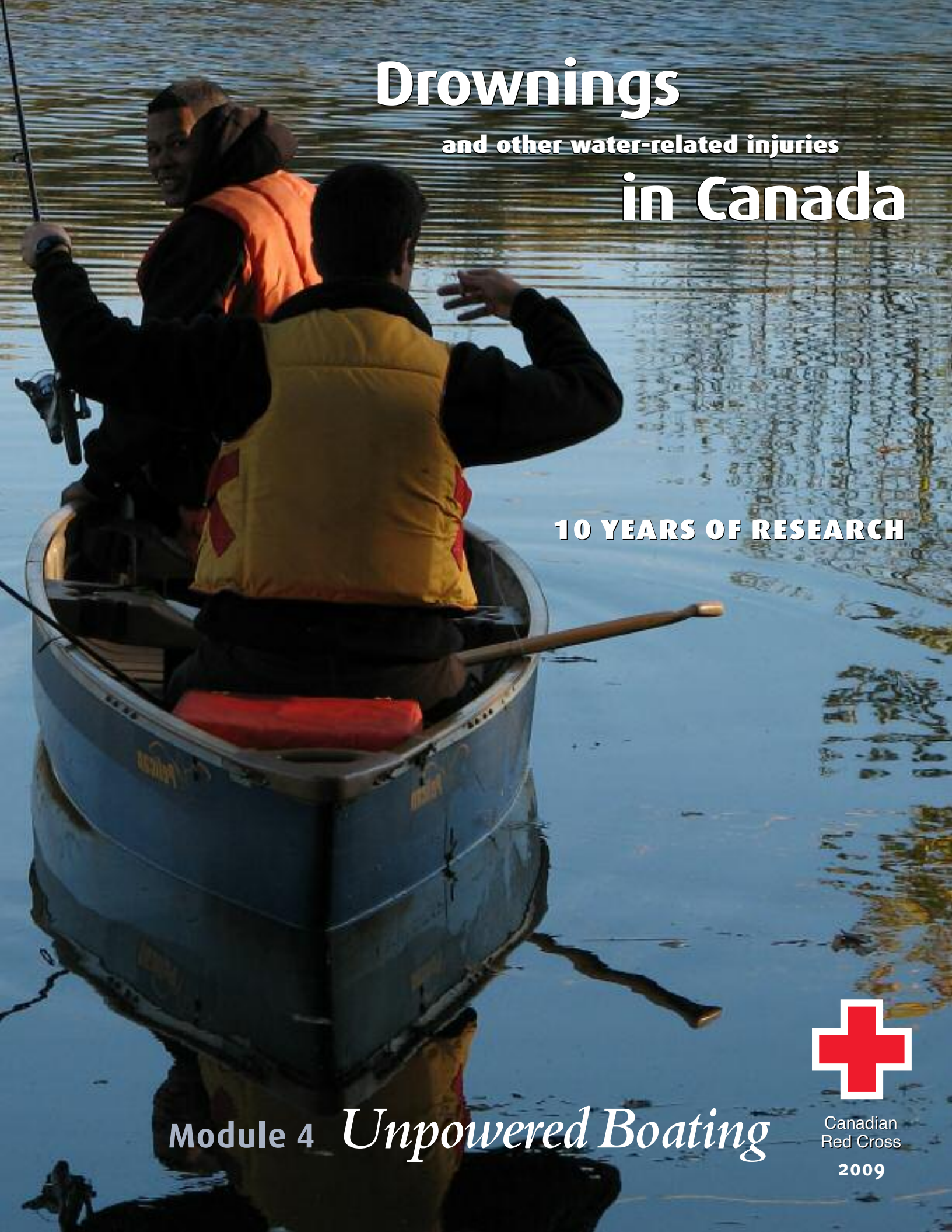


Drownings

and other water-related injuries

in Canada

10 YEARS OF RESEARCH

Module 4 *Unpowered Boating*

Canadian Red Cross

2009

This research is dedicated to the 710 people who died
during unpowered boating in Canada during 1991-2000.
May the evidence of the circumstances of their deaths
be a guide to safety for the Canadians who use
canoes, kayaks, rowboats, rafts, sailboats, and
other small boats for recreation, daily life, or work,
and for professionals and decision makers
with a duty to protect the vulnerable.

On the water Ralph noticed the lake become a little wrinkled. He looked over his shoulder and saw Gwen and Harry, who looked very small on shore. And then the wind hit — a soft blow to the side of his head — an offshore wind out of nowhere, and the canoe started to move …. He looked over his shoulder again and the wrinkle was a ripple moving towards him, darkened water, a disturbance of small waves racing in his direction. The wind swung him around. It came out of the northwest and he knew if he wasn't careful it would blow him out into the middle of a lake two miles wide.

He slid down onto his knees and moved forward until his belly was against the middle thwart and then he began to paddle hard, trying to swing the canoe into the wind, trying to get back to shore, but his knees slid around, he had nothing to lock his feet under, no way to get a good bite with his paddle. He did his best, he worked hard. There were little whitecaps now, but not too bad.

He was thinking he'd been lulled by the perfect stillness into coming out too far, and it felt like a bad decision to be alone on a lake this size. "Once a lake is ten miles long it might as well be an ocean." Some canoeist's voice from another trip years ago. The bow of his empty seventeen-foot canoe was like a weather vane. The wind kept taking it and pushing him farther out. His canoe bounced on the waves, then started to bang, but the sounds were carried off by the wind....

The waves were eighteen inches high now, two feet high, it happened fast. Ralph was exerting all his energy trying to straighten out the canoe, but the errant wind was determined to blow him away. He no longer thought he was in control, but it took him a few moments to realize he was in trouble. The waves picked up his canoe and surfed it forward, and he felt the sweat pour down his back. Out of a clear sky he was thinking — a rogue wind like a mini-storm, a mini-hurricane, at least way out here. On shore, would they even notice?

– Elizabeth Hay, *Late Nights on Air*, 2007

Drownings and Other Water-Related Injuries in Canada, 1991-2000
Module 4: Unpowered Boating

For a pdf version of this module, please visit our website at www.redcross.ca

This Visual Surveillance Report was developed and written by Dr. Peter Barss in collaboration with the Canadian Red Cross and with the assistance of Cait Beattie. Sophie Lapointe, research technician, carried out the data analysis.

Data collectors included volunteers and staff of the Canadian Red Cross and the Lifesaving Society. Data collection was made possible through the assistance and co-operation of provincial coroners, medical examiners, their statistical staff, and the National Association of Coroners. Financing of the work was done collaboratively by sharing resources and staff. Data collection mainly involved the Canadian Red Cross, the Lifesaving Society, and provincial coroners. Data coding, verification, and entry were supported by the Canadian Red Cross and the Lifesaving Society, and carried out by Isabelle Masson, Peter Barss, and Sophie Lapointe.

The National Search and Rescue Secretariat and the Canadian Red Cross Society funded data analysis and writing, as well as editing, design, and layout of this 10-year report. Shelley Dalke of the Canadian Red Cross coordinated this process. The Canadian Red Cross translation department supervised the translation of this module with the assistance of Cait Beattie; additional revisions in French were completed by Monique Edwards. The Canadian Coast Guard and Transport Canada sponsored the project and monitored its progress. The Research Institute of the McGill University Health Centre provided administrative support for data management.

For the initial six years, the National Drowning Report and related special interest reports were generously supported by The Injury Prevention Module of the Régie régionale de la santé et des services sociaux de Montréal-Centre, a member of the World Health Organization's Collaborating Centre for Injury Prevention and Safety Promotion. Rosemary Hong, former coordinator for drowning research at the Canadian Red Cross, inititated this 10-year modular project.

Design, layout and cover photo: Cait Beattie and Jean Louis Martin, Résolutique globale
Translation: Lexi-tech International (text), Résolutique globale (figures)

Ce rapport est aussi publié en français.

Module 4: Unpowered Boating

wearalifejacket.com

A website supported by The Cook-Rees Memorial Fund For Water Search And Safety.

A central location of information on how to find and choose the best flotation device for various water-related activities, and to learn about recent advances in lifejacket design for individual comfort, style and protection.

Sport and safety organizations, policy makers and the media can also consult the website to share knowledge, research and drowning prevention campaigns to help inform the public about the need to wear a lifejacket in, on and around the water.

INTRODUCTION

Unpowered boats have an important place in the Canadian psyche and, for many, the concept of self. First Nations peoples were renowned for their prowess with canoes, inland in turbulent rivers and on windy lakes, and in the Pacific Northwest in large ocean-going vessels. The Inuit mastered the freezing waters of the Arctic with their ingenious kayaks. These elegant, swift and silent boats were key to not only travel and trade, but to survival itself by fishing and hunting. Early explorers and traders also learned to use such boats. On the Atlantic and Pacific coasts, sailing vessels small and large were essential for moving goods and people and for commercial fishing.

Nowadays, subsistence fishing and hunting have become less frequent, while occupational activities primarily involve powerboats. Unpowered boats are mainly used for recreation in nature away from city crowds; activities associated with unpowered boating include canoeing, fishing, kayaking, rowing, rafting, sailing, and hunting.

This module includes an overview of 10 years of research on deaths in unpowered boats in Canada. The report focuses on the incidence or rate of death and trends during 1991-2000, and on personal, equipment, and environment risk factors. It was prepared to provide an epidemiologic profile for prevention. Injury incidents are often multifactorial. Nevertheless, a favourable change in a single factor can be sufficient to tip the balance away from danger in favour of safety to prevent an incident from occurring. This is pre-emptive action in the pre-event phase. The use of appropriate safety equipment or action can prevent injury even if an incident does occur; in this case, injury is aborted or reduced in the event phase. Finally, post-event phase activities such as rapid intervention with lifesaving, first aid, appropriate methods of rewarming, CPR, and so forth after an injury has occurred can minimize, stop, or reverse the progression of damage from any injuries sustained during the event phase.

The report is based on annual data abstraction of information collected by coroners and police about each incident, and recorded in provincial and territorial coroners' and medical examiners' files across Canada. This data collection and verification required more than 10 years of dedicated, exacting, and laborious work by volunteer Red Cross and other data collectors and managers, in collaboration with professional and voluntary researchers. Details of each incident were recorded in 15-page structured questionnaires and converted into electronic format for analysis. Each year's data collection, transformation into electronic format, and analysis required about two year's work. The analysis of 10 years of data, including trends, was much more complex than for a single year.

Due to the fact that much of the work was done on a voluntary basis, the total costs of collecting, analyzing, and reporting on incidence and risk factors of 5,900 drowning deaths, including those described here and in the other four modules of this series, was accomplished for the modest sum of about $C2 million, and has already resulted in averting hundreds of deaths, with about $C500 million savings in direct and human capital costs of lost earnings for families of victims. Our hope is that this report will help to bring about similar savings in lives and economic losses specifically for immersions and trauma during unpowered boating, a popular outdoor activity in Canada.

METHODS

STUDY POPULATION AND TIME PERIOD All drownings and other water-related injury deaths in Canada were monitored between 1 January 1991 and 31 December 2000; during this period there were 5,900 water-related deaths, including 5,535 drownings with or without hypothermia reported, 92 immersion hypothermia deaths without drowning, and 273 other injuries. In the 1996 census, the total population of Canada was 30,300,000. Thus, the unpowered boating deaths in 1991-2000 occurred on the background of about 303 million person years of exposure to risk for all ages. As denominators for incidence and trends for 1991-1995 we used 1991 census data, for 1996-2000, the 1996 census population, and for 1991-2000 the mean of the 1991 and 1996 census populations. We chose these two years since they are actual census data, and not the less valid inter-censual projections.

DROWNING AND IMMERSION HYPOTHERMIA For the purposes of this paper, an immersion death was classified as a drowning if drowning was included in the coroner's report, based upon the autopsy or other findings. The death was classified as hypothermia without drowning only if the autopsy or other coroner's finding excluded drowning as among the causes of death. Drownings with and without hypothermia were analyzed together. This was done because hypothermia is reported inconsistently, due to lack of clear criteria for such a diagnosis as well as lack of training in immersion deaths on the part of some coroners. On the other hand, immersion hypothermia without drowning tends to be based on lack of autopsy findings of drowning, and other supporting factors that exclude drowning, such as wearing of a flotation device.

ETHNICITY Because of greater exposure among aboriginal peoples to boat travel, and communities or homes near the water, the proportion of victims among First Nations and Inuit peoples is provided. Aboriginal status was considered definite if the victim was classified as such in the coroner, police, or autopsy files by coroner, police, or pathologist. Probable aboriginal status was assigned if the address corresponded to a known reserve and if the family name was known to be aboriginal. The definition of aboriginal varies, but they are thought to represent at least three to four percent of the Canadian population.

NATIONAL SURVEILLANCE DATABASE In the early 1990's, the Canadian Red Cross implemented a national drowning surveillance database. This was developed with collaboration of public health injury prevention professionals, all provincial coroners, and other water-safety organizations including the Coast Guard and Lifesaving Society. The database was funded to provide a sound research basis for national water-safety programs, by monitoring the incidence and circumstances of all water-related injury deaths in Canada on an annual basis. It includes annual information from 1991 onwards (Canadian Red Cross, 2001). An epidemiologic profile of all water-related injury deaths is available (Red Cross 2003, 2005).

DATA COLLECTION The surveillance database relies upon annual structured reviews of the mandatory coroner and police reports for all water-related deaths. A questionnaire with 48 questions is used to obtain data on cause of death, activity and purpose of activity, along with personal, equipment, and environment risk factors. Project managers supervise volunteer data collectors in each province.

DATA VERIFICATION AND ANALYSIS All completed questionnaires are verified and corrected at national level by a medically trained injury epidemiologist and demographer. Verification is highly structured and includes such issues as admissibility, completeness, internal consistency of responses, and consistency from year to year. Data entry is done with appropriate quality controls, including double entry and compare. Data are analyzed annually, but for this paper 10 years of data were used. Since coroners take a year or more to finalize all cases and data collection and analysis nearly another year, reporting tends to lag the incidents by about two years. This is not of major consequence for prevention, since major trends usually occur slowly.

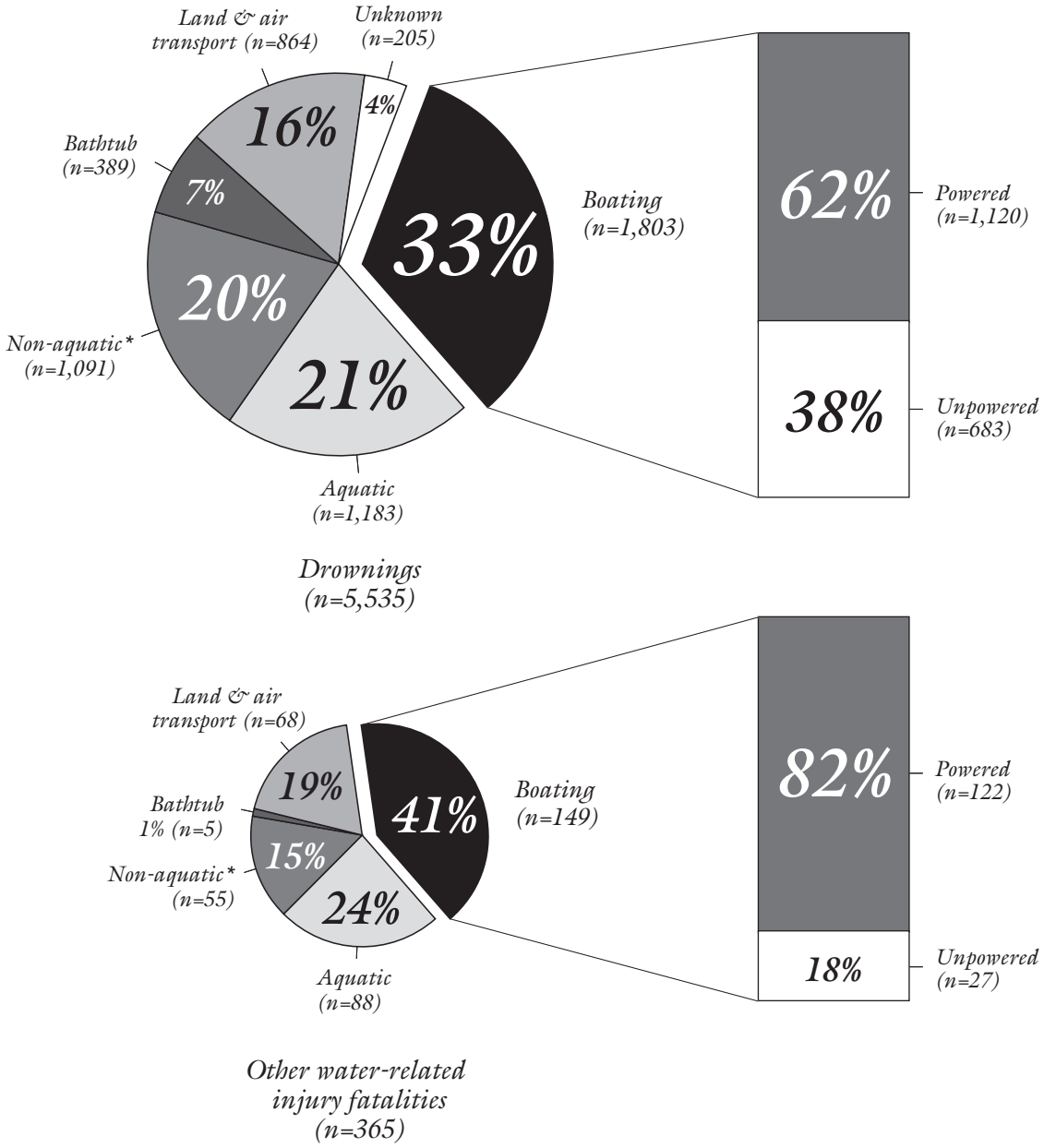
In the early development years, the analytical work was considered research. In later years, much of the analysis was done by a research technician and was considered surveillance. Detailed reports on new topics, such as the present paper, were considered research. Hence it was possible to provide both surveillance and a research basis for new programming. Recommendations were also supported by periodic monitoring of the scientific literature on injury prevention in international citation databases.

RESULTS

BOATING

There were 1,952 boating fatalities in Canada during 1991-2000, including 1,803 drownings, and 149 water-related non-drowning deaths resulting primarily from trauma and hypothermia. Boating accounted for 33% of drownings and 41% of non-drowning deaths (Figure 1). When we exclude land and air transport, boating represented 39% of drownings and 50% of other water-related fatalities.

Figure 1 **BOATING FATALITIES AS A PROPORTION OF DROWNINGS AND OTHER WATER-RELATED FATALITIES, CANADA 1991-2000 (n=5,900)**



** Falls into water during non-aquatic activities*

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Unpowered boating represented 38% of boating drownings and 17% of non-drowning boating fatalities in Canada during 1991-2000 (Figure 1). In total there were 710 deaths, including 683 drownings and 27 non-drowning deaths (hypothermia 17, trauma 10).

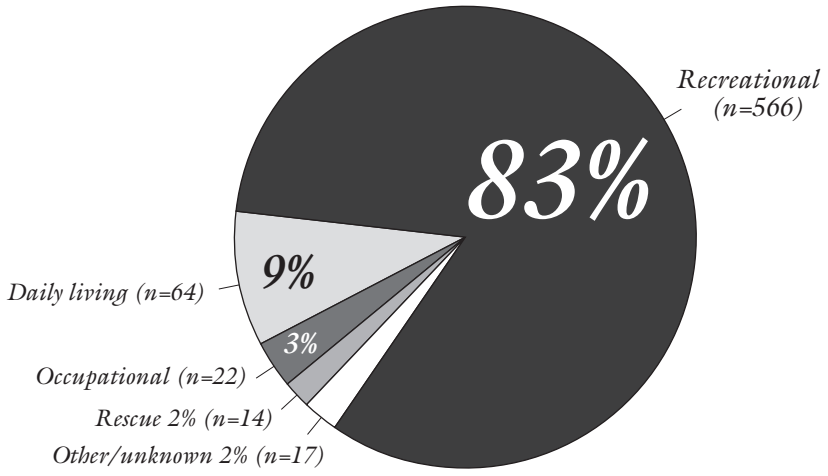
PURPOSE Most unpowered boating drownings occurred during recreational activities (Figure 2).

Recreational activities also accounted for 85% of non-drowning fatalities, followed by daily living 8%, occupational 4% and unknown activities 4%.

TYPE OF INCIDENT 52% of unpowered boating drownings resulted from capsizing. Other incidents included falling or jumping overboard, swamping and collision (Figure 3).

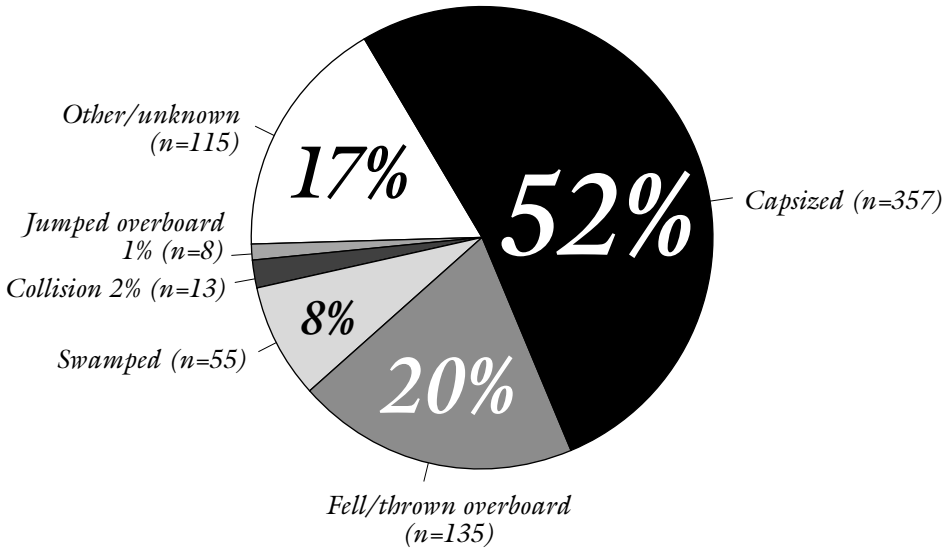
Non-drownings resulted from capsizing 50%, collision 12%, falling overboard 12%, swamping 8%, and other or unknown 19%.

Figure 2 **UNPOWERED BOATING DROWNINGS BY PURPOSE OF ACTIVITY, CANADA 1991-2000 (n=683)**



Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 3 **UNPOWERED BOATING DROWNINGS BY TYPE OF INCIDENT, CANADA 1991-2000 (n=683)**



Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

DROWNINGS

PERSONAL RISK FACTORS

AGE AND SEX The main risk group for unpowered boating drownings was males 15 to 74 years, with the peak at 15-24 years (Figure 4). This contrasts with powerboat drownings, where rates were slightly lower among 15-24-year-old males, but high at all ages over 24. Women and children under 15 were at very low risk.

ALCOHOL For victims 15 years and over, alcohol was involved or suspected in at least 40% of cases (Figure 5).

ALCOHOL BY REGION The involvement of alcohol was highest in the Prairies and the northern territories, and lowest in Quebec, where alcohol was present or suspected in about 20% of cases. However, the true proportion in Quebec may have been higher, since alcohol was unknown for 45% of victims, about twice the percentage for other regions (Figure 6).

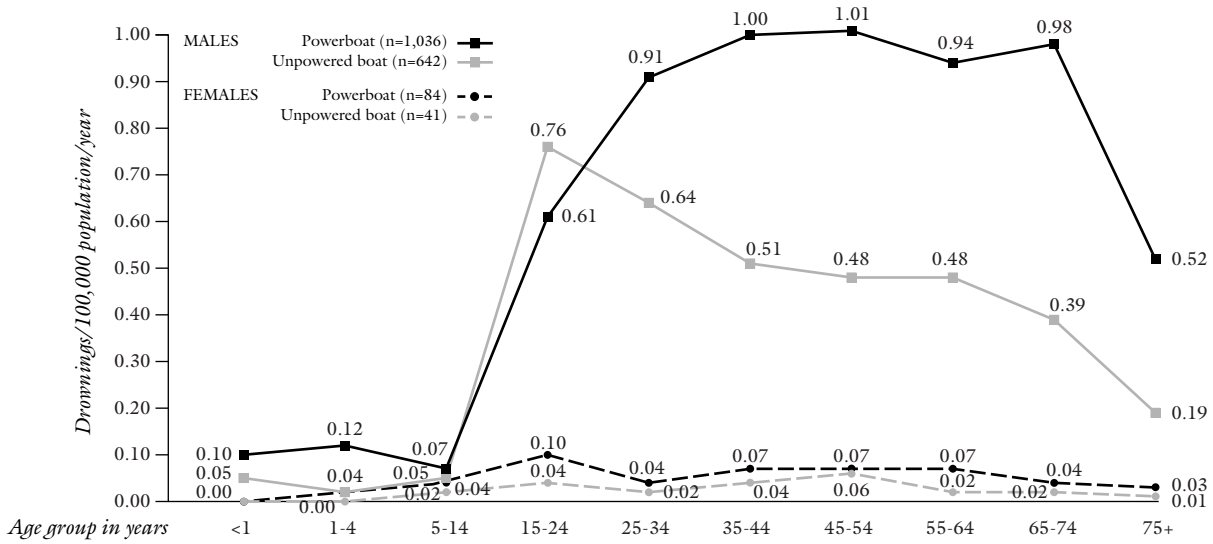
ETHNICITY 14% of victims were aboriginal, possibly more given that ethnicity was unknown for 30% of victims.

EQUIPMENT FACTORS

FLOTATION A flotation device was properly worn by only 11% of victims (Figure 7), a proportion slightly higher that of powerboat victims (9%). Flotation varied by type of unpowered boat, with those in kayaks, sailboats, and rafts more likely to have correctly worn flotation than those in canoes or rowboats (see Figures 23, 31, 38, 52, and 60). The proportion of children under 15 who properly wore flotation was 11% (2/18), the same as for unpowered victims overall. Flotation use did vary somewhat by age, however, with those in the peak risk group of 15-24 years less likely to have correctly worn flotation than those 25 years and older.

FLOTATION BY SWIMMING ABILITY Only 2% of weak or non-swimmers properly wore a flotation device (all were weak swimmers), compared with 13% of other victims (Figure 8).

Figure 4 **RATE AND NUMBER OF BOATING DROWNINGS BY AGE & SEX AND BY TYPE OF BOAT,* CANADA 1991-2000 (n=1,803)†**

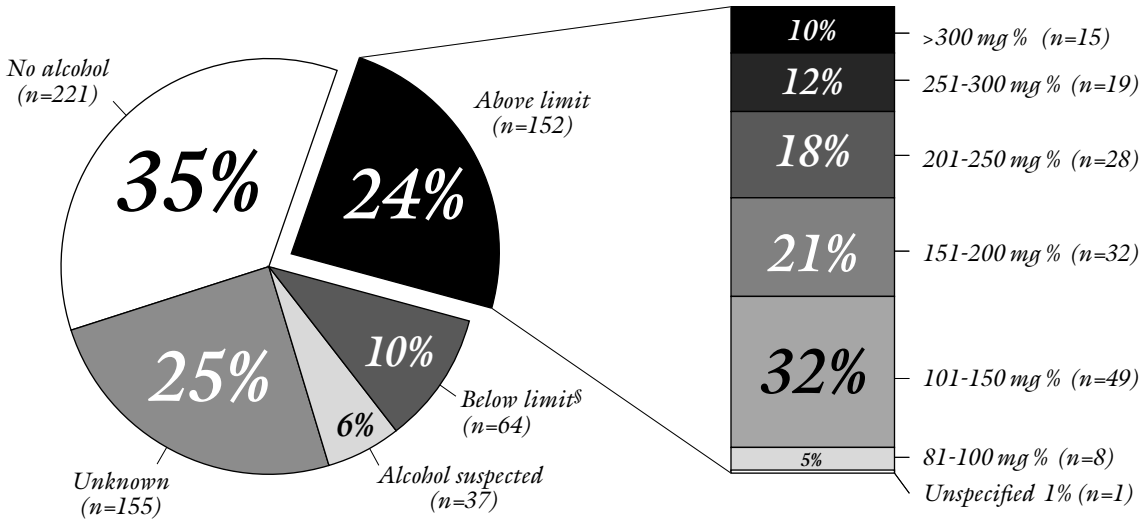


Number of drownings in age group

MALES	Powerboat	2	10	14	125	226	238	172	115	89	27
	Unpowered boat	1	3	11	156	159	121	82	59	36	10
FEMALES	Powerboat	0	3	8	19	10	16	12	9	4	3
	Unpowered boat	0	0	3	8	5	9	1	0 3	2	1

** Powerboat includes personal watercraft † Age unknown for 22 victims (males 17, 4; sex unknown, imputed male 1, 0)*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

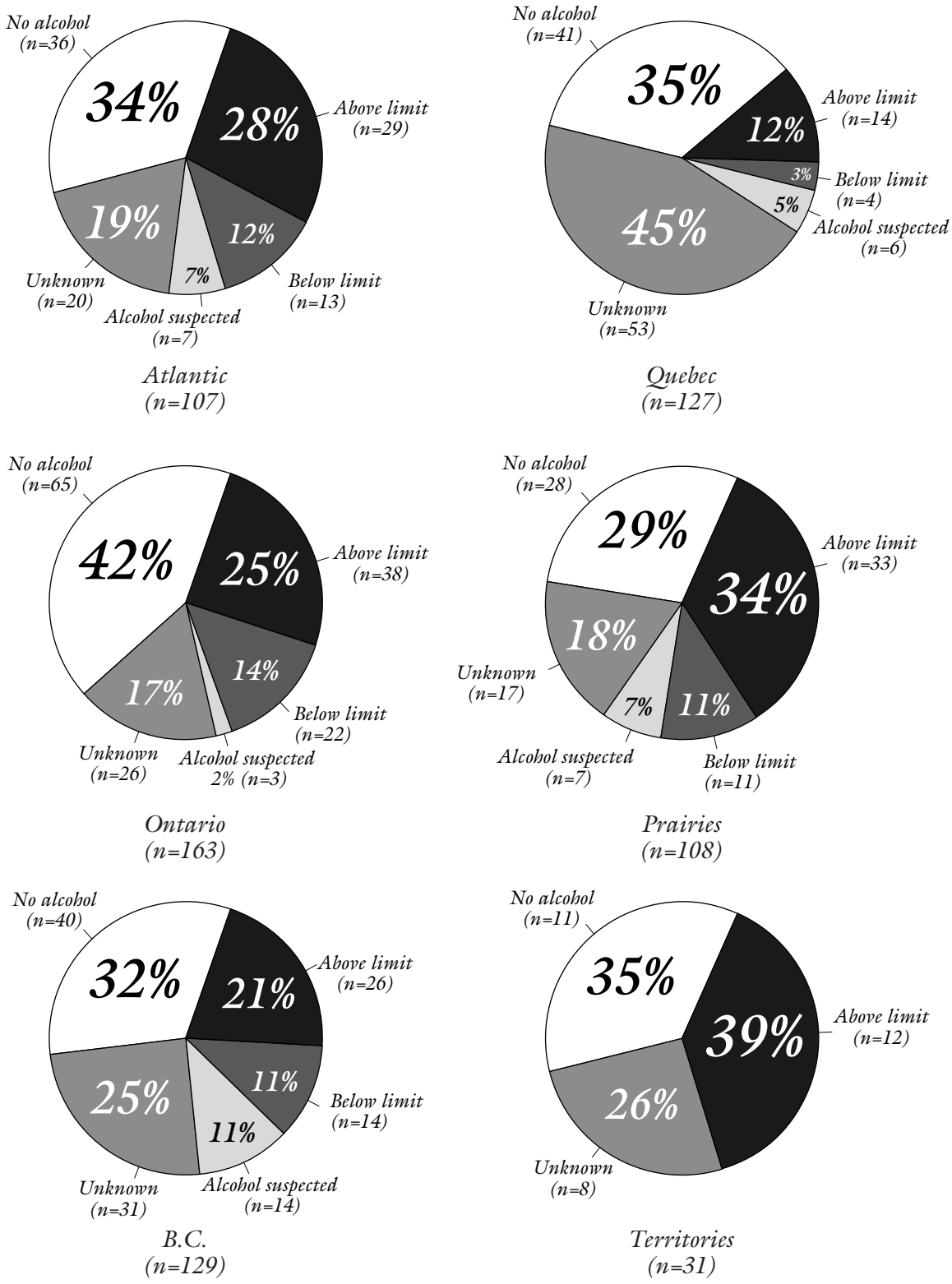
Figure 5 **BLOOD ALCOHOL LEVELS* FOR UNPOWERED BOATING DROWNINGS, CANADA 1991-2000 (VICTIMS ≥15 YEARS OF AGE; n=665)†‡**



** Legal limit is 80 mg % † Age unknown for 4 victims, presumed adult*
‡ This figure excludes 36 victims; decomposition rendered blood alcohol unreliable
§ 30 at 1-49 mg %, 29 at 50-80 mg %, 5 unspecified

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

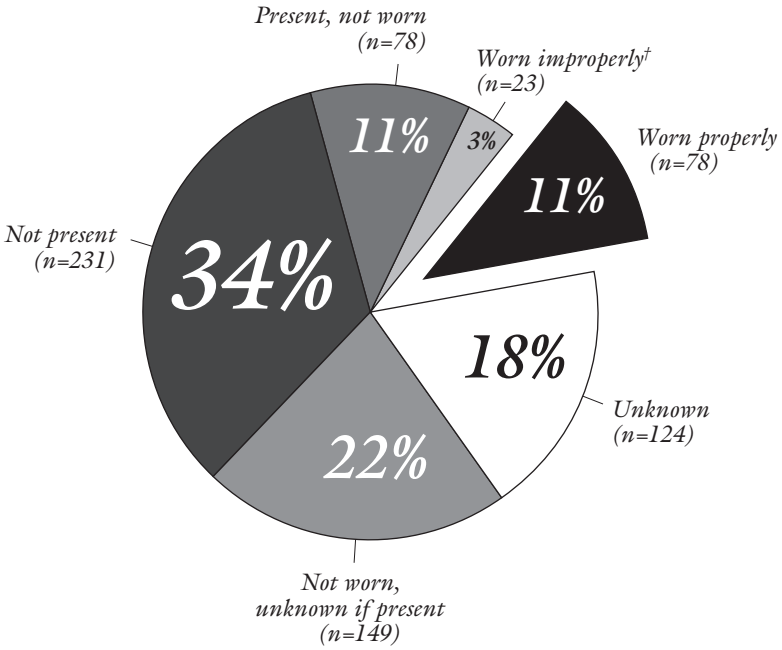
Figure 6 **BLOOD ALCOHOL LEVELS* FOR UNPOWERED BOATING DROWNINGS BY REGION, CANADA 1991-2000 (VICTIMS ≥15 YEARS OF AGE; n=665)†‡**



** Legal limit is 80 mg % † Age unknown for 4 victims, presumed adult*
‡ This figure excludes 36 victims (Atlantic 2, Quebec 9, Ontario 9, Prairies 12, B.C. 4); decomposition rendered blood alcohol unreliable

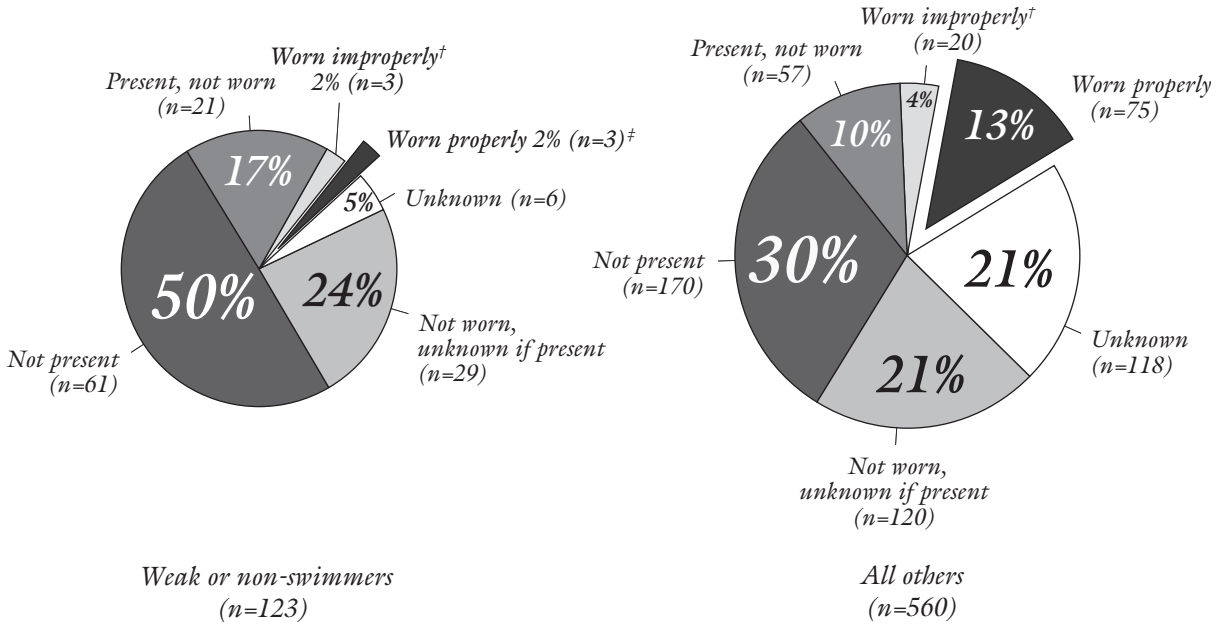
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 7 **BOATING DROWNINGS BY USE OF A FLOTATION DEVICE,* CANADA 1991-2000 (n=683)**



** Personal flotation device (PFD) or lifejacket † Not fastened or inappropriate size*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 8 **UNPOWERED BOATING DROWNINGS BY USE OF A FLOTATION DEVICE* AND SWIMMING ABILITY, CANADA 1991-2000 (n=566)**



** Personal flotation device (PFD) or lifejacket † Not fastened or inappropriate size ‡ Included 3 weak swimmers*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

FLOTATION BY ALCOHOL Use of alcohol was much lower among victims who were properly wearing a flotation device, with alcohol present or suspected in 14% of cases (11/76), as compared with 44% of cases (244/555) for other victims (Figure 9).

INTERACTION OF RISK FACTORS It is clear from the above data that failure to wear a flotation device was associated with both limited swimming ability and alcohol consumption during unpowered boating. Interaction of two or more risk factors can dramatically increase the level of risk.

BOATING EXPERIENCE BY ALCOHOL AND FLOTATION There was no significant difference in alcohol consumption or flotation use between boaters described as "experienced" and other boaters.

TYPE OF BOAT Canoe was the most frequent type of unpowered boat, followed by rowboat, sailboat, raft, and kayak (Figure 10).

ENVIRONMENT FACTORS

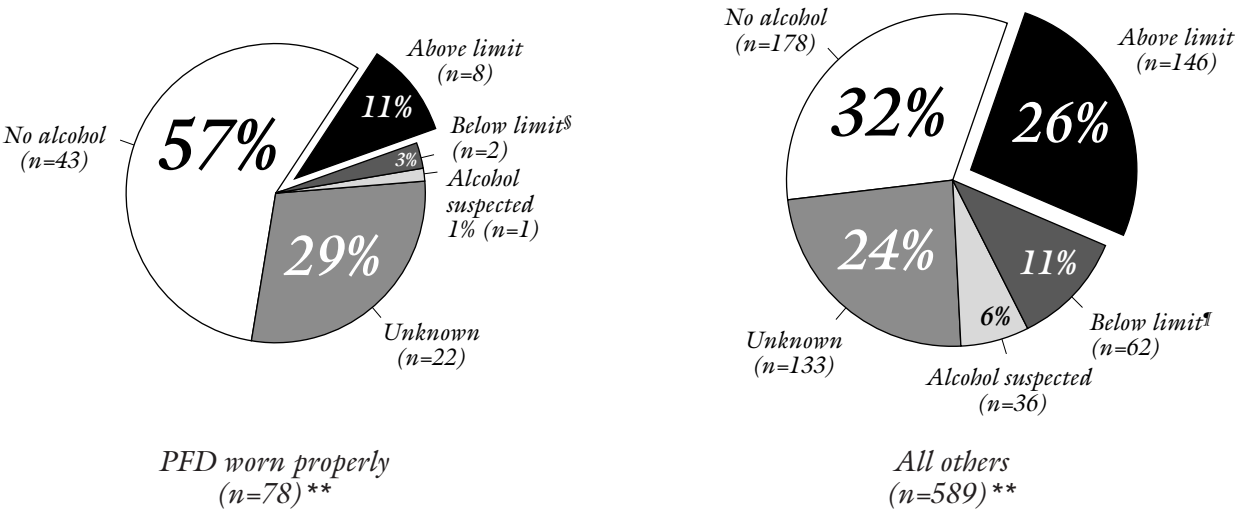
TYPE OF BODY OF WATER Lakes were the most frequent body of water, followed by rivers and oceans (Figure 11). Body of water naturally varied greatly by region (Figure 12).

CURRENT For incidents in rivers, current was unknown in 32% of cases. For the remainder, current was described as rapids or whitewater 45%, fast or strong 52%, dam spillway 2% and other 2%.

WIND AND WAVES For incidents in lakes or the ocean, wind conditions were unknown for 57% of victims. For the remainder, wind was described as strong for 53%, breezy for 23% and calm for 24%. Waves conditions were unknown for 54% of victims. For the remainder, it was stormy for 8%, rough for 45%, choppy for 19%, and calm for 24%.

Figure 9

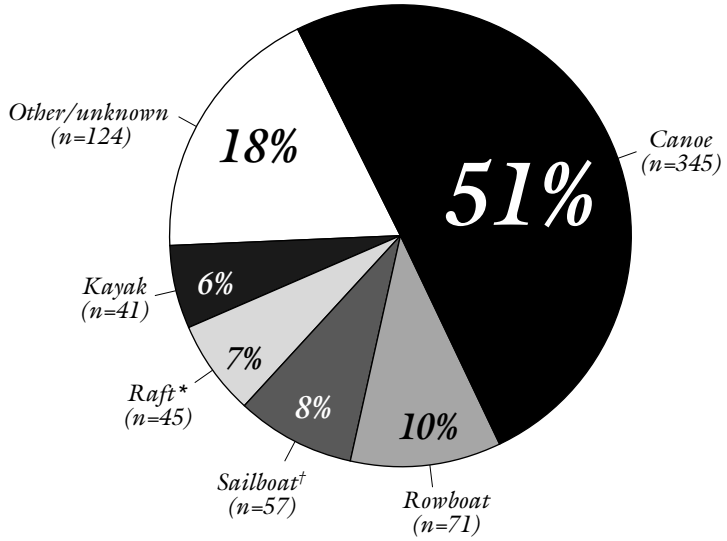
BLOOD ALCOHOL LEVELS* FOR UNPOWERED BOATING DROWNINGS BY USE OF A FLOTATION DEVICE,† CANADA 1991-2000 (VICTIMS ≥15 YEARS OF AGE; n=665)‡



** Legal limit is 80 mg % † Personal flotation device (PFD) or lifejacket ‡ Age unknown for 4 victims, presumed adult*
§ 1 at 1-49 mg %, 29 at 50-80 mg %, 1 unspecified ¶ 29 at 1-49 mg %, 27 at 50-80 mg %, 5 unspecified
*** These graphics exclude 36 victims (2, 34); decomposition rendered blood alcohol unreliable*

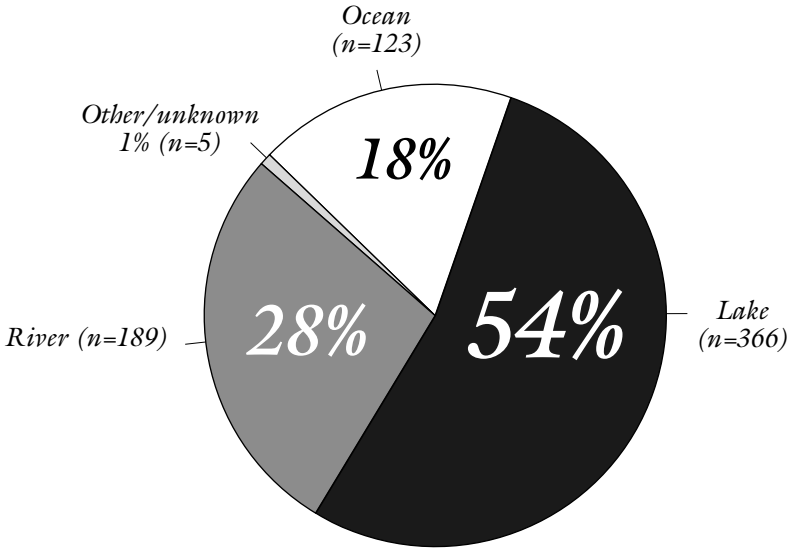
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 10 **UNPOWERED BOATING DROWNINGS BY TYPE OF BOAT, CANADA 1991-2000 (n=683)**



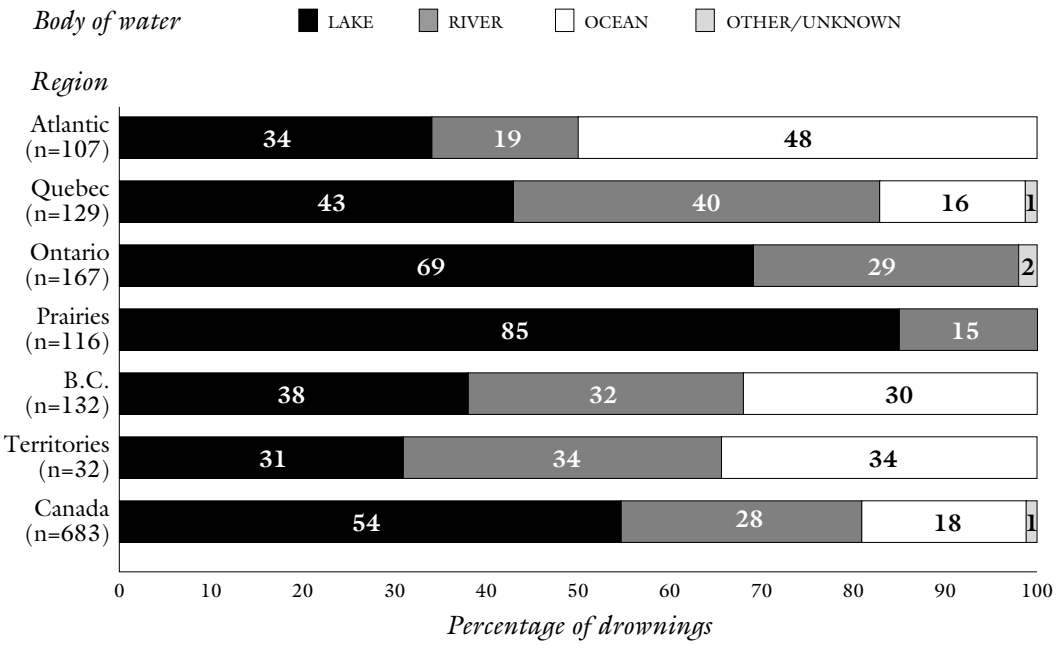
** Includes unpowered inflatable † Includes sailboard*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 11 **UNPOWERED BOATING DROWNINGS BY BODY OF WATER,* CANADA 1991-2000 (n=683)**



** "Lake" includes pond & reservoir*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 12 **UNPOWERED BOATING DROWNINGS BY BODY OF WATER* BY REGION, CANADA 1991-2000 (n=683)**



** "Lake" includes pond & reservoir*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

WATER TEMPERATURE Water temperature was unknown for 59% of unpowered boating drownings. For the remainder, water temperature was reported to be extremely cold (<10°C) for 57%, cold or cool (10-20°C) for 40%, and warm or hot (>20°C) for 3%.

ICE AND COLD WATER Based on the criteria used in Module 2 of this series *(Ice & Cold Water)*, it is probable that extremely cold water played a role in at least 54% of unpowered boating drownings.

LIGHT CONDITIONS 48% of unpowered boating drownings occurred during daylight, 8% during twilight and 19% in the dark. Light conditions were unknown for 25% of victims (Figure 13).

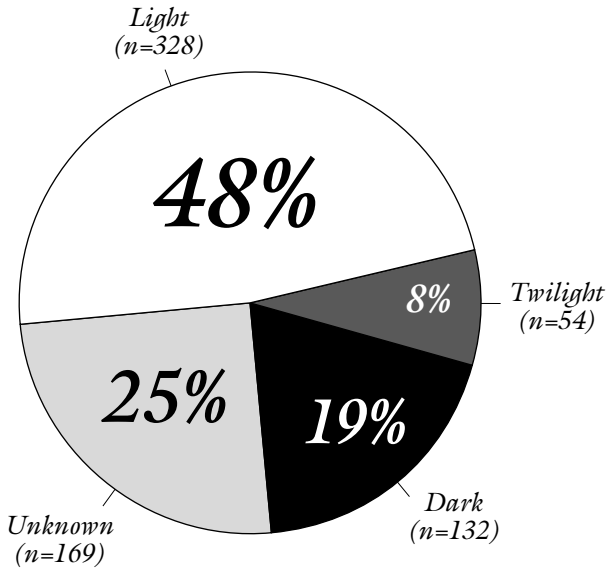
MONTH AND DAY OF THE WEEK 82% of victims drowned between May and October (Figure 14). Although drownings took place throughout the week, about 45% took place on Saturday or Sunday.

RATES BY REGION The highest rate of unpowered boating drownings was seen in the northern territories, followed by the Atlantic region and British Columbia (Figure 15).

ACCOMPANIMENT 65% of victims were accompanied by at least one adult, while 25% were alone, and 5% were accompanied only by minor(s). Accompaniment was unknown for 5% of victims.

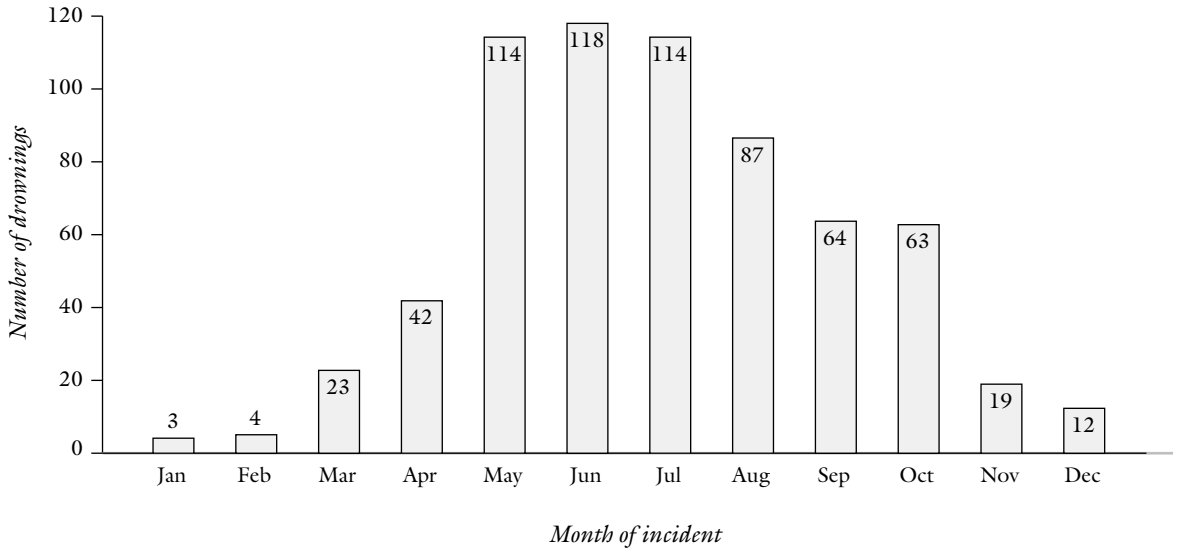
RESCUE An acute rescue for a potentially survivable victim was carried out in only about 37% of incidents, mainly by companions or bystanders (Figure 16). Of these, 42% underwent CPR and/or rescue breathing.

Figure 13 **UNPOWERED BOATING DROWNINGS BY LIGHT CONDITIONS, CANADA 1991-2000 (n=683)**



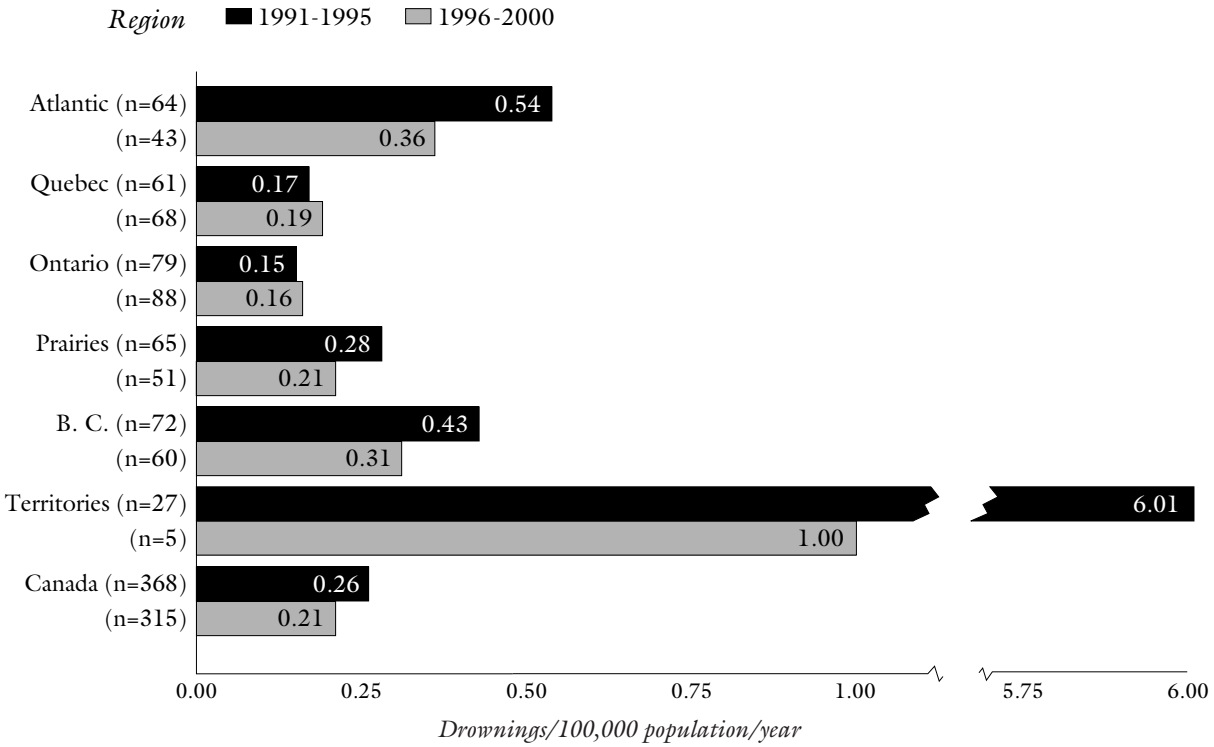
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 14 **UNPOWERED BOATING DROWNINGS BY MONTH OF INCIDENT, CANADA 1991-2000 (n=683)***



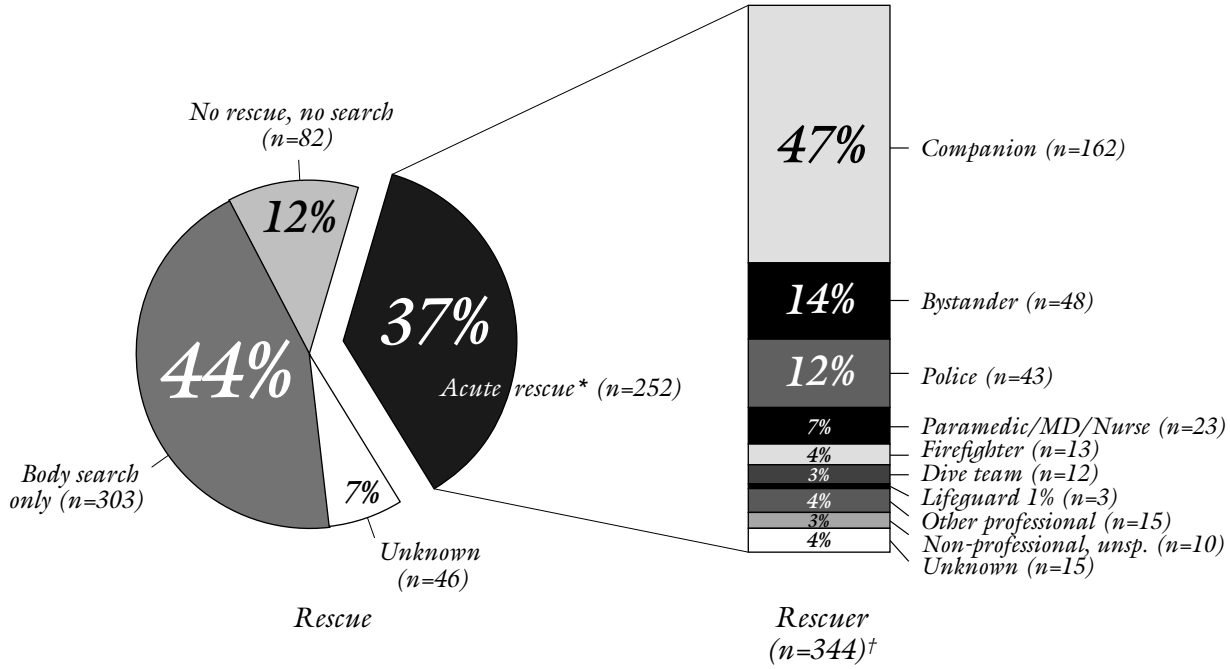
** Month unspecified for 20 drownings*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 15 **RATE AND NUMBER OF UNPOWERED BOATING DROWNINGS BY REGION, CANADA 1991-2000 (n=683)**



Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 16 **UNPOWERED BOATING DROWNINGS BY TYPE OF RESCUE AND RESCUER, CANADA 1991-2000 (n=683)**



** With or without a subsequent body search † There was more than one rescuer for some drownings*

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Canoes were the type of boat most frequently associated with unpowered boating fatalities in Canada during 1991-2000, accounting for 51% of drownings and 46% of deaths other than drownings. In total there were 357 fatalities, including 345 drownings and 12 non-drowning deaths (hypothermia 11, trauma 1).

DROWNINGS

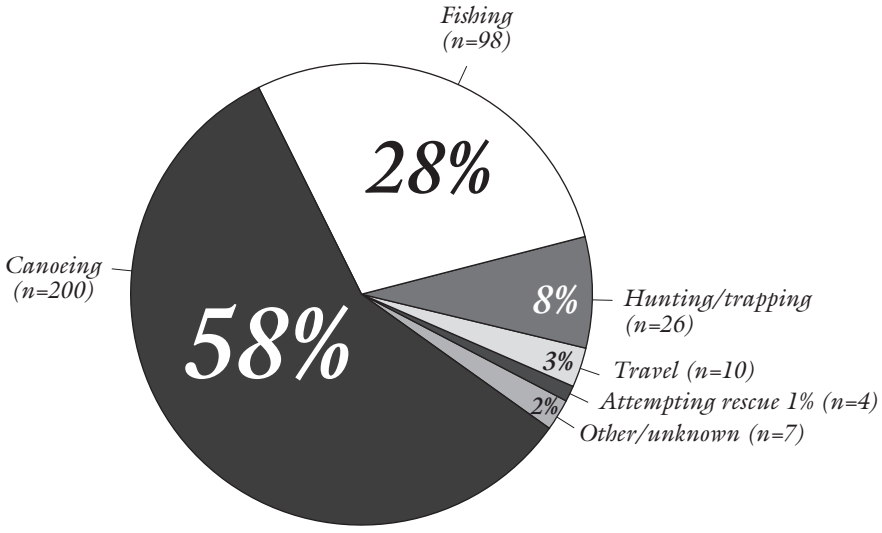
ACTIVITY 58% of canoe drowning victims were canoeing, 28% were fishing and 8% were hunting or trapping. Other activities included travel and attempted rescue (Figure 17).

PURPOSE 87% of drownings occurred during recreational activities, while activities of daily life accounted for 10%. Only 1% of canoe drownings involved occupational activities (Figure 18).

TYPE OF INCIDENT Capsizing was the most common type of incident, accounting for at least 64% of canoe drownings. Other frequent incidents included falling overboard and swamping (Figure 19).

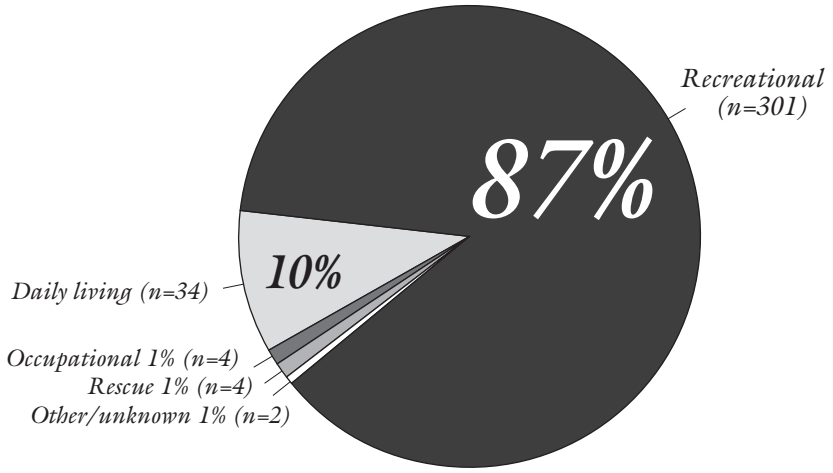
RISK FACTORS Adverse weather conditions such as rough water or strong winds were the most commonly cited risk factors for canoe drownings. Others included standing up in the canoe, overloading, turning abruptly, urinating, embarking, technical problems, and swimming to recover a drifting canoe. More than one risk factor was given for some incidents, none for others.

Figure 17 **CANOE DROWNINGS BY ACTIVITY, CANADA 1991-2000 (n=345)**



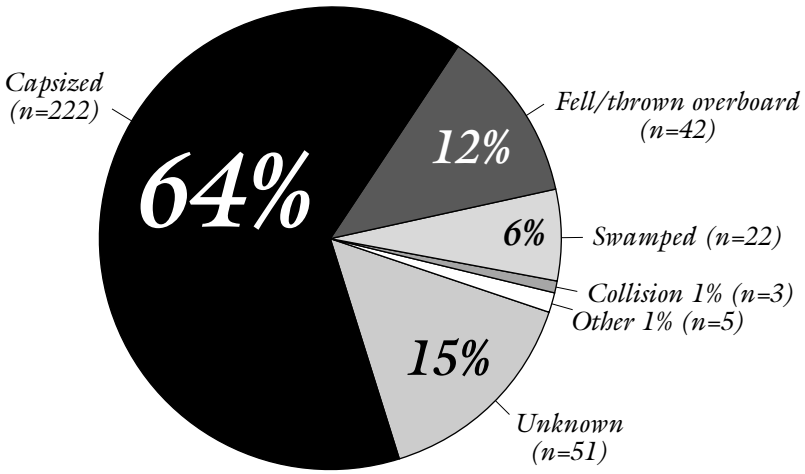
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 18 **CANOE DROWNINGS BY PURPOSE OF ACTIVITY, CANADA 1991-2000 (n=345)**



Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 19 **CANOE DROWNINGS BY TYPE OF INCIDENT, CANADA 1991-2000 (n=345)**



Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

PERSONAL RISK FACTORS

AGE AND SEX Males 15-24 years old were the highest risk group for canoe drownings, followed by older men in all age groups. Risk decreased with age, but remained much higher than for women (Figure 20).

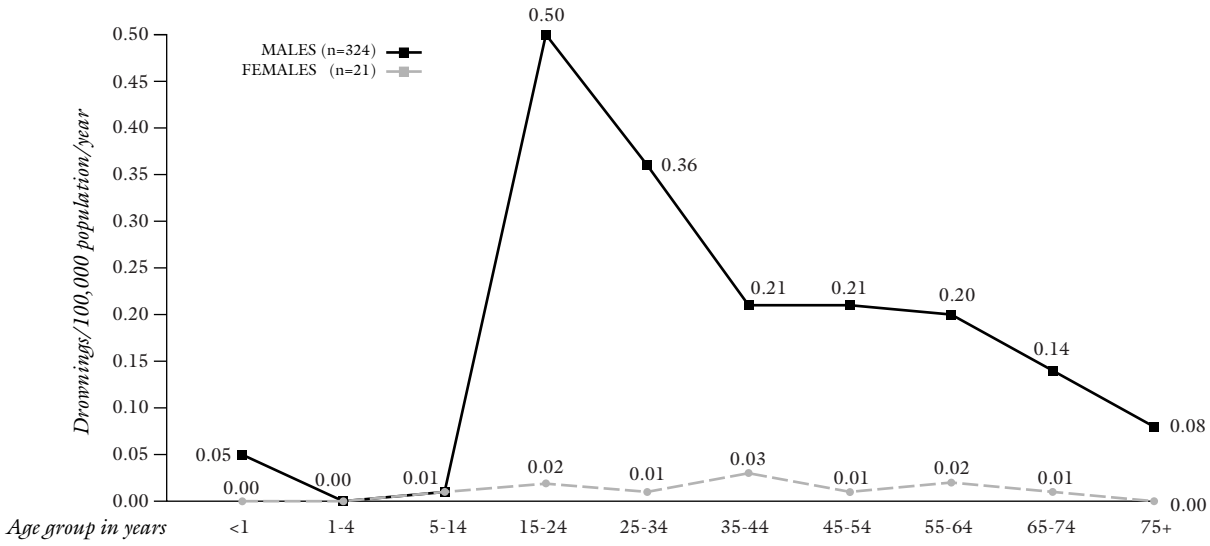
ALCOHOL Alcohol was involved in at least 43% of canoe drownings; alcohol was unknown in 23% of cases (Figure 21).

ETHNICITY 17% of victims were aboriginal, possibly more given that ethnicity was unknown for 32% (Figure 22).

SWIMMING ABILITY Swimming ability was unknown for 59% of victims. Of the remainder, 53% were weak or non-swimmers, 26% were strong or average swimmers, and 21% were swimmers of unspecified ability.

BOATING EXPERIENCE Boating experience was unknown for 70% of victims. Of the remainder, 50% were experienced boaters and 50% were inexperienced or occasional boaters.

Figure 20 **RATE AND NUMBER OF CANOE DROWNINGS BY AGE & SEX, CANADA 1991-2000 (n=345)***



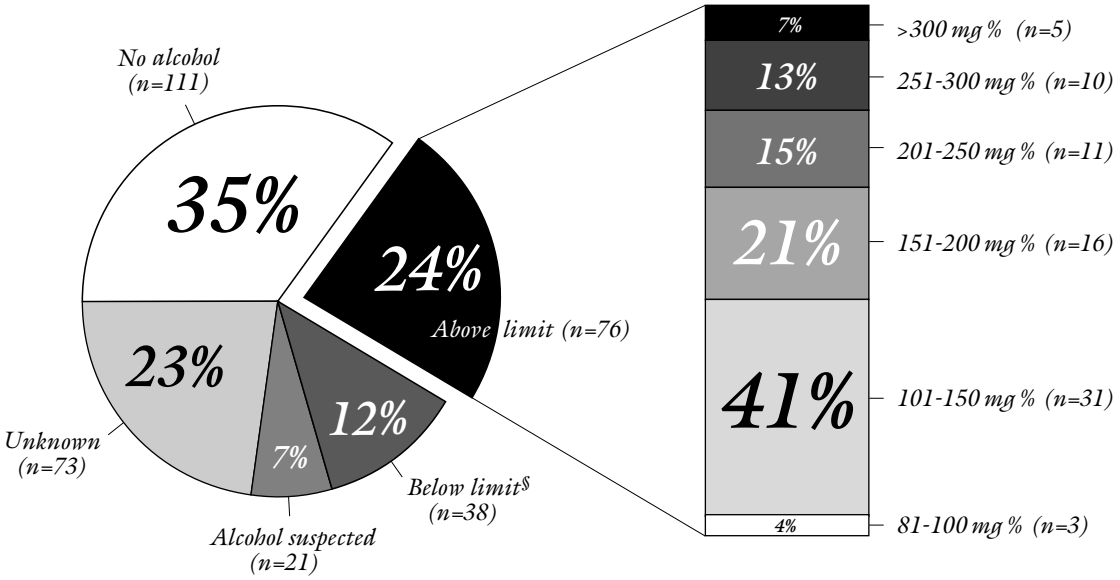
Number of drownings in age group

MALES	1	0	3	102	89	49	36	25	13	4
FEMALES	0	0	2	4	3	6	2	3	1	0

** Age unknown for 2 male victims*

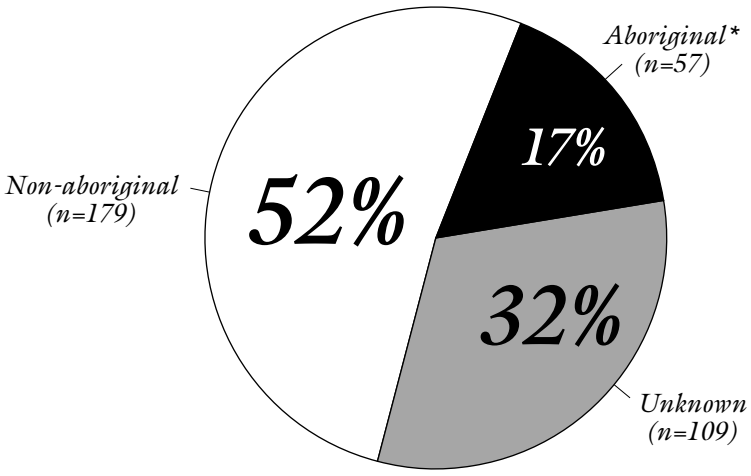
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 21 **BLOOD ALCOHOL LEVELS* FOR CANOE DROWNINGS, CANADA 1991-2000 (VICTIMS ≥15 YEARS OF AGE; n=339)†‡**



** Legal limit is 80 mg % † Age unknown for 2 victims, presumed adult*
‡ This figure excludes 20 victims; decomposition rendered blood alcohol unreliable § 20 at 1-49 mg %, 17 at 50-80 mg %, 1 unspecified
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 22 **CANOE DROWNINGS BY ETHNICITY, CANADA 1991-2000 (n=345)**

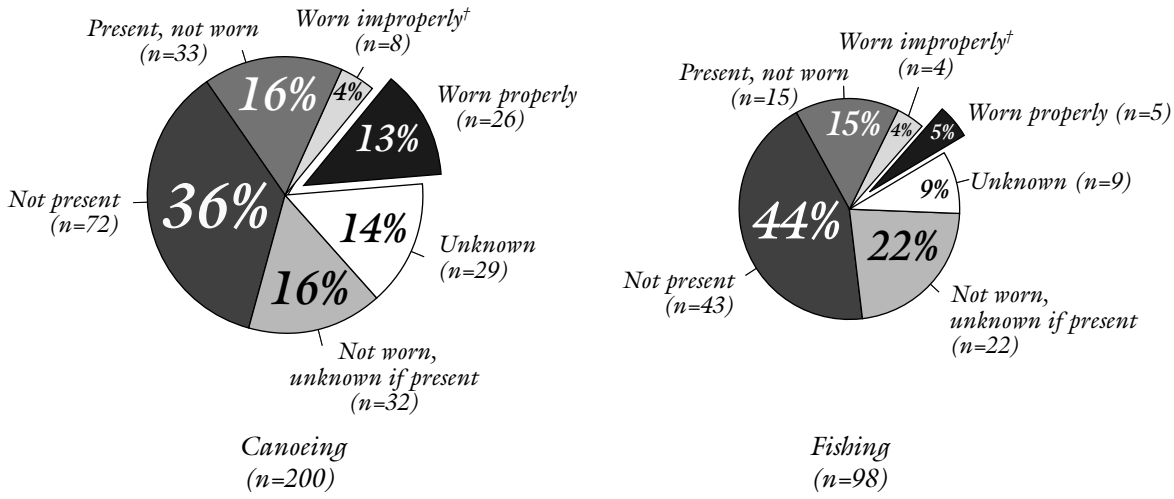


** Includes definite & probable aboriginals (First Nations, Inuit & Metis)*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

EQUIPMENT FACTORS

FLOTATION A flotation device was worn properly by 10% of all canoe drowning victims. Only 1% of weak or non-swimmers correctly wore a flotation device, as compared with 12% of all others. Use of flotation also varied by activity; as seen in Figure 23, 13% of canoeing victims properly wore flotation, compared with only 5% of fishing victims.

Figure 23 **CANOE DROWNINGS DURING CANOEING AND FISHING BY USE OF A FLOTATION DEVICE,* CANADA 1991-2000 (n=298)**



** Personal flotation device (PFD) or lifejacket † Not fastened or inappropriate size*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

ENVIRONMENT FACTORS

BODY OF WATER 62% of canoe drownings occurred in lakes, 33% in rivers and 6% in the ocean. Body of water varied by region (Figure 24).

CURRENT For incidents in rivers, current was unknown in 32% of cases. For the remainder, current was described as rapids or whitewater for 45%, fast or strong for 53%, and dam whirlpool for 1%.

WIND AND WAVES For incidents in lakes or the ocean, wind conditions were unknown for 62% of victims. For the remainder, wind was described as strong for 55%, breezy for 17% and calm for 28%. Waves conditions were unknown for 56% of victims. For the remainder, it was stormy for 5%, rough for 42%, choppy for 18%, and calm for 35%.

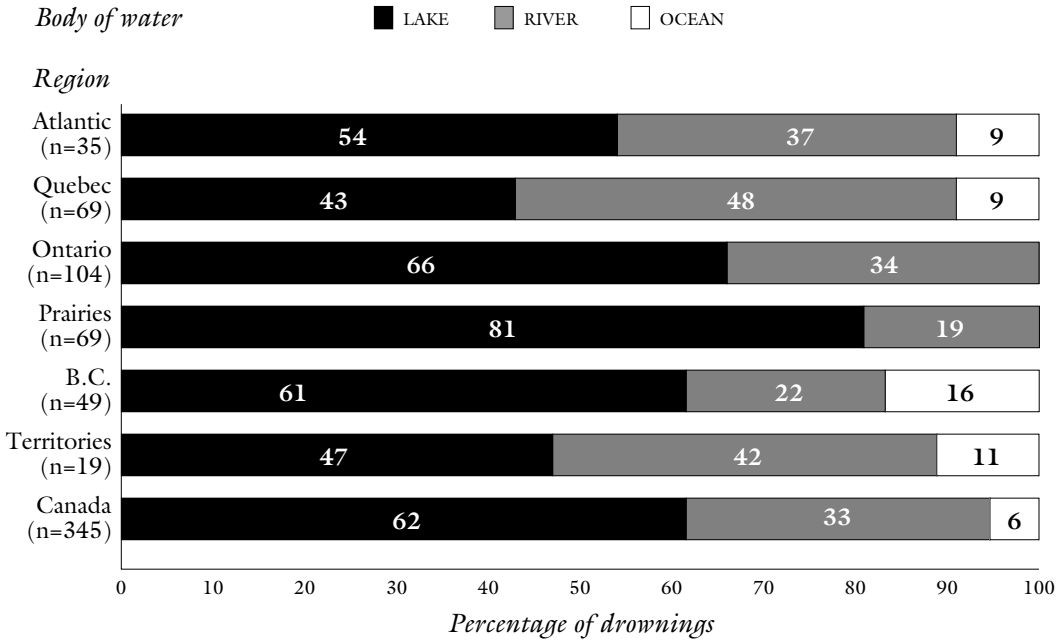
WATER TEMPERATURE Water temperature was unknown for 62% of canoe drownings. For the remainder, water temperature was reported to be extremely cold (<10°C) for 58%, cold or cool (10-20°C) for 38%, and warm or hot (>20°C) for 4%.

ICE AND COLD WATER Based on the criteria used in Module 2 of this series *(Ice & Cold Water)*, it is probable that extremely cold water played a role in at least 59% of canoe drownings.

LIGHT CONDITIONS 46% of canoe drownings occurred during daylight, 9% during twilight and 18% in the dark. Light conditions were unknown for 27% of victims.

MONTH & DAY OF THE WEEK 82% of victims drowned between May and October. Although drownings took place throughout the week, about 43% took place on Saturday or Sunday.

Figure 24 **CANOE DROWNINGS BY BODY OF WATER* BY REGION, CANADA 1991-2000 (n=345)**

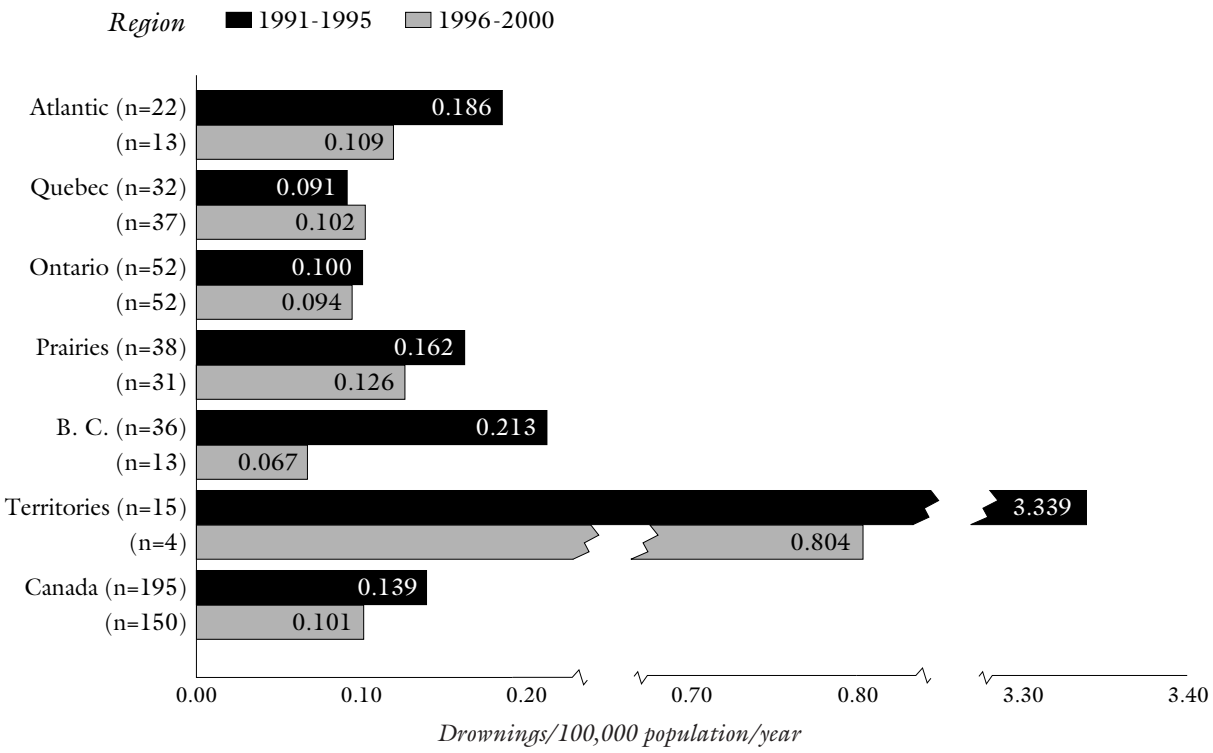


** "Lake" includes pond & reservoir*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

RATES AND TRENDS BY REGION Although Ontario was the most frequent location, followed by Quebec and the Prairies, the highest rates were seen in the northern territories, followed by the Atlantic region and British Columbia (Figure 25). Between 1991-1995 and 1996-2000 there was an overall improvement, with the greatest reduction in rates occurring in the northern territories, British Columbia, and the Atlantic region. Quebec was the only region where the rate of canoe drowning increased.

ACCOMPANIMENT 67% of victims were accompanied by at least one adult, 25% were alone, and 5% were accompanied only by minor(s). Accompaniment was unknown for 3% of victims.

Figure 25 **RATE AND NUMBER OF CANOE DROWNINGS BY REGION, CANADA 1991-2000 (n=345)**



Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

There were 43 kayak fatalities in Canada during 1991-2000, including 41 drownings and 2 non-drowning deaths, both due to hypothermia.

DROWNINGS

ACTIVITY AND PURPOSE Recreational kayaking accounted for 90% of kayak drownings, daily living activities such as travel and subsistence fishing accounted for 5%, and another 5% drowned while attempting rescue (Figure 26). There were no occupational victims.

TYPE OF INCIDENT Capsizing was the most common type of incident, accounting for at least 56% of kayak drownings. Other incidents included collision and falling or jumping overboard (Figure 27).

RISK FACTORS Factors which may have contributed to the incident included rough water, strong winds, an abrupt turn, and the wake of a powerboat.

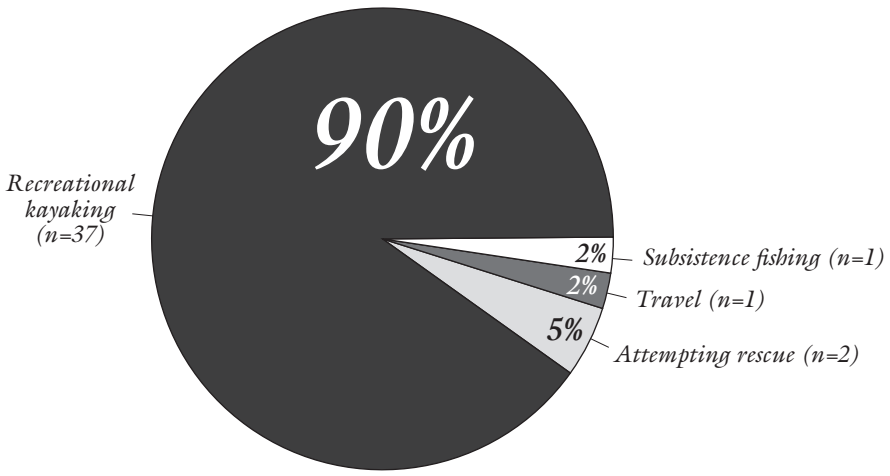
PERSONAL RISK FACTORS

AGE AND SEX Males 15-44 years old were at highest risk for kayak drownings, followed by males 45-64 and females 15-34 (Figure 28).

ALCOHOL Alcohol was less common in kayak drownings than in canoe drownings, but was nevertheless present or suspected in at least 20% of cases (Figure 29).

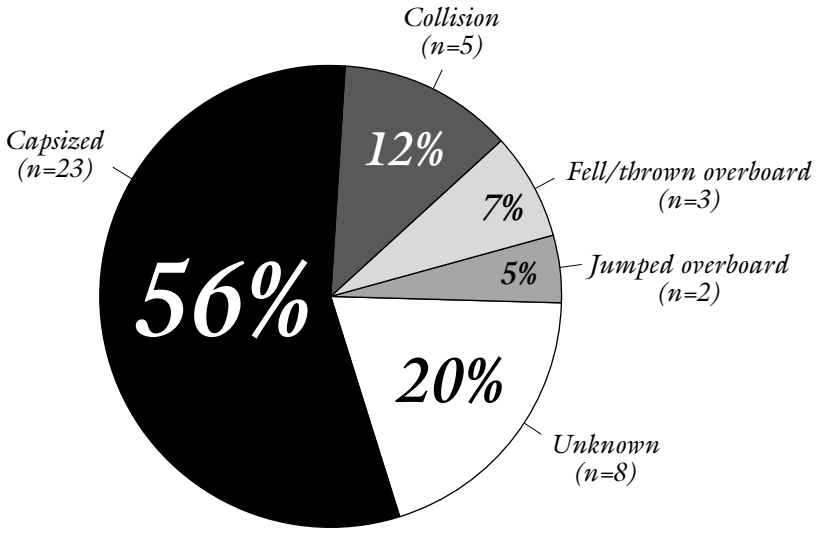
ETHNICITY At least 12% of victims were aboriginals; this may be an underestimate, since ethnicity was unknown for 15% of victims (Figure 30).

Figure 26 **KAYAK DROWNINGS BY ACTIVITY, CANADA 1991-2000 (n=41)**



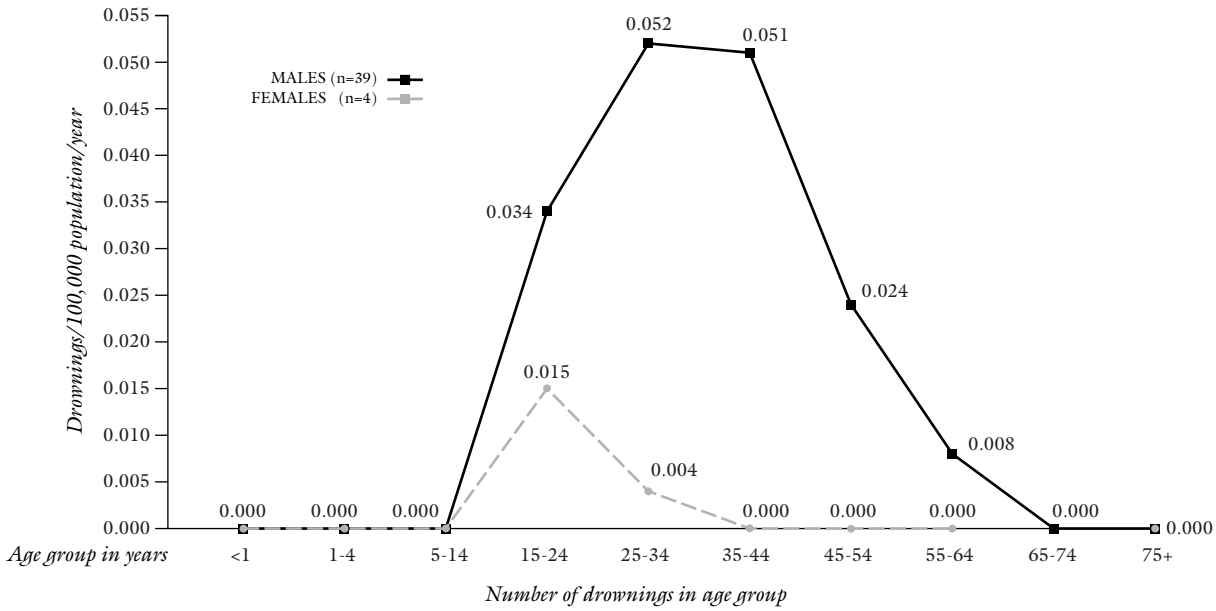
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 27 **KAYAK DROWNINGS BY TYPE OF INCIDENT, CANADA 1991-2000 (n=41)**



Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

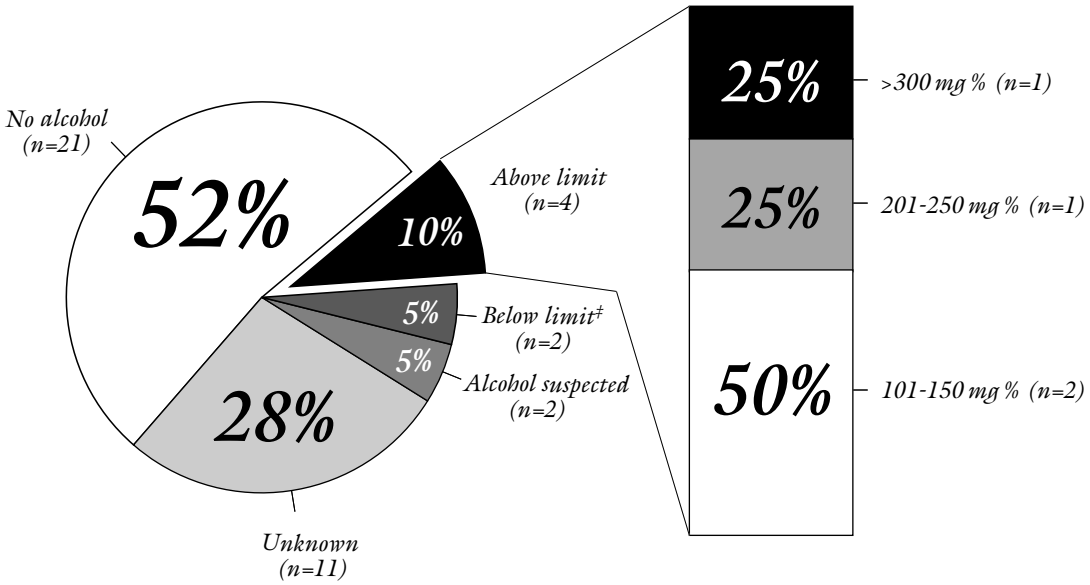
Figure 28 **RATE AND NUMBER OF KAYAK DROWNINGS BY AGE & SEX, CANADA 1991-2000 (n=41)**



MALES	0	0	0	7	13	12	4	1	0	0
FEMALES	0	0	0	3	1	0	0	0	0	0

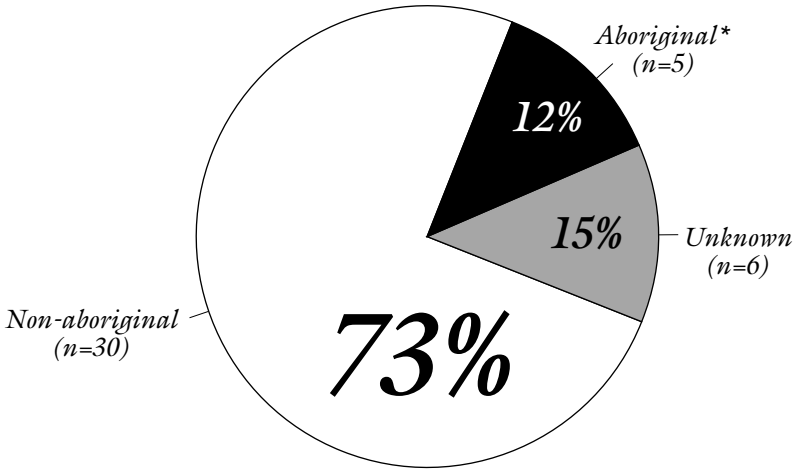
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 29 **BLOOD ALCOHOL LEVELS* FOR KAYAK DROWNINGS, CANADA 1991-2000 (VICTIMS ≥15 YEARS OF AGE; n=41)†**



** Legal limit is 80 mg % † This figure excludes 1 victim; decomposition rendered blood alcohol unreliable ‡ 2 at 1-49 mg %*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 30 **KAYAK DROWNINGS BY ETHNICITY, CANADA 1991-2000 (n=41)**



** Includes definite & probable aboriginals (First Nations, Inuit & Metis)*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

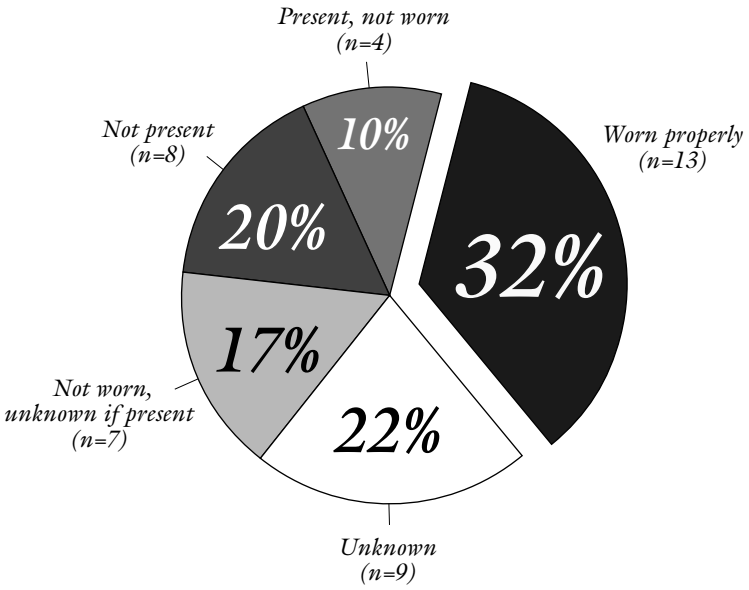
SWIMMING ABILITY Swimming ability was unknown in 72% of cases. Of the remainder, 17% were weak or non-swimmers, 33% were strong or average swimmers, and 50% were swimmers of unspecified ability.

BOATING EXPERIENCE Boating experience was unknown for 30% of kayak drowning victims. Of the remainder, 60% were experienced boaters, while 40% were inexperienced or occasional boaters.

EQUIPMENT FACTORS

FLOTATION A flotation device was worn properly by 32% of kayak drowning victims, a higher proportion than for other unpowered boating victims (Figure 31). However, only 20% of weak or non-swimmers correctly wore flotation, compared with 33% of all others.

Figure 31 **KAYAK DROWNINGS BY USE OF A FLOTATION DEVICE,* CANADA 1991-2000 (n=41)**



** Personal flotation device (PFD) or lifejacket*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

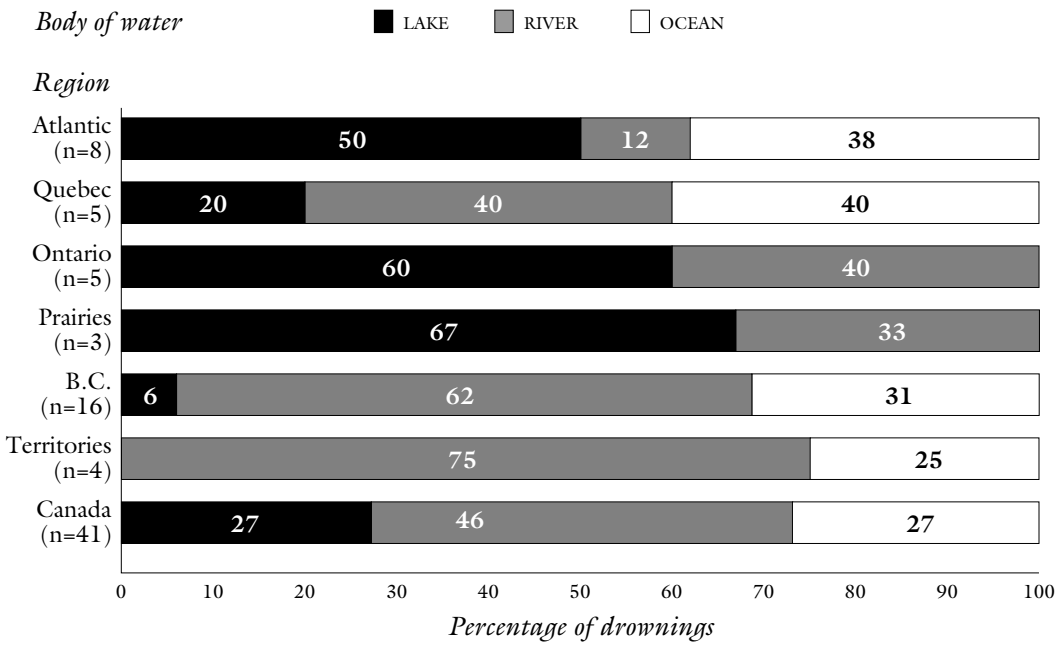
ENVIRONMENT FACTORS

BODY OF WATER 46% of kayak drownings occurred in rivers, followed by lakes and the ocean, accounting for 27% each. Body of water varied by region (Figure 32).

CURRENT Current was unknown for 26% of victims in rivers. Where current was known, it was described as rapids/whitewater in 43% of cases, strong in 43%, dam-spillway in 7% and hydraulic current in 7%.

WIND AND WAVES For incidents in lakes and the ocean, wind conditions were unknown for 32% of victims. Where wind was known, it was described as strong in 40% of cases, breezy in 20% and calm in 40%. Waves conditions were unknown for 27% of victims. For the remaining victims, it was stormy for 25%, rough for 25%, choppy for 25%, and calm for 25%.

Figure 32 **KAYAK DROWNINGS BY BODY OF WATER* BY REGION, CANADA 1991-2000 (n=41)**



** "Lake" includes pond & reservoir*

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

WATER TEMPERATURE Water temperature was unknown in 51% of cases. For the remainder, it was extremely cold (<10°C) in 85% and cold or cool (10-20°C) in 15%.

ICE AND COLD WATER Based on the criteria used in Module 2 of this series *(Ice & Cold Water)*, it is probable that extremely cold water played a role in at least 76% of kayak drownings.

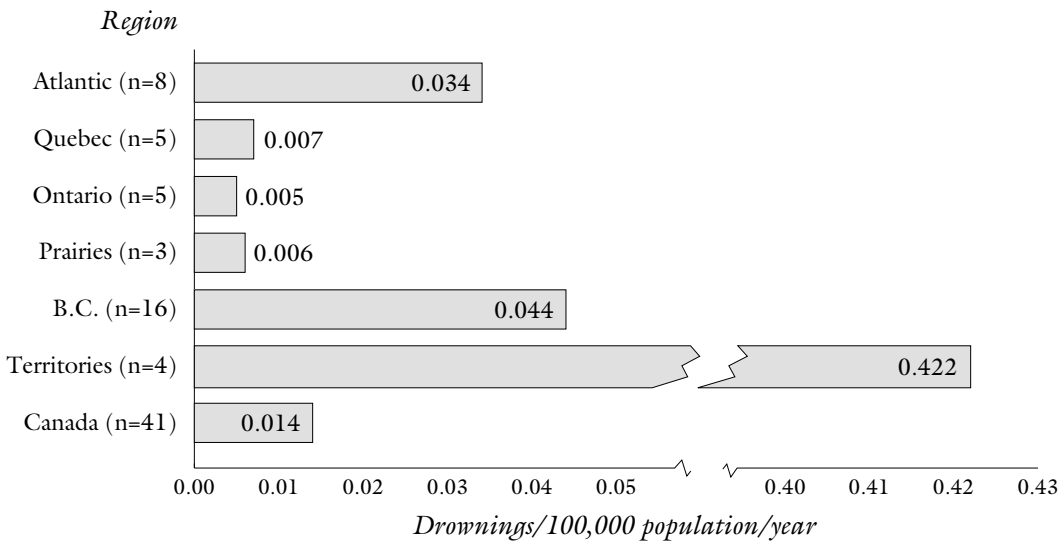
LIGHT CONDITIONS 63% of kayak drownings occurred during daylight, 10% during twilight and 2% in the dark. Light conditions were unknown for 24% of victims.

MONTH AND DAY OF THE WEEK 65% of victims drowned between May and October, 10% between November and February, and 25% in March and April. Although drownings took place throughout the week, 51% took place on Saturday or Sunday.

RATES BY REGION The highest rate of kayak drowning per unit of population was in the northern territories, followed by British Columbia and the Atlantic region (Figure 33).

ACCOMPANIMENT 59% of victims were accompanied by at least one adult, while 34% were alone, and 2% were accompanied only by minor(s). Accompaniment was unknown for 5% of victims.

Figure 33 **RATE AND NUMBER OF KAYAK DROWNINGS BY REGION, CANADA 1991-2000 (n=41)**



Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

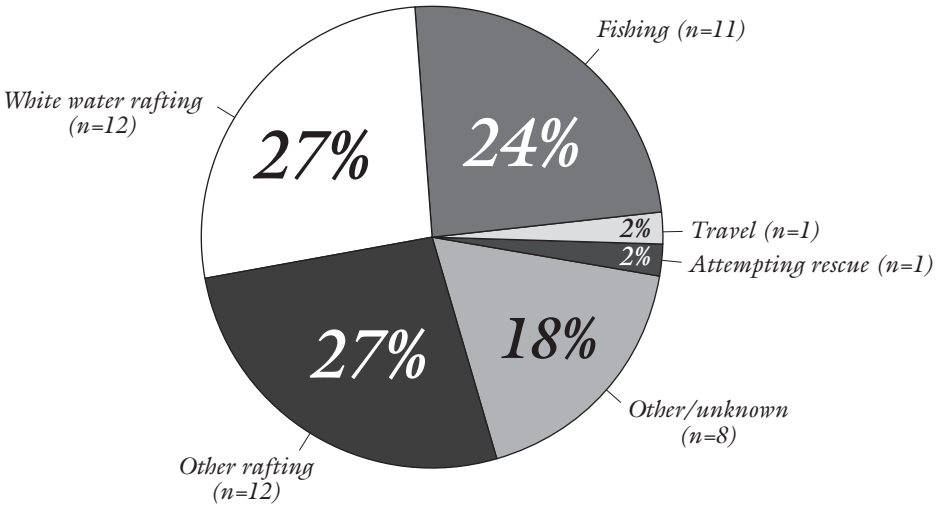
In Canada during 1991-2000 there were 53 fatalities involving rafts (including unpowered inflatables): 45 drownings and 8 non-drowning fatalities (hypothermia 1, trauma 7).

DROWNINGS

ACTIVITY White water rafting accounted for 27% of raft drownings. Other activities included other rafting and fishing (Figure 34).

PURPOSE 93% of drownings occurred during recreational activities, while occupational activities, daily living activities, and attempted rescue each accounted for 2% of raft drownings.

Figure 34 **RAFT* DROWNINGS BY ACTIVITY, CANADA 1991-2000 (n=45)**



**Includes unpowered inflatable*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

TYPE OF INCIDENT Capsizing and falling into water were the main types of incident for raft drownings. Other incidents included falling or jumping overboard, swamping, and collision (Figure 35).

PERSONAL RISK FACTORS

AGE AND SEX Males in most age groups 5 years and over were at highest risk for raft drowning (Figure 36). Although at much lower risk than males, females represented 16% of victims, as compared with 6% for all unpowered boating.

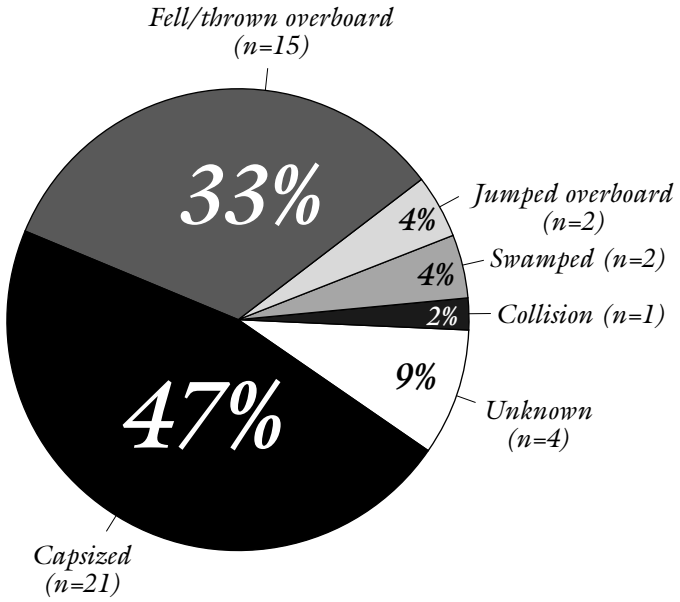
ALCOHOL Alcohol was present or suspected in about 34% of cases (Figure 37).

ETHNICITY At least 9% of victims were aboriginals; this may be an underestimate, since ethnicity was unknown for 24% of victims.

SWIMMING ABILITY Swimming ability was unknown for 67% of victims. Where swimming ability was reported, 33% were weak or non-swimmers, 53% were strong or average swimmers, and 13% were swimmers of unspecified ability.

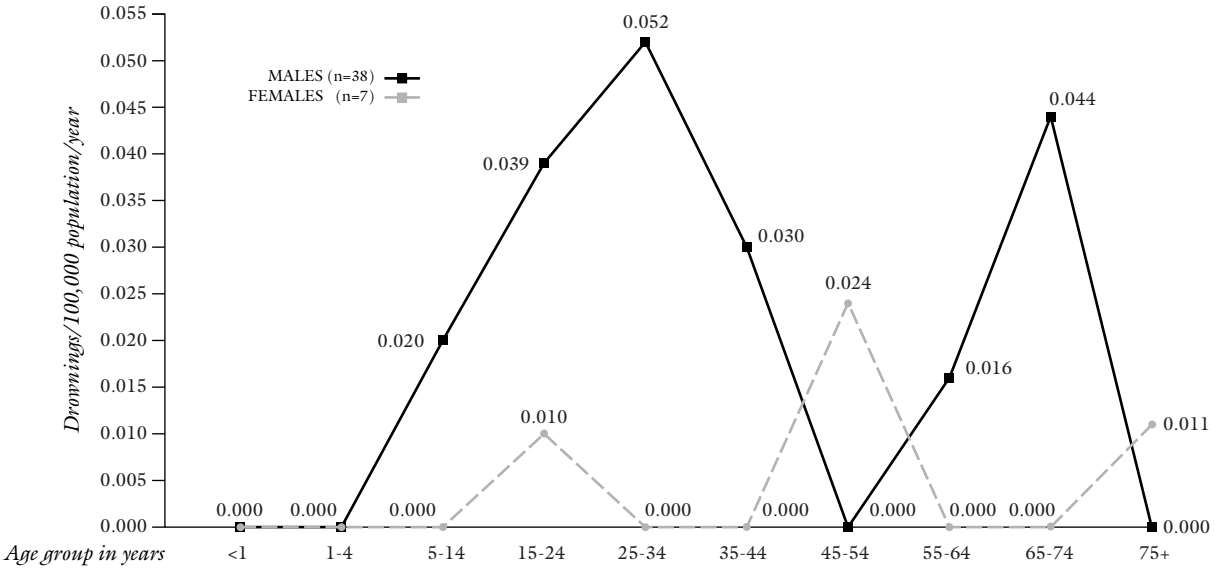
BOATING EXPERIENCE Boating experience was unknown for 80% of victims. Of the remainder, 78% were inexperienced or occasional boaters, while 22% were experienced boaters.

Figure 35 **RAFT* DROWNINGS BY TYPE OF INCIDENT, CANADA 1991-2000 (n=45)**



**Includes unpowered inflatable*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 36 **RATE AND NUMBER OF RAFT* DROWNINGS BY AGE & SEX, CANADA 1991-2000 (n=45)**

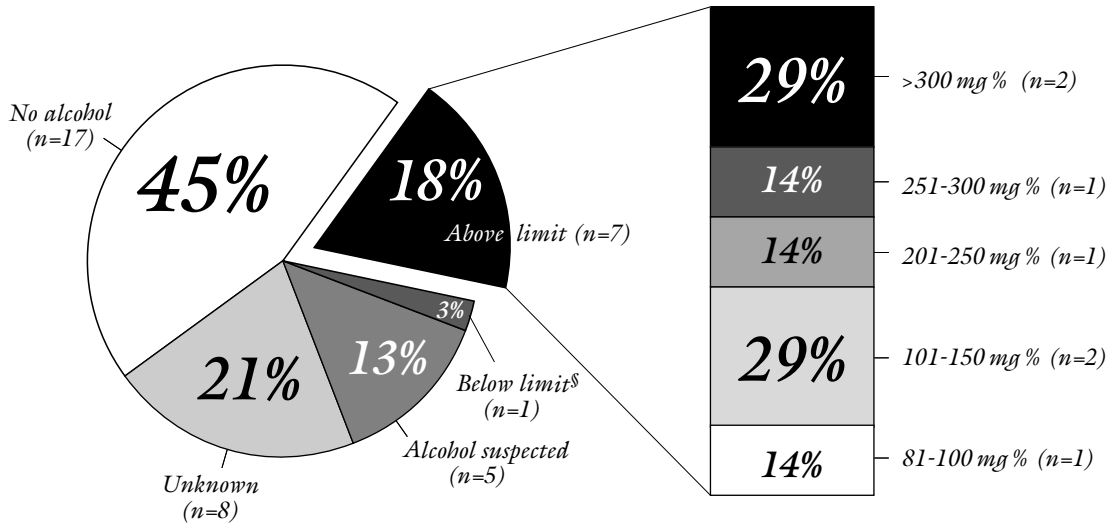


Number of drownings in age group

MALES	0	0	4	8	1	37	0	2	4	0
FEMALES	0	0	0	2	0	0	4	0	0	1

** Includes unpowered inflatable*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 37 **BLOOD ALCOHOL LEVELS* FOR RAFT† DROWNINGS, CANADA 1991-2000 (VICTIMS ≥15 YEARS OF AGE; n=41)‡**

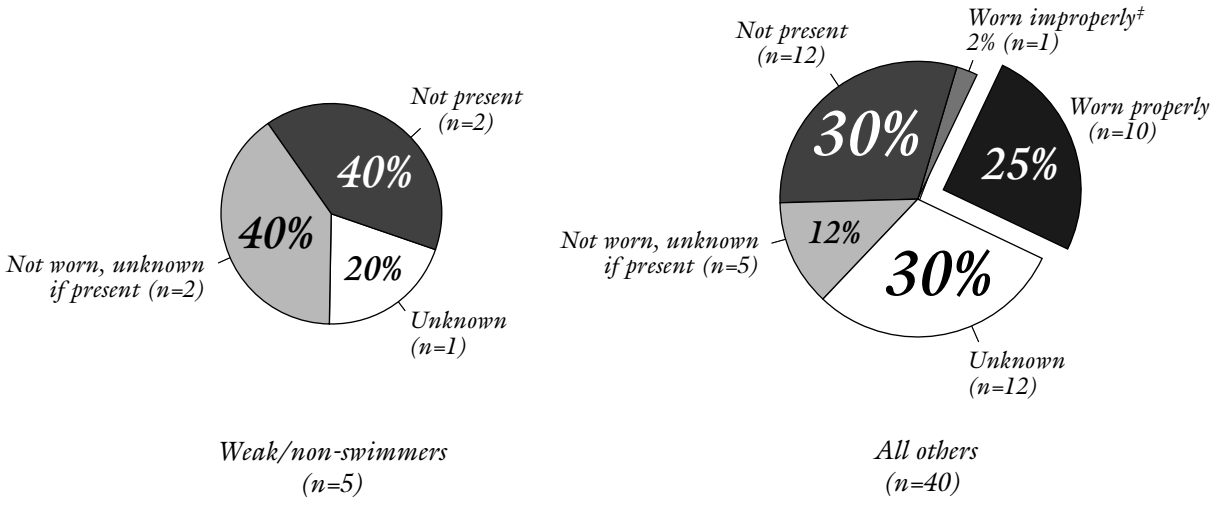


** Legal limit is 80 mg % † Includes unpowered inflatable*
‡ This figure excludes 3 victims; decomposition rendered blood alcohol unreliable § 1 at 1-49 mg %
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

EQUIPMENT FACTORS

FLOTATION A flotation device was worn properly by 22% of all raft drowning victims. No weak or non-swimmer wore flotation, whereas 25% of other raft victims properly wore flotation (Figure 38).

Figure 38 **RAFT* DROWNINGS BY USE OF A FLOTATION DEVICE† AND SWIMMING ABILITY, CANADA 1991-2000 (n=45)**



**Includes unpowered inflatable † Personal flotation device (PFD) or lifejacket ‡ Not fastened or inappropriate size*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

ENVIRONMENT FACTORS

BODY OF WATER 49% of raft drownings occurred in rivers, followed by 42% in lakes and 9% in the ocean.

CURRENT Rapids/whitewater were reported in 64% of raft drownings in rivers, and fast/strong current in 32%. Current was unknown for the remaining victims.

WIND AND WAVES For victims who drowned in lakes or the ocean, wind conditions were unknown for 52% of victims. Where wind was known, it was described as strong in 45% of cases, breezy in 27% and calm in 27%. Waves conditions, reported for all lake/ocean victims, were rough in 17%, choppy in 70%, and calm in 13%.

WATER TEMPERATURE Water temperature was unknown for two thirds of victims. For the remainder, it was extremely cold (<10°C) for 47%, cold or cool (10-20°C) for 47% and warm/hot (>20°C) for 7%.

ICE AND COLD WATER Based on the criteria used in Module 2 of this series *(Ice & Cold Water)*, it is probable that extremely cold water played a role in at leas 44% of raft drownings.

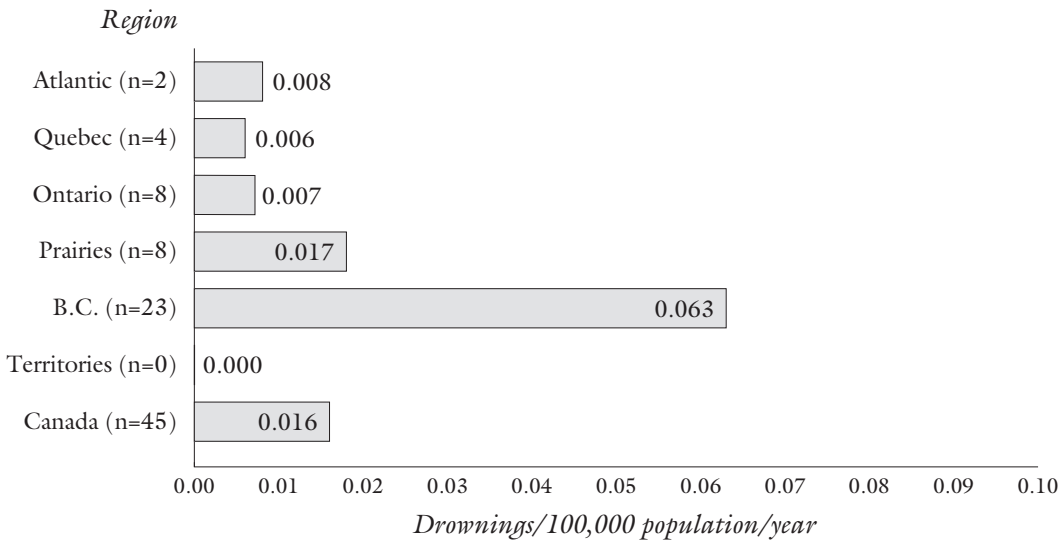
LIGHT CONDITIONS 80% of raft drownings occurred during daylight, 11% during twilight and 4% in the dark. Light conditions were unknown for 4% of cases.

MONTH AND DAY OF THE WEEK All raft victims drowned between March and October; 84% drowned between May and August. May alone accounted for 29% of raft drownings. 71% of raft drownings occurred from Friday through Sunday.

RATES BY REGION The highest rate of raft drowning was seen in British Columbia, where 51% of all such drownings occurred. The lowest rate was in the northern territories, where there were no raft drownings during 1991-2000 (Figure 39).

ACCOMPANIMENT 60% of victims were accompanied by at least one adult, while 20% were alone, and 11% were accompanied only by minor(s). Accompaniment was unknown for 9% of victims.

Figure 39 **RATE AND NUMBER OF RAFT* DROWNINGS BY REGION, CANADA 1991-2000 (n=45)**



**Includes unpowered inflatable*

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

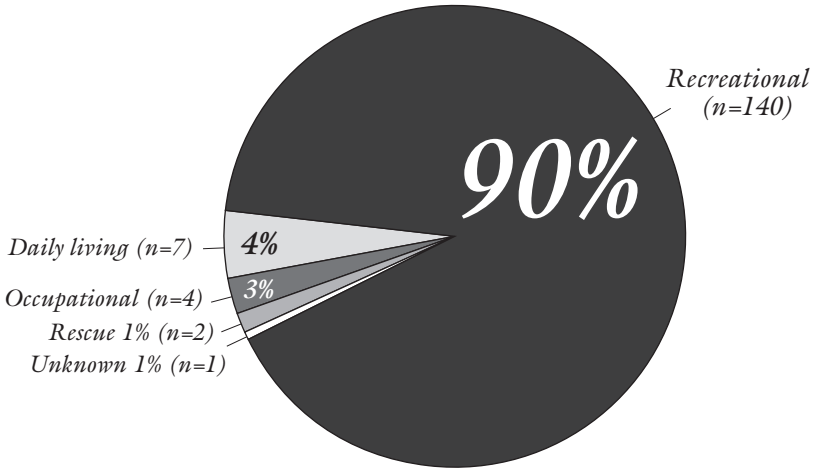
In Canada during 1991-2000 there were 161 unpowered boating fatalities involving canoes, kayaks and rafts in rivers, including 154 drownings and 7 non-drowning deaths (hypothermia 2, trauma 5).

DROWNINGS

PURPOSE Recreational activities accounted for 90% of drownings, followed by daily living, occupational activities, attempted rescue and unknown activities (Figure 40). For the 113 canoe victims, recreational activities accounted for 90%, followed by daily living 6%, occupational 3%, and unknown activities 1%. For the 19 kayak victims, 89% occurred during recreational activities and 11% during attempted rescue. For the 22 raft victims, recreational activities accounted for 95% of drownings and occupational activities for 5%.

TYPE OF INCIDENT Capsizing accounted for 65% of drownings. Other incidents included falling overboard, swamping, and collision (Figure 41).

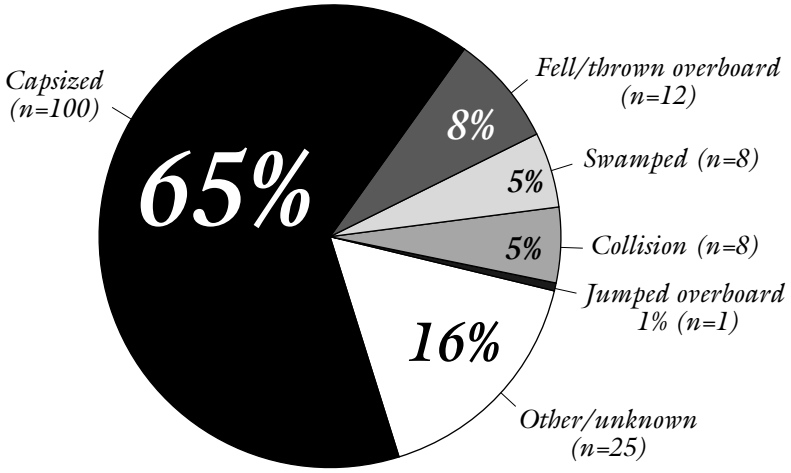
Figure 40 **RIVER DROWNINGS IN CANOE, KAYAK OR RAFT* BY PURPOSE OF ACTIVITY, CANADA 1991-2000 (n=154)**



** Includes unpowered inflatable*

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 41 **RIVER DROWNINGS IN CANOE, KAYAK OR RAFT* BY TYPE OF INCIDENT, CANADA 1991-2000 (n=154)**

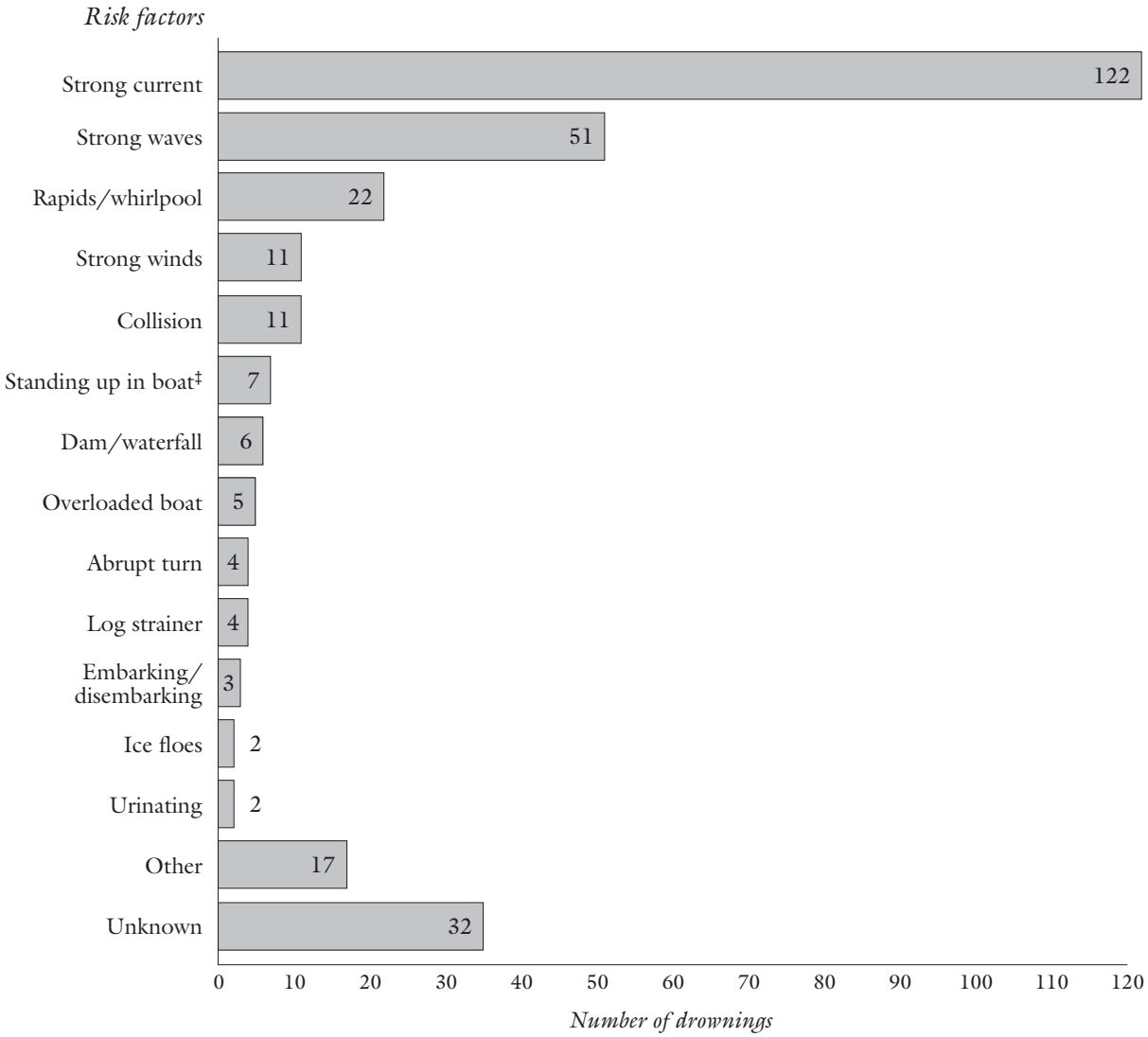


** Includes unpowered inflatable*

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

RISK FACTORS Strong current was a frequent risk factor for river drownings (Figure 42).

Figure 42 **RIVER DROWNINGS IN CANOE, KAYAK OR RAFT* BY RISK FACTOR,† CANADA 1991-2000 (n=154)**



** Includes unpowered inflatable † There may be more than 1 risk factor per incident ‡ Other than to urinate*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

PERSONAL RISK FACTORS

AGE AND SEX Males represented 90% of victims. Males 15-34 years old were at highest risk (Figure 43).

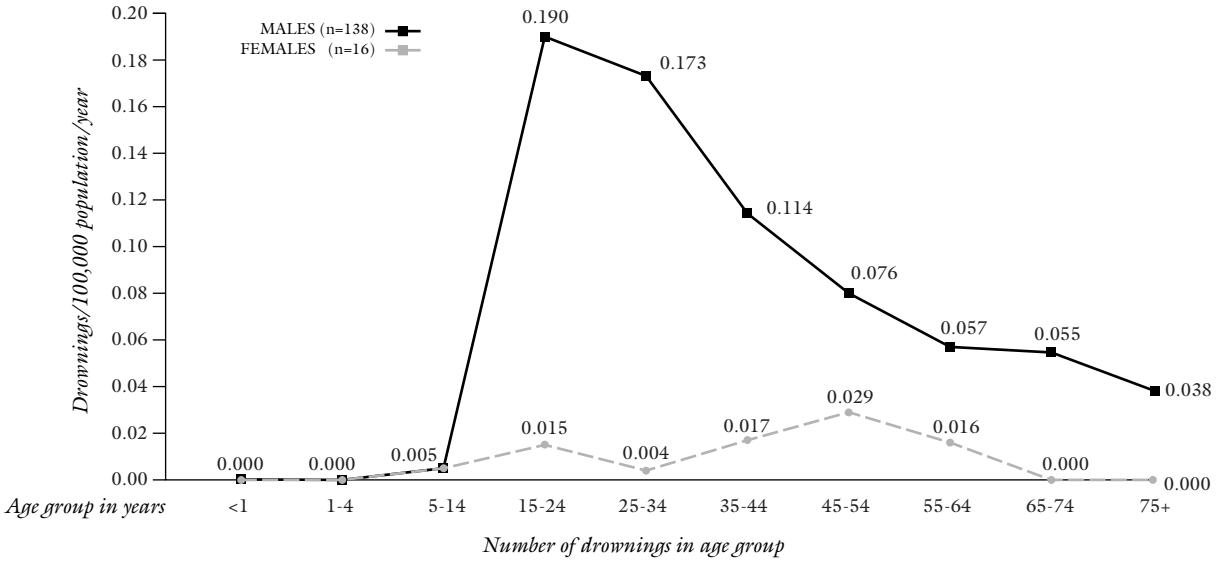
ALCOHOL Alcohol was present or suspected in 34% of victims (Figure 44).

ETHNICITY 11% of victims were aboriginals. Ethnicity was unknown for 36% of victims.

SWIMMING ABILITY Swimming ability was unknown for 74% of victims. Where swimming ability was known, 43% were weak or non-swimmers, 32% were strong or average swimmers, and 25% were swimmers of unspecified ability.

BOATING EXPERIENCE Boating experience was unknown for 60% of victims. Of the remainder, 76% were experienced boaters and 24% were occasional boaters.

Figure 43 **RATE AND NUMBER OF RIVER DROWNINGS IN CANOE, KAYAK OR RAFT* BY AGE & SEX, CANADA 1991-2000 (n=154)†**

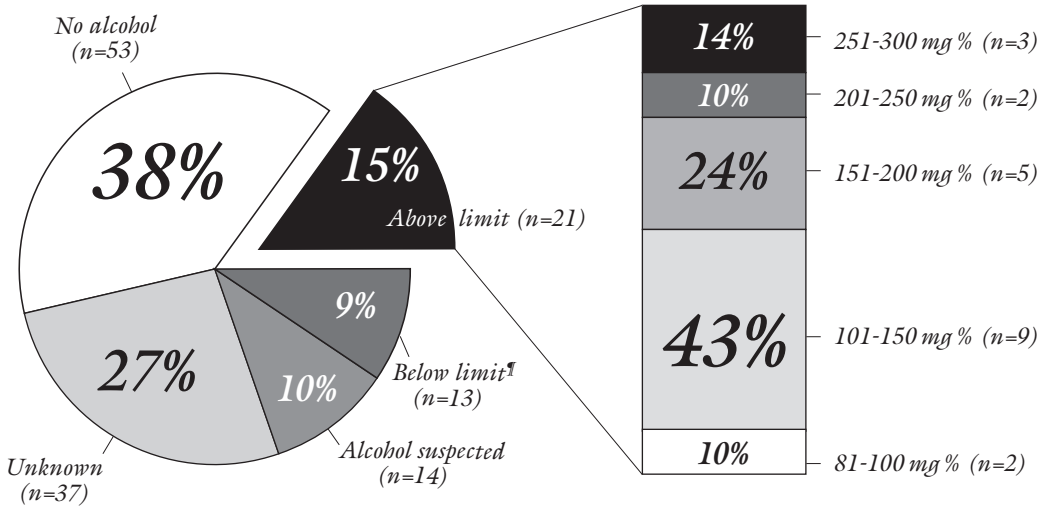


Number of drownings in age group

MALES	0	0	1	39	43	27	13	7	5	2
FEMALES	0	0	1	3	1	4	5	2	0	0

** Includes unpowered inflatable † Age unknown for 1 male victim*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 44 **BLOOD ALCOHOL LEVELS* FOR RIVER DROWNINGS IN CANOE, KAYAK OR RAFT,† CANADA 1991-2000 (VICTIMS ≥15 YEARS OF AGE; n=151)‡§**



** Legal limit is 80 mg % † Includes unpowered inflatable ‡ Age unknown for 1 victim, presumed adult*
§ This figure excludes 13 victims; decomposition rendered blood alcohol unreliable ¶ 7 at 1-49 mg %, 6 at 50-80 mg %
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

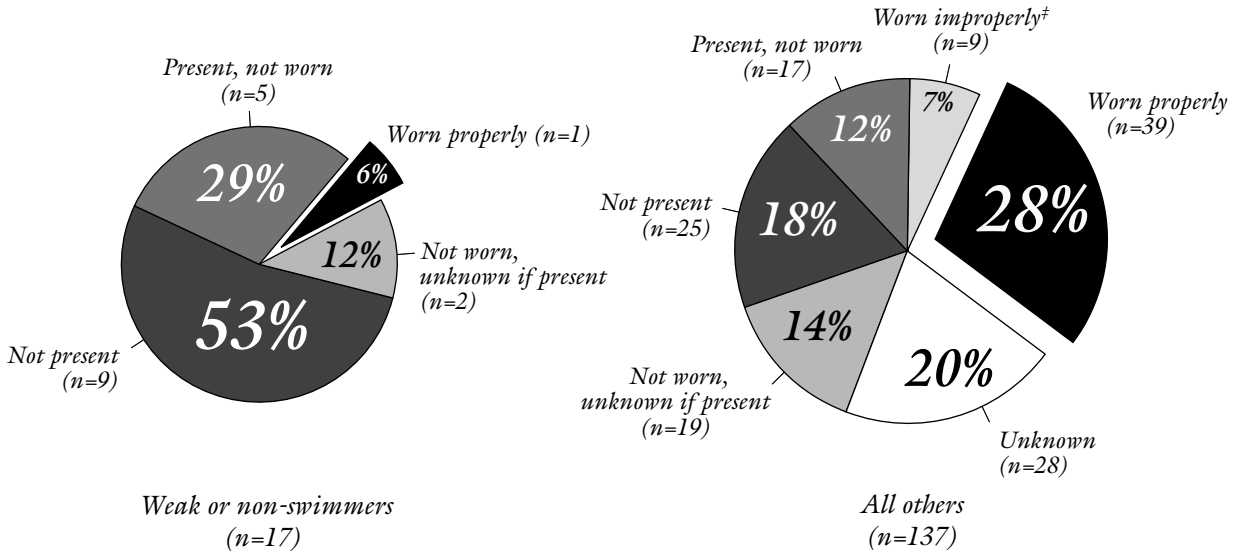
EQUIPMENT FACTORS

FLOTATION A flotation device was worn properly by 26% of all victims. 6% of weak or non-swimmers properly wore flotation as compared with 28% of other victims (Figure 45).

ENVIRONMENT FACTORS

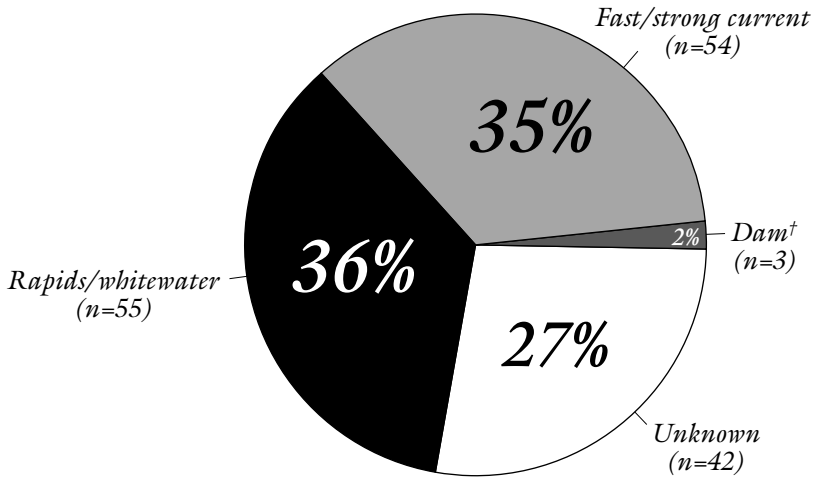
CURRENT Current was a factor for at least 73% of victims (canoe 67%, kayak 89%, raft 95%). Most cases involved strong current or whitewater/rapids (Figure 46).

Figure 45 **RIVER DROWNINGS IN CANOE, KAYAK OR RAFT* BY FLOTATION DEVICE† AND SWIMMING ABILITY, CANADA 1991-2000 (n=154)**



** Includes unpowered inflatable † Personal flotation device (PFD) or lifejacket ‡ Not fastened or inappropriate size*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 46 **RIVER DROWNINGS IN CANOE, KAYAK OR RAFT* BY TYPE OF CURRENT, CANADA 1991-2000 (n=154)**



** Includes unpowered inflatable † Included spillway, hydraulic current & whirlpool*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

WATER TEMPERATURE Water temperature was unknown in 66% of cases. For the remainder, it was extremely cold (<10°C) in 60%, cold or cool (10-20°C) in 37% and warm/hot (>20°C) in 4%.

ICE AND COLD WATER Based on the criteria used in Module 2 of this series *(Ice & Cold Water)*, it is probable that extremely cold water played a role in at least 54% of cases (canoe 55%, kayak 79%, raft 27%).

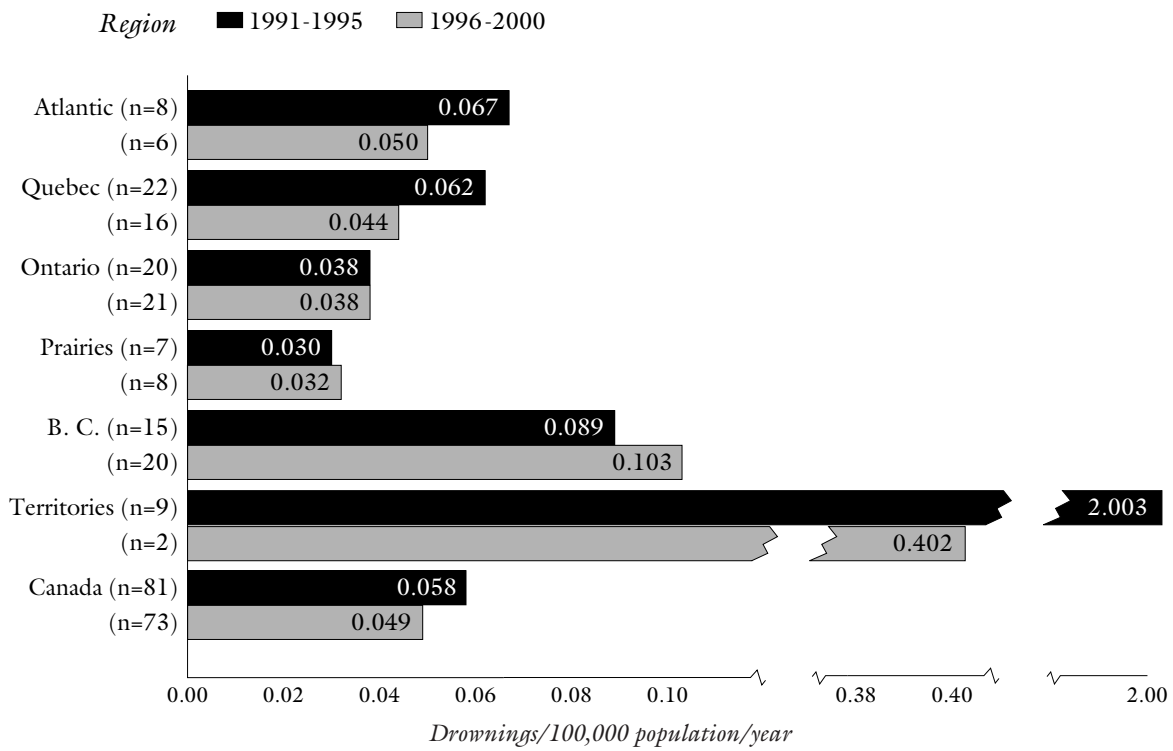
MONTH AND DAY OF THE WEEK 88% of victims drowned between April and October, and 8% between November and March; the month was unknown for 3%. Drownings took place throughout the week, but there was a dip on Wednesday and Thursday (8% each), and a peak on Sunday (23%).

LIGHT CONDITIONS 55% of victims drowned during daylight, 4% during twilight and 12% in the dark. Light conditions were unknown for 29%.

REGION Ontario, Quebec, and British Columbia were the most frequent locations for river drownings involving canoes, kayaks and rafts; the highest rates were seen in the territories and British Columbia (Figure 47).

ACCOMPANIMENT 76% of victims were accompanied by at least one adult, 18% were alone, and 3% were accompanied only by minor(s). Accompaniment was unknown for 2% of victims.

Figure 47 **RATE AND NUMBER OF RIVER DROWNINGS IN CANOE, KAYAK OR RAFT* BY REGION, CANADA 1991-2000 (n=154)**



** Includes unpowered inflatable*

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

There were 71 rowboat fatalities in Canada between 1991 and 2000; all were classified as drownings.

DROWNINGS

ACTIVITY 54% of rowboat drowning victims were fishing. Other activities included rowing, hunting, travel and attempting rescue (Figure 48).

PURPOSE Recreational activities accounted for 82% of drownings, daily living for 8%, occupational for 6%, attempted rescue for 1% and unknown for 3%.

TYPE OF INCIDENT Capsizing was the most common type of incident, accounting for 44% of rowboat drownings. Other incidents included falling overboard, swamping, and collision (Figure 49).

PERSONAL RISK FACTORS

AGE AND SEX With the exception of one female victim, all rowboat victims were male. Those 15 and older were at highest risk (Figure 50).

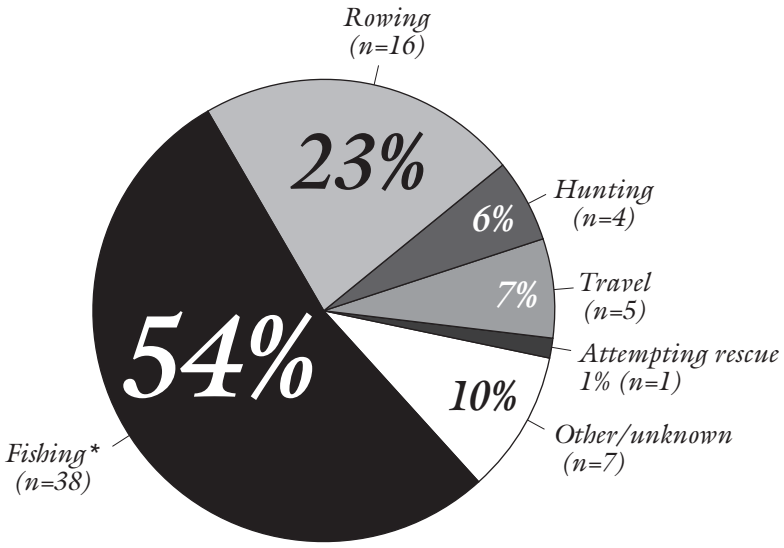
ALCOHOL Alcohol was present or suspected in at least 52% of cases (Figure 51).

ETHNICITY 11% of victims were aboriginal, which may be an underestimate since ethnicity was unknown for 36% of victims.

SWIMMING ABILITY Swimming ability was unknown for 56% of victims. Of the remainder, 58% were weak or non-swimmers, 19% were strong or average swimmers, and 23% were swimmers of unspecified ability.

BOATING EXPERIENCE Boating experience was unknown for 56% of victims. Of the remainder, 74% were experienced boaters and 26% were inexperienced or occasional boaters.

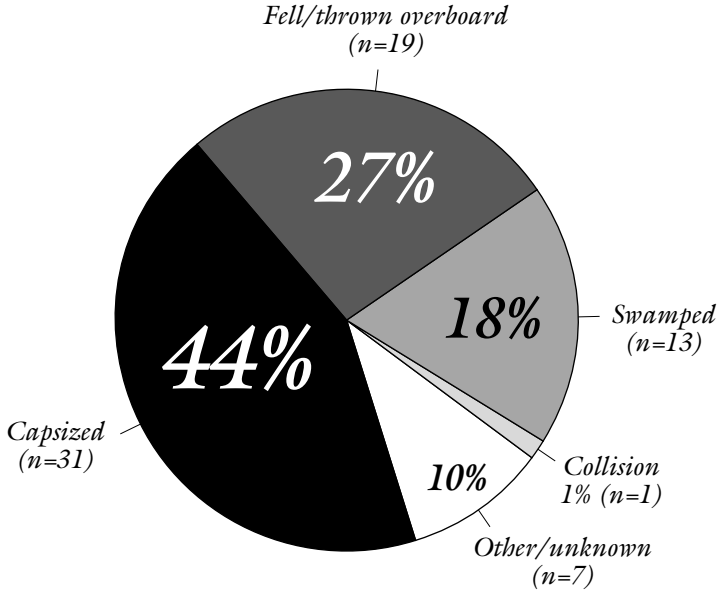
Figure 48 **ROWBOAT DROWNINGS BY ACTIVITY, CANADA 1991-2000 (n=71)**



**Included recreational fishing 33, commercial fishing 4, subsistence fishing 1*

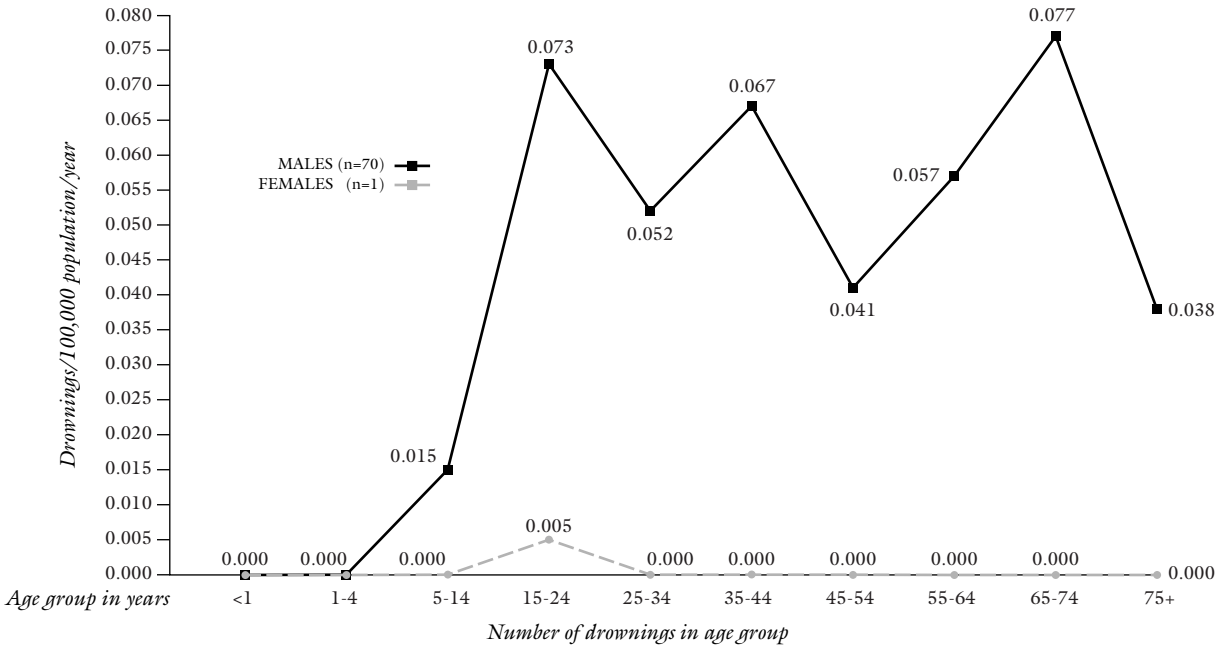
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 49 **ROWBOAT DROWNINGS BY TYPE OF INCIDENT, CANADA 1991-2000 (n=71)**



Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 50 **RATE AND NUMBER OF ROWBOAT DROWNINGS BY AGE & SEX, CANADA 1991-2000 (n=71)**

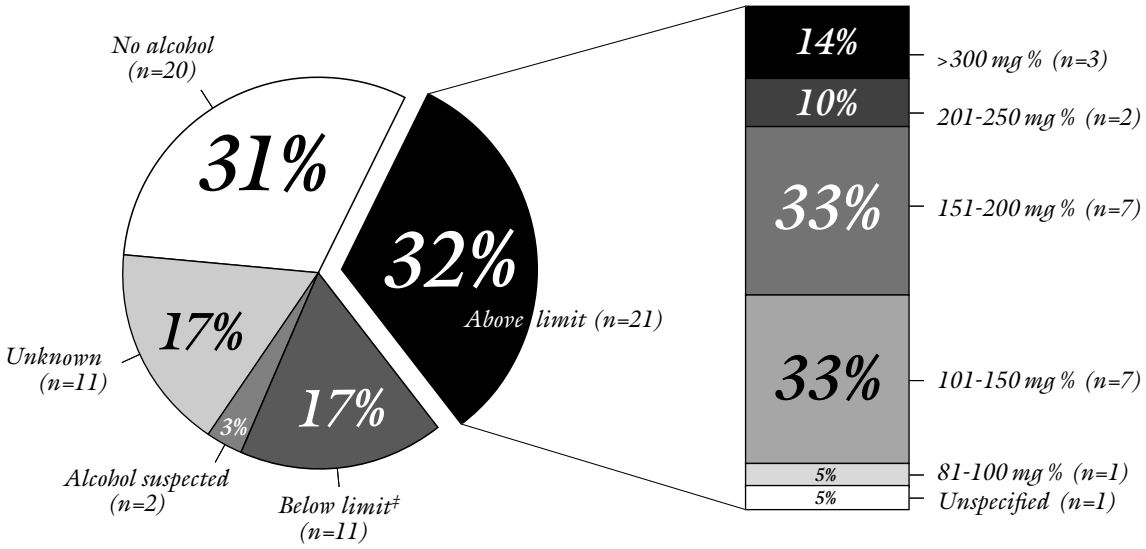


Number of drownings in age group

MALES	0	0	3	15	13	16	7	7	7	2
FEMALES	0	0	0	1	0	0	0	0	0	0

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 51 **BLOOD ALCOHOL LEVELS* FOR ROWBOAT DROWNINGS, CANADA 1991-2000 (VICTIMS ≥15 YEARS OF AGE; n=68)†**



** Legal limit is 80 mg % † This figure excludes 3 victims; decomposition rendered blood alcohol unreliable*
‡ 3 at 1-49 mg %, 6 at 50-80 mg %, 2 unspecified

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

EQUIPMENT FACTORS

FLOTATION A flotation device was properly worn by only 6% of victims. No weak or non-swimmer wore flotation (Figure 52).

ENVIRONMENT FACTORS

TYPE OF BODY OF WATER 51% of rowboat drownings occurred in lakes, 37% in the ocean and 13% in rivers.

WIND AND WAVES Wind conditions were unknown for 58% of victims. For the remainder, wind was described as strong in 43% of cases, breezy in 40% and calm in 17%. Wave conditions were unknown for 48% of victims. For the remainder, there was an ocean swell in 3%, it was stormy in 3%, rough in 49%, choppy in 30%, and calm in 14%.

WATER TEMPERATURE Water temperature was unknown for 51% of rowboat drownings. Where temperature was known, it was reported to be extremely cold (<10°C) in 71% and cold or cool (10-20°C) in 29%.

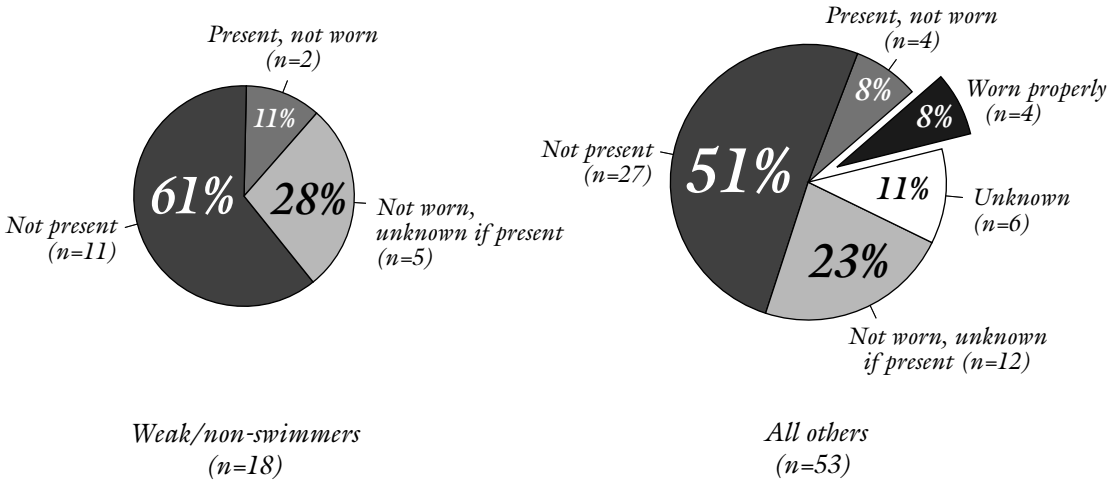
ICE & COLD WATER Based on the criteria used in Module 2 of this series *(Ice & Cold Water)*, it is probable that extremely cold water played a role in at least 76% of rowboat drownings.

LIGHT CONDITIONS 49% of rowboat drownings occurred during daylight, 8% during twilight and 27% in the dark. Light conditions were unknown for 15% of victims.

MONTH, DAY OF THE WEEK 41% of rowboat drownings occurred in May and June, 44% from July to October, and 15% from November to April. Drownings occurred throughout the week; 44% occurred on Friday or Saturday.

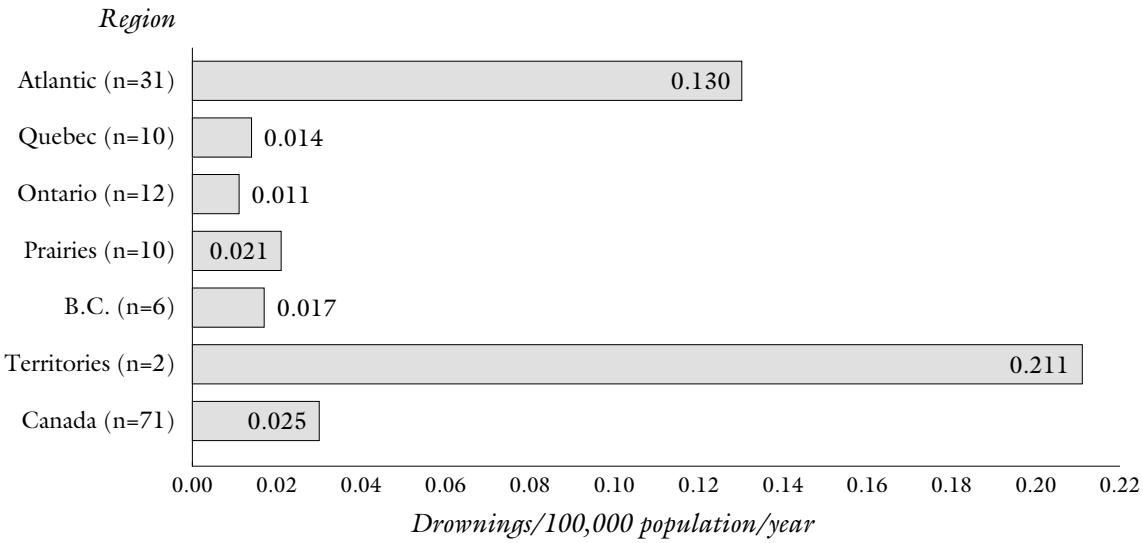
RATES BY REGION 44% of fatalities occurred in the Atlantic region; there were few deaths in British Columbia (Figure 53).

Figure 52 **ROWBOAT DROWNINGS BY USE OF A FLOTATION DEVICE* AND SWIMMING ABILITY, CANADA 1991-2000 (n=71)**



**Personal flotation device (PFD) or lifejacket*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 53 **RATE AND NUMBER OF ROWBOAT DROWNINGS BY REGION, CANADA 1991-2000 (n=71)**



Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

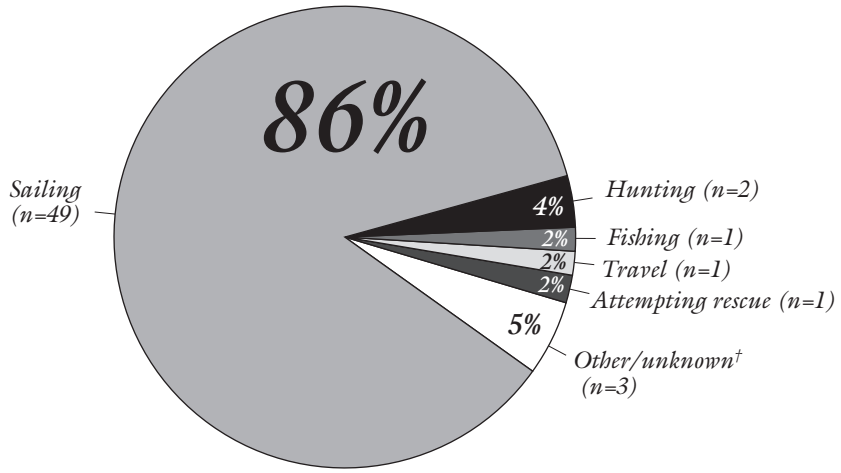
There were 60 sailboat fatalities in Canada during 1991-2000, including 57 drownings and 3 non-drowning fatalities (hypothermia 1, trauma 2).

DROWNINGS

ACTIVITY Sailing accounted for the 86% of sailboat drownings. Other activities included hunting, fishing, travel and rescue (Figure 54).

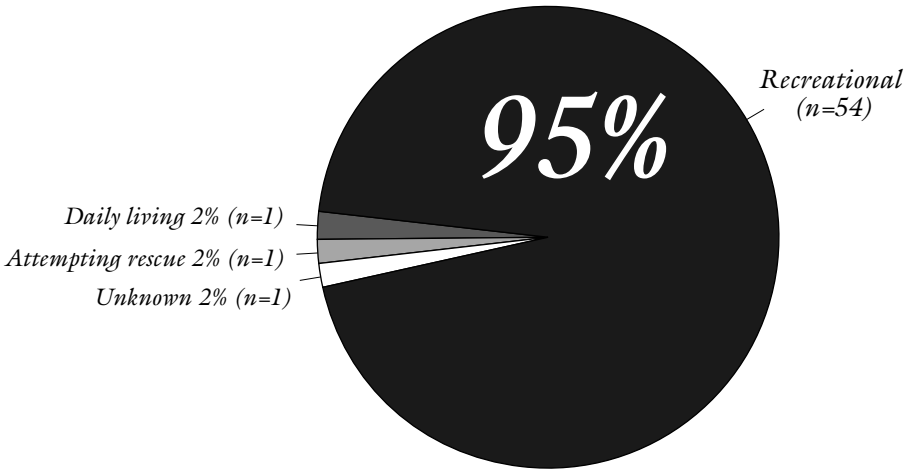
PURPOSE 95% of sailboat drownings occurred during recreational activities (Figure 55).

Figure 54 **SAILBOAT* DROWNINGS BY ACTIVITY, CANADA 1991-2000 (n=57)**



** Included 53 sailboats (25 >5.5 m, 13 ≤5.5 m, 15 unspecified), and 4 sailboards † Included child who wandered onto deck 1, unknown 2*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 55 **SAILBOAT* DROWNINGS BY PURPOSE OF ACTIVITY, CANADA 1991-2000 (n=57)**

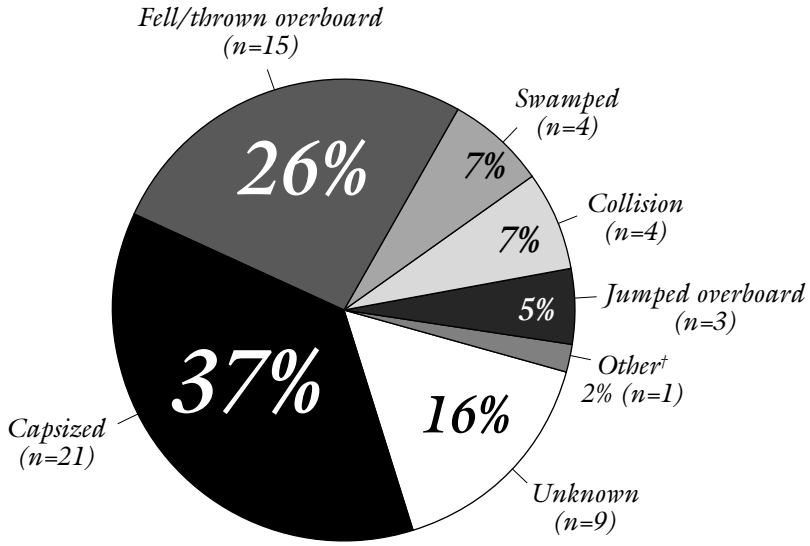


** Included 53 sailboats (25 >5.5 m, 13 ≤5.5 m, 15 unspecified), and 4 sailboards*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

TYPE OF INCIDENT Capsizing accounted for 37% of sailboat drownings, falling overboard for 26%. Other incidents included swamping, collision, and jumping overboard (Figure 56).

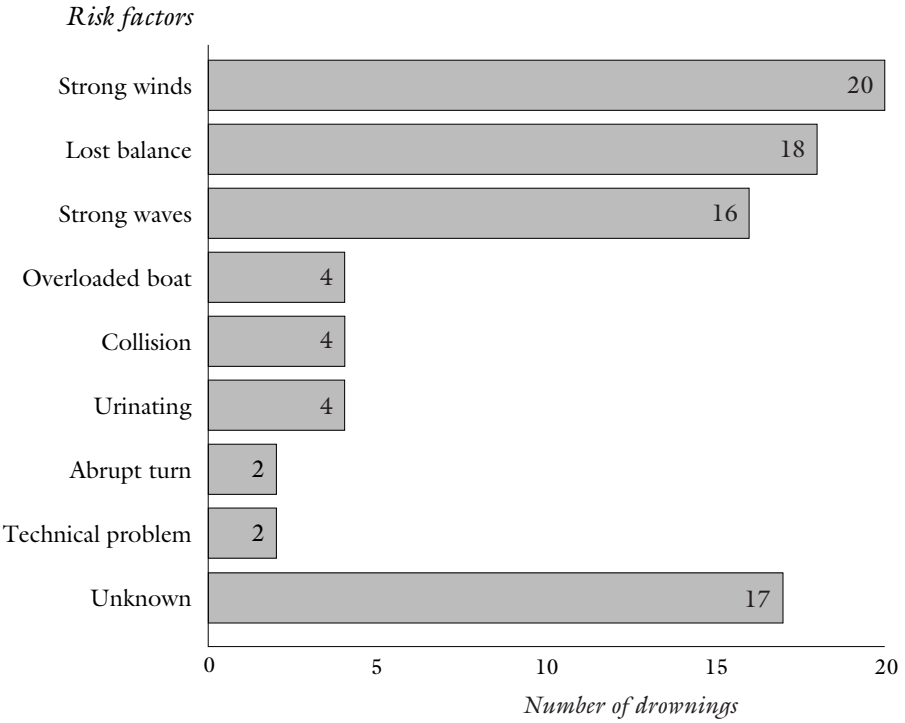
RISK FACTORS Factors which may have contributed to the incident included strong winds, loss of balance, and strong waves (Figure 57).

Figure 56 **SAILBOAT* DROWNINGS BY TYPE OF INCIDENT, CANADA 1991-2000 (n=57)**



** Included 53 sailboats (25 >5.5 m, 13 ≤5.5 m, 15 unspecified), and 4 sailboards † Seizure*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 57 **SAILBOAT* DROWNINGS BY RISK FACTOR,† CANADA 1991-2000 (n=57)**



** Included 53 sailboats (25 >5.5 m, 13 ≤5.5 m, 15 unspecified), and 4 sailboards † There may be more than 1 risk factor per incident*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

PERSONAL RISK FACTORS

AGE AND SEX Males 25-64 years old were at highest risk for sailboat drownings (Figure 58).

ALCOHOL Alcohol was present or suspected in at least 19% of cases (Figure 59).

ETHNICITY Only 2% of victims were aboriginals. Ethnicity was unknown for 33% of victims.

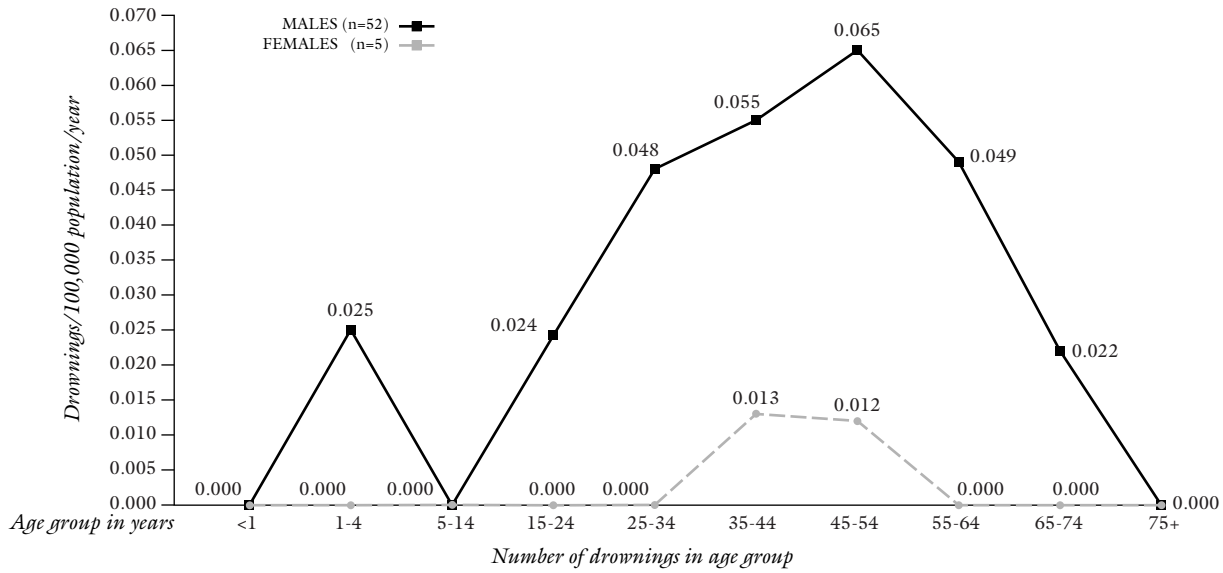
SWIMMING ABILITY Swimming ability was unknown for 72% of victims. Of the remainder, 44% were weak or non-swimmers, 44% were strong or average swimmers, and 12% were swimmers of unspecified ability.

BOATING EXPERIENCE Boating experience was unknown for 46% of victims. Of the remainder, 58% were experienced boaters and 42% were inexperienced or occasional boaters.

EQUIPMENT FACTORS

FLOTATION A flotation device was worn properly by 26% of all sailboat drowning victims. 14% of weak or non-swimmers properly wore flotation, as compared with 28% of other victims (Figure 60).

Figure 58 **RATE AND NUMBER OF SAILBOAT* DROWNINGS BY AGE & SEX, CANADA 1991-2000 (n=57)†**

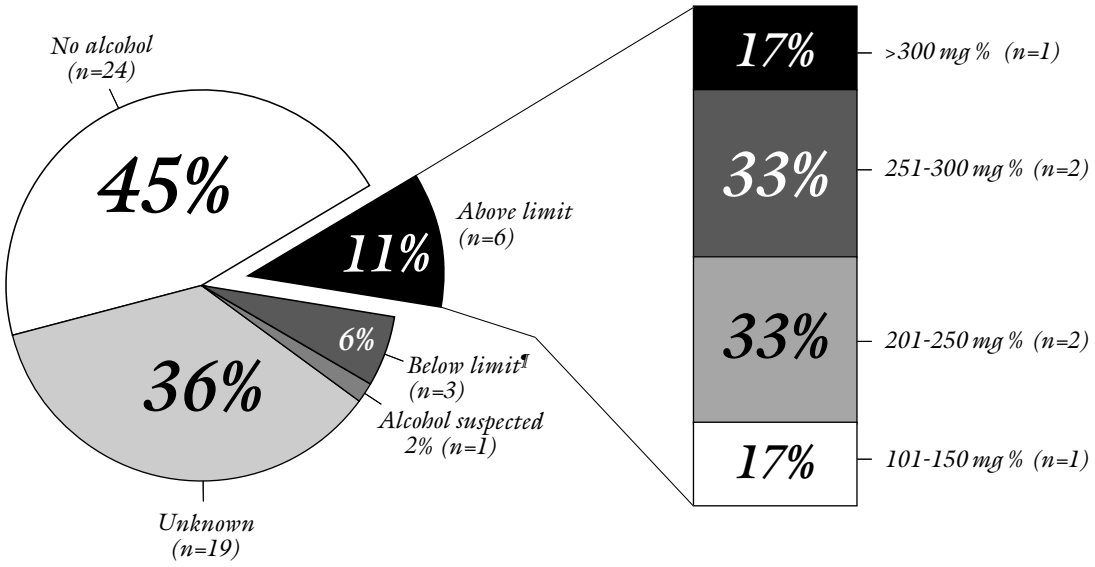


Number of drownings in age group

MALES	0	2	0	5	12	13	11	6	2	0
FEMALES	0	0	0	0	0	3	2	0	0	0

** Included 53 sailboats (25 >5.5 m, 13 ≤5.5 m, 15 unspecified), and 4 sailboards † Age unknown for 1 male victim*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

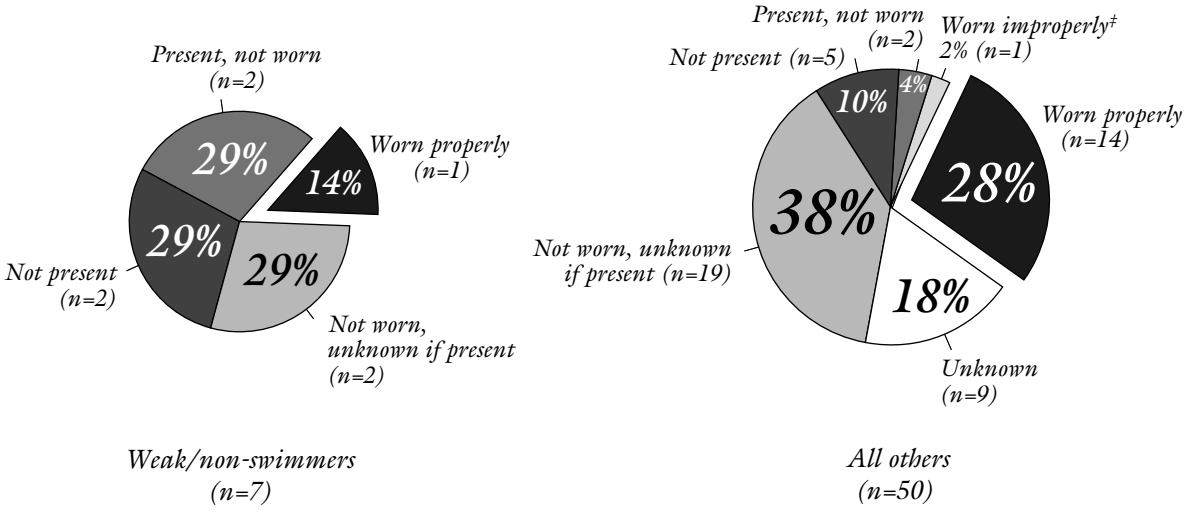
Figure 59 **BLOOD ALCOHOL LEVELS* FOR RECREATIONAL SAILBOAT† DROWNINGS, CANADA 1991-2000 (VICTIMS ≥15 YEARS OF AGE; n=55)‡§**



** Legal limit is 80 mg % † Included 51 sailboats (25 >5.5 m, 13 ≤5.5 m, 13 unspecified), and 4 sailboards ‡ Age unknown for 1 victim, presumed adult § This figure excludes 2 victims; decomposition rendered blood alcohol unreliable ¶ 1 at 50-80 mg %, 1 unspecified*

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Figure 60 **SAILBOAT* DROWNINGS BY USE OF A FLOTATION DEVICE† AND SWIMMING ABILITY, CANADA 1991-2000 (n=57)**



** Included 53 sailboats (25 >5.5 m, 13 ≤5.5 m, 15 unspecified), and 4 sailboards*
† Personal flotation device (PFD) or lifejacket ‡ Not fastened or inappropriate size

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

ENVIRONMENT FACTORS

BODY OF WATER 51% of sailboat drownings occurred in lakes, followed by 42% in the ocean and 5% in rivers. Body of water was unknown for 2% of victims.

WIND AND WAVES Wind and wave conditions were reported in about 60% of sailboat drownings. Of these, winds were strong and water was rough or stormy in about two thirds of cases (Figure 61).

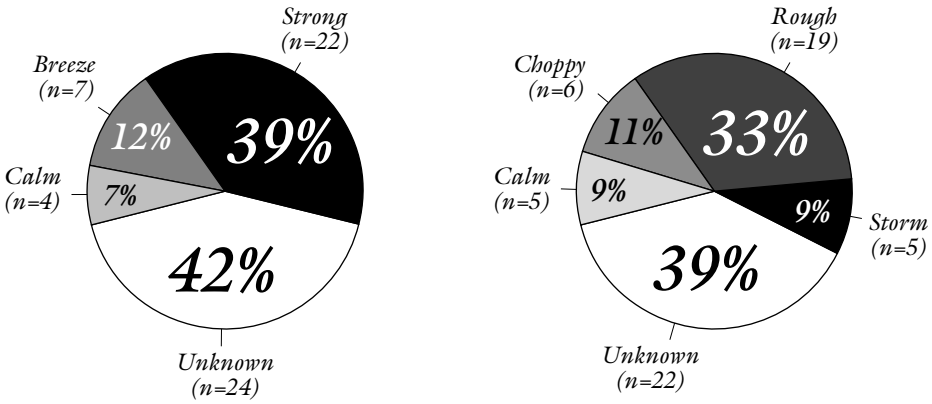
WATER TEMPERATURE Water temperature was unknown for 40% of victims. Where reported, it was extremely cold (<10°C) in 35%, cold or cool (10-20°C) in 59% and warm/hot (>20°C) in 6%.

ICE AND COLD WATER Based on the criteria used in Module 2 of this series *(Ice & Cold Water)*, it is probable that extremely cold water played a role in at least 65% of sailboat drownings (37/57).

LIGHT CONDITIONS 37% of sailboat drownings occurred during daylight, 5% during twilight and 32% in the dark. Light conditions were unknown for 26% of victims.

MONTH AND DAY OF THE WEEK 77% of victims drowned between May and September, 14% between October and April. Month was unknown for 9% of victims. Sailboat drownings took place throughout the week, but about a third took place on Saturday.

Figure 61 **SAILBOAT* DROWNINGS BY WIND & WAVE CONDITIONS, CANADA 1991-2000 (n=57)**

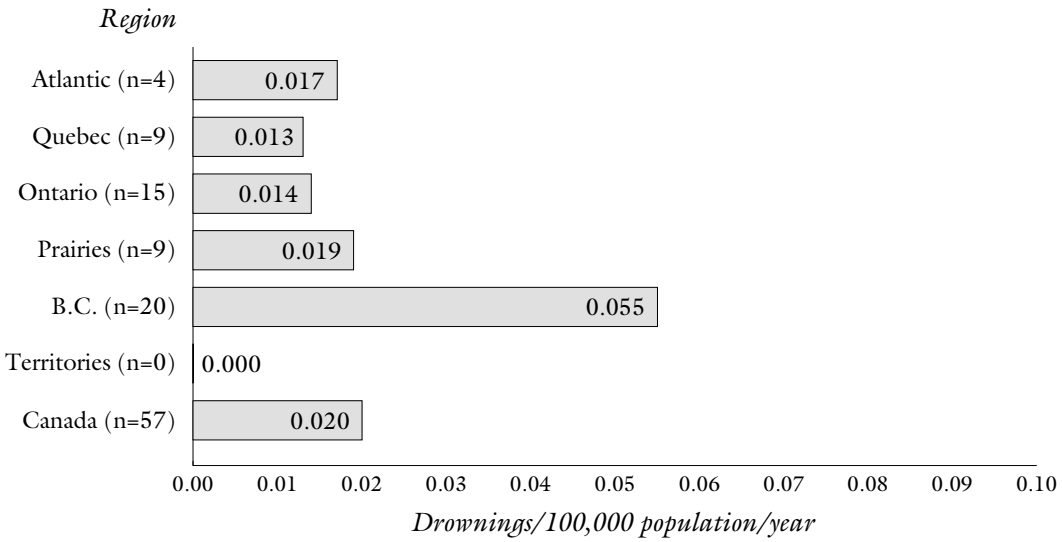


** Included 53 sailboats (25 >5.5 m, 13 ≤5.5 m, 15 unspecified), and 4 sailboards*

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

RATES BY REGION The highest rate and number of sailboat drownings occurred in British Columbia (Figure 62).

Figure 62 **RATE AND NUMBER OF SAILBOAT* DROWNINGS BY REGION, CANADA 1991-2000 (n=57)**



** Included 53 sailboats (25 >5.5 m, 13 ≤5.5 m, 15 unspecified), and 4 sailboards*
Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

The sun goes down so slowly, it hangs on the horizon and goes slowly down. A wave splashed over the back of his canoe, then another, and his knees were in two inches of water. He leaned out far, dug in extra-hard and the paddle gave way and he was in the water before he knew he was going over. In the water, holding the shaft of his cedar paddle in one hand, the blade gone. Gasping from the cold. He grabbed the canoe — it was wallowing upright — he grabbed it with his left hand, but he couldn't catch his breath, the water barely above freezing, and nothing mattered, except getting out of it. He heaved what was left of his paddle into the canoe and tried to climb in over the side and the canoe rolled over. He tried to pull himself up onto its bottom, but the bow went up and the stern went down under his weight and the canoe slid out from under him. He tried once more from the side and the canoe rolled over again and sat upright. Then he was just hanging on, hands on the gunwales, an iron grip, the shore endlessly far away….

He had no idea how much time had passed, how much time he had left. So quiet now. So incongruous, he thought, to be fighting for his life when it was calm and peaceful. Breathing is loud when there's no other sound. It reminded him he was alive. He rested his head against the side of the canoe and there was the astounding silence and his breathing. He was eating apple pie with his mother. He was looking at the wedding ring on her floury hand. Then he was back in the present, an old man with no feeling in his submerged body, agony in his arms, hands like stone claws from holding on. He was sorry, so profoundly sorry to be losing everything, and so sorry about the trouble he was going to cause.

– Elizabeth Hay, *Late Nights on Air,* 2007

ACTIVITIES & RISK FACTORS FOR ALL UNPOWERED BOATS

The research shows that unpowered boating accounted for 12% of water-related injury fatalities and 36% of boating fatalities in Canada during 1991-2000. Most deaths were due to drowning or immersion hypothermia. The activities most often leading to death were canoeing, fishing, rowing, rafting, sailing, and kayaking. More than 80% of incidents were recreational, with most resulting from capsizing or falling overboard.

Victims were nearly all males 15 years and older, with the peak risk at 15-24 years of age. Although males of all ages were at risk, the rate of death declined somewhat after 25 years, whereas for powered boating, the risk remained consistently high until the age of 75. Alcohol was associated with 40% of unpowered boating deaths, possibly more, since alcohol was unknown for 25% of deaths overall, 45% in Quebec. Poor swimming ability was another frequent personal risk factor.

Canoes accounted for more than half of unpowered boating drownings, while rowboats, sailboats, rafts, and kayaks accounted for between 6% and 10% each. Although capsizing and falling overboard are frequent with such small unstable boats, proper wearing of a flotation device as protection against such sudden unexpected immersion was only 11%. Even more alarming was the fact that wearing was only 2% for weak or non-swimmers. Greater consumption of alcohol by non-users of flotation devices was also of concern, putting these individuals at least doubly at risk, but possibly much more since interaction of risk factors can be multiplicative rather than additive.

Lakes were the most frequent body of water, followed by rivers and oceans. Lakes predominated in the Prairies and Ontario, with a more even mix of lakes, rivers, and oceans in B.C. and the northern territories, mainly lakes and rivers in Quebec, and the ocean and lakes in the Atlantic region. Environmental factors were important, with extremely cold water associated with at least 54% of incidents. Strong winds and rough waves were frequent factors in lakes and oceans, while rapids or strong current were

reported for most river drownings. Close to a third of deaths took place in the reduced visibility of darkness or twilight. Most deaths occurred between April and October.

There was a 19% decrease in the rate of unpowered boating drownings (i.e. the number per unit of population) between 1991-1995 and 1996-2000. The greatest reduction was seen in the Atlantic region, British Columbia, and the northern territories, while Quebec and Ontario showed slight increases.

In summary, the main personal risk factors for unpowered boating deaths were age 15 years and older, male gender, and alcohol; few women or children were involved. Lack of flotation was a prevalent equipment factor, particularly among weak and non-swimmers, those who had consumed alcohol, and those using rowboats or fishing from canoes. Environmental factors included cold water, river current, wind, waves and darkness.

CANOES

Canoeing was the most frequent activity associated with canoe fatalities, followed by fishing and hunting. Most incidents occurred during recreational activities; a majority of cases involved capsizing.

Males 15-24 years old had the highest drowning rates, followed by those 25-34. Only 2% of victims were children less than 15 years old. Alcohol was involved in more than 40% of deaths. Where swimming ability was known, it was weak or poor for about half the victims. At least 15% were aboriginal.

A flotation device was worn properly by only 13% of those canoeing and 5% of those fishing.

Environmental risk factors were frequently associated with canoe drownings, with extremely cold water involved in 60% of cases, possibly more, followed by strong winds, rough waves and darkness. Lakes were the most frequent body of water in nearly all regions, although rivers were more frequent in Quebec. Nearly two-thirds of drownings took place in lakes, where wind and waves often played a role, while one-third took place in rivers, often in the presence of rapids and strong current.

There was a 19% decrease in canoe drownings overall, with the greatest improvement seen in the northern territories, British Columbia and the Atlantic region; there was little change in Quebec and Ontario.

In summary, risk factors associated with canoe drownings included male gender, ages 15-24 years, alcohol consumption, lack of flotation (particularly among weak and non-swimmers), extremely cold water, wind, waves, strong current, and darkness. The fact that people of limited swimming ability use unstable boats prone to capsize without wearing a flotation device suggests a lack of awareness of basic water safety among the most vulnerable members of the public.

KAYAKS

The highest risk group for kayak drownings was somewhat older than for canoes, with peak rates seen for males 25-44 years old. Drowning rates were about a tenth those for canoes, probably due to a much lower prevalence of kayaks. Alcohol was much less frequently involved, at about 20%. Wearing of flotation was higher at 32%. However, it is disturbing to note that at least 17% of kayaking victims were weak or non-swimmers; of these, only 20% wore flotation.

Environmental risk factors were even more frequently associated with kayak than with canoe drownings. Rapids or strong current were reported for nearly all incidents in rivers, and wind and waves were frequent factors in lakes and oceans. Extremely cold water was associated with 76% of deaths; 35% occurred during the cold weather months of November

to April. Rivers were the most frequent location, followed by equal numbers in oceans and lakes. Drowning rates were several times higher in the coastal provinces and territories than in the rest of Canada.

In summary, environmental determinants predominated as causal factors in kayaking deaths, although at least one in six victims were poor or non-swimmers, and only one in three were known to be wearing flotation.

RAFTS

White water rafting, other rafting, and fishing were the main activities associated with raft drownings, with capsizing and falling or being thrown off as the main types of incident. Most victims were 15 to 44-year-old males, although a few incidents involved children and the elderly. Alcohol was associated with about one-third of deaths. Although some victims lacked swimming ability, others were strong swimmers. While 22% of victims wore a flotation device, none of the weak or non-swimmers did.

Environmental factors were the main determinants in raft drownings, with 49% of incidents occurring in rivers, where rapids or strong current were present in 96% of cases, and the remainder in lakes and the ocean, where wind and waves were frequent. Extremely cold water was associated with 44% of incidents; 29% occurred during the month of May. Half of all deaths occurred in British Columbia, where the death rate was about six times higher than in other provinces.

In summary, about half of rafting incidents occurred in river rapids and current, often in extremely cold water. Under such hazardous conditions, it is surprising that so many rafters did not wear flotation.

OVERVIEW OF RIVER DROWNINGS IN CANOES, KAYAKS & RAFTS

33% of canoe, 46% of kayak and 42% of raft drownings occurred in rivers; most of these incidents took place during recreational activities. In 65% of cases the boat capsized. Males 15-34 were at highest risk. At least 35% of victims had consumed alcohol, and many were weak or non-swimmers. Many victims were reported to be experienced boaters. Wearing of flotation devices was surprisingly low for such a hazardous activity (26%). It was even lower (6%) for weak or non-swimmers, who should not be running fast rivers at all, given the high risk of unexpected immersion.

Strong current, rapids or whirlpools were frequent risk factors, especially for kayaks and rafts. Extremely cold water was a factor in at least 54% of incidents, more so for kayaks and less for rafts. Although there were several deaths from notorious river hazards such as being caught in log strainers and recirculating hydraulics at the base of dams or waterfalls, most river deaths were associated with the less exotic factors noted above and observed over and over again in all types of unpowered and powered boating deaths.

In summary, river drownings in small unpowered boats involved young males who capsized in strong current, often in extremely cold water. For a majority of victims, failure to wear a flotation device was an important factor.

ROWBOATS

Recreational fishing was the activity most often associated with rowboat drownings, followed by rowing. Capsizing, falling overboard, and swamping were the most common types of incident. Rowboat drownings almost exclusively involved males 15 years and older. Alcohol was associated with over half the deaths, and many victims had limited or no swimming ability, although many were reported to be experienced boaters. Only 6% of victims wore a flotation device, and none of the weak or non-swimmers did so.

Environmental factors were the main determinants, with extremely cold water associated with 76% of deaths; wind, waves, and darkness were also frequently reported. Lakes were

the most frequent body of water, followed by oceans. Nearly half the incidents occurred in Atlantic Canada, where the mortality rate was much higher than in the other provinces.

In summary, alcohol, poor swimming ability, failure to wear a flotation device, wind, and cold immersion were the main risk factors for deaths involving rowboats.

SAILBOATS

Recreational sailing was the main activity associated with deaths involving sailboats. Capsizing and falling overboard were the most frequent types of incident. Most victims were males 25-64 years old, with alcohol reported in only 19% of incidents, although alcohol was unknown in many cases. There were about equal numbers of swimmers and non-swimmers; a majority of victims were experienced boaters. 26% of victims wore a flotation device.

Extremely cold water was present in at least 65% of deaths, and rough or stormy weather and darkness were frequent factors. Incidents were frequent in both lakes and oceans. British Columbia had both the highest number of deaths as well as the highest rate of mortality.

In summary, non-wearing of a flotation device, cold immersion, adverse weather, and darkness were important factors for deaths involving sailboats.

HOW TO AVOID UNPOWERED BOATING INJURIES

Ten years of research across Canada show that most unpowered boaters who die have neglected basic principles of boating safety such as always wearing a flotation device, using protective equipment against cold immersion, verifying weather conditions such as wind, waves, and water temperature, and obtaining appropriate training in boating safety and swimming.

Most of the deaths described in this report could have been averted by observing the following fundamentals:

- Many unpowered boats are relatively unstable and subject to capsize, so swimming ability is important;
- Immersion is a sudden unexpected event requiring advance preparation by proper wearing of a comfortable flotation device appropriate to the activity;
- All adverse conditions, especially water temperatures 15°C or less, necessitate wearing of supplementary hypothermia protection;
- Wind and waves frequently arise suddenly, posing a major threat for those far from sheltered waters in lakes and on the ocean, so advance verification and ongoing observation of weather conditions is essential;
- River currents, especially when concentrated around rocks, bridge pilings, and in hydraulics at the base of dams, have enormous kinetic energy that can trap the unwary;
- Self-rescue knowledge, skills, and periodic retraining of all boaters are essential for survival of immersion in cold-water and river currents, and coping with high winds and waves;
- Only well-trained autonomous boaters capable of self-rescue should be allowed to join higher risk boating activities such as running rivers or open water ocean kayaking, since even when experienced companions are present they cannot be relied upon for help under adverse conditions;
- Boating “experience” may be useless in hazardous situations, unless it includes research-based water safety knowledge and regular practical training updates. Repeated survival of risks such as consuming alcohol on the water and not wearing flotation is not the recommended experience for safe boating.

It has been found that errors people make tend to be related to the type of boat they habitually use, so general training on key safety issues should also be accompanied by more specific information and practice for the boat being used (McKnight et al., 2006). As well, specific activities such as running rapids require specialized training, skills, and equipment in order to avoid hazards such as being trapped in recirculating hydraulics at the base of dams or pinned against rocks or fallen trees.

A structured comprehensive approach to prevention is essential. Modern principles of injury prevention include careful assessment of personal, equipment, and environment risk factors for different time phases of potential injury incidents, including pre-event, event, and post-event phases (Barss et al., 1998; Haddon, 1980). Pre-event phase interventions include evidence-based personal training of all boaters in open-water boating hazards and skills so that life-threatening immersions do not occur. A flotation device is an item of safety equipment; when worn by a boater, it helps to prevent injury (drowning and/or hypothermia) during an immersion in water due to swamping or capsizing, i.e., the event phase of an incident. A properly worn and activity-appropriate flotation device is the single most important item of safety equipment.

Other safety equipment includes flotation bags to prevent flooding and sinking of canoes and kayaks in heavy rapids, or pinning of a submerged craft against obstacles such as rocks; throw ropes for rescue; and cold-protective equipment such as wet and dry suits to enhance survival of cold water immersions. Helmets may be advisable where a blow to the head is likely, such as in kayaks or canoes running high grade rapids, since even momentary concussion of the brain can be fatal in the water. Helmets are already required by all reputable clubs and instructors for most white water kayaking, rafting and some canoeing. Post-event phase interventions include personal rescue skills for retrieving boaters safely from current, and cardiopulmonary resuscitation (CPR) for revival if needed.

PERCEPTION OF RISK

A key issue in prevention is perception of risk for different activities. Actual risk of water-related injury and death per exposure to water tends to be much higher than commonly perceived. Thus while the risk of death or severe injury from a motor vehicle crash is quite low per trip, nearly all drivers and passengers in Canada now wear a safety belt and avoid alcohol. On the other hand, people are often seen loading their boat with alcohol and forgetting to bring or sitting on their flotation devices rather than wearing them. Strangely enough, the research shows that non-swimmers and weak swimmers were even less likely than other victims to correctly wear flotation (2% vs. 11% for all boaters); this is particularly alarming since many unpowered boats are small and narrow and hence relatively unstable and easily capsizable. The implication for those who train and educate the public is that discussion of risk perception should be a priority. Only then can misperceptions be corrected so that each individual has a realistic appreciation of the risk of injury for boating activities. At that point, the discussion can move on to risk factors associated with specific boats, activities and environments; essential training and equipment; and how best to reduce risk of injury to a sensible and reasonable level.

BOAT SMART

Wearing rates for flotation devices in boats lag far behind those for seatbelts in cars: only 11% of unpowered boaters boaters who drowned during 1991-2000 were properly wearing a flotation device. This is a major opportunity for prevention by good legislation and enforcement, and of course individual safety practices. Taking time in advance to choose and purchase an appropriate flotation device for the activity that is planned ensures that the device is comfortable and will be worn. Nearly all unpowered boating victims are males 15 years and older, with the peak risk from 15 to 44 years, so this should be the key target group. It is best to focus mainly on youth and adult male or family wearing, rather than child wearing, since 97% of victims were 15 and older and 94% were males.

A one-hour blow, that's all it was. The wind died down as they watched, the water went flat, and they kept looking and Ralph didn't appear. Maybe he was fine, probably he was fine. They took Harry's canoe; he thought to throw in a jacket and a length of rope, and set off down the lake, staying fairly close to shore. Eleanor stopped paddling to raise her binoculars and scan the water. Gwen, with another pair of binoculars, walked the tundra above the shore. She had a whistle around her neck. She would blow the whistle if she saw anything, that was their agreement.

Midnight, and it was perfectly still …. Eleanor and Harry paddled and looked until their eyes hurt. The sun below the horizon, the light duskier, it was harder to see and they lost track of time. "I'm not an artisan" Eleanor remembered Ralph joking once. "I don't make anything except commotion." Which wasn't true, but she loved him for saying it. This is too much commotion, she was saying to him. Please.

The landscape changed before her eyes. A movement here, a shadow over there, a hint of light, a shape that her eyes fastened on with such greed, such greedy longing. She was looking for Ralph and seeing nothing but ghosts. Her arms worked, her eyes were intact, but her soul was coming apart. And when she saw, finally, a spot of drifting orange that receded and shifted and came into being, she recognized that she was seeing her future, and it was a future of infinite sadness.

– Elizabeth Hay, *Late Nights on Air,* 2007

UNDERSTANDING HAZARDS AND PREVENTION OF COLD IMMERSION

The overall trend for Canada in cold-water boating immersions has been discouraging, with a rate of 0.28 deaths per 100,000 population per year in 1991-1995 and 0.26 during 1996-2000. The greatest improvement during the 1990's was seen in the northern territories, where the rate was reduced by half. It is probable that the only highly effective means of bringing about a major reduction in the overall cold-water boating immersion death rate is legislation and enforcement to ensure wearing of appropriate personal protective equipment. While research-based education and training are essential, on their own they have proven relatively ineffective, as with other injury prevention measures such as safety belts in cars.

Users of unpowered boats, especially those who paddle in large lakes, fast rivers, and during spring and fall when the hazards of cold immersion are greater, should be familiar with how to avoid cold immersion and how to deal with the consequences. It is highly recommended for all boaters to review Module 2 of this series, Ice & Cold Water. A summary of its main points is reproduced here.

The ***four stages of death*** from cold immersion (Brooks/Transport Canada, 2003; Golden & Hervey, 1984), include:

STAGE 1. Gasping and cold shock
STAGE 2. Swimming failure
STAGE 3. Hypothermia
STAGE 4. Post-rescue collapse

Most cold-water immersion deaths occur during the first two stages, rather than from generalized hypothermia. Knowledge of the effects of these stages is essential for prevention, and should be well understood by all boaters. Unpowered boats are relatively unstable, so immersion can occur at any time without warning. Because immersion in cold water at ≤15°C can kill almost immediately without the presence and proper use of flotation equipment, any immersion is potentially fatal and should be avoided if at all possible.

For larger boats, life rafts are strongly recommended to help avoid immersion (Brooks/ Transport Canada, 2003), but since this is impractical for most unpowered boats, flotation is essential to minimize the degree of immersion as well as to prevent submersion of the airways. Prevention of hypothermia is necessary mainly where immersion is prolonged,

such as during incidents far from shore on large lakes or oceans, or near dangerous rocks and cliffs in rough seas. Prevention of post-rescue collapse after prolonged immersion involves appropriate handling of a victim during and after rescue.

Since they are least understood and most important for the general public, now consider details of stages 1 and 2 of the event phase of cold immersions:

STAGE 1. GASPING/COLD SHOCK Death can occur rapidly during the first few minutes of immersion from so-called cold shock. The use of the term "shock" for this stage could be misleading, since in most types of clinical shock, the blood pressure drops dangerously low, whereas in response to cold, it can rise very high. It is helpful to remember that the "shock" or stress of sudden immersion in cold water leads to various responses by the body, the most serious of which is involuntary gasping respirations, which, if the airways are below the surface when this response occurs, can lead to *aspiration of water* resulting in drowning. A temporary decrease in or loss of consciousness due to the effects on the brain of rapid deep breathing (hyperventilation) could also be fatal in the context of immersion (Mantoni et al., 2007). Death may also occur as a result of cardiac arrhythmias. The biochemical effects of hyperventilation on muscles might also impair the ability to swim or tread water.

STAGE 2. LOSS OF MANUAL PERFORMANCE Next in the time sequence is *loss of strength in the limbs* due to cooling of muscles and nerves. Nerves may fail to signal muscle to contract, and muscle may be unable to contract (Tipton and Golden, 2006). First to go may be the fine muscles of the hands. Ability to hang on to an overturned boat is lost, the individual is unable to perform activities such as putting on or fastening a flotation device, and, more gradually, loses the ability to swim effectively. The effects of stage two may result from both local cooling and from the shutdown of blood to the limbs in response to cold. Limb strength is necessary for a person floating in water to help keep the face turned away from wind and waves so that water is not aspirated into the lungs. If the victim is unable to keep the airways above the surface or away from waves, drowning will occur.

On a positive note, experiments in Sweden and the United Kingdom showed that volunteers were able to swim for at least an hour in water at 10°C, and most swam for 90 minutes (Tipton et al., 1999). Even among volunteers who swam for 90 minutes in water at 10°C, the problem leading to swim failure was not hypothermia, which by definition is generalized and affects the core of the body, but rather local muscle cooling of the limbs. Other experiments with swimmers wearing a personal flotation device (PFD) showed that they were able to swim an average of 889 metres in water at 14°C and 650 metres at 10°C before swim failure (Wallingford et al., 2000, Kenny et al., 2000). During another study of both novice and expert swimmers in Canada, it was observed that both groups could swim for about 45 minutes in 10°C water before incapacitation. The expert swimmers could swim faster and were able to swim an average 1.4 km, compared with 820 m for the novices, with an average distance for both groups of 1.1 km (Lounsbury 2004, Lounsbury and Ducharme 2005). However, these results may not always apply to an unexpected injury incident in dark and/or stormy conditions.

Now consider some ***practical implications*** of the four stages of death from immersion. First, for people who fall into very cold water, *protection of the airway* from gasping associated with sudden exposure to cold is very important. Otherwise, water can be inhaled and drowning initiated rapidly. Hence from a practical perspective, this stage is a phase of *gasping/acute drowning* and also of sudden cardiovascular effects. For prevention of sudden drowning, use of appropriate flotation helps keep the body higher and the mouth and nose out of the water to minimize inhalation, i.e., prevents submersion of the head during this critical phase. Appropriate flotation should also help to avoid submersion of the airways if consciousness or use of muscles is temporarily impaired due to hyperventilation. Such findings provide strong support for mandatory wearing of a flotation device by boaters, since a submersed boater will be at high risk of immediate death before they have an opportunity to find and put on a flotation device, a difficult task even in warm water.

Specialized flotation devices are now available to boost the body high out of the water during this stage of immersion. Other protection of airways such as splashguards has been recommended.

Whatever the available equipment, the victim of a sudden cold immersion should concentrate on protecting their airway from cold water inhalation until their breathing stabilizes and gasping stops (Ducharme, 2006). This would include avoiding swimming for a few minutes during the cold shock period, until the massive gasping, rapid breathing, high blood pressure, and rapid heart rate have a chance to subside. Only then should the individual decide on a course of action.

Practical implications of the sequence of progression and rapidity of loss of strength of hands and later limbs, known as the *incapacitation phase*, include the fact that hanging on to an overturned boat is a reasonable survival strategy only if rescue will be rapid. If rescue is delayed, the immersed person will lose the ability to hang on — this can occur within 10-15 minutes — or even to keep the face away from wind and waves, and will drown. Unfortunately, with both nerve conduction and muscle contraction blocked, and with no blood flowing to the limbs, mind cannot control matter.

Hence if one is immersed in cold water, unable to climb out of the water onto a stable object, drifting away from shore, and rapid rescue is unlikely, it may be preferable to swim to safety, especially if the distance is not too great, one is a good swimmer, and wearing a flotation device, i.e., immediate self-rescue. Red Cross drowning data support such an approach (Sawyer and Barss 1998). As noted above, it may be feasible to swim up to about one kilometre in cold water.

On the other hand, if the distance is great and/or rapid rescue by others is known or probable, the victim should immediately make every effort to get as much of the body as possible out of the water as quickly as possible if there is something to climb onto; although it may feel colder out of the water than in, it is always better to be out of the water (Tipton and Golden, 2006). If this cannot be achieved in the first 10 to 20 minutes or so, it may rapidly become impossible due to loss of hand and arm strength. Other options include raising the probability of detection and rescue by immediate use of flares and other measures (Ducharme, 2006). This must be done right away, as the ability to open and deploy flares is also rapidly lost in cold water. As noted by Ducharme, *the goal or ultimate objective is not to preserve body heat, but to move out of the water as quickly as possible.*

Furthermore, since boaters have been found dead on shore after surviving an initial cold immersion, those who travel in isolated conditions should always carry a change of warm dry clothing in a waterproof float bag so that if immersion does occur, dry clothing can be donned immediately upon reaching shore.

DON'T UNDERESTIMATE CURRENT

Current was a factor in most river drownings of unpowered boaters. On the positive side, current has sped many a boater to their destination. For some, current provides interesting and exciting recreation; for others, a quietly flowing river is a joy to behold and its music soothing to the tired soul. However, as for many sources of powerful kinetic energy, current can be dangerous for boaters who have not dedicated sufficient time to the study of river currents or received expert training in paddling and river rescue.

A boater, swimmer or wader who underestimates the power of current can be swept away in an instant. At best one may be swept into calmer water and escape to shore, at worst trapped underwater against an immovable object or in recirculating current. Consider the canoeist who broadsides a boulder in current. The French term for what can ensue, "cravat" or necktie, is a vivid portrayal of how tons of water can collapse and wrap a canoe around a river rock in a matter of seconds. Pity the canoeist trapped between the canoe and the rock. Imagine the canoeist or kayaker, unaware of the danger of a "strainer"

or fallen tree across the stream, suddenly caught in the branches and swept underwater by the current. Many a river paddler who decided to shoot an innocent-looking small dam has been trapped underwater by the immense power of a recirculating hydraulic, to be expected at the base of most such man-made structures. Boaters may also at times need to walk in current, so must be familiar with the hazards of foot entrapment when moving about on the rocky bottoms of fast-flowing rivers.

Rivers were the site of drowning for 28% of unpowered boating drownings, resulting in 189 deaths over 10 years. Current is also a factor in some ocean drownings. Since boaters may be immersed suddenly in current, they need effective evidence-based training not only in how to cope with all hazards of current while in their boat, but also while swimming, wading, or after falling into water. This could help *avert about 30% of unpowered boating drownings per year, saving about 200 lives.*

Education and training should include the theory of current and the types of scenarios to be expected based on epidemiologic analysis of the determinants of many incidents. Training needs to include how to safely manoeuvre a canoe, raft or kayak in current, avoid hazards such as log strainers and dam hydraulics, use the power of current for self-rescue, and rescue others. Other important issues include the selection and use of appropriate boats for river, including a smooth rounded bottom to avoid catching on rocks and sufficient rocker for rapid turning in current; adequate freeboard or safety skirts so the boat does not fill with water in turbulent zones; basic safety equipment such as bow and stern ropes; and, for canoes and kayaks, flotation bags to keep water out and prevent collapse and pinning. Kayakers, who must to be ready to Eskimo roll at any time, and canoeists and rafters who run rapids at high levels of difficulty and hazard, also need to protect against brain injury from collision with rocks by always wearing a helmet, since even a momentary loss of consciousness can be fatal in water.

Armed with the right knowledge and training, the individual should be much better protected during all time phases of injury, including pre-event, event, and post-event. And, of course, the right attitude is also essential to avoid unwise risks.

Research-based water safety instruction and swimming instruction on how to deal with current for high school students and later reinforcement for youth and young adults, represents a grand opportunity for prevention. In our country, covered with innumerable rivers and streams, every Canadian should be able to safely manoeuvre in current, when the need arises.

SPECIAL OPPORTUNITIES FOR LARGE GAINS IN PREVENTION

There are several major opportunities for prevention of unpowered boating fatalities in Canada which could limit the suffering of affected families and reduce the enormous costs associated with these deaths. While all of these recommendations would be beneficial and mutually supportive in many incidents, the single most effective initiative, based on the research, would be the mandatory wearing of appropriate flotation.

1 – Knowledge and **Safety Equipment** for Pre-event Phase Since many incidents involved neglect of elemental boating safety measures, knowledge about and attitudes towards basic hazards and their consequences need to be improved by appropriate programmes that are regularly evaluated and updated. Since unpowered boats are relatively harmless to other boaters and swimmers, training programs should not focus on licensing but rather on the development — by both users and passengers — of specific water competencies for the most frequent activities, environments and hazards associated with unpowered boating. Flotation devices, cold immersion, the hazards of wind and waves on large lakes and current in rivers, and the use of a weather radio and water temperature gauge are other key issues that need mastery by at least one and preferably every occupant of the boat. Although data to assess the overall impact of the foregoing measures are not available, based on the other measures that follow, it is probable that most immersion incidents could have been avoided by their application.

2 – Safety Equipment for Event Phase Interventions mandating and enforcing wearing of a flotation device by all unpowered boaters could have potentially averted 90% of drownings. This could be achieved by regulation and enforcement, together with research-based education and marketing. Policy makers should take note of recent research showing the critical need to keep the nose and mouth above the water surface immediately upon immersion, which strongly supports mandatory wearing of flotation. Flotation devices in the boat, but unworn, will not prevent fatalities during this phase of immersion.

3 – Safety Equipment for Post-event Phase Environment Factors – **Extremely Cold Water** Appropriate protective equipment against cold immersion, including an appropriate flotation device as well as more specialized devices such as coats, wetsuits, dry suits, and immersion suits, could have averted as many as 54% of unpowered boating fatalities. Increased use of such equipment could be achieved by education, training, regulations, and enforcement.

4 – Personal Behaviour and **Marketing Factors** for Pre-event Phase – **Alcohol** Avoidance of alcohol could have averted at least 40% of deaths among unpowered boaters 15 years and older. Alcohol consumption could be discouraged through education, regulations, and enforcement, as well as restrictions on marketing, especially in boating environments.

5 – River Current, an Environment Risk Factor for Pre-Event, Event, and Post-event Phases of **Unpowered Boating** Incidents – Enhancing Personal Knowledge, Attitude & Ability River paddling in canoes, rafts, and kayaks was associated with 23% of unpowered boating deaths. Boaters who choose to paddle in current need to be fully aware of the enormous kinetic energy of moving water, and how to use this energy to manoeuvre their boat and themselves safely at all times and to avoid being trapped by it. Theory and practice in the boat to be used and in the water, under skilled supervision and controlled conditions, is essential prior to undertaking unsupervised boating activities in current.

CONCLUSION

From the above, it is clear that by an appropriate combination of preventive measures, the vast majority of unpowered boating deaths could be averted, saving over 700 lives a decade. Since most victims are young adult wage-earners, human capital costs of such losses are high. Conservatively estimating an economic loss of $2 million per life, losses total about $1.4 billion for the 10-year period of this research, i.e., $140 million per year. If even a proportion of such losses were allocated by government to research-based prevention, evaluation, training, and education, and especially to legislation and enforcement of flotation-wearing, the economic return on investment would be substantial.

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Annex 1a

ANNUAL SUMMARY OF NUMBERS AND PERCENTS* FOR INJURY FATALITIES DURING BOATING, CANADA 1991-2000 (n=1,952)

	1991		1992		1993		1994		1995		1996		1997		1998		1999		2000		1991-2000	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
DROWNINGS	**209**	**95**	**214**	**95**	**191**	**91**	**186**	**93**	**197**	**93**	**185**	**90**	**176**	**92**	**171**	**92**	**145**	**92**	**129**	**88**	**1.803**	**92**
Recreational	**165**	**79**	**145**	**68**	**143**	**75**	**122**	**66**	**153**	**78**	**156**	**84**	**138**	**78**	**120**	**70**	**122**	**84**	**98**	**76**	**1,362**	**76**
Powerboat	89	54	98	68	93	65	65	53	89	58	76	49	81	59	70	58	78	64	57	58	796	58
♦ Small powerboat† (≤5.5m)	65		71		53		45		64		45		53		34		41		40		511	
♦ Large powerboat (>5.5m)	5		13		16		6		4		4		9		8		15		6		86	
♦ Personal watercraft	1		4		4		0		2		1		3		4		2		3		24	
♦ Powerboat, size unspecified	18		10		20		14		19		26		16		24		20		8		175	
Unpowered boat	76	46	47	32	50	35	57	47	64	42	80	51	57	41	50	42	44	36	41	42	566	42
♦ Canoe	40		33		21		37		39		39		27		25		16		24		301	
♦ Kayak	6		4		5		3		1		4		3		4		2		5		37	
♦ Rowboat	7		0		6		3		9		10		8		5		4		6		58	
♦ Raft/inflatable	3		2		3		5		4		6		8		4		5		2		42	
♦ Sailboat/sailboard	10		4		6		1		2		12		3		6		10		0		54	
♦ Other/unknown	10		4		9		8		9		9		8		6		7		4		74	
Daily living	**17**	**8**	**45**	**21**	**19**	**10**	**29**	**16**	**15**	**8**	**10**	**5**	**11**	**6**	**21**	**12**	**11**	**8**	**9**	**7**	**187**	**10**
Powerboat	14	82	34	76	11	58	21	72	8	53	8	80	8	73	14	67	3	27	2	22	123	66
♦ Small powerboat† (≤5.5m)	6		24		3		10		7		4		8		4		3		2		71	
♦ Large powerboat (>5.5m)	8		4		3		8		0		1		0		7		0		0		31	
♦ Powerboat, size unspecified	0		6		5		3		1		3		0		3		0		0		21	
Unpowered boat	3	18	11	24	8	42	8	28	7	47	2	20	3	27	7	33	8	73	7	78	64	34
♦ Canoe	2		6		6		1		5		0		2		5		5		2		34	
♦ Kayak	1		0		0		1		0		0		0		0		0		0		2	
♦ Rowboat	0		0		1		1		0		1		1		1		1		0		6	
♦ Raft/inflatable	0		1		0		0		0		0		0		0		0		0		1	
♦ Sailboat/sailboard	0		1		0		0		0		0		0		0		0		0		1	
♦ Other/unknown	0		3		1		5		2		1		0		1		2		5		20	
Occupational	**23**	**11**	**15**	**7**	**22**	**12**	**32**	**17**	**22**	**11**	**14**	**8**	**23**	**13**	**26**	**15**	**9**	**6**	**15**	**12**	**201**	**11**
Powerboat	19	83	11	73	17	77	29	91	21	95	14	100	21	91	23	88	9	100	15	100	179	89
♦ Small powerboat† (≤5.5m)	7		7		2		5		4		4		6		4		1		3		43	
♦ Large powerboat (>5.5m)	12		4		12		23		16		7		12		18		6		11		121	
♦ Personal watercraft	0		0		0		0		1		0		0		0		0		0		1	
♦ Powerboat, size unspecified	0		0		3		1		0		3		3		1		2		1		14	
Unpowered boat	4	17	4	27	5	23	3	9	1	5	0	0	2	9	3	12	0	0	0	0	22	11
♦ Canoe	0		1		0		1		1		0		0		1		0		0		4	
♦ Rowboat	1		0		1		1		0		0		1		0		0		0		4	
♦ Raft/inflatable	0		0		0		0		0		0		1		0		0		0		1	
♦ Other/unknown	3		3		4		1		0		0		0		2		0		0		13	
Attempting rescue	**0**	**0**	**2**	**1**	**6**	**3**	**1**	**1**	**5**	**3**	**1**	**1**	**2**	**1**	**2**	**1**	**3**	**2**	**6**	**5**	**28**	**2**
Other/unknown	**4**	**2**	**7**	**3**	**1**	**1**	**2**	**1**	**2**	**1**	**4**	**2**	**2**	**1**	**2**	**1**	**0**	**0**	**1**	**1**	**25**	**1**
NON-DROWNING FATALITIES‡	**11**	**5**	**11**	**5**	**18**	**9**	**13**	**7**	**15**	**7**	**20**	**10**	**16**	**8**	**15**	**8**	**12**	**8**	**18**	**12**	**149**	**8**
TOTAL	**220**	**11**	**225**	**12**	**209**	**11**	**199**	**10**	**212**	**11**	**205**	**11**	**192**	**10**	**186**	**10**	**157**	**8**	**147**	**8**	**1,952**	**100**

** Values in unshaded areas refer to shaded totals above; values in lighter shaded areas refer to darker shaded totals above; drowning and non drowning percents refer to bottom row totals; bottom row percents refer to 10-year total at right*
† Includes open outboard motorboats & other open powered boats such as inflatables; excludes personal watercraft
‡ Primary cause of death was injury other than drowning, although drowning may have complicated another injury; in case of hypothermia, only hypothermia deaths reportedly uncomplicated by drowning are included here

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Annex 1b

ANNUAL SUMMARY OF NUMBERS AND PERCENTS* FOR NON-DROWNING† INJURY FATALITIES DURING BOATING, CANADA 1991-2000 (n=149)

	1991		1992		1993		1994		1995		1996		1997		1998		1999		2000		1991-2000	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
NON-DROWNINGS	**12**	**8**	**11**	**7**	**17**	**11**	**13**	**9**	**15**	**10**	**20**	**13**	**16**	**11**	**16**	**11**	**11**	**7**	**18**	**12**	**149**	**100**
Hypothermia	**2**	**17**	**6**	**55**	**6**	**35**	**2**	**15**	**5**	**33**	**6**	**30**	**5**	**31**	**6**	**38**	**6**	**55**	**7**	**39**	**51**	**34**
Powerboat	0	0	5	83	5	83	2	100	3	60	4	67	4	80	1	17	6	100	4	57	34	67
♦ Small powerboat‡ (≤5.5m)	0		4		5		2		3		4		1		1		5		0		25	
♦ Large powerboat (>5.5m)	0		1		0		0		0		0		3		0		1		4		9	
Unpowered boat	2	100	1	17	1	17	0	0	2	40	2	33	1	20	5	83	0	0	3	43	17	33
♦ Canoe	0		1		0		0		2		2		1		2		0		3		11	
♦ Kayak	0		0		0		0		0		0		0		2		0		0		2	
♦ Raft/inflatable	1		0		0		0		0		0		0		0		0		0		1	
♦ Sailboat/sailboard	0		0		0		0		0		0		0		1		0		0		1	
♦ Other/unknown	1		0		1		0		0		0		0		0		0		0		2	
Collision	**7**	**58**	**3**	**27**	**9**	**53**	**10**	**77**	**8**	**53**	**11**	**55**	**9**	**56**	**6**	**38**	**4**	**36**	**9**	**50**	**76**	**51**
Powerboat	6	86	3	100	9	100	10	100	8	100	9	82	9	100	5	83	4	100	8	89	71	93
♦ Small powerboat‡ (≤5.5m)	0		2		4		7		1		2		3		1		0		3		23	
♦ Large powerboat (>5.5m)	2		0		1		1		5		1		2		0		1		3		16	
♦ Personal watercraft	3		0		0		1		2		5		4		3		2		1		21	
♦ Powerboat, size unspecified	1		1		4		1		0		1		0		1		1		1		11	
Unpowered boat	1	14	0	0	0	0	0	0	0	0	2	18	0	0	1	17	0	0	1	11	5	7
♦ Canoe	1		0		0		0		0		0		0		0		0		0		1	
♦ Sailboat/sailboard	0		0		0		0		0		1		0		1		0		0		2	
♦ Other/unknown	0		0		0		0		0		1		0		0		0		1		2	
Propeller injury	**1**	**8**	**0**	**0**	**1**	**6**	**0**	**0**	**1**	**7**	**1**	**5**	**1**	**6**	**1**	**6**	**0**	**0**	**0**	**0**	**6**	**4**
Powerboat	1	100	0		1	100	0		1	100	1	100	1	100	1	100	0		0		6	100
♦ Small powerboat‡ (≤5.5m)	0		0		0		0		0		0		0		1		0		0		1	
♦ Large powerboat (>5.5m)	1		0		0		0		1		0		0		0		0		0		2	
♦ Personal watercraft	0		0		1		0		0		0		1		0		0		0		2	
♦ Powerboat, size unspecified	0		0		0		0		0		1		0		0		0		0		1	
Fell/thrown overboard	**1**	**8**	**1**	**9**	**1**	**6**	**1**	**8**	**0**	**0**	**2**	**10**	**1**	**6**	**3**	**19**	**1**	**9**	**0**	**0**	**11**	**7**
Powerboat	0	0	1	100	1	100	0	0	0		1	50	1	100	3	100	0	0	0		7	64
♦ Small powerboat‡ (≤5.5m)	0		0		0		0		0		1		1		0		0		0		2	
♦ Large powerboat (>5.5m)	0		0		1		0		0		0		0		2		0		0		3	
♦ Powerboat, size unspecified	0		1		0		0		0		0		0		1		0		0		2	
Unpowered boat	1	100	0	0	0	0	1	100	0		1	50	0	0	0	0	1	100	0		4	36
♦ Raft/inflatable	1		0		0		0		0		0		0		0		1		0		2	
♦ Other/unknown	0		0		0		1		0		1		0		0		0		0		2	
Other/unknown	**1**	**8**	**1**	**9**	**0**	**0**	**0**	**0**	**1**	**7**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**11**	**5**	**3**
Powerboat	0	0	1	100	0		0		1	100	0		0		0		0		2	100	4	80
♦ Large powerboat (>5.5m)	0		0		0		0		1		0		0		0		0		2		3	
♦ Powerboat, size unspecified	0		1		0		0		0		0		0		0		0		0		1	
Unpowered boat	1	100	0	0	0		0		0	0	0		0		0		0		0	0	1	20
♦ Raft/inflatable	1		0		0		0		0		0		0		0		0		0		1	

** Values in unshaded areas refer to shaded totals above; values in lighter shaded areas refer to darker shaded totals above; top row percents refer to 10-year total at right*
† Primary cause of death was injury other than drowning, although drowning may have complicated another injury; in case of hypothermia, only hypothermia deaths reportedly uncomplicated by drowning are included here
‡ Includes open outboard motorboats & other open powered boats such as inflatables; excludes personal watercraft

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Annex 2a

REGIONAL SUMMARY OF NUMBERS AND PERCENTS* FOR INJURY FATALITIES DURING BOATING, CANADA 1991-2000 (n=1,952)

	NL		NS		PE		NB		QC		ON		MB		SK		AB		BC		NU/NT†		YT		CANADA	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
DROWNINGS	**114**	**93**	**115**	**97**	**20**	**100**	**57**	**93**	**308**	**92**	**502**	**93**	**91**	**99**	**78**	**94**	**81**	**92**	**357**	**88**	**61**	**94**	**19**	**95**	**1,803**	**92**
Recreational	**61**	**54**	**67**	**58**	**11**	**55**	**38**	**67**	**260**	**84**	**433**	**86**	**62**	**68**	**55**	**71**	**74**	**91**	**267**	**75**	**20**	**33**	**14**	**74**	**1,362**	**76**
Powerboat	25	41	37	55	7	64	22	58	151	58	279	64	37	60	33	60	36	49	150	56	14	70	5	36	796	58
♦ Small powerboat‡ (≤5.5m)	20		24		3		13		103		187		22		21		18		94		1		5		511	
♦ Large powerboat (>5.5m)	4		4		3		2		9		29		1		0		2		30		2		0		86	
♦ Personal watercraft	0		2		0		1		6		5		0		0		6		4		0		0		24	
♦ Powerboat, size unspecified	1		7		1		6		33		58		14		12		10		22		11		0		175	
Unpowered boat	36	59	30	45	4	36	16	42	109	42	154	36	25	40	22	40	38	51	117	44	6	30	9	64	566	42
♦ Canoe	9		13		1		10		62		99		15		12		22		46		3		9		301	
♦ Kayak	3		4		0		1		4		5		1		1		0		16		2		0		37	
♦ Rowboat	17		4		2		3		9		11		2		0		5		5		0		0		58	
♦ Raft/inflatable	1		1		0		0		4		7		0		3		4		22		0		0		42	
♦ Sailboat/sailboard	0		3		0		1		9		14		6		1		2		18		0		0		54	
♦ Other/unknown	6		3		1		1		21		18		1		5		5		10		1		0		74	
Daily living	**6**	**5**	**6**	**5**	**0**	**0**	**2**	**4**	**27**	**9**	**42**	**8**	**19**	**21**	**13**	**17**	**3**	**4**	**29**	**8**	**36**	**59**	**4**	**21**	**187**	**10**
Powerboat	5	83	4	67	0		1	50	16	59	37	88	11	58	4	31	0	0	19	66	26	72	0	0	123	66
♦ Small powerboat‡ (≤5.5m)	5		1		0		0		11		24		6		4		0		13		7		0		71	
♦ Large powerboat (>5.5m)	0		3		0		1		2		2		1		0		0		5		17		0		31	
♦ Powerboat, size unspecified	0		0		0		0		3		11		4		0		0		1		2		0		21	
Unpowered boat	1	17	2	33	0		1	50	11	41	5	12	8	42	9	69	3	100	10	34	10	28	4	100	64	34
♦ Canoe	0		0		0		0		6		2		7		8		1		3		3		4		34	
♦ Kayak	0		0		0		0		1		0		0		0		1		0		0		0		2	
♦ Rowboat	0		0		0		0		1		1		0		0		1		1		2		0		6	
♦ Raft/inflatable	0		0		0		0		0		1		0		0		0		0		0		0		1	
♦ Sailboat/sailboard	0		0		0		0		0		0		0		0		0		1		0		0		1	
♦ Other/unknown	1		2		0		1		3		1		1		1		0		5		5		0		20	
Occupational	**43**	**38**	**36**	**31**	**7**	**35**	**14**	**25**	**13**	**4**	**13**	**3**	**9**	**10**	**6**	**8**	**3**	**4**	**54**	**15**	**2**	**3**	**1**	**5**	**201**	**11**
Powerboat	40	93	35	97	6	86	13	93	10	77	10	77	6	67	5	83	1	33	51	94	1	50	1	100	179	89
♦ Small powerboat‡ (≤5.5m)	9		6		0		3		3		7		4		4		1		5		0		1		43	
♦ Large powerboat (>5.5m)	31		25		6		8		6		2		1		0		0		42		0		0		121	
♦ Personal watercraft	0		0		0		0		0		1		0		0		0		0		0		0		1	
♦ Powerboat, size unspecified	0		4		0		2		1		0		1		1		0		4		1		0		14	
Unpowered boat	3	7	1	3	1	14	1	7	3	23	3	23	3	33	1	17	2	67	3	6	1	50	0	0	22	11
♦ Canoe	0		0		0		0		1		0		2		1		0		0		0		0		4	
♦ Rowboat	2		0		1		0		0		0		1		0		0		0		0		0		4	
♦ Raft/inflatable	0		0		0		0		0		1		0		0		0		0		0		0		1	
♦ Other/unknown	1		1		0		1		2		2		0		0		2		3		1		0		13	
Attempting rescue	**0**	**0**	**0**	**0**	**1**	**5**	**1**	**2**	**3**	**1**	**10**	**2**	**1**	**1**	**2**	**3**	**1**	**1**	**6**	**2**	**3**	**5**	**0**	**0**	**28**	**2**
Other/unknown	**4**	**4**	**6**	**5**	**1**	**5**	**2**	**4**	**5**	**2**	**4**	**1**	**0**	**0**	**2**	**3**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**25**	**1**
NON-DROWNING FATALITIES§	**8**	**7**	**3**	**3**	**0**	**0**	**4**	**7**	**27**	**8**	**39**	**7**	**1**	**1**	**5**	**6**	**7**	**8**	**50**	**12**	**4**	**6**	**1**	**5**	**149**	**8**
TOTAL	**122**	**6**	**118**	**6**	**20**	**1**	**61**	**3**	**335**	**17**	**541**	**28**	**92**	**5**	**83**	**4**	**88**	**5**	**407**	**21**	**65**	**3**	**20**	**1**	**1,952**	**100**

** Values in unshaded areas refer to shaded totals above; values in lighter shaded areas refer to darker shaded totals above; drowning and non drowning percents refer to bottom row totals; bottom row percents refer to 10-year total at right*
† Data for Nunavut and Northwest Territories have been combined, since Nunavut was not a separate territory until 1999 ‡ Includes open outboard motorboats & other open powered boats such as inflatables; excludes personal watercraft
§ Primary cause of death was injury other than drowning, although drowning may have complicated another injury; in case of hypothermia, only hypothermia deaths reportedly uncomplicated by drowning are included here

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

Annex 2b

REGIONAL SUMMARY OF NUMBERS AND PERCENTS* FOR NON-DROWNING† INJURY FATALITIES DURING BOATING, CANADA 1991-2000 (n=149)

	NL		NS		PE		NB		QC		ON		MB		SK		AB		BC		NU/NT†		YT		CANADA	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
TOTAL	**8**	**5**	**3**	**2**	**0**	**0**	**4**	**3**	**27**	**18**	**39**	**26**	**1**	**1**	**5**	**3**	**7**	**5**	**50**	**34**	**4**	**3**	**1**	**5**	**149**	**100**
Hypothermia	**6**	**75**	**1**	**33**	**0**		**1**	**25**	**8**	**30**	**9**	**23**	**0**	**0**	**2**	**40**	**3**	**43**	**16**	**32**	**4**	**100**	**1**	**100**	**51**	**34**
Powerboat	5	83	1	100	0		1	100	4	50	5	56	0		1	50	2	67	11	69	4	100	0	0	34	67
♦ Small powerboat§ (≤5.5m)	5		1		0		0		4		3		0		1		2		9		0		0		25	
♦ Large powerboat (>5.5m)	0		0		0		1		0		2		0		0		0		2		4		0		9	
Unpowered boat	1	17	0	0	0		0	0	4	50	4	44	0		1	50	1	33	5	31	0	0	1	100	17	33
♦ Canoe	0		0		0		0		4		1		0		1		1		3		0		1		11	
♦ Kayak	0		0		0		0		0		2		0		0		0		0		0		0		2	
♦ Raft/inflatable	0		0		0		0		0		1		0		0		0		0		0		0		1	
♦ Sailboat/sailboard	0		0		0		0		0		0		0		0		0		1		0		0		1	
♦ Other/unknown	1		0		0		0		0		0		0		0		0		1		0		0		2	
Collision	**1**	**13**	**1**	**33**	**0**		**2**	**50**	**14**	**52**	**26**	**67**	**1**	**100**	**3**	**60**	**3**	**43**	**25**	**50**	**0**	**0**	**0**	**0**	**76**	**51**
Powerboat	1	100	1	100	0		2	100	14	100	25	96	1	100	3	100	3	100	21	84	0		0		71	93
♦ Small powerboat§ (≤5.5m)	0		1		0		0		4		6		0		2		1		9		0		0		23	
♦ Large powerboat (>5.5m)	0		0		0		1		3		7		0		0		0		5		0		0		16	
♦ Personal watercraft	1		0		0		1		3		5		1		1		2		7		0		0		21	
♦ Powerboat, size unspecified	0		0		0		0		4		7		0		0		0		0		0		0		11	
Unpowered boat	0	0	0	0	0		0	0	0	0	1	4	0	0	0	0	0	0	4	16	0		0		5	7
♦ Canoe	0		0		0		0		0		1		0		0		0		0		0		0		1	
♦ Sailboat/sailboard	0		0		0		0		0		0		0		0		0		2		0		0		2	
♦ Other/unknown	0		0		0		0		0		0		0		0		0		2		0		0		2	
Propeller injury	**0**	**0**	**0**	**0**	**0**		**0**	**0**	**2**	**7**	**2**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**4**	**0**	**0**	**0**	**0**	**6**	**4**
Powerboat	0		0		0		0		2	100	2	100	0		0		0		2	100	0		0		6	100
♦ Small powerboat§ (≤5.5m)	0		0		0		0		0		1		0		0		0		0		0		0		1	
♦ Large powerboat (>5.5m)	0		0		0		0		1		1		0		0		0		0		0		0		2	
♦ Personal watercraft	0		0		0		0		1		0		0		0		0		1		0		0		2	
♦ Powerboat, size unspecified	0		0		0		0		0		0		0		0		0		1		0		0		1	
Fell/thrown overboard	**0**	**0**	**1**	**33**	**0**		**1**	**25**	**2**	**7**	**2**	**5**	**0**	**0**	**0**	**0**	**1**	**14**	**4**	**8**	**0**	**0**	**0**	**0**	**11**	**7**
Powerboat	0		1	100	0		1	100	1	50	2	100	0		0		0	0	2	50	0		0		7	64
♦ Small powerboat§ (≤5.5m)	0		0		0		1		1		0		0		0		0		0		0		0		2	
♦ Large powerboat (>5.5m)	0		1		0		0		0		1		0		0		0		1		0		0		3	
♦ Powerboat, size unspecified	0		0		0		0		0		1		0		0		0		1		0		0		2	
Unpowered boat	0		0	0	0		0	0	1	50	0	0	0		0		1	100	2	50	0		0		4	36
♦ Raft/inflatable	0		0		0		0		0		0		0		0		1		1		0		0		2	
♦ Other/unknown	0		0		0		0		1		0		0		0		0		1		0		0		2	
Other/unknown	**1**	**13**	**0**	**0**	**0**		**0**	**0**	**1**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**6**	**0**	**0**	**0**	**0**	**5**	**3**
Powerboat	1	100	0		0		0		1	100	0		0		0		0		2	67	0		0		4	80
♦ Large powerboat (>5.5m)	1		0		0		0		1		0		0		0		0		1		0		0		3	
♦ Powerboat, size unspecified	0		0		0		0		0		0		0		0		0		1		0		0		1	
Unpowered boat	0	0	0		0		0		0	0	0		0		0		0		1	33	0		0		1	20
♦ Raft/inflatable	0		0		0		0		0		0		0		0		0		1		0		0		1	

** Values in unshaded areas refer to shaded totals above; values in lighter shaded areas refer to darker shaded totals above; top row percents refer to 10-year total at right † Primary cause of death was injury other than drowning, although drowning may have complicated another injury; in case of hypothermia, only hypothermia deaths reportedly uncomplicated by drowning are included here ‡ Data for Nunavut and Northwest Territories have been combined, since Nunavut was not a separate territory until 1999 § Includes open outboard motorboats & other open powered boats such as inflatables; excludes personal watercraft*

Source: The Canadian Red Cross Society & the Canadian Surveillance System for Water-Related Fatalities, 2009

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