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AVALANCHES IN NEWFOUNDLAND AND LABRADOR – AN UPDATE

D.G.E. Liverman
Emeritus Scientist, Geological Survey

ABSTRACT

The historical record of avalanches in Newfoundland and Labrador is expanded by descriptions of numerous incidents, including five that resulted in fatalities. The total number of deaths known to be caused by avalanches in the Province is increased from 65 to 75. Incidents occurring in coastal and western Labrador, Belle Isle and the Northern Peninsula, Trepassey, Fogo and the Lewis Hills are described. Although avalanches in the Province are widespread, these new descriptions, when analyzed in conjunction with other known occurrences, point to areas of particularly high avalanche hazard.

INTRODUCTION

The book "Killer Snow" (Liverman, 2007) compiled and described avalanche incidents that occurred in Newfoundland and Labrador between 1781 and 2006. Forty-five avalanche incidents resulting in the deaths of sixty-five people were detailed. The book highlighted just one aspect of a long-term research project of the Geological Survey, designed to document geological hazards and disasters in the Province (Batterson *et al.*, 1995, 1999; Liverman *et al.*, 2001, 2003). This project demonstrated the value of archival and historical research in identifying hazards.

Since 2007, a number of other avalanche incidents have come to light, as well as additional information about previously recorded avalanches. New information has come through archival research, as well as direct contact from a number of individuals who had information relating to incidents (Table 1; Figure 1). Much of the previous research was performed by manually scanning microfilmed newspapers, a time-consuming task that also was not comprehensive. The extensive digitization of Newfoundland and Labrador newspapers in the last ten years has enabled a much more efficient means of searching contemporary sources for avalanche incidents – the text of digitized newspapers can be electronically searched, a much more focused, wide-ranging, and efficient means of locating historical avalanche incidents.

Previous publications resulted in greater awareness of avalanches in the Province, and a number of courses on avalanche safety were held, particularly on the west coast of Newfoundland by Keith Nicol of Grenfell College. These resulted in a network of outdoor enthusiasts who reported avalanche occurrences regularly for a number of years, and these were compiled by Nicol (2014).

The avalanche incidents described here are located across the Province, took place from 1880 to 2017, and vary in severity from fatal accidents to very minor occurrences.

New records of avalanche deaths include five people killed at Saglek in 1880; one killed in Little Paradise, Burin Peninsula in 1907; one killed on Belle Isle, Strait of Belle Isle in 1932; and one on the Northern Peninsula in 2007.

New records of avalanches causing injury include two injured in an avalanche near Woody Point, Bonne Bay in 1880, and minor injuries in an avalanche in the Battery, St. John's, in 1919. Other minor incidents are reported from Fogo, the Lewis Hills, St. John's, Labrador City, Trepassey, the Humber Gorge, Port au Choix, the Bay of Islands and St. Anthony. Additional photographs and updated information on avalanches previously recorded at Tilt Cove and Burgeo are also provided.

FATAL AVALANCHES

SAGLEK, 1880

The Inuit of Labrador lived in coastal Labrador long before European settlement of the Province and as such were exposed to avalanche hazard frequently. The worst avalanche disaster in the history of the Province, and the earliest recorded avalanche disaster in Canada was the 1781 incident near Nain that killed 22 people (Liverman, 2007). It was recorded in the papers of the Moravian Mission (National Archives of Canada 1764–1955), and further searching of these records has revealed another severe avalanche disaster that took place 100 years later in the Saglek area. Saglek Fjord lies north of the site of the former Moravian Mission in Hebron, and is a steep-sided narrow inlet with slope angles that would provide high avalanche

Table 1. Avalanche incidents described in the text, in chronological order

Date	Location	Description	Source
1877	Betts Cove, Baie Verte Peninsula	6 killed	Harbour Grace Standard
Sept. 1880	Saglek	5 killed	Moravian Church papers
Feb. 8, 1888	Woody Point	2 injured	Evening Telegram
Feb. 15, 1903	Tilt Cove	Outbuildings and property destroyed	Evening Telegram
1897-1916	St. John's area	Minor avalanches from buildings	Evening Telegram and Daily News
March 12, 1907	Little Paradise	John Mullowney killed outside his house	Evening Telegram
March 9, 1911	Burgeo area	1 killed	Evening Telegram
March, 1911	Trepassey	One buried	Western Star
March, 1912	Tilt Cove, Baie Verte Peninsula	5 killed	David Baxter, Michael Baxter, Judy Powell
Dec. 27, 1919	Battery, St. John's	Several houses damaged	Evening Telegram
March 25, 1932	Belle Isle	Michael Thomas (Morrell) killed	Chubbs and Kearley (2013), Western Star
1935	Okak	Two killed in their house	Lyall (2011)
1987	Tilt Cove	Avalanche struck a house	Tilt Cove museum
March 10, 2007	Blue Mountains, Northern Peninsula	Jamie Patey killed	CBC and other news reports
March 13, 2008	Fogo, Fogo Island	House struck	Pilot, CBC news
2009-2014	Lewis Hills, Gros Morne	Avalanche reports by recreational users	Keith Nicol web site
Feb. 2011	Smokey Mountain ski area, Labrador City	Avalanche on ski hill when closed	CBC web site
Feb. 6, 2015	York Harbour	Avalanche struck car, buried road	CBC web site
March 2017	St. Anthony	Struck house, minor damage	Northern Pen
March 2017	Port au Choix	Struck house, minor damage	CBC web site
April 29, 2017	Steady Brook	Ice and rocks blocked highway	CBC, NTV web sites

hazard. The papers of the Moravian Mission provide two references to the incident (Moravian Church, 1881).

The first reference to the Saglek area avalanche by the Moravian Church, 1881 (page 116) states "In November five persons were in an avalanche near Saglek, and perished. The saddest feature about this loss of life was that all were unprepared for this sudden transition from life to death." The second reference to the same avalanche by the Moravian Church, *op. cit.* (page 331) provides more detail: "A party of seven Eskimoes from Hebron, who had sailed to a bay west of Saglek for trout-fishing, were imprudent enough to encamp under an overhanging snow-wall, which came down upon them as an avalanche, carrying away the whole encampment; only two persons, a woman and a boy, were miraculously preserved, and enabled to return to Hebron. The bodies of the four unfortunate men were found on the shore, that of a woman was probably carried out to sea."

The exact location is hard to pinpoint but given that the people killed were trout fishing it is likely at the head of the fjord, either Southwest Arm or North Arm where rivers enter the sea. Slopes in this area are steep and up to 1000 m high. November is early in the winter for an avalanche but this far north, significant snowfall can occur at that time of year.

LITTLE PARADISE, 1907

The Evening Telegram of March 27, 1907 reports the death of John Mullowney of Little Paradise as follows: "A DREADFUL fatality happened at Little Paradise on the 12th inst., in which John Mullowney, a fine young man, lost his life in a most unexpected manner. He was going from his dwelling to his stage when an avalanche of snow came down from a hill by which he had to pass and swept him into the sea. He was drowned in a minute or so in sight of his wife, who was powerless to render him any assistance".

Little Paradise was a community on the Burin Peninsula at the tip of a long peninsula reaching into Placentia Bay from the Burin, east of Petit Forte. It was resettled in 1968 although still has housing used seasonally.

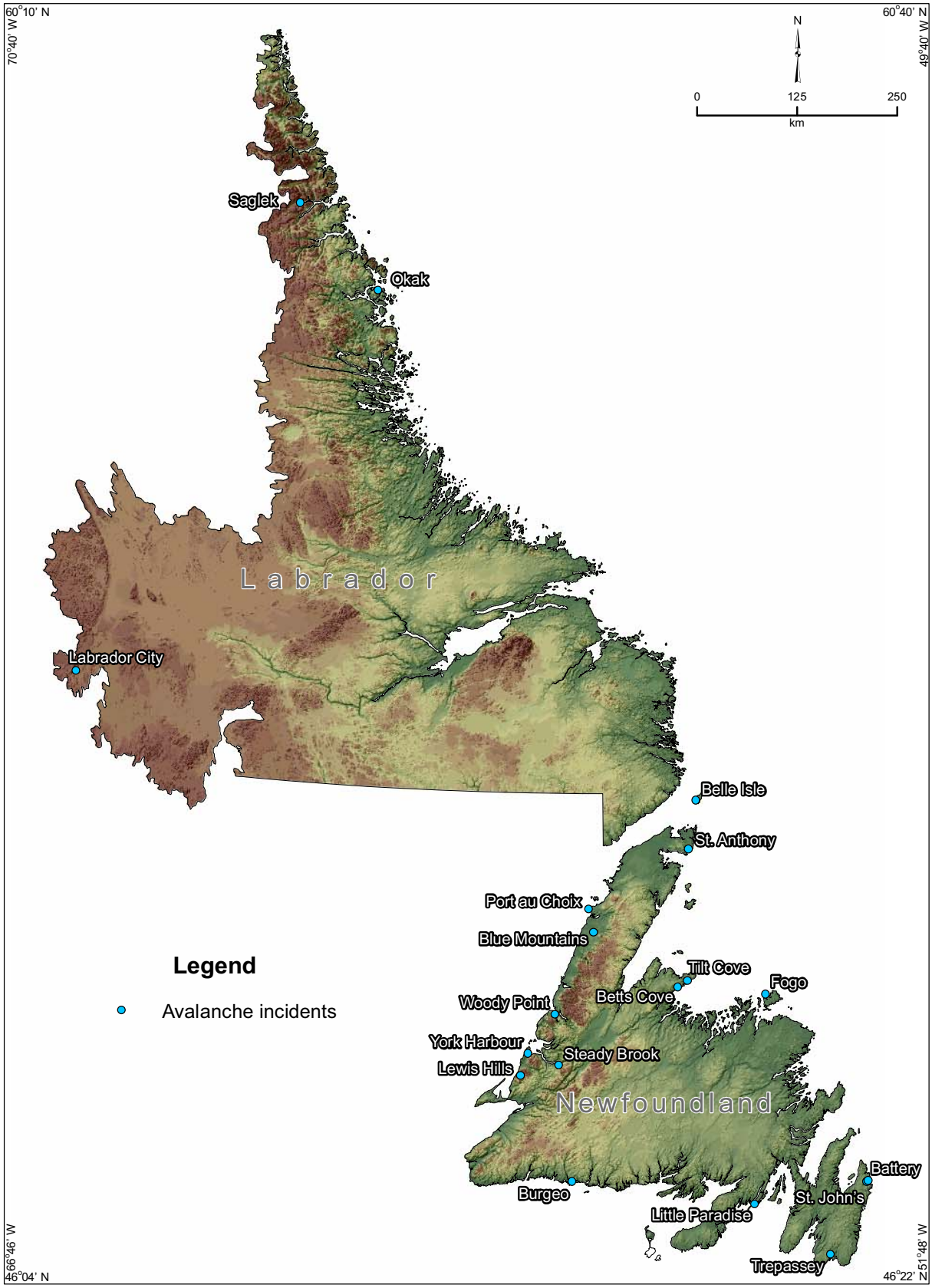

Figure 1. *Map of avalanche incidents described in text.*

The community was built surrounded by steep slopes up to 100 m high that might be prone to avalanches. A serious avalanche took place in nearby Footes Cove on March 11, 1907, severely injuring two people, suggesting that the snow pack was highly prone to failure at this time (Liverman, 2007). No climate data is available for Burin on this date, but St. John's recorded 45.7 mm of rain on March 12th, suggesting a major storm. If this had fallen as snow on the Burin Peninsula this may have caused the instability in the snow pack that resulted in these avalanches.

BELLE ISLE, 1932

Chubbs and Kearley (2013) reported the death of Michael Thomas Jr., assistant lightkeeper at Southwest Belle Isle, smothered by an avalanche while checking his fox traps at Green Cove Brook, March 25, 1932. They recount the story of Thomas, the son of the lightkeeper Michael Thomas Sr., not returning from checking his traps. A storm prevented a search party being sent out until the following day, but no sign of Thomas Jr. was found. His body was apparently found later in the spring as the snow retreated and the search party believed he had been smothered by an avalanche. The body was recovered and returned to the Thomas family home for burial.

Belle Isle lies in the middle of the Strait of Belle Isle, a popular shipping route for vessels entering or leaving the Gulf of St. Lawrence, allowing passage between the Island of Newfoundland and Labrador, rather than travelling east of the Island. Given Belle Isle's position, lighthouses were considered essential, and the southern lighthouse was constructed in the 1850s. The web site Lighthousefriends.com indicates the lighthouse keeper from 1918 to 1944 was Michael Thomas. The lighthouse was constructed on the southern tip of the Island; Green Cove is on the western side of the Island about 5 km northwest of the lighthouse. Green Cove is a small bay, surrounded by steep slopes of an ideal angle for the generation of avalanches (30–50°).

The Western Star on May 18, 1932 reported "The body of Michael Morell, who was caught in a snowslide and carried over a cliff at Belle Isle in March, was found on the beach there last Saturday".

There is thus contradictory information as to the name of the victim – Michael Thomas or Michael Morrell. Chubbs and Kearley (2013) used as sources, stories told to them many years after the events that occurred, and there may be some inadvertent inaccuracies in these accounts.

Michael Thomas Sr. was from the St. George's area of western Newfoundland. The 1921 census of Newfoundland has Michael Morrell (born in 1909) living in St George's in the household of Michael Thomas (born in 1873) and Isabel Thomas, and listed as their nephew. It thus seems possible that Michael Thomas Jr./Morrell were the same person, nephew of the lightkeeper. He may have taken the surname of his uncle.

OKAK, 1935

Lyall (2011) described travelling between Okak and Nutak in 1935, and visiting an Inuit family in their house located about halfway between the two communities. He continued on to Nutak through a major storm, and on his return the next day met the father and son of the family who told him an avalanche had struck their house, killing the man's wife and eighteen year old daughter.

The communities of Okak and Nutak were both situated on Okak Island in the mouth of Okak Bay. Maps suggest that any route around the north coast of the Island would pass under numerous steep, likely avalanche-prone, slopes.

Liverman (2007) described another fatal avalanche in the Okak area that killed two people, and injured eleven in 1934-35. The location was described as being at Udlik, 20 km south of Okak. The Udlik Peninsula is part of the mainland of Labrador, and therefore the avalanche described by Lyall (2011) appears to be at a different location. In addition, the description of the disaster is quite different. It seems likely, therefore, that there were two fatal avalanches in the Okak area in the winter of 1934-35. The snow and weather conditions likely to cause avalanches would affect a wide area, so it would not be unusual to have numerous avalanches occurring.

BLUE MOUNTAIN, NORTHERN PENINSULA, 2007

On March 10, 2007 an avalanche on Eastern Blue Hills, near River of Ponds, Northern Peninsula, killed 30 year old Jamie Patey. Various news sources described the incident. A party of eleven – two adults and nine teenagers – were out on snowmobiles, in good weather. They stopped at the foot of a steep slope and started walking up it. Jamie and Jason Patey were perhaps 30-50 m from the snowmobiles, and the teenagers higher on the slope, when the avalanche started. It swept downslope – reports suggest seven were buried; the two older men were most deeply buried. Jason Patey was dug out quickly and was unhurt. Jamie was buried perhaps 1 m down in a pile of debris up to 5 m thick. When he was located, efforts at CPR were unsuccessful.

Nine of the party were later recognized for their rescue efforts, receiving a Certificate of Commendation from the Governor General of Canada.

AVALANCHES CAUSING DEATH AND INJURY

WOODY POINT, 1888

The Evening Telegram of March 13, 1888 contains a letter from Mr. N.N. Taylor in which he describes an avalanche accident that took place on February 8, 1888 in the area of Woody Point, Gros Morne. Two youths (aged 15 and 19, Mannaseh and James Mudge) were cutting firewood when struck by an avalanche. The elder was completely buried and the younger carried 30–40 m and thrown against some trees. The younger boy had both his legs broken but was able to cry for help. Fortunately a neighbour was in the vicinity, and heard the cries. He went to seek help at the nearest house, 700–800 m away, and on his return dug out the older victim from under 2 m of snow. He had been buried for at least 45 minutes, but was alive. Both were taken to the nearby community and apparently survived.

Liverman (2007) described an 1876 avalanche near Woody Point in which three were killed. The site is described as being at Charlie Fons Brook, halfway between Mudge's Point and Curzon Village. The 1888 occurrence may be in the same area.

BATTERY, ST. JOHN'S, 1919

The Evening Telegram of December 27, 1919 described an avalanche in the Battery, St. John's. "Some time this morning an avalanche of snow turned over one of the small buildings at the South Battery. The house was wrecked and the furnishings were scattered over the hill. The family barely escaped with their lives. Several other small dwellings were completely buried, and two had the roofs stove in by the pressure of the snow."

The Battery has seen frequent avalanches over the years. Liverman (2007) described two avalanches in 1921, the first injuring three people when their house was destroyed, and the second killing a man on his way to work. In February 1959, five were killed and nine injured in a major avalanche. Minor avalanches were also recorded in 1960 and 1987.

COASTAL LABRADOR

McGrath (2014) described a number of incidents on the northern coast of Labrador, based on oral history, and interviews. They include a report of a trapper buried (without serious injury) in an avalanche south of Hopedale in the 1920s, and a near escape from an avalanche in the Hebron area around 1940.

OTHER INCIDENTS

TREPASSEY, 1911

The Western Star of March 15, 1911 reported "a young lad named St. Croix was buried in a snow slide near Trepassey on Thursday". No further details regarding this incident have been found to date.

FOGO, 2008

A heavy winter storm struck most of central Newfoundland on March 13, 2008 with up to 50 cm of snow falling and high winds. Weather records show close to 50 cm of snow on the ground prior to the storm. The Pilot (March 13, 2008) provided a detailed report of an avalanche that occurred in the community of Fogo. Fred Snow was clearing snow outside his house when the avalanche struck. He was carried 10 m across the road by the avalanche and buried up to his throat. He was able to free his hands and dig himself out, and was unhurt. The avalanche had covered the back of his house, up to roof level, blocking the main doorway and trapping his mother, girlfriend and two children inside. He and a neighbour were able to clear the doorway, and the house was mostly undamaged, apart from the rear deck being destroyed. A pick up truck and snowmobile parked by the house were hit by the avalanche and moved several metres. The Pilot also reported that another avalanche had occurred in the area several years before.

The house is located on the east side of Fogo Harbour, below steep rocky slopes rising 50–60 m above the shoreline.

LEWIS HILLS, 2009–2014

Keith Nicol of Grenfell College offered avalanche training in western Newfoundland for a number of years, and through his connections became aware of a number of avalanches experienced by snow-machine users and backcountry skiers, mostly in the Lewis Hills, and Gros Morne areas. None of these incidents caused death or injury but there were a number of lucky escapes. Some of these were detailed in Liverman (2007) but since its publication more have occurred, described by Keith Nicol on his web site (Nicol, 2014), and on internet snowmobile discussion groups.

On March 14, 2009 an avalanche affected a group of snowmobilers in the Lewis Hills. Three were ascending a slope behind a cabin when the second rider triggered a large slab avalanche. All three escaped unhurt but the avalanche was large enough to snap off trees on the slopes below.

On March 22, 2009 a snowmobiler high marking (an activity where the rider tries to ride as high as possible on a steep slope) in the upper Fox Island River valley, Lewis Hills, triggered a small avalanche. He was able to ride out the avalanche without being buried. This area is prone to avalanches and much bigger events have been observed in the past. YouTube video of the incident shows a classic slab avalanche breaking away from the steepest part of the hillside and travelling perhaps 100 m downslope.

On March 30, 2011 an avalanche was triggered by a snowmobiler in the Lewis Hills. He barely escaped. The avalanche had a crown fracture in excess of 3–4 m and snapped off many trees. Some blocks were the size of cars and trucks. Keith Nicol posted a video about this incident on YouTube (Canadian Avalanche Foundation, Spring 2011 newsletter).

Reports were only collected for a relatively brief time, but these incidents, combined with those reported in Liverman (2007), and the fatal accident on the Northern Peninsula in 2007, clearly show that avalanche hazard is significant in the western Newfoundland mountains, and that avalanche awareness, training and preparation are important in minimizing the impact of avalanches on back-country skiers and snow-machine users.

LABRADOR CITY, 2011

CBC reported in February 2011: “There was a small avalanche at Smokey Mountain in Labrador City last week. It happened adjacent to the ski hill, but nobody was skiing at the time. There have been two other such incidents in the past number of years”.

The report features an interview with ski-club president Mike Power. Liverman (2007) reported avalanches in the same location – a 1985 avalanche that buried five skiers, and a 2006 avalanche that buried a snowmobiler.

YORK HARBOUR, 2015

On February 6, 2015 an avalanche blocked the road between York Harbour and Lark Harbour in the Bay of Islands. Taxi-driver Bill McDowell was traveling from York Harbour to Lark Harbour when an avalanche swept down onto the road in front of him, striking but not burying his car. McDowell was uninjured, and the road was cleared later that day. The area the avalanche occurred is known as “The Scrape” and also is prone to rockfall, with protective measures installed by highway maintenance.

Route 450 lies below steep slopes for much of its length between Corner Brook and Lark Harbour, and other avalanche incidents are known in the area. Liverman (2007) described the 1905 avalanche at the York Harbour mine that buried two men, and back-country skiers and snowmobilers have reported avalanches in the Blomidon Hills.

ST. ANTHONY, 2017

The Northern Pen newspaper of March 8, 2017 reported that an avalanche had struck the house of Leonard and Hazel Tucker on Johnson’s Road, St. Anthony. The avalanche pushed a vehicle up against the house, damaging siding, and burst through the front door of the house. The Tuckers reported a previous avalanche in February 2014 had buried their vehicle completely.

Liverman (2007) described an avalanche that damaged a house on Johnson’s Road in February 2004. Although no major damage or injury occurred in these incidents, the occurrence of three avalanches at this location in thirteen years suggests this is a highly hazardous area, and that protective measures might be considered.

PORT AU CHOIX, 2017

The west coast of Newfoundland was hit by several winter storms in March 2017; on March 12, a small avalanche hit the house of Janice Gould and Rick Cooper on Laver’s Drive in Port au Choix. The back wall of the house was damaged by the avalanche, and it took three days to clear the debris. In the CBC report of the incident, the owners talked about trying to install a protective fence on the slope above the house, or moving the house away from the slope, to prevent further incidents.

An avalanche in Port au Choix is unexpected as the town is located in an area having few steep slopes and a maximum elevation of only 30–40 m. The house affected, when viewed on Google Street View, lies below a slope, only 10–20 m high and of gentle gradient. The same house was featured in news reports from 2014, when it was completely buried by snow. Photographs show a massive build up of snow behind the house and it appears that this is an area of exceptional snow accumulation caused by drifting. The 2017 avalanche thus may have occurred when the continued deposition of drifting snow resulted in instability in the snow pack itself, rather than being a result of the underlying slopes.

STEADY BROOK, 2017

The Trans-Canada Highway in the vicinity of Steady Brook was blocked for several hours on April 29, 2017 by a fall of ice and rocks. The eastbound lane was covered by debris, resulting in the complete closure to traffic for 6

hours, and then diversion into the westbound lane for a day. No damage to vehicles was reported. Photographs show a mass of dominantly ice and snow but also carrying rocks covering one lane of the Trans-Canada. The incident was described as a rockfall, landslide and avalanche by various news reports. Given the dominant material involved was ice and snow, this is best classified as an avalanche.

The Humber Gorge in this area is prone to slope movements, and these impact transportation through the area. Steep slopes rise 300–400 m directly above the road, and numerous rockfalls, landslides and avalanches are known to have occurred (Liverman, 2007; Batterson *et al.*, 1995, 1999). In 1922, a train carrying forty people was swept from the tracks in the gorge, and in 1918, Joshua Peddle was killed by an avalanche while clearing the rail tracks of the debris of a previous avalanche.

April is late in the winter for avalanches in Newfoundland, but not unprecedented. Liverman (2007) described two very similar incidents in the same area; in May 1952 and April 1953, avalanches of snow and ice blocked the rail tracks in the Humber Gorge. The slopes above the Trans-Canada Highway in the gorge are north-facing and get very little direct sunlight. They thus retain snow and ice for a long period, and this may release from the slope forming an avalanche once air temperatures increase in the spring. The 2017 incident followed a period of warm weather, and it would be wise to be prepared for similar incidents in the future.

ST. JOHN'S BUILDINGS

Newspapers of the late 19th and early 20th centuries report a number of minor incidents in downtown St. John's of pedestrians being struck by snow falling off buildings (Table 2). Only minor injuries resulted but similar avalanches have been known to cause serious injury or death – Liverman (2007) recounted the case of Michael MacNeill who was killed by 15 tonnes of snow sliding off the roof of a blast furnace in Sydney, Nova Scotia in 1902. It is likely that falls from buildings have been common throughout the history of St. John's, and the reporting of these incidents over just a comparatively brief period of time is curious. They do serve as a warning that building design in Newfoundland has to accommodate high snowfall conditions, the potential for snow sliding off roof structures and causing damage to property or injury.

UPDATES ON PREVIOUSLY REPORTED INCIDENTS

BETTS COVE, 1877

The 1879 Harbour Grace Standard published an anonymous serial "Recollections of a Year in

Table 2. Minor avalanches from buildings, St. John's

Date	Source	Description
January, 1897	Evening Telegram	A snowslide from Goodridge's office landed on the back of a horse that ran off.
March, 1897	Evening Telegram	A large amount of snow and ice fell from the roof of the Church Institute Rooms, on Duckworth Street. One large piece of ice struck an old man on the head, inflicting a slight wound on his right cheek.
December, 1897	Evening Telegram	A snow slide took place off the roof of Duggan's shop on Water Street. A horse standing near took flight.
December, 1897	Evening Telegram	A reporter and a railway official were struck by snow sliding off a roof on Water Street.
April, 1908	Evening Telegram	A man was struck by an avalanche of snow off J. O'Reilly's roof, Water Street. He was knocked to his knees and an umbrella that he carried was smashed to pieces.
February, 1912	Evening Telegram	An avalanche of snow from the ledge over the second story of the Royal Bank of Canada fell on a man, with no injury.
January, 1916	Evening Telegram	A man was struck by an avalanche from the roof of one of the stores. The snow being light, he was not injured.
January, 1916	Evening Telegram	A snowslide from a roof on Duckworth Street struck a boy on the head and knocked him unconscious.
February, 1916	St. John's Daily Star	Over a ton of ice and snow fell to the sidewalk from the Anderson Building on Water Street. A passer-by had a narrow escape and telephone wires were broken.

Newfoundland". Although not specifically identifying the community, the author spent time at a mining community in northeast Newfoundland and recounted in detail an avalanche disaster that was almost certainly the 1877 avalanche in Betts Cove that killed six people described by Liverman (2007). The Harbour Grace Standard account confirms that five of the six fatalities were children, and provided additional details. The avalanche occurred at 2 am, in the middle of a fierce storm. It struck one house, removing it from its foundation and driving it against another house, both being swept down-slope until coming to rest on the road below. One child survived after being buried for three and a half hours.

TILT COVE, 1912

The 1912 avalanche in Tilt Cove killed five people, and is described in detail by Liverman (2007). A recent discovery is the report of the Evening Telegram of 11 March 1903 that describes an avalanche that took place on the 15th of February that year. The avalanche destroyed two outbuildings, and damaged property belonging to the mine manager. The report indicates that some residents were relocating to other parts of the community due to the avalanche danger; unfortunately it seems that the mine manager and neighbours chose to stay with tragic consequences nine years later. Since the publication of Liverman (*op. cit.*), descendants of victims of the avalanche contacted the Geological Survey and provided more details and photographs of those affected. David and Michael Baxter of British Columbia are children/grandchildren of Dora Williams, who was buried in the 1912 avalanche, along with her mother and sisters but survived. Dora's father, Francis, and brother, James, were killed in the avalanche (Plates 1 and 2). The Baxters supplied photographs of the Williams family. Judy Powell of Calgary is the grand-daughter of Cyril Cunningham, who, along with his siblings, was buried in the avalanche in the house next door to the Williams – she also provided a family photograph (Plate 3).

Plate 1. *Francis Williams, mine manager, (killed in the avalanche) at his desk in Tilt Cove (supplied by David Baxter, used with permission).*

The Baxters provided some details of the Williams family after the avalanche. Mrs. Williams never fully recovered

Plate 2. *Mrs. Sarah Williams, James Williams (killed in the avalanche) and Dora Williams. Supplied by David Baxter, used with permission.*

Plate 3. *The Cunningham children. The back row (left to right) Isabel, Helen, Evelyn and Vera. Front row Cecil and Edward Cunningham. Edward was buried in the avalanche but saved by Emily Day. Supplied by Judy Powell, used with permission.*

from the experience of losing her husband and son, but lived into her eighties in Rochester, Kent, England. Michael Baxter remembers her as "a tiny lady with a very happy disposition". Dora Williams, buried with her mother in the avalanche, married George Baxter, and died in the 1960s, also in England.

The 100th anniversary of the 1912 Tilt Cove avalanche was commemorated on the Baie Verte Peninsula by a series of events in the communities there. The small museum at Tilt Cove was the venue for the reception, and there they have a photograph of a small avalanche in 1987 that impacted one of the few remaining houses. This avalanche took place on the eastern side of the cove, below relatively short slopes, as opposed to the 1912 avalanche that took place at the head of the cove below much longer and steeper slopes.

Hazard research often is relatively impersonal, yet these disasters have a huge impact on those affected. These photographs of the Tilt Cove victims act to humanize this impact, and helps remind those who research such disasters that they levy a toll of lives, and on lives – so much so that this incident is well remembered by the families of those affected a century after it occurred. The 100th anniversary of the death of Emily Day, the servant of the Cunninghams (who saved the life of Edward Cunningham but died later after suffering for months with severe burns) was commemorated in 2012 by a wreath laid on her grave in St. John's, provided by descendants of the Cunningham family.

BURGEO, 1911

Liverman (2007) located a passing reference to the death of Joseph Strickland by avalanche in the diary of Joseph Small of Burgeo. Further research confirms that Strickland did indeed die in an avalanche. The Evening Telegram of March 9, 1911 reported a wire from the magistrate at Burgeo that reported Joseph Strickland had gone missing while travelling in the country. A search party found tracks leading under avalanche debris, and it was assumed his body was buried there. The Register of Deaths for the Burgeo and LaPoile District (transcribed on the "Newfoundland's Grand Banks" website) recorded his death by accident on March 7, 1911.

DISCUSSION

Liverman (2007) described eighteen fatal avalanche incidents in the Province, causing sixty-five deaths. This study describes a further five fatal avalanches, causing ten deaths. Apart from the 2007 death on the Northern Peninsula, the other four fatal incidents were prior to World War II, and in relatively remote locations. It seems probable that coastal Labrador likely has seen occasional fatal avalanches throughout the written historical record and beyond, impacting the Inuit prior to European settlement, and continuing on. The Inuit traditional way of life meant that winter activities and settlement were in areas close to the coast, and where steep slopes existed, prone to avalanches. Although there was likely a strong understanding of avalanche danger passed on through traditional knowledge, accidents still would occur, as shown by those known from the written record. With a sparse written historical record, the oral tradition may be the only way in which many such events might be further documented.

These five further incidents impacted people at work, during recreation, and in their homes. Liverman (2007) noted that the number of people killed in their homes in the Province was relatively high compared to the recent Canadian record of avalanche deaths, which is dominated by those engaged in recreation. These additional accidents further reinforce this pattern, with the combined data showing nearly 70% of recorded deaths taking place while the victims were at home, 21% while engaged in work or travel to and from work, and only 7% while engaged in recreation. Boyd *et al.* (2009) reported that between 1984 and 2005, 92% of avalanche deaths in Canada occurred when the victims were engaged in outdoor recreation. It is likely that modern patterns are dominated by the expansion of outdoor recreation in western Canada, and that historically a lower proportion of deaths would occur while engaged in recreation.

Liverman (2007) identified avalanche "hot-spots" – areas of the Province where repeated avalanches have occurred. These included the St. Anthony area, Corner Brook and Bay of Islands, the Baie Verte Peninsula, the northeast Avalon, southern Labrador and the northern Labrador coast.

Additional incidents reported here further confirm that the St. Anthony area, the Battery in St. John's, Bay of Islands, southern Labrador/Straits area, and the west coast are particularly hazardous for avalanches. The appropriate response to the knowledge that serious avalanche hazard may occur depends on the circumstances. In the cases where repeated avalanches have occurred impacting a small area, particularly houses or work-places, then options normally considered would be installation of protective measures, or re-location of the impacted properties. For example, the Government of Québec, in response to avalanche deaths in Blanc-Sablon, in the Straits area, relocated a number of houses thought to be at risk in the early 2000s. It is also important to consider avalanche hazard when planning new developments, and in permitting of construction.

If the impact is more general, and may largely affect recreational users, then the appropriate response is measures to increase avalanche awareness, training in avalanche safety, and encouragement for users to carry appropriate equipment.

The record of avalanches for the Battery includes fatal avalanches in 1921 (two separate incidents) and 1959, an avalanche causing serious property damage in 1919, as well as minor avalanches in 1960 and 1987. As reported in Batterson *et al.* (1999), protective fencing was installed by the City of St. John's in 1996 in order to mitigate avalanche and rockfall hazard in the area. No avalanches are known to have taken place subsequently, but given the severity of previous incidents it might be wise to review these safety measures to ensure they remain adequate.

The Johnson's Road area of St. Anthony has seen repeated avalanches, fortunately without serious injury. That potential does exist and it would be prudent to engage professional advice in regard to possible mitigation measures in this area.

Two of the incidents described here deal with impact on roads. The York Harbour avalanche was a "near-miss" – the car involved could easily have been swept over the guard rail with serious consequences. The Humber Gorge has had several avalanches affecting the road and rail routes through it. Re-routing transportation to avoid avalanche hazard is not possible in these areas, with no clear alternate routes available to by-pass the gorge, or along the Bay of Islands. Avalanches blocking roads are inconvenient and costly but if they directly impact users then the consequences can be serious. In addition, great care has to be taken in clearing avalanches. Joshua Peddle was killed in 1918 clearing the debris of a pervious avalanche, and the worst known avalanche in Canada killed 62 workers clearing the rail line in the Rogers Pass, B.C. in 1910. Consideration needs to be given to training so that highway workers are not exposed to danger, and potentially closing roads at times of high avalanche danger.

The west coast of Newfoundland and the northern Labrador coast clearly also have significant potential for avalanches. The mostly likely impact in these areas in the future will be on recreational users, and subsistence hunters. It will be important to ensure residents and visitors to these areas for recreational purposes are well aware of avalanche danger and are appropriately prepared. Following the increased understanding of avalanche risk in the Province that grew from the Geological Survey research project, the Canadian Avalanche Association has funded avalanche safety training in western Newfoundland, and has on occasion issued avalanche warnings for the area.

CONCLUSIONS

Archival research is an important tool in identifying avalanche hazard in the Province. This technique, following the example of the Geological Survey study, has been applied elsewhere in eastern Canada, notably in Québec (Hetu *et al.*, 2008) who identified 69 deaths, 37 in residential settings, and mostly in similar settings to those identified in this Province – relatively short, steep slopes in the St. Lawrence valley. Isenor *et al.* (2006) described an avalanche in Cape Breton, Nova Scotia, that killed five people. Thus, this continuing study has made a significant contribution to the understanding of avalanche hazard in eastern Canada, an area where avalanches had not been considered a threat in the past. The growing accessibility of archival material in digital form greatly increases the ease and efficiency of locating past incidents. It was thought in 2007 that all fatal avalanche incidents likely had been identified, but this study clearly demonstrates that the record may continue to grow.

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