

Outdoor education fatalities in Australia 1960-2002

Part 3: Environmental circumstances

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Abstract

This article, the third in a series, examines 114 outdoor education-related fatalities in Australia in the period 1960-2002. It reviews the environmental circumstances in which fatalities have occurred and the extent to which environmental circumstances contributed to fatal incidents. All of the accidental deaths (105) could be linked to particular environmental circumstances. Patterns of environmental circumstances that have been associated with fatal incidents are reviewed. The paper concludes that in outdoor education, knowledge of particular environments is more important for fatality prevention than knowledge of outdoor recreation activities (although the latter may imply the former in some cases). At least one-third of the accidental (non-motor vehicle) deaths appeared preventable given specific local knowledge. The study shows that there is a geography of fatality risk, and that improved prevention requires more attention to regional or local considerations. The study provides no support for the contention that more general approaches to fatality prevention (national rather than state or regional) would be intrinsically more effective than more local approaches; the opposite appears true.

Introduction

In the first article in this series (Brookes, 2003c), I discussed the role of case studies in developing fatality prevention strategies in outdoor education and provided a summary of 72 outdoor education-related incidents in Australia since 1960, involving 114 deaths. Further, I provided a brief description of each incident, grouped by immediate circumstance. The incidents are summarised in Table 1.

The second article in this series (Brookes, 2003d) considered the role of adult supervisors and examined first aid and rescue considerations. I examined 'supervision' rather than alternatives such as 'leadership' or 'instruction' because supervision is not confined to the periods in which students are undertaking specific activities in the outdoors. A number of fatalities have occurred on the fringes of the organised program of activities. I found no incidents in which it could be said that inadequate first aid contributed to a fatal outcome, although clearly supervisors should be proficient in basic first aid, especially CPR. Rescue time, on the other hand, was potentially critical in a number of incidents. Training in first aid beyond the basics would apparently not have prevented any of the deaths in this study; more planning devoted to potential rescue may have prevented a number of deaths.

In this article I consider if and how particular environmental circumstances have contributed to fatal incidents. Most of the deaths in this study were accidental (105), and can be grouped according to environmental circumstances: drowning in lakes or pools (12); drowning in moving water (18); drowning in open water (11); falls (8); falling objects (24); fire/lightning (4);

hypothermia (5); motor vehicle-related (23). Two deaths in this study were homicides, one was undetermined (possibly accidental) and seven were from natural causes. Death sometimes occurs in the outdoors – one can die anywhere; however, deaths in which the outdoor education situation was not a factor accounted for less than one in ten of those studied. Even allowing for the fact that there were deaths from natural causes or other reasons such as suicide that I did not discover, outdoor environments have contributed to most outdoor education fatalities.

Understanding environmental hazards is therefore central to fatality prevention in outdoor education:

1. While some hazards are diffuse and unpredictable – a tree may fall on a windless day as someone walks underneath, a swimmer may have a seizure and drown at any time – most hazards occur in specific, recognisable circumstances.
2. Given sufficient expertise – particularly, but not exclusively on the part of supervisors – most environmental dangers can be avoided or neutralised.

Some limitations

This study used public records relating to fatal incidents. Some of the material I examined attempted to describe or quantify environmental conditions, sometimes in detail. Some material provided only limited descriptions. In a few cases I sought additional information on particular environmental factors, for example by consulting guidebooks or maps.

Table 1. Brief summary of incidents included in the study

Incident	Deaths	Incident	Deaths
<i>Open water</i>		<i>Falls</i>	
Lake Hume 1963	M21 M19 M19 M19 M22 M29* M25*	Tatachilla 1976	M11
Lake Alexandrina 1987	M40* M12 M36* M16	Barkly River 1979	M16
<i>Drowning - moving water</i>		Grampians 1979	M15
Stony Creek 1974	F18	Cathedrals 1983	M15
Thomson R. 1976	M16	Hawkesbury River 1986	M15
Anglesea 1976	M28*	Bungonia 1991	M16
Crooked R. 1978	M15	Bungonia 1994	M15
Anglesea 1979	M13	Thredbo 2000	M16
Stokes Bay 1980	F15	<i>Falling objects</i>	
Growling Swallet 1990	F14 F14 F23*	Steavenson Falls 1968	M19 M18 F15 F13
Shoalhaven R. 1990	M15	Two Scouts Track 1975	M16 M16
Logan R. 1990	F16	Lal Lal Falls 1990	F12 F13
Barrington R. 1995	M19*	Serpentine Gorge 1990	M16
Conto Springs 1998	M15	Mt Edwards 1993	F13
Forth R. 1998	M15	Cowaramup Bay 1996	F12 M47* M41* M49* F41* F35* M13 F12 F11
Sandbar Beach 1998	F14 M16 M25*	Bremmer Bay 1997	F15
Yarrunga Ck 1999	M15	Rowallan 1998	M12
<i>Drowning - dams, lakes, pools</i>		Crosslands Reserve 2001	F15 F15
Falls Creek 1961	M15	Carnarvon Gorge 2002	F?*
Moogerah Dam 1976	M17	<i>Hypothermia</i>	
Woorabinda 1980 (?)	M?	Cradle Mountain 1964	M15
Lake Eppalock 1980	M14	Cradle Mountain 1965	M25* M14
Maroon 1981	M?	Kanangra Walls 1981	M16
Crystal Lake 1990	M11	Cradle Mountain 1971	M15
Galston 1991	M6	<i>Fire, lightning</i>	
Bibra Lake 1994	M14	Noojee 1984	M12
Avon Valley 1997	F15	Sutton 1994	M11
Murgon 2000	M13	Lamington 1992	F12 F12
Morley 2000	M12	<i>Motor vehicle</i>	
Bayswater 2000	M10	Christmas Creek 1979	F? F? F?* M?*
<i>Natural causes</i>		Anglesea 1980	M14, M15, F43
Bogong High Plains 1979	M?*	Cathedrals 1982	Unknown
Coastal NSW 1991	??	Gordonvale 1987	F16 F16 F16 M15 M16 F17 F16 F17
Rermark 1991	F14	Morgan 1988	M17
Coastal NSW 1992	?16	Catherine Hill 1990	M14
Howitt 1996	M?	Flinders 1992	M14
Sam Hill 1999	F14	Coober Pedy 1993	F16
Margaret R. 2001	M50*	Chillagoe 1997	F18
<i>Homicide</i>		Omeo 2000	F17 F16
Loftia park 1977	M7		
Coogee Beach 1993	M21*		

*Adult supervisor

I did not examine any accident sites. A hypothetical observer at any one of these incidents might have noticed environmental factors that did not come to my attention.

Deaths involving poisonous bites or stings, animal attacks of other kinds, hot weather, arid environments, or bushfire are possible and may have occurred in outdoor education or related activities, but are not included in this study because I found no such instances.

For a more detailed discussion of limitations of this study, and for a list describing the nature of the sources I had access to for each incident, see Brookes (2003c).

Incidents in which environmental circumstance were not directly relevant

The study included seven deaths from natural causes. There have probably been more – deaths from natural causes will not necessarily attract publicity, in which case they may not have been discovered by this research. Such deaths may occur on a component of a program that is not

directly supervised (Mt. Stirling 1996) or the deceased may be one of the supervisors (Bogong High Plains 1979, Margaret River 2001). Moreover, suicides may have occurred on school camps and excursions – there have certainly been attempted suicides.

The study revealed two homicides. The outdoor education settings were happenstance. At Loftia Park 1977 both the motive and the opportunity for the murder arose incidentally in the course of a youth camp. At Coogee Beach 1993, a teacher was stabbed after intervening in a dispute between a student and a fisherman who had accused the student of theft. In neither case was outdoor education as such a contributing factor, but more generally outdoor education situations could provide an opportunity for a serious assault to be disguised as an accident. In a letter to the editor of a major newspaper, one writer alleged he was systematically bullied at school, including: "[t]here was an occasion of a primary level school excursion in 1965, when several students, the ringleader now prominent, attempted to take my life by pushing me from a high cliff at Kangaroo Valley" (Tan, 2000). In the Bungonia 1991 incident, homicide detectives investigated the possibility that the victim, one of four juvenile offenders on the trip, had been pushed. Allegations were made that the victim, who fell to his death, had earlier been threatened by the participant closest to him when he fell. The coroner was unable to determine what caused the fall.

Sleepwalking deaths are a possibility. I found no deaths attributed to sleepwalking. A near-miss demonstrates the possibility. On 18 October 2000, a 14-year-old boy on a school trip to Bundaleer in the Grampians (Victoria) fell four meters and suffered serious injuries while sleepwalking (Cullen & Gardiner, 2000).

Activity-related fatality analysis and prevention?

Safety planning in outdoor education is sometimes organised around outdoor recreation activities, particular those seen as 'high risk'. However, this study indicates that outdoor education fatality prevention, at least in principle, should focus primarily on environmental hazards. While all of the accidental deaths in this study could be linked to environmental dangers, only some could be linked to so-called adventurous activities.

Some incidents related to outdoor 'adventure' activities occurred after the organised activity had ceased, or involved victims not engaged in the activity. Some drowning victims had entered the water at a time or place other than what the supervising staff intended. Examples included Thomson River 1976, Stokes Bay 1980, Avon Valley 1997, Forth River 1998, Yarrunga Creek 1999. In the Forth River case, the intended

activity was canoeing, but the victim was observing the canoeing and drowned while attempting an impromptu river crossing to join another student on a rock. In other cases it is unclear if the victim drowned during supervised swimming or entered the water at another time (Woorabinda 1980, Maroon 1981, Crystal Lake 1990, and Galston 1991). Fatal falls occurred during breaks from rock climbing or abseiling at Grampians 1979 and Bungonia 1991. In neither the Barkly River 1979 incident (victim fell) nor Serpentine Gorge 1990 incident (victim killed by a rock dislodged by another student) was rock climbing a planned activity. At Cowaramup Bay 1996 and Lal Lal Falls 1990 all but one of the victims were spectators or waiting their turn. At Barkly River 1979, Cathedrals 1983, Hawkesbury River 1986, and Bungonia 1994 fatal falls occurred during bushwalking or orienteering, and the student killed by a falling boulder at Mt Edwards 1993 was bushwalking. I found no fatal falls that occurred during supervised rock-climbing or abseiling [cf recreational rock-climbing (Brown, 1997)].

Arguably fatality prevention should not rely on the technical skills of participants. Some incidents might have been avoided, hypothetically, had participants been more skilled. For example, Thomson River 1976 and Logan River 1990 incidents involved avoidable capsize. Fatal river crossings at Stony Creek 1974 and Crooked River 1978 involved rivers that experts possibly could have crossed safely. The Bungonia 1994 incident (victim fell) and Yarrunga Creek 1999 incident (victim swept off a log by water while crossing a creek) followed navigation errors on the part of teenage boys. Several drownings might not have occurred had the victims been stronger swimmers. (More speculatively, in other cases a weaker swimmer may have been more cautious). However, outdoor education involves novices; fatality prevention can hardly be based on presumptions of expertise. All students make mistakes, and most students learn only some of what they are taught. Students may become ill and unable to exercise skills they have. Participants in some forms of outdoor recreation may seek out situations in which there is little margin for error, but outdoor education, like all education, requires situations in which it is safe to make mistakes.

Arguably the technical skills of supervisors are significant only to the extent that they relate to avoiding or overcoming environmental dangers:

1. Most incidents in this study presented no opportunity for a skilful supervisor to 'save the day'. Few, if any, would have been prevented even had the supervisors been elite swimmers, rally drivers, canoeists, orienteers or rock-climbers.
2. It is reasonable to surmise that once a situation has reached a point where

heroic intervention seems the only option, supervisors of any skill level may be tempted to take on a situation beyond their ability. Some supervisors died attempting to rescue swimmers (Anglesea 1976, Growling Swallet 1990, Sandbar Beach 1990), and at Cradle Mountain 1965 a student teacher died while evidently attempting to carry a student to safety. Both instructors died in the Lake Hume 1963 incident while trying to rescue participants.

It is, of course, desirable that swimming supervisors be strong swimmers, bushwalking leaders be physically fit, those driving minibuses be skilful, and so on. There were several instances in which lives were saved when an individual walked out to seek help, or swam with a flotation aid to rescue a person in difficulty.

Activity expertise is not sufficient to ensure fatality prevention. For fatality prevention, supervisors must have the knowledge and experience to recognise and avoid or neutralise hazardous environmental conditions. It is possible that a supervisor could be expert at an activity (for example, canoeing) but not have sufficient knowledge of the environmental hazards at a particular site.

In most cases, it would not be possible to develop the expertise to avoid or neutralise environmental hazards; furthermore, it would not be possible to act as a supervisor without some activity expertise. However, in principle, at least activity expertise is not in itself necessary to prevent fatal incidents associated with particular environments. I have included this statement because it follows logically from the above discussion, and may help emphasise the findings of this study. It should be understood that where a supervisor did not have rock-climbing expertise, but did understand the environmental hazards around cliffs, then he/she would avoid climbing activities. The option of neutralizing the hazard of falling requires expert knowledge of rope work.

The conclusion that activity expertise is not sufficient and, in principle, not necessary for fatality prevention should not be extended to outdoor recreation with experienced adult groups, or to teenage groups engaging in outdoor recreation at an expert level. The Kanangra Walls 1981 incident, which I have included in this study although the trip was apparently a recreation trip (party of three) loosely associated with a school, illustrates this point. Unequal length ropes were joined to abseil a long drop near a waterfall. The deceased became caught on the knot, and lacked the means to self-rescue. His companions lacked the means to rescue him. While hypothermia

undoubtedly contributed to his death, clearly technical errors or failures also contributed. This incident, however, was exceptional. Most incidents in this study involved non-specialised activities, or specialised activities conducted at a novice level.

Local and generic environmental knowledge and fatality prevention

On 9 January 1968, the top section of a large Mountain Ash snapped off 12 meters above the ground. A length of the trunk one meter in diameter fell down the hill and shattered, killing four of a group of seven teenagers walking on a popular tourist track, missing the others by centimetres (Steavenson Falls 1968). In the words of the father of one of those killed: "It was a windless day. For that particular tree to fall ... at that particular time must have been fate" (The Sun, 1968). Most incidents in this study were more avoidable than this. Even avoiding forests would not eliminate danger from falling trees or branches - there are trees in urban areas and trees along many roadsides.

However, most accidents in this study were avoidable given sufficient environmental knowledge, especially on the part of supervisors. The knowledge required to recognise environmental dangers may be generic, for example a knowledge of rips and tides, but may need to be more local, for example knowing exactly where the rips, bars, and other hazards are at a particular beach on a given day, and knowing from experience the likely effects of weather, swell, and tides. I did not attempt to determine if inadequate local knowledge was a factor in any motor vehicle-related deaths, but of the remaining accidental deaths, inadequate local knowledge was clearly a consideration in more than a third.

At Barkly River 1979 and Bungonia 1994 teenage boys died after falling down cliffs that adult leaders did not know were there and that were not marked on maps. If supervisors do not know the location of cliffs they may not be in a position to provide the close supervision teenage boys require around cliffs (Brookes, 2003d). At Sandbar Beach 1998 three members of a visiting Christian group drowned, and others were rescued, at a beach which the local council had reportedly not signed as hazardous for fear of litigation (Miranda & Lator, 1998). According to a local life guard, the rip which caught the victims had sandbars on either side and would have carried them 15 meters to another sandbar where the water was knee-deep had they not panicked. There was a bridge several kilometres downstream from the site where a teenage boy drowned while crossing the Crooked River in 1978 and, according to police, a safe crossing 500 meters upstream. At Anglesea 1979, a teenage boy scout drowned at the same location and in very similar circumstances to those in which a

teacher drowned in 1976. An Army enquiry into the Murgon 2000 incident, in which a fully clothed cadet drowned in weedy, muddy water during an exercise, found the supervising staff failed to check the water for depth and weeds prior to the exercise (Nolan, 2001). In the event of a rescue, knowing in advance where phone and radio reception is possible may be important (Bungonia 1994, Avon Valley 1997).

In the aftermaths of both the Lal Lal Falls 1990 and Cowaramup Bay 1996 incidents evidence emerged that at least some individuals with local knowledge regarded the fatal cliffs as unstable. Both open water incidents – Lake Hume 1963 and Lake Alexandrina 1987 – involved stretches of water that were regarded as hazardous by those with extensive experience of them.

Consulting a person with local knowledge may not be a satisfactory substitute for supervisors having personal local experience (Conto Springs 1998, Stokes Bay 1980).

Even a broad understanding of the circumstances in which fatalities have occurred in the past may contribute to reducing future fatalities. However, many of the incidents in this study could have been prevented if supervisors or others close to the incident had specific local knowledge. Obtaining that knowledge may be a matter of relatively simple checking, but may also require extensive relevant local experience.

The geography of safety

Certain hazards are regional. Those associated with snow or cold water are confined to south-east Australia, thunderstorms are far more prevalent in the north, crocodile attack is confined to the far north, and so on. Steep ground and moving water incidents have occurred in all states (these are preferred environments for some forms of outdoor education) but Melbourne-based programs can more easily avoid cliffs than Sydney-based programs. Environmental hazards are neither evenly distributed, nor uniformly encountered. The incidents in this study are indicative of the dangers only in those regions most frequently used for outdoor education, reflecting not only patterns such as the concentration of population in certain parts of the continent but also differences in the extent to which outdoor education is available and how outdoor education is conceived.

In Australia, outdoor education has tended to be organised at either local or state levels – most of the relevant legal and administrative frameworks, including education and land management, are state responsibilities. Furthermore, formal expertise has tended to cluster in state or regional organisations such as bushwalking clubs, rescue groups, or outdoor

education associations. Can safety be improved by shifting the organisational centre of outdoor education safety to a national (or international) level? If anything, the evidence suggests that prevention of serious incidents in outdoor education requires approaches geared more, not less, to specific regions and localities. Unlike industrial production, office work, or even sport – activities that take place in more or less standardised, controllable environments and that might benefit from national or international standardisation – outdoor education is inherently tied to local physical environments and embedded in local educational structures, local land use practices, and state legal frameworks.

I now discuss the categories of environmental circumstance evident in the overall summary of fatal incidents (Brookes, 2003c) in more detail, concentrating on safety aspects particular to outdoor education.

Gravity-related fatalities - Falling objects

Twenty-four deaths, almost one in four of the accidental deaths in this study, were from falling objects. Additionally, two of the eight deaths I categorised as falls, Grampians 1979 and Hawkesbury River 1986 (Brookes, 2003c), involved loose rock, making a total of 26 deaths from 12 incidents.

Lal Lal Falls 1990 attracted considerable publicity in south-east Australia and a vigorous inquest. Large rocks dislodged by a student on a rockclimb killed a student on an adjacent climb and another waiting below. A QC representing the school argued that the event should be seen as a unique and freak accident. However, the coroner made a number of findings, including some critical of both the selection of the site and the management of the climbing, while acknowledging that the slab of rock which fell was unusually large. The death of another Victorian student on an excursion to central Australia a few months after the Lal Lal incident attracted far less attention. Students from a party of 98 were scrambling or climbing on the walls of Serpentine Gorge. A large rock was dislodged by one, fatally injuring another student below (Serpentine Gorge 1990). At Mt. Edwards 1993, the deceased was bushwalking when struck by a rock dislodged by another student. At Bremmer Bay 1997, the victim was belaying an abseil when struck by a rock, dislodged by an unknown agency. At Cowaramup Bay 1996, nine parents, teachers and children attending a school surfing competition died when the limestone cliff under which they were sheltering from rain collapsed.

Several aspects of these incidents point to prevention strategies:

1. Rock-climbing or abseiling set-ups should aim to place the belayer and

others out of range of falling or ricocheting rocks. Walkers should avoid steep ground if others are moving higher on the slope; alternatively, groups should move diagonally so no walker is directly below another, with individuals closely spaced to ensure dislodged material has passed the group by the time it gains sufficient momentum to ricochet.

2. The risk can be eliminated by avoiding the bases of cliffs, and reduced by minimising time there.
3. Cliffs should be regarded as unstable unless they have been inspected for signs of instability and found to be sound. Loose material may be evident on inspection, there may be evidence of material that has fallen previously, or there may be individuals who know of previous incidents. (Stability is relative, of course. All cliffs erode). Questions of liability from the Cowaramup Bay 1996 incident are still before the courts seven years after the nine deaths (King & Hickman, 2003). However, these proceedings appear to hinge more on the question of whether particular organizations (WA State Government, Education Minister, Conservation and Land Management Department and local shire) are liable than on whether the hazard from the cliffs was foreseeable. Following the tragedy, newspapers reported claims that locals had warned about the cliffs, and quoted a local cave guide who explained the cliffs were relatively youthful, and therefore unconsolidated, limestone – 'halfway between sand and rock' that had been loosened by recent rain (The Australian, 1996). Immediately after the incident, the Acting Deputy Commissioner of Police Mr Bruce Brennan said the cliffs "were highly unstable and had been made even more precarious by recent heavy weather and erosion" (Walker, Irving & Hughes, 1996).
4. Well-designed helmets provide some protection against small rocks striking the head, and are therefore important. So far as I can determine, however, none of the victims killed by falling objects in this study would have been saved by a helmet of any description (some were wearing helmets).

Trees or branches

Many Australian tree species shed branches and every tree eventually falls over. Except in forests where deadfall has been scavenged for firewood and mature trees are harvested before they fall, in most Australian forests and woodlands the signs are everywhere in the form of limbs on the ground or caught in the canopy.

In the absence of wind, branches usually fall directly below the tree, if anything pivoting closer to the trunk. When a whole tree falls the danger extends to anywhere within reach of the topmost branches, bearing in mind that most trees have at least a slight lean and are most likely to fall in the direction of the lean. It may be possible to completely avoid hazardous areas in woodland, but not in tall forests. Some deaths in this study were of individuals who were momentarily passing the fatal area (Steavenson Falls 1968). However, most deaths occurred in circumstances where a group was not moving. At Carnarvon Gorge 2002 a large tree fell on a group swimming, killing one teacher. The other three incidents – Two Scouts Track 1975, Rowallan 1998 and Crosslands Reserve 2001 – all involved a tree or branch landing on a tent, killing one and injuring one at Rowallan, and killing two in the other two incidents. The longer a group is lingering in a particular spot, the more important it is to check for danger and to choose a location that minimises or eliminates it.

In severe weather it may be necessary to abandon activities in treed areas. High winds increase the risk of falling material, as does a build-up of snow or ice. However, in only one of the incidents in this study was the weather clearly a factor. At Crosslands Reserve 2001 two students were killed when a branch fell on their tent during a severe storm that brought down many trees and branches. Heavy rain may have contributed to the Rowallan 1998 incident (inquest not sighted).

The degree to which such incidents are preventable may be moot, but there are reasons to think the risk can be reduced. Using sub-alpine areas in Victoria as an example:

1. Risk is proportional to time spent in any danger zone. It would be safer not to linger (for example camping, or stopping for a meal) immediately under trees with heavy branches.
2. Broken or loose heavy branches (so called widow-makers) should be avoided completely.
3. The possibility of falling trees should be assessed when selecting campsites or resting places. For example, in Alpine Ash forests, some trees have a forked trunk. These trees tend to split down the fork. It is safer in front or behind such trees (facing the fork) than on either side. Some trees have a pronounced lean – such trees are more likely to fall, and will fall in the direction of the lean. Alpine Ash adjacent to tracks or clearings tend to grow unevenly towards the clearing. Such trees will fall towards the clearing; moreover, the additional branches over the clearing

exert a twisting force that can snap the tree when wind is funnelled along the track or across the clearing. In Snow Gum woodland branches tend not to fall except when loaded with ice. Moreover, because Snow Gums are relatively small it is easier to find a clearing out of reach of falling trees than in the adjacent Ash forests.

4. Some tent sites are protected. For example, a tent placed below an embankment, in a hollow, or next to a large log will be partly protected. Large trees near a tent that lean away from the tent provide some protection against other trees.
5. Danger increases during windstorms, unless trees are sheltered. During storms it would be safer to remain in the most protected area available (see above) than to move.

Some risk from falling trees or branches is unavoidable. Many roads in Australia are tree-lined, for example, and while it may be prudent not to travel these roads during high winds, a chance remains that in fine weather a tree will happen to fall at the moment a vehicle is passing.

Falls

Ten incidents involved falls, including two - Falls Creek 1961 and Moogerah Dam 1976 - where the ultimate cause of death was drowning. In the Falls Creek incident the deceased was tobogganing unsupervised. He apparently went over a bank, and struck his head on the edge of a large concrete pipe buried vertically in the snow. He was evidently knocked out, fell into the pipe, and drowned in shallow water. In the Moogerah Dam incident the deceased was climbing unroped on a wet rock-face above water. He fell into turbulent water, possibly striking his head, and did not resurface. All of the incidents involved a single victim.

Teenage males are at risk of death or serious injury around steep ground. All of the victims were male, aged between 11 - 17 (one 11-year-old, five 15-year-olds, three 16-year-olds, one 17-year-old). In comparison, deaths from falling objects involved males and females in about equal proportion with more varied ages, including six adults.

The common feature of the incidents was the presence of a steep drop, not any particular activity. I found no deaths from falls while roped climbing or abseiling. Two of the deaths (Falls Creek 1961 and Thredbo 2000) involved tobogganing and snow-boarding, respectively. At Tatachilla 1976, the eleven-year-old victim fell from a building at a school camp. Two victims fell a relatively short distance during a bushwalk (Cathedrals 1983) and orienteering activity (Hawkesbury River 1986), the latter involving a loose rock that landed on the victim. Two incidents involved boys who had been allowed to find their own way on a bushwalk attempting to descend a cliff, the existence of which was not known to the adult supervisors (Barkly River 1979, Bungonia 1994). Two incidents occurred during breaks in organised rock-climbing or abseiling activities (Grampians 1979, Bungonia 1991).

Drowning

There are close to 300 deaths due to drowning or immersion in Australia annually, although the number appears to be steadily falling (Table 2). Drowning is a major cause of death for toddlers (age 0-5 years), decreases for the primary school years, then increases as teenagers approach adulthood.

Drownings have been a problem for organized outdoor youth activities at least since the origins of scouting. In the United States:

[D]rownings forced better supervision. Lives were lost because Scoutmasters stood lifeguard fully dressed or went in with the boys. When the number reached twelve in 1916, headquarters named L. L. McDonald ... to be national camp director ... safety improved (Macleod, 1983, p. 242).

More than one third of the accidental deaths in this study were due to drowning or immersion. There is a risk of drowning wherever there is water (see Falls Creek 1961 above). However, the incidents that lead to drowning are strongly related to particular environmental circumstances. There is an extensive literature on water safety which should be consulted by anyone concerned with fatality prevention. My intention here is to consider what, if anything, characterizes outdoor education-related drowning incidents in particular.

Table 2. Drownings in Australia 1993-2001, selected age groups (Royal Life Saving Society of Australia, 2001).

Year	1993-'96 average	1997-'98	1998-'99	1999-2000	2000-'01
Total, all ages	339	326	305	296	269
6-9 years	14	6	13	5	12*
10-19 years	29	26	25	13	NA

* figure is for 6-14 age group

Pools, dams, lakes

Four incidents in this study involved school excursions to a swimming pool. Pools might be considered constructed and therefore relatively simple and controllable environments. The Galston 1991, Bayswater 2000, and possibly Morley 2000 (inquest pending) incidents involved weak swimmers out of their depths in pools. However, it cannot be assumed that pool environments are simple and controlled.

Bystanders may help, but crowds may make an environment more hazardous. Bystanders may initiate or assist rescue, as was the case at Sandbar Beach in 1998. In that incident, a bystander grabbed a boogie board and saved several people. At Bayswater 2000 the deceased was pulled from the water and teachers from a different school began resuscitation after a student from another school raised the alarm. However, there is not necessarily safety in numbers; at Anglesea 1979, Lake Eppalock 1980, and Morley 2000 nearby swimmers at first thought the victim was joking, and at Bayswater 2000 two or more students thought they saw a body on the bottom of a pool prior to a third student raising the alarm. In both Anglesea incidents several individuals were in difficulty at once, possibly distracting attention from the deceased at the crucial time. The Bayswater Aquatic Centre had seven pools, both indoor and outdoor, a jumping castle, and a live radio broadcast booth (it is unclear if the latter was operating at the time the deceased got into difficulties). At Bibra Lake 1994 a pool, part of a large adventure complex, had around 350 swimmers in it. The deceased was thought to have been pushed or knocked underwater, then struck by another swimmer entering the water; evidently none of the other swimmers noticed him in difficulty. Lifeguards did not see the victim go under, and later had difficulty deciding whether or not there was a body on the bottom of the pool. Both the Bibra Lake and Bayswater incidents illustrate that certain pool environments, like outdoor environments, should be regarded as complex and relatively uncontrolled.

In environments other than pools access to water is harder to manage and rescue may be more complicated. In the Avon Valley 1997 incident, the deceased entered a river away from a supervised swimming area. She became ill while swimming, something that could have happened anywhere. However, once the victim was in distress, the location made rescue difficult – students attempting to rescue her failed to get her out of the water on one bank, and then took her to the other. The Thomson River 1976 incident began with the victim and another boy taking a canoe without the supervising teachers' knowledge for one last paddle on the river. Once the victim, who contrary to instructions was not wearing a

flotation device, had released his grip on the swamped canoe, the situation became one of a weak swimmer out of his depth. A teacher swam to his aid and almost reached him, but once the victim was underwater the current defeated the attempted rescue.

In dams or lakes the depth of water may vary less consistently than in a pool, and turbidity greatly adds to the problem of rescuing a distressed swimmer who has gone under. At Lake Eppalock 1980 and Murgon 2000, rescue and attempted resuscitation were delayed because rescuers took some minutes to locate the victim in muddy water. At Crystal Lake 1990, the body was not recovered for some time, as was the case (I believe) at Maroon 1981. It is possible, but not certain, that the deceased went underwater unnoticed at Crystal Lake during supervised swimming (the water was anything but "crystal", the coroner noted). It is clear to me that PFDs, normally associated with canoeing rather than swimming, should be worn during swimming in muddy water.

Open water

Open water incidents have been rare but are not freak events. Overseas, the 'Sheppey disaster' occurred on 4 August 1912 off the Kent coast in the UK. Nine boy scouts died when a cutter capsized in a squall. On 12 June 1978, 12 boys and one leader died on Lake Témiscamingue, Canada, when all four (large) canoes carrying a party of 27 boys and 4 leaders capsized in a squall. On 22 March 1993 at Lyme Bay, England, four school students died when eight students and one leader were swept out to sea in their canoes.

Open water incidents in outdoor education tend to be catastrophes, because they occur when most or all of a party are capsized by rough conditions in cold water with no immediate prospect of rescue. Cold water reduces the rescue window. Rescue is complicated by difficulties in locating individuals on large areas of open water, and by the fact that individuals in choppy water may be difficult to see, especially if there is windblown spray, fog, rain, or darkness. Moreover, once it is obvious that the group has disintegrated individual craft tend to disperse. Apart from avoiding open stretches of cold water completely, prevention should focus on keeping warm (wet suits or dry suits), visibility, and on-call rescue (for example, having a rescue craft shadow a group of canoeists).

The study included two open water catastrophes, Lake Alexandrina 1987 (4 died) and Lake Hume 1963 (7 died). Both cases involved water of around 10°C, a sudden squall that produced severe chop in shallow water that swamped boats and defeated attempts at self-rescue. In both cases none of the adult leaders survived. In both cases some participants

struggled to shore and raised the alarm. In both cases police had to mount difficult rescue operations, without which there would have been more deaths. Neither party involved individuals with extensive local knowledge; both groups encountered conditions that locals expected to occur from time to time.

Moving water – coastal beaches

All ocean beach incidents involved individuals unfamiliar with a particular beach and carried out of their depths by currents that were known to locals. I found five incidents; three of the seven who drowned were attempting to rescue others. All but one incident involved several individuals in difficulty.

At Stokes Bay 1980, 3 clothed primary school students who had evidently not intended to go swimming were swept out to sea before the teachers had reached the beach, which was signed as hazardous. The organization of the trip had been left to a tour company; the driver had selected the beach. At Conto Springs 1998 a trip to the beach was a more or less ad hoc addition to the planned program. The beach was signed as hazardous, and the teacher in charge had sought advice from someone with local knowledge. As discussed above, Anglesea 1979 was a repeat, in many respects, of Anglesea 1976 (those involved in 1979 were probably unaware of the earlier incident). Sandbar Beach 1998 involved a hazard well-known to locals.

The extent to which surf expertise transfers from one beach to another is debateable, as is the extent to which local knowledge can be communicated effectively to a non-local. 'Local knowledge' must be specific to the group and its intended activity, and the fact an individual is a local does not necessarily imply sufficient local knowledge to manage outdoor education safety, or even that the person's knowledge is sound. It is clearly preferable, and perhaps essential, to have a supervisor with extensive local experience who has checked the conditions on the day and is in a position to relate his/her knowledge to the specific group and planned activity.

Moving water – rivers

I found eleven deaths (nine incidents) involving immersion in river currents. Five of the incidents were associated with canoeing or kayaking (Thomson River 1976, Shoalhaven River 1990, Logan River 1990, Barrington River 1995, and Forth River 1998). In the Shoalhaven and Forth River cases, the deceased were swimming or wading when they encountered difficulties. The fact the victims were paddling was more directly relevant in the other three cases. Of the six deaths not associated with paddling, three died while attempting to cross a river in the Growling Swallet cave (Growling Swallet 1990). The Stony Creek 1974, Crooked

River 1978 and Yarrunga Creek 1999 incidents also involved attempted river crossings.

PFDs may not prevent fatalities in river currents. In the Thomson River incident the deceased was a weak swimmer not wearing a PFD. The victims in the other canoeing or kayaking-related incidents were wearing PFDs; all were trapped by the current on snags or other obstacles. The body of the deceased in the Crooked River incident (swept away while attempting a river crossing) was found entrapped on a log, the current having removed most clothing. Most clothing was absent from the body in the Yarrunga Creek incident (swept away by a flash flood while attempting to cross a creek on a log), also suggesting entrapment. Similarly, the body of the deceased in the Stony Creek incident (swept away while attempting a river crossing) was found caught on flood debris. In the Logan River 1990 incident, the deceased's life jacket surfaced but the deceased remained submerged against a bridge pylon, tangled in a canoe painter.

Arguably substantial river currents should be regarded as having an unavoidable fatality risk if there is the possibility of someone entering the water, although some river crossing sites may be relatively safe, for example if the current would carry a person into deep, quiet water. All of the river crossing incidents in this study involved rescuers unable to reach the victim, either because of difficulty in getting along the bank, or, in the case of the Growling Swallet 1990 incident, finding themselves in difficulty upon entering the water and subsequently dying. In the Shoalhaven River 1990 and Forth River 1998 incidents (both were canoeing/kayaking-related river crossings) supervisors had local canoeing experience but were unaware of the particular snags that trapped the victims.

Lightning

Two girls were killed by lightning at Lamington National Park in 1992. They were on high ground near the edge of an escarpment in an area prone to thunderstorms. It may not have been possible to move away from the escarpment or off the high ground. However, they were sheltering against the trunk of a particularly large tree. Lightning struck the tree and jumped from the trunk to the girls. Keeping two meters from the tree trunk would have prevented this (Davies, 1993).

Fire

Two fatal incidents both involved primary school children in semi-permanent sleeping quarters, teachers not in the immediate vicinity. At Noojee 1984, a twelve-year-old died, and a second boy received very serious burns. At Sutton 1994, an eleven-year-old boy, also from a Victorian school, died, and a second boy received very serious burns. In the Noojee incident a gas lamp that had apparently been

moved from where the teacher said he placed it, ignited a large ex-army tent on a platform. It was a very windy night. The victims had gone to bed for the night. At Sutton six students were sharing a cabin in a caravan park on a warm, humid night. Apparently, a student switched on an air-conditioner, which started the fire around 12.20 am. In both cases teachers were not present in the tent or cabin at the time. In both cases the fire was well alight when teachers were alerted. My request to see the findings from the Sutton inquest was refused; however, newspaper reports made no mention of a smoke alarm.

Rustic or temporary accommodation may be particularly vulnerable to fire. I am aware of some huts used by groups in the snow, for example, where escape in the event of fire would be problematic. (Moreover, survival in cold conditions may be problematic for those who did successfully escape.)

Hypothermia

Three hypothermia incidents involved school bushwalking parties that encountered blizzard conditions. All occurred at the Cradle Mountain end of the Cradle Mountain Lake St Clair National Park (Tasmania) in the space of six years (1964, 1965 and 1971). The common location is probably not coincidental; risk of hypothermia is a function of both weather and terrain. Each of the incidents had the potential for more deaths. In the 1964 incident a party of 20, including 5 adults, became separated in a blizzard. A student, 15, died. In the 1965 incident a student teacher died in an attempt to get a student, who also died, to shelter. In both cases most of the survivors were rescued after the alarm was raised by individuals who walked to safety. In the 1971 incident in which a student died, a teacher also became unconscious from hypothermia but was rescued. In all three cases parties separated as conditions deteriorated (this is not to imply the outcome would have been better had they stayed together - it may have been worse). In the two open water incidents, in which immersion hypothermia almost certainly contributed to the deaths (seven at Lake Hume 1963 and four at Lake Alexandrina 1987) there was a point at which the group was no longer functioning, and individuals or pairs sought to survive as best they could. Individuals who reached the shore were able to raise the alarm in both cases, resulting in some lives saved. The Mt. Hood (USA) disaster provides some insights into the difficulties that face a stationary party that does not have the resources to keep the whole group warm. Ten students and three adults from the Oregon Episcopal School descending from a failed attempt to reach the summit, on 12 May 1986, sought shelter by constructing a small snow cave when caught in severe weather. Two of five who set out to seek help after the first night survived. Rescuers had great difficulty locating the cave, in which the

remaining eight spent a total of three days and nights. Two of the eight survived (Tacoma Public Library, 1998).

The Cradle Mountain deaths occurred more than 30 years ago. There were several near misses in Victoria in the 1980s (Ministry of Education, 1988), in which tragedy was avoided at least partly because, unlike the gravity-related or drowning incident, hypothermia creeps up relatively slowly, allowing time for rescue. It is possible that extensive efforts to educate outdoor leaders and teachers about hypothermia in south-east Australia following the Cradle Mountain 1971 incident were relatively successful. If so, it remains to be seen if these efforts persist as memories fade and 'national' approaches to bushwalking focus attention away from strictly regional issues such as hypothermia.

Weather and climate

Weather was a consideration in almost every accidental death in this study, even if only to the extent of determining what activities were undertaken at the time of an incident. I have not included a separate discussion of weather here, because in almost every case in which weather was a circumstance it was in the context of how weather conditions affected a particular location and activity. The fact of variable weather, more than anything else, determines the need for knowledge of particular locales to be accumulated over years; only some of the knowledge needed to prevent fatal incidents can be acquired in a single reconnaissance. Many of the incidents here occurred when weather conditions transformed a planned activity into something completely different.

Motor vehicle-related fatalities

I have included motor vehicle-related incidents in this study because, based on the number of motor vehicle-related incidents relative to other incidents, travel to and from outdoor education sites is a relatively high-risk activity. Although much of what is true about road safety in general will be true of outdoor education-related road safety, and is therefore already the subject of an extensive literature, I also wanted to consider whether the motor vehicle incidents in outdoor education had any particular characteristics.

I found 23 deaths (including eight in a single incident) that could be related to outdoor education excursions, amounting to around one quarter of the accidental deaths in this study. Limiting travel in motor vehicles is an obvious and simple way to reduce the chance of such incidents.

Five of the incidents (16 of 25 deaths) involved rollovers. The average proportion of rollover fatalities Australia-wide is about 20 percent (Richardson, Rechnitzer, Grzebieta & Hoareau,

2002). Even allowing for the fact that the incidents I found could not be considered a valid statistical sample, this is a relatively high proportion, exceeding figures for outback Western Australia and the Northern Territory (Richardson et al., 2002). Issues that require further discussion include the rollover propensity of certain vehicles (for example, troop carrier-style vehicles and mini buses), passenger safety in the event of a rollover (poor in some vehicles), and whether the nature of the roads used to get to outdoor education sites is a factor.

Most incidents I found were single-vehicle. At Anglesea 1980, a car carrying campers collided with another vehicle, and at Catherine Hill 1990, a truck driver swerved off the road while trying to retrieve a dropped cigarette, killing a student wheeling his bicycle up a hill. Road conditions, driver error, vehicle characteristics and mechanical failure (Gordonvale 1987 – faulty brakes) may all be implicated in single vehicle incidents.

In two incidents (Morgan 1988 and Chillagoe 1997), the deceased had been travelling in the trays of utilities. One incident (Omeo 2000) involved a troop carrier-style vehicle (although I am unclear where the deceased were sitting). Previous research has shown that sideways facing seats are potentially lethal, and should not be used in any circumstances (in Brookes, 2002c, 2002d). The fact that such seating arrangements are legal, at least in some states, and used extensively (for example in ski resort shuttles) does not change the fact that passengers in sideways facing seats will almost certainly be killed in even a low speed collision.

Fatigue and 'production pressure' may contribute to driver error. Professional drivers are required to maintain log books and comply with regulations limiting driving hours. Log books may help to limit fatigue caused by production pressure in the long haul transport industry, although there is some evidence that they are ineffective. Fatigue, for example, can only be combated by sleep (Hartley, Penna, Corry & Feyer, nd), and log books do not record sleep. Recording driving hours alone is even less likely to help limit fatigue in outdoor education where driving distances tend not to be 'long haul' and where the sources of fatigue, and the origins of production pressure that might lead to mistakes, will not be due to driving commitments alone. There is a need for further investigation into the circumstances that lead to fatigue and into any pressures that may lead to driver error, particularly in the light of attempts to treat all bus drivers, private and commercial, as if they are part of the transport industry.

Further study

Questions of the sources of human error, and the broader administrative, regulatory, and organisational frameworks in which outdoor education occurs, extend beyond motor vehicle incidents.

1. The origins of mistakes and errors in outdoor education require further consideration. For example, fatigue may be an issue across outdoor education programs, not just in relation to driving. Fatigue affects judgement in a similar way to alcohol (Hartley et al., nd).
2. Errors can occur due to individuals being overwhelmed (temporarily or chronically), or because of production pressures. To take the example of a hospital emergency department, if the number of serious cases exceeds staffing capacity on a given night, staff will have too much to do. If one is a patient in such circumstances, one hopes the overwhelmed staff will do what they need to do to keep you alive and forget about the paperwork, for example. But one also hopes the person who takes your details does not miss something crucial because of pressure to deal with the backlog. In reviewing adverse incidents with the benefit of hindsight, it can be easy to make the mistake of noting what individuals 'should have done' without noticing what the circumstances were that explain why they did not do it. If staff are overwhelmed, admonitions or requirements to 'try harder' can make matters worse.
3. Outdoor activities occur in wider organisational and institutional frameworks, including qualification and accreditation schemes, organisational norms and expectations, educational imperatives, and widely held beliefs and expectations. These wider frameworks may or may not be sound, or they may fail to operate properly, or they may introduce the risk of 'normal accidents' that occur because of inherent characteristics of the system rather than failure as such (Perrow, 1999; Sagan, 1993). There has been little research into the nature of these 'system' considerations in outdoor education, which should include questions about the theories, evidence and assumptions on which they are based.

Perhaps the most important of the wider considerations is the question of how outdoor education is justified. Broad brush justifications for outdoor education as 'adventure education' sometimes assert or imply that benefits to many participants justify a certain number of

individual tragedies, echoing, perhaps, the justifications for wartime sacrifice. Such statements are so common that it would be unfair to single out any example here.

Rationales (or rationalisations) for outdoor education based on accepting an elevated risk of fatalities are unnecessary. If the avoidable risks are put aside, the 'residual' fatality risk associated with outdoor education in Australia is comparable to or less than the residual risk at home or school. Most of the fatal incidents studied were avoidable.

I can see no loss of educational benefits in putting a tent in a safe rather than an unsafe location, moving belayers away from the danger zone at the base of a cliff, ensuring students enter the water at safe locations on surf beaches, choosing an alternative activity to an open water crossing in canoes, insisting that leaders who would guide students in an area are very familiar with that area, and so on. Outdoor education premised on understanding the bush well enough to see and avoid its particular dangers may have educational benefits. There are reasons to think that the notion of the bush as a strange and dangerous place in which individuals test themselves, bond into military style groups, and emerge with changed personalities is outdated (Brookes, 2002b), educationally suspect (Brookes, 2002a), and based on wrong assumptions (Brookes, 2003a, 2003b).

In the fourth article in this series I will examine some of these wider considerations.

Conclusion

In outdoor education, knowledge of particular environments is more important for fatality prevention than knowledge of outdoor recreation activities. At least one third of the accidental (non-motor vehicle) deaths in this study appeared preventable given specific local knowledge. The study shows that there is a geography of fatality risk, and that improved prevention requires more attention to regional or local considerations. The study provides no support for the contention that more general approaches to fatality prevention (national rather than state or regional) would be intrinsically more effective than more local approaches; the opposite appears true.

It is clear that safety management in Australian outdoor education has not consistently and comprehensively absorbed the lessons of past fatalities. This article, together with the second article in this series, provides those responsible for safety management the means to check their thinking and practices against the knowledge of fatality prevention that can be derived from the study of actual incidents. In my opinion it is imperative that this be done.

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