazards effectively.

The TSB investigations into the engine compartment fire of the passenger vessel *La Releve II* (11 August 2014[80]) and the allision of the tug *Vachon* against a breakwater (12 September 2014[81]) found that if vessel operators do not have a formal process for managing safety, there is a risk that hazards will not be identified and effectively mitigated.

1.22 Outstanding recommendation

The TSB recently investigated an occurrence involving the whale-watching vessel *Leviathan II*,[82] which capsized off the west coast of British Columbia and resulted in 6 fatalities. The investigation report on this occurrence identified a similar safety concern to that raised in the *Aventure 6* occurrence with respect to shortcomings in the identification and mitigation of operational risks by commercial passenger vessel operators. Following the *Leviathan II* occurrence, the Board recommended that

> the Department of Transport require commercial passenger vessel operators to adopt explicit risk management processes, and develop comprehensive guidelines to be used by vessel operators and Transport Canada inspectors to assist them in the implementation and oversight of those processes.
>
> **TSB Recommendation M17-02**

77 TSB Marine Investigation Report M15P0035.

78 TSB Marine Investigation Report M15A0045.

79 TSB Marine Investigation Report M15A0348.

80 TSB Marine Investigation Report M14C0156.

81 TSB Marine Investigation Report M14C0193.

82 TSB Marine Investigation Report M15P0347.

TC agreed in principle with Recommendation M17-02 and stated that further research and analysis was needed to determine whether the development of comprehensive guidelines would be an effective means to supplement the existing requirements. In its response, TC indicated that these safety concerns continued to be best addressed through the existing provisions of the *Canada Shipping Act, 2001* and through TC's compliance programs. TC pointed to the existing SMS guidance on their website as covering the necessary elements to build an SMS and proposed putting more emphasis on section 106[83] of the *Canada Shipping Act, 2001* with small passenger vessel operators as a way to promote SMSs and increase safety for masters and crew.

TC proposed to address the second part of the recommendation by adapting the 2014/15 Concentrated Inspection Campaign (CIC) checklist for domestic vessels carrying less than 50 passengers. This would include reviewing, in further detail, compliance with paragraph 106(1)(b) of the *Canada Shipping Act, 2001*. This approach would also provide further guidance to small passenger vessel operators, promote SMS, and ultimately increase safety and security awareness among masters and crew.

The TSB is currently assessing TC's response to the recommendation.

1.23 TSB Watchlist

The TSB Watchlist identifies the key safety issues that need to be addressed to make Canada's transportation system even safer.

Safety management and oversight is a Watchlist 2016 issue. As this occurrence demonstrates, some companies consider safety to be adequate as long as they are in compliance with minimum regulatory requirements, but regulations alone cannot foresee and account for all of the risks unique to a particular operation or industry. That is why the TSB has repeatedly emphasized the advantages of having an SMS: an internationally recognized framework that allows companies to effectively manage risk and make operations safer.

Furthermore, numerous recent investigations have found companies that have not managed their safety risks effectively, either because they were not required to have an SMS or because their

Safety management and oversight will remain on the TSB Watchlist until

- Transport Canada implements regulations requiring all commercial operators in the air and marine industries to have formal safety management processes and effectively oversees these processes;
- transportation companies that do have an SMS demonstrate that it is working—that hazards are being identified and effective risk-mitigation measures are being implemented; and
- Transport Canada not only intervenes when companies are unable to manage safety effectively, but does so in a way that succeeds in changing unsafe operating practices.

[83] Section 106 of the *Canada Shipping Act, 2001* states that the vessel's authorized representative is responsible for ensuring that the vessel and its machinery meet the applicable regulations, for developing procedures for the safe operation of the vessel and for dealing with emergencies, and for ensuring that the crew and passengers receive safety training.

SMS was not implemented effectively. The move toward an SMS regime has to be supported by appropriate regulatory oversight. Regulators will encounter companies with varying degrees of ability or commitment to managing risks effectively, so this oversight must be balanced: it needs to include proactive auditing of companies' safety management processes, ongoing education and training, and traditional inspections to ensure compliance with existing regulations.

2.0 Analysis

This section will analyze the deficiencies found in the familiarization and training programs used by the owning company of the *Aventure* 6 and the inadequate assessment of vessel operator proficiency. It will also analyze the absence of formal risk assessment and, more broadly, the lack of safety management in the operations for the owning company of the *Aventure 6*. The Small Vessel Compliance Program (SVCP), delivered by Transport Canada (TC), will also be examined.

2.1 Factors leading to the collision

The *Aventure 6* collided with an unidentified object, possibly a whale, while transiting the Saguenay–St. Lawrence Marine Park during a marine mammal observation tour.

The operator navigated the vessel from one observation zone to another as fast as regulatory requirements allowed. He proceeded from the blue whale observation zone at 11.88 knots (instead of the required 10 knots). Once the vessel was 0.8 nautical miles (nm) from the closest vessel, the operator increased speed toward 25 knots, believing that he was compliant with the park's minimum requirement regarding vessel speed in relation to the distance from other vessels observing marine mammals. Parks Canada requests operators to respect a radius of 1 nm, although regulations only require 0.5 nm.

The operator was preoccupied with vessel navigation, transiting as quickly as possible between observation sites in order to stay within the tour's time limit, and complying with the Saguenay–St. Lawrence Marine Park's restrictions on vessel speed. Therefore, the operator's visual attention was focused on constantly scanning the various equipment on the vessel's conning console.

The demands of the visual attention required to monitor the vessel's speed and position would have required most of the operator's attentional resources, decreasing the attention that the operator could have directed toward navigational hazards. The operator had to assess the position of the nearest vessel by looking at the radar screen, the vessel's speed by looking at the GPS screen, and the engines' rotations per minute by monitoring both tachometers and manually adjusting both throttle handles. As a result, he would have had little attention to focus on looking out ahead of the vessel. Additionally, the operator assumed that all nearby whales were behind the vessel at the last observation site, and not in the immediate vicinity of the vessel.

Although some passengers saw a whale surfacing ahead of the vessel just prior to the collision, the operator did not see it.

Because the vessel was travelling at 21.6 knots when it hit the object, the operator and several passengers sustained injuries; in addition, the operator and 1 passenger were thrown overboard and into the water. Although the engines' safety cut-off lanyard was not fastened to the operator and was rendered ineffective, both engines automatically shut down due to

another built-in safeguard that is designed to shut off the ignition if the engine skegs sustain a high-velocity impact.

Because the remaining passengers on board were unfamiliar with the use and operation of the vessel's equipment, they were unable to broadcast a marine distress call, immediately resume propulsion of the vessel, and deploy pyrotechnics or the lifebuoy. The passengers pressed the red "distress" key on the very high frequency (VHF) unit with no result, because the digital selective calling (DSC) function, although installed, had not been configured. After a few attempts, one of the passengers was able to restart 1 engine and manoeuvre the vessel beside the 2 persons in the water.

Seven minutes had elapsed since the 2 persons entered the water. The flotation clothing they wore kept their heads and mouths out of the water, resulting in minimal ingestion of water. However, they were affected by cold incapacitation.

The vessel was not fitted with appropriate man overboard (MOB) recovery equipment, and it took several attempts before the persons overboard could be helped back on board, further injuring one of them. The flotation clothing they wore also made it difficult for the passengers to grab onto them: flotation clothing lacks the straps and handles that are present on lifejackets, which can facilitate recovery.

2.2 Operator proficiency

The competency of the operator in the use and maintenance of critical equipment such as navigation, life-saving, and fire-extinguishing equipment is key to the safety of passengers, vessels, and crews, especially since the majority of passengers may not have marine experience and may not be able to operate the vessel and its equipment in the event of an emergency.

Although newly hired operators at the owning company of the *Aventure 6* are required to hold the appropriate TC certification, the company considers this, along with previous operator experience, sufficient proof of competency; it does not have a formal assessment or training program for its operators. After the informal training and familiarization given to new operators, which varies in length and may only be a day of training, the company does not assess whether the minimum competency has been attained or conduct any further competency assessments before operators are given the responsibility of carrying passengers on offshore tours. This lack of oversight creates a non-standardized work environment in which varying levels of operator proficiency and competency exist.

Although the company did not have documented, formal emergency procedures for its employees, the investigation found that the practice of the informal procedures that did exist was not consistent among all operators, even though these procedures are key to properly managing passenger safety, and to appropriately responding to emergencies such as fire, flood, vessel abandonment, MOB, and injuries. Therefore, some of the company's operators may not be proficient in the emergency procedures as specified in the *Small Vessel Regulations*.

The investigation also found that, although it was not a factor in this occurrence, the company does not require vessel operators to perform regular safety drills. The investigation found that most operators work through the full 5-month season for marine mammal observation tours without conducting any safety exercises, such as fire, abandonment, and MOB drills.

If a company operating in the marine mammal observation industry relies solely on minimum regulatory requirements and does not fully assess the competencies of its passenger vessel operators, there is a risk that operators will respond ineffectively in an emergency.

2.3 Risk assessment and safety management

Although there is no regulatory requirement for the owning company of the *Aventure 6* to have a formal safety management system, safety management processes, which would include conducting a thorough risk assessment, can help to identify hazards and mitigate risks associated with operations in the Saguenay–St. Lawrence Marine Park. The need for an independent risk assessment by the company is particularly important given that local resources are insufficient to address a major search-and-rescue operation in the park.

The operating model used by the company requires each operator to conduct several observation tours a day, according to a strict schedule. This model requires operators to cover a wide area of the park within the tour's time limit, and may lead them to perform the scheduled tours even in harsh meteorological conditions, beyond the vessel's TC-approved operational limits for wave heights and wind speeds. In addition, the model puts pressure on the company and its operators to carry as many passengers as possible on each vessel. The investigation found that, at times, the number of passengers on board exceeded the vessel's maximum capacity, and that there were not enough approved lifejackets on board for the number of children.

This model, therefore, can result in potentially unsafe operating conditions where passenger safety could be jeopardized; if the company had conducted risk assessments, it might have identified those practices as a risk. Any other company operating within the marine mammal observation industry in the Saguenay–St. Lawrence Marine Park, when using a similar operating model, also needs to identify and mitigate these risks.

The company relies on Parks Canada regulatory requirements as the baseline for its operational limits, as indicated by Alliance Éco-Baleine's guidance booklet and code of conduct, even though these regulatory requirements were established not to enforce navigational safety, but to balance the use of the park with wildlife preservation.

Although the scientific literature states that a maximum speed of 10 knots is the baseline for effectively reducing the risk of vessel-whale collisions in waters where mammals are present, the company did not identify the higher risk of collision associated with higher speeds. Moreover, park authorities recognize that some of the regulatory requirements are not stringent enough and therefore require the industry to, for example, respect an observation zone radius of 1 nm instead of the mandatory 0.5 nm.

TC does not have local resources in the Saguenay–St. Lawrence Marine Park geographic area, and many of the company's vessels are not required to undergo inspection and carry a certificate of inspection. Because there is no continued on-site oversight, it is critical that the company manage safety adequately. The familiarization, continued training, and safety oversight provided by the company are inconsistent.

On a single-operator vessel such as the *Aventure 6*, there is a risk of the only operator falling overboard or becoming incapacitated; the company did not identify this risk and did not have any measures in place to address it. Possible mitigation strategies include fitting vessels with MOB recovery equipment, giving a more thorough pre-departure briefing to the passengers, and addressing the location and use of the vessel's equipment. These could allow passengers to take immediate actions to recover persons in the water quickly and easily, broadcast a distress message, or deploy pyrotechnics to alert responders to their location. Other measures could include enforcing the requirements for operators to properly use preventative propulsion stoppage mechanisms such as an engine safety cut-off lanyard.

Although it was not a factor in this occurrence, the investigation found that marine occurrences, such as collisions, mechanical failures, and injured passengers, are not always reported by the companies of the marine mammal observation industry in the Saguenay–St. Lawrence Marine Park. Some operators are encouraged to manage the events "in-house" and not report these events to the relevant authorities. Consistent reporting would provide authorities with valuable information about emerging risks and safety concerns, and give authorities the opportunity to take remedial actions and inform the appropriate stakeholders.

If a company operating in the marine mammal observation industry does not adequately manage safety by identifying and mitigating the existing risks inherent in its operations, unsafe practices will remain and passenger safety may be compromised.

2.4 Small Vessel Compliance Program

TC does not have provisions to systematically inspect every vessel enrolled in the SVCP. As a result, it relies on auditing the periodic reports submitted by the authorized representative (AR) to confirm continued compliance. TC can also order an inspection given risk-based factors or if there are inconsistencies in the reports. TC does not require an independent marine expert to verify the report's content.

Although the AR normally completes these reports, the AR does not necessarily have adequate maritime expertise to ensure that the report content is complete and accurate. TC assists ARs with regulatory compliance only upon request. In this occurrence, the AR assumed that the regulatory requirement to have a re-boarding device did not apply to the vessel, and that assumption was reflected in the report submitted to TC. As a result, the *Aventure 6* did not have a re-boarding device, although this had been previously recommended in a report from an independent marine expert.

The AR's report also stated that the proper lifebuoy was on board. Although it was indeed on board, it was incorrectly stowed. If TC had carried out an inspection of the vessel, it may

have identified the missing re-boarding device, the improperly stowed lifebuoy, the inadequacy of a single dual-watch VHF radio to monitor 5 different frequencies, the non-configured DSC function, the incomplete passenger pre-departure briefing, and the vessel modifications done by the AR.

The Commission des transports du Québec (CTQ) issues an annual permit that allows vessels, such as the *Aventure 6*, to carry passengers. The CTQ requires proof that the vessel has proper protection and indemnity insurance coverage and that the applicable federal regulatory requirements have been met. Because small commercial vessels are not required to be inspected by TC, even under the SVCP, the CTQ issues annual permits to vessels without tangible proof that regulatory compliance has been achieved.

As a result, as was the case in this occurrence, an AR may mistakenly assume that, because the vessels are enrolled in the SVCP and the CTQ has issued its annual permit, the vessels are fully compliant with all provincial and federal regulatory requirements and are safe to operate and carry passengers.

Therefore, if TC does not conduct systematic on-site inspections of all registered small commercial vessels, there is a risk that safety deficiencies and regulatory non-conformities will remain unidentified and persist.

3.0 Findings

3.1 Findings as to causes and contributing factors

1. Once the vessel was 0.8 nautical miles from the closest vessel, the operator began to increase the vessel's speed up to 25 knots, believing that he was compliant with the Saguenay–St. Lawrence Marine Park's requirement of being 1 nautical mile away from the closest observation vessel.

2. A whale surfaced about 100 m in front of the bow of the vessel on the port side, in the range of sight of the vessel operator.

3. Although some of the passengers noticed the presence of a whale ahead of the bow, they assumed the operator had also seen it and did not report its presence.

4. The attention necessary to carry out all of the tasks required of the operator, including conducting the tour and monitoring the vessel's speed and position, resulted in the operator not seeing the whale.

5. As the vessel reached the speed of 21.6 knots, its bow collided with an unidentified object, possibly a whale.

6. The force of the initial impact caused the vessel's bow to jump, which threw 1 passenger overboard, and the operator struck the windshield of the conning station and sustained minor head injuries.

7. Due to the vessel's speed of 21.6 knots, the vessel kept moving ahead after its initial impact, and the skegs of both outboard engines subsequently collided with the object.

8. The force of the secondary impact caused the vessel's stern to jump, which threw the passengers against the contents of the vessel and caused various injuries; this impact also threw the operator against the port side of the conning station and then into the water, causing additional minor head injuries.

9. The vessel drifted away from the 2 persons in the water, with both outboard engines shut down.

10. Because the passengers were unfamiliar with the use and operation of the vessel's equipment, they were unable to deploy the lifebuoy and pyrotechnics, broadcast a marine distress vocal or digital call, or immediately restart propulsion.

11. One of the passengers eventually restarted 1 engine and manoeuvred the vessel beside the 2 persons overboard.

12. Because the vessel did not have man-overboard recovery equipment, the passengers struggled to retrieve the persons in the water and get them back on board. As the operator was brought on board, he sustained serious arm and shoulder injuries.

3.2 Findings as to risk

1. If a company operating in the marine mammal observation industry relies solely on minimum regulatory requirements and does not fully assess the competencies of its passenger vessel operators, there is a risk that operators will respond ineffectively in an emergency.

2. If a company operating in the marine mammal observation industry does not adequately manage safety by identifying and mitigating the existing risks inherent in its operations, unsafe practices will remain and passenger safety may be compromised.

3. If Transport Canada does not conduct systematic on-site inspections of all registered small commercial vessels, there is a risk that safety deficiencies and regulatory non-conformities will remain unidentified and persist.

3.3 Other findings

1. The confirmation letter given to the *Aventure 6* when the vessel enrolled in the Small Vessel Compliance Program required the operator to hold a Marine Emergency Duties (MED) A3 certificate. However, regulations require an operator of this type of vessel to hold a MED A2 certificate.

2. The *Aventure 6* did not comply with the confirmation letter, which required that the passengers wear lifejackets and that a copy of the vessel's stability document be kept on board at all times. The passengers and the operator were instead wearing Transport Canada–approved personal flotation devices.

3. The Commission des transports du Québec issues and renews permits annually to small commercial vessels like the *Aventure 6* based on a written statement by the authorized representative. Quebec's *Regulation respecting the transport of passengers by water* does not provide the Commission des transports du Québec with the power to request further proof of compliance with the regulatory requirements.

4. The digital selective calling function of the very high frequency radiotelephones was not configured on multiple company vessels.

5. Although multiple regulatory and operational requirements result in vessel operators communicating and maintaining radio watch on 5 different frequencies while conducting marine mammal observation in the Saguenay–St. Lawrence Marine Park, many company's vessels are fitted with a single dual-watch very high frequency radiotelephone.

6. The lifebuoys on board most of the company's fleet were stowed in such a manner that they could not be promptly deployed.

7. It is not a common practice for the company's vessel operators to use engine safety cut-off lanyards when they are available.

8. Vessel operators across the marine mammal observation industry often do not comply with the *Collision Regulations* while transiting a marine mammal observation zone in the Saguenay–St. Lawrence Marine Park.

9. Some companies operating in the marine mammal observation industry in the Saguenay–St. Lawrence Marine Park do not provide suitable flotation clothing to protect passengers and crew against cold-water immersion and hypothermia, and the suitability of the provided clothing varies widely depending on the company.

10. The marine mammal observation industry operating in the Saguenay–St. Lawrence Marine Park does not always report marine occurrences, which hinders the relevant authorities' ability to identify safety concerns and take appropriate action.

4.0 Safety action

4.1 Safety action taken

4.1.1 Transportation Safety Board of Canada

On 31 January 2017, the TSB sent Marine Safety Information Letter 01/17 to Croisières Essipit, with a copy to Transport Canada, Parks Canada, Parcs Québec (Sépaq), the Commission des transports du Québec, and 5 other industry companies that conduct commercial marine mammal observation tours within the Saguenay–St. Lawrence Marine Park. The safety information letter concerned the installation and configuration of specific shipboard safety appliances and identified safety issues that required immediate remediation before the 2017 season.

Specifically, the issues identified were the improper stowage of lifebuoys, the incomplete digital selective calling configuration of the very high frequency radiotelephones, the absence of a re-boarding device on board vessels that require one, the lack of use of the propulsion shutdown safety lanyard by operators, and incomplete pre-departure briefings to passengers.

4.1.2 Croisières Essipit

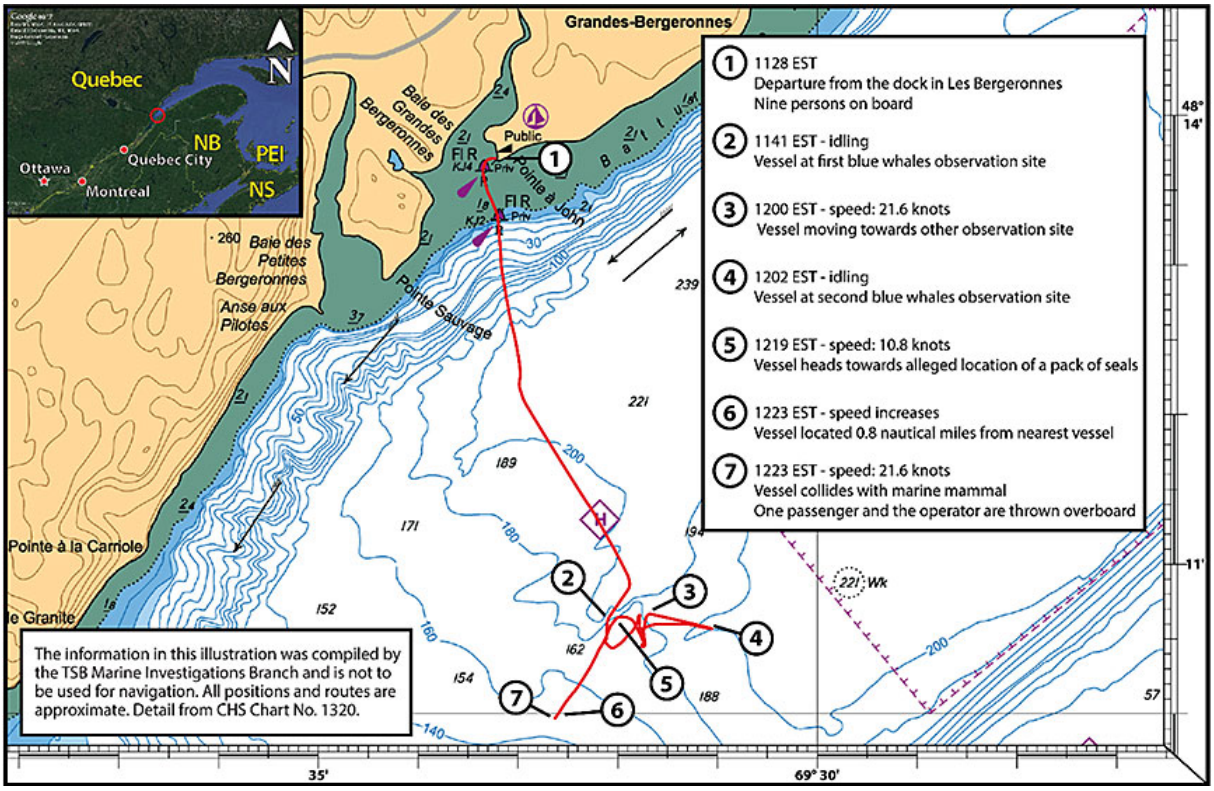
After the occurrence, and after receiving Marine Safety Information Letter 01/17, Croisières Essipit modified the location and stowage of lifebuoys on its entire fleet, acquired new equipment with digital selective calling capability, equipped its fleet with a removable ladder as a re-boarding device, and updated its standard pre-departure passenger briefing to include information that had been missing.

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 28 February 2018. It was officially released on 27 March 2018.

Visit the Transportation Safety Board of Canada's website (www.tsb.gc.ca) for information about the TSB and its products and services. You will also find the Watchlist, which identifies the key safety issues that need to be addressed to make Canada's transportation system even safer. In each case, the TSB has found that actions taken to date are inadequate, and that industry and regulators need to take additional concrete measures to eliminate the risks.

Appendices

Appendix A – Area of the occurrence



Source: Canadian Hydrographic Service and Google Earth, with TSB annotations

Appendix B – Previous occurrences

M07L0120 – On 11 September 2007, the passenger vessel *Famille Dufour* struck the berthed vessel *Cavalier Royal* in Baie-Sainte-Catherine, Quebec. Strong winds and heavy seas were reported in the area at the time of the collision.

M08L0075 – On 29 May 2008, a passenger was injured on board the passenger vessel *Sentinelle II*, as the vessel encountered a large wave.

M09L0154 – On 02 September 2009, a passenger was injured on board the passenger vessel *Sentinelle III* as the vessel encountered winds of 20 to 30 knots and waves of 1.2 to 1.5 m.

M09L0173 – On 18 September 2009, the passenger vessel *Grand Fleuve* allided with the wharf while berthing in Tadoussac, Quebec. Winds of 30 to 40 knots were reported in the area at the time of the impact. Multiple passengers were injured.

M10L0100 – On 28 July 2010, a passenger was injured on board the passenger vessel *Tadoussac III* as the vessel encountered 25 to 30 knot winds and waves of 1.82 m.

M11L0139 – On 04 October 2011, 3 passengers were injured on board the *Tadoussac III* in winds of 30 to 35 knots and waves of 1.82 m.

M13L0108 – On 15 July 2013, the passenger vessel *Grand Charlevoix*, with 38 persons on board, ran aground on the strand known as Batture aux Alouettes near Baie-Sainte-Catherine, Quebec, which punctured the vessel's hull. Following the grounding, the engine compartment was flooded, which disabled the vessel. The 36 passengers were evacuated by other tour vessels, with no injuries reported. The TSB assessment of this occurrence concluded that, at the time of occurrence, the radar was dysfunctional, the magnetic compass was unstable, no voyage plan had been established, and the vessel's position was not monitored or recorded on a nautical chart. Moreover, there was no evacuation plan on board and the crew gave no instruction to the passengers on the donning of lifejackets and on the evacuation process. Finally, the investigation determined that the crew was not properly certified to carry out their assigned tasks.

M16C0101 – On 21 July 2016, a passenger was injured on board the passenger vessel C14378QC as the vessel encountered a large wave in 20-knot winds.