

## ORIGINAL RESEARCH

# Dead Men Walking: Search and Rescue in US National Parks

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**Objective.**—To identify search and rescue (SAR) trends in US National Park Service (NPS) units.

**Methods.**—A retrospective review of the US National Park Service Annual Search and Rescue Reports from 1992 to 2007 and the SAR statistics for all NPS units in 2005.

**Results.**—From 1992 to 2007 there were 78 488 individuals involved in 65 439 SAR incidents. These incidents ended with 2659 fatalities, 24 288 ill or injured individuals, and 13 212 saves. On average there were 11.2 SAR incidents each day at an average cost of \$895 per operation. Total SAR costs from 1992 to 2007 were \$58 572 164. In 2005, 50% of the 2430 SAR operations occurred in just 5 NPS units. Grand Canyon National Park (307) and Gateway National Recreation Area (293) reported the most SAR operations. Yosemite National Park accounted for 25% of the total NPS SAR costs (\$1.2 million); Wrangell-St. Elias National Park and Preserve (\$29 310) and Denali National Park and Preserve (\$18 345) had the highest average SAR costs. Hiking (48%) and boating (21%) were the most common activities requiring SAR assistance. Hiking (22.8%), suicides (12.1%), swimming (10.1%), and boating (10.1%) activities were the most common activities resulting in fatalities.

**Conclusions.**—Without the presence of NPS personnel responding to SAR incidents, 1 in 5 (20%) of those requesting SAR assistance would be a fatality. Future research and the development of any prevention efforts should focus on the 5 NPS units where 50% of all SAR incidents are occurring.

*Key words:* search, rescue, national park, fatality, injury, illness

## Introduction

Search and rescue (SAR) refers to an emergency operation commenced to render aid to individuals believed to be in distress, ill or injured, and possibly lost.<sup>1</sup> During the past few decades there has been a growing interest in research related to wilderness SAR.<sup>2–6</sup> For example, recent studies have reported on helicopter air-rescue systems in Austria and Switzerland, mountain SAR in Taiwan, the epidemiology of wilderness SAR in the state of New Hampshire, and SAR in Yosemite National Park, Utah's National Parks, and Alaska's National Parks.<sup>1,7–12</sup> Although these existing studies are serving to increase our knowledge of SAR issues in various regions, what is missing is a larger picture of SAR trends at a national or global scale.

In the United States, the US National Park Service (NPS) and the US Coast Guard are the 2 primary federal agencies involved in SAR activities on a daily basis. The NPS policy states that the saving of human life will take precedence over all other management actions.<sup>13</sup> Moreover, even though there is no legal mandate for the NPS to conduct SAR operations, the agency supports making reasonable efforts to search for lost persons and to rescue ill, injured, or stranded persons.<sup>13</sup> The involvement of the NPS in SAR provides an opportunity to look beyond a regional picture and increase our knowledge of SAR trends at a national scale. Thus, the purpose of this study was to identify the trends and patterns associated with SAR within the NPS from 1992–2007.

## Methods

Data for this study were collected from the Annual US National Park Service Search and Rescue Reports from 1992–2007 and from the annual SAR statistics for all

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**Table 1.** Total search and rescue (SAR) costs, incidents, fatalities, illness or injured, nonillness or injured, and saves associated with National Park Service SAR operations, 1992–2007

Year	Total SAR cost*	Total SAR operations	Fatalities	Illness or injured	Nonillness or injured	Save
2007	\$4 735 424	3593	136	1218	2566	1023
2006	\$4 524 875	3623	119	1445	2900	1211
2005	\$4 996 705	2430	152	1129	2016	402
2004	\$3 592 218	3216	127	1087	3077	815
2003	\$3 468 255	3108	124	1199	2162	427
2002	\$3 040 020	4537	129	1338	3492	1832
2001	\$3 683 086	3619	123	1502	2782	155
2000	\$2 779 967	4869	244	1471	3495	709
1999	\$3 483 500	4387	211	1366	2987	1343
1998	\$3 803 526	5761	122	2244	4763	1023
1997	\$3 433 839	4264	225	2499	4036	1020
1996	\$3 309 192	4544	297	1367	2806	953
1995	\$3 061 806	3725	156	1188	3465	496
1994	\$2 996 299	4821	175	1940	3746	778
1993	\$4 578 521	5120	160	1868	4192	635
1992	\$3 084 931	3822	159	1427	3056	390
Total	\$58 572 164	65 439	2659	24 288	51 541	13 212

\*SAR costs are not adjusted for inflation.

existing individual NPS units in 2005. When an NPS unit initiates a SAR operation, the unit completes a case incident report (NPS Form 10–343), a supplemental case incident report (NPS Form 10–344), and a search and rescue funding report (NPS Form 10–347) at the conclusion of the operation. At the end of each year these reports are summarized and submitted as an annual report to a regional office. The regional office then compiles the reports for each unit in the region and submits the information to the Branch Chief of Emergency Medical Services to be used in the Annual National Park Service Regional Search and Rescue Report. Because the reported variables were not consistent throughout all years, only data reporting the total number of SAR operations, the number of individuals requiring SAR assistance, the SAR classification (fatality, illness or injury, nonillness or injury), whether the SAR was considered a *save*, the personnel and aircraft costs, and the grand total SAR costs were reported for 1992–2007. Any SAR operation considered a *save* is defined as an operation involving a rescue where death or serious harm would have occurred without SAR intervention by NPS. The total personnel costs are defined as the total programmed (NPS employees working regular hours), unprogrammed (NPS employees working overtime or nonscheduled hours), and non-NPS employee costs.

The 2005 SAR statistics collected for each individual NPS unit contained the same data mentioned above as well as information about the day of week the SAR was

initiated, the demographics and subject activities of those requiring SAR assistance, and the factors contributing to the SAR incident. The 2005 statistics also reported the rescue environment and the rescue methods used during SAR operations, the SAR notification method, and the duration of the SAR operation. The cumulative data for each year and each NPS unit were coded and entered into spreadsheets using SPSS (version 15.0) software. The SAR costs were not adjusted for inflation. Also, SAR incident rates were not calculated as it was unclear whether NPS differentiated between incidents involving employees, visitors classified as recreational visitors, or total visitation. Total visitation includes individuals in NPS units for business or concession operations.

## Results

From 1992 to 2007 there were 65 439 SAR incidents involving 78 488 individuals in NPS units. During the 16-year period there was an average number of 4090 SAR operations per year, ranging from a low of 2430 operations in 2005 to a high of 4869 operations in 2000. During the same period there were 2659 reported fatalities, 24 288 individuals reported as either ill or injured, 51 541 individuals who were neither ill nor injured, and 13 212 individuals classified as a *save*. The total cumulative SAR cost from 1992 to 2007 was \$58 572 164 (Table 1). The average annual SAR cost was \$3.7 million, and total SAR costs ranged from a low of \$2.7 million in 2000 to a high of \$4.9 million in 2005.

**Table 2.** Most common activities requiring search and rescue (SAR) assistance in National Park Service units, 2005

<i>Activity</i>	<i>No. of incidents</i>	<i>% of SAR</i>	<i>Fatalities</i>	<i>Illness/injury</i>
Hiking	1167	48%	34	730
Day hiking (870)				
Overnight hiking (297)				
Boating	506	21%	15	116
Motorized (338)				
Nonmotor (168)				
Swimming	153	6%	15	29
Climbing	127	5%	13	84
Scrambling (39)				
Technical roped (76)				
Technical unroped (12)				
Vehicle/driving	73	3%	9	35
Canyoneering	57	2%	3	39
Mountaineering	52	2%	14	37
Roped (39)				
Unroped (11)				
Ski/snowboard (2)				
Stock (animal) riding	42	2%	0	42
Aircraft	29	1%	6	4
Snowmobile	28	1%	1	28
Fishing	27	1%	4	7
Surfing	26	1%	0	4
Biking/bicycle	25	1%	2	17
Skiing	23	1%	0	18
Suicide	23	1%	18	2

Personnel costs accounted for 49.8% of the total SAR costs from 1992 to 2007, and aircraft costs accounted for 49.7% of the total cost. Unprogrammed NPS personnel costs such as employees working unscheduled hours accounted for 59% of the total personnel costs. Direct NPS air operation costs accounted for 61% of the total aircraft costs. Another 33% was related to the use of military aircraft.

During 2005 there were 2430 SAR incidents involving 3297 individuals. The SAR operations for 2005 ended with 152 fatalities, 1379 individuals reported as ill or injured, and 2016 individuals who were not ill or injured. In addition, 402 individuals were classified as a save. As previously noted, the total SAR cost for 2005 was \$4.9 million. Out of this total, personnel costs accounted for \$2.3 million, aircraft costs accounted for \$2.1 million, vessel costs totaled \$103 529, and supply costs totaled \$469 361. Unprogrammed NPS personnel costs accounted for 65% of the personnel costs. Direct NPS air operation costs accounted for 59% of the aircraft costs. During 2005 SAR operations were most common on Saturday (18.6%), Sunday (16.6%), and Friday (11.8%),

and the majority of individuals requiring SAR assistance were male (60.2%). Requirement of SAR assistance according to age was highest for those aged 20 to 29 years (22.3%), 30 to 39 years (17.3%), and 40 to 49 years (16%). This was followed by those aged 13 to 19 years (14.2%), 50 to 59 years (13%), 60+ years (9.8%), and 0 to 12 years (7%). The most common search type was land (66%), lake (15%), river (10%), and ocean (9%). Moreover, the most common activities resulting in a request for SAR assistance were hiking, boating, swimming, canyoneering, and mountaineering (Table 2). Errors in judgment (22.3%); fatigue and physical conditioning (16.8%); insufficient equipment, clothing, or experience (15.6%); falls (8.9%); and weather (7.4%) were the most common factors contributing to the request for SAR assistance. The most common activities ending with a SAR operation classified as a fatality were hiking activities (22.8%), suicides (12.1%), swimming (10.1%), boating activities (10.1%), mountaineering (9.4%), and climbing (8.7%).

The most common SAR environment reported in 2005 was the mountain environment between 1524 m and

**Table 3.** National Park Service units with the highest occurrence of search and rescue (SAR) operations, 2005

<i>National Park Service unit</i>	<i>No. SAR operations</i>	<i>% Total National Park Service SAR operations</i>
Grand Canyon National Park (Arizona)	307	13%
Gateway National Recreation Area (New York)	293	12%
Yosemite National Park (California)	231	10%
Lake Mead National Recreation Area (Nevada)	197	8%
Rocky Mountain National Park (Colorado)	168	7%
Grand Teton National Park (Wyoming)	90	4%
Cape Cod National Seashore (Massachusetts)	79	3%
Sequoia and Kings Canyon National Parks (California)	79	3%
Golden Gate National Recreation Area (California)	78	3%
Glen Canyon National Recreation Area (Utah)	77	3%

4572 m (24%), canyons (13%), rivers (13%), lakes (12%), and mountain environments below 1524 m (11%). Only a total of 16 SAR operations took place in mountain environments above 4572 m. Moreover, the most reported SAR rescue methods were hiking (24%), watercraft (19%), helicopter rescue/evacuation (18%), litter carryout (10%), swimming (5%), and technical rescue (5%). The SAR duration was reported for only 1812 of the 2430 incidents in 2005 but indicated that 94% of all subjects were found within 24 hours. Only 2.5% of all subjects were never found. The method of requesting SAR assistance was reported for 97% of the SAR incidents; the most common notification method was in person contact (29%), landline telephone (23%), cell or satellite phone (23%), and marine/citizens band radio (5%). Moreover, out of all SAR operations in 2005, Grand Canyon National Park, Gateway National Recreation Area, Yosemite National Park, Lake Mead National Recreation Area, and Rocky Mountain National Park recorded the highest total number of SAR incidents (Table 3). Yosemite National Park, Sequoia and Kings Canyon National Parks, Rocky Mountain National Park, Grand Canyon National Park, and Denali National

Park and Preserve recorded the highest total SAR costs (Table 4). However, the NPS units with the highest average SAR costs were Wrangell-St. Elias National Park and Preserve, Denali National Park and Preserve, Mount Rainier National Park, Sequoia and Kings Canyon National Parks, and Yellowstone National Park (Table 5).

**Discussion**

Search and rescue operations in NPS units can be costly endeavors, with many of them occurring in undeveloped backcountry areas where normal emergency services are unavailable or inadequate. Because of chronic underfunding and understaffing challenges that have led to a reduction in visitor services in many NPS units, any SAR operation can place a strain on budgets used to pay for emergency services. Based on the information identified in this study, there is an average of 11.2 SAR operations occurring in NPS units across the United States each day at an average cost of \$895 per operation. Moreover, although it is fortunate that only 3.4% of the individuals

**Table 4.** National Park Service units with the highest search and rescue (SAR) costs, 2005

<i>National Park Service unit</i>	<i>SAR costs</i>	<i>% Total National Park Service SAR cost</i>
Yosemite National Park (California)	\$1 228 238	25%
Sequoia and Kings Canyon National Parks (California)	\$476 159	10%
Rocky Mountain National Park (Colorado)	\$416 260	8%
Grand Canyon National Park (Arizona)	\$400 629	8%
Denali National Park and Preserve (Alaska)	\$348 565	7%
Yellowstone National Park (Wyoming)	\$280 757	6%
Mount Rainier National Park (Washington)	\$236 606	5%
Zion National Park (Utah)	\$139 869	3%
Great Smoky Mountains National Park (Tennessee)	\$132 943	3%
Wrangell-St. Elias National Park and Preserve (Alaska)	\$117 238	2%

**Table 5.** National Park Service units with the highest average search and rescue (SAR) costs, 2005

<i>National Park Service unit</i>	<i>Total No. of SAR operations</i>	<i>Average SAR cost</i>
Wrangell-St. Elias National Park and Preserve (Alaska)	4	\$29 310
Denali National Park and Preserve (Alaska)	19	\$18 345
Mount Rainier National Park (Washington)	26	\$9100
Sequoia and Kings Canyon National Parks (California)	79	\$6027
Yellowstone National Park (Wyoming)	52	\$5339
Yosemite National Park (California)	231	\$5317
Canyonlands National Park (Utah)	20	\$3662
Zion National Park (Utah)	43	\$3253
Rocky Mountain National Park (Colorado)	168	\$2478
Great Smoky Mountains National Park (Tennessee)	63	\$2110

requiring SAR assistance were classified as fatalities and another 65.7% were neither ill nor injured, these figures must be treated with caution. For instance, the number of operations classified as a save, incidents where a rescue was performed and the individual would have likely died or suffered serious harm without SAR intervention, has the potential to raise the number of fatalities up above 15 000 deaths to a total of 20.2% of those requiring SAR assistance. This would mean that without the presence of NPS personnel trained and willing to respond to SAR situations, almost 1 in 5 of all those requiring assistance could be a fatality.

An issue frequently raised about SAR operations in NPS units is that of total SAR costs and SAR cost recovery. At present, NPS does not charge individuals requiring SAR assistance and any expense directly associated with the complete resolution of the SAR incident is authorized for funding from the agency. Incidents that cost less than \$500 are funded from base park accounts, and incidents that cost more than \$500 are generally funded from a National SAR Account. The National SAR Account consists of funding that is reprogrammed from other NPS accounts such as those for maintenance, visitor services, new construction, or new land acquisitions. In the past, calls for SAR cost recovery have typically followed high profile incidents that received national media attention. For instance, recent attention has shed light on the fact that SAR costs in Alaska's Denali National Park and Preserve and Wrangell-St. Elias National Park and Preserve range in cost from \$18 000 to \$29 000 per operation and that annual SAR costs in Yosemite National Park are more than \$1 million.<sup>1</sup> Moreover, the Yosemite costs account for 25% of the total NPS SAR costs.

Despite the obvious costs associated with SAR operations, NPS will not seek reimbursement from the people it rescues out of concern that financial considerations would possibly keep individuals from reporting

their situation or requesting SAR assistance in the early stages of distress. Also, NPS is concerned that if they ask for reimbursement the agency would become mandated to provide SAR services. This would take away the discretionary ability of the agency to decide how and when to provide SAR services and hold the agency liable for SAR-related tort actions. In addition, as an agency within the US Department of Interior, NPS is a participant member of the United States National Search and Rescue Plan, which states that SAR services provided to persons in danger or distress will be without subsequent cost recovery from the person(s) assisted.<sup>14</sup>

The 2005 results for all individual NPS units found that hiking activities were associated with almost half of all SAR incidents, 22.8% of all fatalities, and 52.9% of all illnesses and injuries. In contrast, mountaineering and climbing were only associated with 7% of the total SAR incidents yet still accounted for 18.1% of all fatalities, and suicides accounted for only 1% of all SAR incidents yet were responsible for 12.1% of all deaths. The suicide statistics are not surprising given that suicides have been recognized as the second leading cause of death in NPS units.<sup>15</sup> Likewise, mountaineering and hiking have been identified as some of the fastest growing outdoor activities and have figured prominently in mountaineering accident studies from New Zealand and SAR investigations in Alaska's NPS units.<sup>1,16,17</sup> Hiking was also specifically identified as the most common activity requiring SAR assistance in studies from Yosemite National Park, Utah's National Parks, and the state of New Hampshire.<sup>10-12</sup> The challenge this presents to NPS is that any prevention efforts made can be difficult because there is rarely any uniform time or location to connect with hikers.<sup>10</sup> Combine this with the fact that water-based activities such as swimming and boating factored in on 20.2% of all fatalities and 27% of all SAR incidents and any prevention efforts become even more challenging.

This study was limited by the use of cumulative reports that did not break SAR incidents down to the individual level with various outcomes. Hence, the identification of factors contributing to specific SAR incidents with various outcomes was impossible. Nonetheless, the data were successful at achieving the stated purpose of providing a national view of SAR trends across the country. For example, most SAR incidents occur on weekends and predominately involve males aged 20 to 29 years. Also, despite the common image of risky mountain or land-based wilderness SAR operations, it is interesting to note the presence of water-based units such as Gateway National Recreation Area, Lake Mead National Recreation Area, Cape Cod National Seashore, Glen Canyon National Recreation Area, and Golden Gate National Recreation Area figuring prominently as 5 of the 10 NPS units recording the highest number of SAR operations in 2005. National recreation areas such as these are generally located on large reservoirs of water and have a designated focus on water-based recreation. Likewise, the findings that Yosemite National Park accounts for 25% of all NPS SAR costs, that 50% of all SAR operations occur in just 5 NPS units (Grand Canyon National Park, Gateway National Recreation Area, Yosemite National Park, Lake Mead National Recreation Area, and Rocky Mountain National Park) and that the average SAR cost in Wrangell-St. Elias National Park and Preserve and Denali National Park and Preserve are double the costs of SAR operations in all other NPS units highlight areas of emphasis for future prevention efforts and a starting point for future research.

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