



Section 7

Safety Issues Related to Non-Motorized Boating



7. Safety Issues Related to Non-Motorized Boating

This assessment of non-motorized boating safety in California is based on: (1) a literature review of studies on non-motorized boating safety, (2) United States Coast Guard (USCG) boating safety reports, (3) DBW accident data for non-motorized boats over the last twelve years, (4) interviews with non-motorized boating safety experts and waterway managers, and (5) results of the random, active-user, and commercial surveys.

This section is organized as follows:

- A. Non-Motorized Boating Safety Issues and Concerns*
- B. Statistics and Demographics of Non-Motorized Boating Accidents*
- C. Reasons for Non-Motorized Boating Safety Issues and Accidents*
- D. Implications for Improving Non-Motorized Boating Safety.*

A. Non-Motorized Boating Safety Issues and Concerns

As participation in non-motorized boating increases, safety is of greater concern. In addition, when there are serious non-motorized boating accidents, they often receive high-level publicity, thus heightening concerns and fear about non-motorized boating safety. When considering activities such as whitewater paddling, non-motorized boating safety issues are often more closely associated with outdoor recreation safety, rather than with boating safety. In other cases, particularly for the casual paddler, safety concerns have many of the same characteristics as those of motorized boating.

Nationally, a significant number of non-motorized boating fatalities occur in one of three situations: (1) relatively inexperienced boaters in canoes or rowboats on flat water, without life jackets, often fishing, (2) relatively inexperienced private rafters, often without life jackets, in conditions beyond their experience level, or (3) highly experienced and well-outfitted paddlers, typically kayakers with life jackets, attempting to paddle in extreme and challenging conditions. The first two types of non-motorized boating fatalities account for more than one-half of non-motorized boating fatalities, with the third type accounting for less than one-half.

Most boating accidents, no matter what type, are a result of a combination of poor judgment and environmental conditions. The judgment component is based, in part, on an individual's perception of risk. The perceived risk associated with an activity may dictate whether a boater wears a life jacket, checks the weather report, or performs other boating safety precautions, all factors that reduce the chance of an accident.

Accident studies in manufacturing, aeronautical, medical, and maritime environments often refer to a "chain of errors" leading to an accident. The concept is that "accidents are

not usually caused by a single failure or mistake, but by the confluence of a whole series, or chain, of errors.”¹ This concept of a progressive series of events, many of which alone would be minor, but cumulatively leading to serious accidents, applies to many non-motorized boating accidents as well. Typically, when human-error is involved (for example an incorrect decision, improperly performed action, or inaction), one poor decision may lead to another, with the final result being calamitous.

There are various theories of risk and risk-seeking activities. Risk homeostasis theory basically states that people subjectively accept a certain level of risk in any activity, and that they maintain a level of risk they are comfortable with.² Thus, if they perceive that an activity is riskier, such as paddling in whitewater, they will take action to reduce the risk, such as wearing a life jacket. Each person has their own acceptable level of risk, and for a whitewater kayaking enthusiast, that acceptable level is much higher than for a weekend canoeist. Accidents often result when the perceived level of risk and the actual level of risk are not the same.

There is inherent risk in most outdoor activities, although statistically speaking, often not greater than normal daily life. Studies of outdoor activities often favorably compare the risk of the activity – kayaking, mountain biking, climbing, etc. – with day-to-day activities such as driving a car.

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The following discussion of non-motorized boating safety issues analyzes statistics and demographics that provide insights into various types of non-motorized boating accidents and safety concerns. This discussion examines the reasons for non-motorized boat accidents, and discusses implications for improving non-motorized boating safety.

B. Statistics and Demographics of Non-Motorized Boating Accidents

There are a number of data sources and compilations of non-motorized boating accidents. Most motorized and non-motorized boating safety analyses are based, at some point, on accident data from the United States Coast Guard (USCG).

1. USCG Accident Data

The USCG requires the operator of any registered vessel, or vessel used for recreational purposes, to file a Boating Accident Report (BAR) when: (1) a person dies; or (2) a person is injured and requires medical treatment beyond first aid; or (3) damage to vessels or property exceeds \$2,000 or there is a complete loss of vessel; or (4) a person disappears from the vessel.³ The USCG database does not include accidents or vessels from commercial activities (such as commercial guide trips), and does not include many non-fatal accidents, as USCG believes that “only a small fraction of all non-fatal boating accidents occurring in the United States are reported to the Coast Guard, State, or local law enforcement agencies.”⁴

In California, boaters typically report accidents to local law enforcement agencies, who report to the DBW, who in turn submits accident reports to the USCG. The USCG reports accidents by boat type or by state, although not for both together, so there are no USCG California-specific data on non-motorized boating accidents. In addition, USCG boating categories for non-motorized boats are limited to: canoe/kayak (in some cases separated into two categories), inflatables, and rowboats. While these boat types are often used without motors, they may also be used with motors. The USCG data does not distinguish between motorized and non-motorized use. There also is a sail category, which could include small sailboats. There is no USCG category for windsurfing accidents.

Table 7.1
USCG National Boating Accident Data (2005)

Category	Number
Total fatalities (all boats)	697
Total injuries (all boats)	3,451
Canoe/kayak fatalities	78
Canoe/kayak injuries	72
Inflatable fatalities	22
Inflatable injuries	31
Rowboat fatalities	39
Rowboat injuries	7

Table 7.2
USCG National Fatality Data for Canoes and Kayaks (2005)

Fatalities	Canoes	Kayaks
Drownings	40	24
With life jacket	3	14
Without life jacket	37	10
Percent without life jacket	93%	42%
Other deaths	9	5
Total	49	29

Table 7.1, above, provides a summary of 2005 USCG accident data. In 2005, nationwide, there were 697 boating fatalities and 3,451 boating injuries reported to the USCG. A total of 4,969 vessels were involved in reported accidents. Non-motorized vessels (canoes, kayaks, inflatables, and rowboats) appear to have made up a significant portion of the fatalities, accounting for 139 deaths, or 20 percent of the total. Non-fatal accidents for these three non-motorized boat categories also appear to have been drastically underreported. Only 221 non-motorized vessels were involved in accidents, just 4 percent of the total. However, 63 percent of these reported non-motorized boating accidents resulted in fatalities. Clearly, only the most serious non-motorized boating accidents were being reported.

The USCG accident data, shown in **Table 7.2**, left, appear to reflect that boaters participating in perceived low risk activities, such as canoeing, tend not to wear life jackets, and those participating in perceived high risk activities such as kayaking, more often wear life jackets. In 2005, there were more deaths resulting from canoeing, without a life jacket, than from any other type of non-motorized boating.

2. DBW Accident Data

The DBW compiles and reviews data for all boating accidents reported in California, including non-motorized boat accidents. This subsection summarizes DBW non-motorized boat accident data from 1995 to 2006. As with the USCG data, these data likely include the majority of actual fatality accidents, and only a small portion of actual injury accidents.

Over the twelve year period, there were 242 reports filed for accidents involving non-motorized boats. The number of separate incidents is just over 200, as one report is filed for each boat involved in an accident. There were 168 accidents involving a single boat, 33 accidents involving two boats, and three accidents involving more than two boats each.

The number of non-motorized boating fatalities for the twelve years between 1995 and 2006 was 95, and the number of injuries was 139.^a **Table 7.3**, on the next page, summarizes the total number of annual fatalities and injuries since 1995. Based on this accident data and the estimated participation days of non-motorized boating in 2006, the risk of suffering a fatality or injury accident in non-motorized boating is relatively low. In 2006, there were 1.4 fatalities per 10 million participation days of non-motorized boating, and 3.3 reported injuries per 10 million participation days of non-motorized boating. By means of comparison, there were 35 motorized boating fatalities in California in 2006.

^a In a few cases, more than one injury or death was reported on a single accident report, thus deaths and injuries sum to 234, not the number of accident reports, 242.

Table 7.3
Non-Motorized Boating Accident Deaths and Injuries in California (1995 to 2006)

Year	Number of Deaths	Number of Injuries
1. 1995	8	11
2. 1996	8	11
3. 1997	7	16
4. 1998	15	6
5. 1999	7	13
6. 2000	7	6
7. 2001	2	13
8. 2002	5	14
9. 2003	12	17
10. 2004	4	4
11. 2005	13	12
12. 2006	7	16
Total	95	139

Table 7.4
Type of Non-Motorized Boating Accident in California (1995 to 2006)

Type of Accident	Number of Reported Accidents
Capsizing	114
Collision with vessel	59
Falls overboard	23
Collision with fixed object	8
Flooding/swamping	8
Fall in boat	8
Struck submerged object	7
Struck by motor/propeller	3
Collision with floating object	1
Fire/explosion	1
Other/unknown	10
Total	242

Table 7.4, left, summarizes the type of accident for each of the 242 reported non-motorized incidents. The most frequent types of accidents were capsizing, followed by collisions with vessels and falling overboard.

Over 90 percent of the California fatalities were due to drowning.^b The most commonly identified activities of fatality victims were: whitewater activities (36 victims); fishing (15 victims); and recreating (15 victims). General paddling activities were identified for the remaining 29 victims. **Table 7.5**, on the next page, identifies the vessel type for non-motorized fatality and injury accidents.

Accidents occurred on all types of waterways, and in all regions of the State. The waterways with the most accidents generally are a reflection of the waterways with the most use, although some waterways, such as the Yuba River and Trinity River, have higher numbers of accidents than would be expected for their use levels. During the twelve years for which data were analyzed, non-motorized boating accidents were reported on 87 different waterways. The ten waterways with the greatest number of reported accidents, are identified in **Table 7.6**, on the next page.

California non-motorized boating accident data generally reflects the non-motorized boating accident trends identified in national studies. Similar to other studies, only one-third of deaths were due to whitewater activities, while the remaining deaths occurred while the victim was fishing, recreating, or generally paddling. This finding again reflects the split between types of non-motorized accidents, with most accidents taking place during perceived low-risk activities such as fishing, and fewer than expected accidents occurring during perceived high-risk activities, such as whitewater boating.

^b Although not directly related to non-motorized boating, river managers raised concerns about drowning accidents among individuals recreating alongside rivers and waterways. Often these individuals are not aware of river currents. As a result of this issue, the State Coastal Conservancy has funded bilingual safety signage for some locations on the coast and Russian River.

3. American Whitewater Accident Data

American Whitewater, a national non-profit organization focused on both conserving whitewater resources and safety, also maintains an accident database.⁵ The large majority of accidents reported in the American Whitewater database were fatalities. The American Whitewater database includes accidents that are self-reported by paddlers, and may not necessarily be reported to the State.

There were 92 California accidents in the American Whitewater database, covering the period from May, 1980 to July, 2006. Most of these accidents (79) were fatalities, occurring on over thirty different rivers, a lagoon, and a lake. The rivers with the greatest number of fatalities were the South Fork of the American River (11), the Kern River (10), and the Tuolumne River (9).

A more detailed analysis of the 29 accidents occurring since 2000, found 27 fatalities and 2 near drownings. Thirteen accidents involved rafts, and eleven involved kayaks (including inflatable and sit-on-tops). Three of the thirteen raft accidents involved commercial trips, with the remaining ten private. When the experience level of the boater was known, it was almost evenly split between experienced (12) and inexperienced (14) boaters.

Accidents since 2000 were spread evenly between twenty rivers and one lake; however, Cache Creek had three fatalities, as did the Tuolumne River. The types of accidents at these two waterbodies reflected the differences in non-motorized boating accidents.

One set of accidents involved private rafters, often inexperienced, and in a few cases without life jackets. Another set of accidents involved experienced boaters, typically kayakers, trapped in sieves, strainers, undercuts, or tree pins. In most cases, rescue attempts were unsuccessful, and in one case, the rescuer drowned.

Table 7.5
Number of Non-Motorized Boating Death and Injury Accidents by Vessel Type in California (1995 to 2006)

Vessel Type	Number of Deaths	Number of Injuries
Canoe/kayak	47	69
Raft	32	35
Rowboat	9	14
Sailboard	3	10
Kiteboard	1	1
Small sailboat	1	1
Paddle boat	1	5
Amphibious Tricycle	1	0
Inflatable dinghy	0	1
Rowing scull	0	3
Total	95	139

Table 7.6
Top Ten Waterways for Non-Motorized Boating Accidents in California (1995 to 2006)

Waterway	Region	Number of Accidents
1. Pacific Ocean	NC, SF, CC, SC, SD	32
2. American River	SB	18
3. Trinity River	SB, NC	11
4. Lake Tahoe	SB	10
5. Yuba River	SB	10
6. Lake Isabella	CV	8
7. San Francisco Bay	SF	8
8. Sacramento River	SB	8
9. Russian River	NC	7
10. Kern River	CV	6

In addition to the accident database, American Whitewater prepares a National Accident Study, the most recent of which was published in 2006.⁶ The study analyzed USCG and American Whitewater accident data from 1995 through 1998, but also included fatality trends from previous reports, going back to 1977. Between 1977 and 1998, the number of “non-motorized human powered boating” fatalities nationally ranged from 83 to 163 per year. Nationally, American Whitewater found that accidents in flatwater were slightly more common than accidents in whitewater, with only a small percentage (less than 10 percent) of accidents occurring in the ocean.

The majority of accidents involved either canoes or whitewater kayaks, with fewer rafting accidents, and even fewer sea kayaking accidents. Most canoe accidents were in flatwater, and most victims were not wearing life jackets. Sea kayakers had far fewer accidents, mostly resulting from bad weather or sudden, unexpected weather changes. Whitewater kayaking accidents (as well as whitewater rafting accidents) were most often caused by river and water conditions such as strainers, sieves, and being caught and held in hydraulics.

4. American Canoe Association Accident Analysis

In 2004, the American Canoe Association (ACA), the oldest recreation-based waterway conservation organization in the country, published a report, *Critical Judgment II Understanding and Preventing Canoe and Kayak Fatalities 1996-2002*.⁷ The ACA’s report also utilized USCG boating accident data for canoes and kayaks. The purpose of the report was to improve knowledge about canoe and kayak fatalities in order to more effectively reduce the risk of these activities. The ACA analysis of USCG data supports that of other organizations in identifying fatality characteristics.

Over the seven years of the ACA’s analysis, 76 percent of canoe and kayak fatalities involved capsizing, with capsizing probability about the same between canoes and kayaks, and as likely on calm water as on choppy or rough water. Hazardous water or weather was more likely to be a cause of kayak fatalities (46 percent of the total), than canoe fatalities (20 percent). Alcohol was more often a factor in canoe fatalities (25 percent), than kayak fatalities (9 percent). Alcohol use was a greater problem in calm water, as was a lack of life jackets. The ACA analysis found that about 90 percent of canoe and kayak fatalities were males, and about 50 percent of victims were fishing at the time of the accident. Most canoe accidents involved aluminum and/or inexpensive canoe brands.

5. Safety Concerns from Random, Active-User, and Commercial Surveys

Two-thirds of the statewide random survey respondents indicated that they had safety concerns related to non-motorized boating. Respondents were asked to identify those concerns, from a list of options. Respondents could identify as many concerns as they chose. **Table 7.7**, on the next page, summarizes the safety concerns of statewide random survey respondents. **Table 7.8**, on the next page, summarizes the safety concerns of active-user survey respondents.

The safety issues raised by survey respondents reflect those issues that non-motorized boaters are concerned about. These are not necessarily the same problems, or concerns, that result in injury and fatality accidents. For example, non-motorized boaters were most concerned about interactions with motorized boaters. This is a valid safety concern; however, interactions with motorized boaters were not the primary cause of non-motorized boating accidents.

The active-user survey respondents had more safety concerns than the statewide random survey respondents, which is expected given that this group is on the water more frequently. For both groups, interactions with motorized vessels was the greatest concern, with one-third of statewide random boaters, and two-thirds of active-user boaters, identifying this issue.

Inexperienced or unprepared boaters was the second-most mentioned safety concern for both survey groups. After these two safety concerns, the two survey groups diverge. The statewide random survey respondents were also concerned, in order, about boaters not using life jackets, unsafe water conditions, and water quality. The active-user survey respondents were more concerned about water quality, overcrowding, and unsafe water conditions. The active-user survey respondents identified several additional safety concerns that reflect their more frequent use of more remote waterways, such as vandalism of parked cars, hostile landowners, and dangerous access to water. Both kiteboarders and others expressed the need for safe launching and kiting areas for this new activity.

Approximately two-thirds of commercial and institutional survey respondents identified safety concerns. **Table 7.9**, on the next page, summarizes the safety concerns of commercial and institutional operators.

For commercial and institutional respondents, the key safety issue was inexperienced boaters. Most respondents noted that they were concerned about inexperienced private boaters that they see on the waterways, as opposed to inexperienced commercial operations, although a few respondents mentioned the latter concern as well.

Table 7.7
Safety Concerns of Statewide Random Survey Respondents, Percent of Respondents with Concerns (2006) (n=193, with 294 total responses)

Safety Concern	Percent of Respondents with Concern*
Interactions with motorized vessels	35%
Inexperienced or unprepared boaters	25%
Boaters not using life jackets	18%
Boating in unsafe water conditions	17%
Waterborne illness/poor water quality	15%
Problems related to overcrowding	13%
Using unsafe boats or equipment	12%
Boating in unsafe weather conditions	9%
Boaters using alcohol	3%
Hunters near boating areas	1%
Other	4%

* Sums to greater than 100% due to multiple answers per respondent.

Table 7-8
Safety Concerns of Active-User Survey Respondents, Percent of Respondents with Concerns (2006) (n=1,171, with 3,627 total responses)

Safety Concern	Percent of Respondents with Concern*
Interactions with motorized vessels	67%
Inexperienced or unprepared boaters	61%
Boaters not using life jackets	22%
Boating in unsafe water conditions	32%
Waterborne illness/poor water quality	50%
Problems related to overcrowding	33%
Using unsafe boats or equipment	16%
Boating in unsafe weather conditions	22%
Boaters using alcohol	1%
Hunters near boating areas	<1%
Marine life	1%
Need for safe kitelaunching and kiteboarding areas	1%
Vandalism and security at parking areas	1%
Hostile landowners	1%
Need for better/faster rescue support	1%
Interactions with sailboats or surfers	<1%
Not observing channel traffic, or poorly marked harbor channels	<1%
Dangerous access to water	<1%
Other	1%

* Sums to greater than 100% due to multiple answers per respondent.

Table 7.9
Safety Concerns of Commercial/Institutional Survey Respondents, Percent of Respondents with Concerns (2006) (n=72, with 249 total responses)

Safety Concern	Percent of Respondents with Concern*
Interactions with motorized vessels	46%
Inexperienced or unprepared boaters	75%
Boaters not using life jackets	38%
Boating in unsafe water conditions	49%
Waterborne illness/poor water quality	29%
Problems related to overcrowding	26%
Using unsafe boats or equipment	31%
Boating in unsafe weather conditions	32%
Boaters using alcohol	6%
Dangerous access to water	8%
Lack of enforcement of boating laws	3%
Other	4%

* Sums to greater than 100% due to multiple answers per respondent.

There was growing concern among commercial outfitters that as it becomes easier and cheaper to own a non-motorized boat, uneducated novice boaters are placing themselves in harm’s way. Any increase in non-motorized boating accidents deters the general public from participating in the activity, even when accidents are a result of new boater negligence.

Almost one-half of commercial respondents also identified boating in unsafe water conditions, and interactions with motor boats, as safety concerns. Several commercial respondents noted that certain access locations and trails to the water are dangerous, sometimes resulting in injuries to guides and/or customers.

6. Studies of Non-Fatal, Non-Motorized Boating Accidents and Injuries

Fatal accidents are the most significant and problematic non-motorized boating safety concern. However, there are other safety issues that have been addressed in the literature, ranging from acute injuries, to chronic overuse injuries, to waterborne illness. Accidents and overuse injuries are typically specific to the sport, while waterborne illness may be an occupational hazard of water-based activities.

Waterborne Illness and Non-Motorized Boating

Several studies have examined waterborne illness among participants in water sports. Fewtrell et al., examined health effects from marathon canoeing and rowing in varying water qualities, and found that “health effects of low-contact water sports are minimal, within the water quality ranges which were studied.”⁸ Several studies have examined illness among windsurfers due to polluted water. However, a paper and Internet survey of 294 windsurfers completed in 1997 did not discuss the topic.⁹ In a year 2000 survey of 319 whitewater kayakers and canoeists, 14.5 percent reported giardia infections, compared to only 4 percent for the U.S. population overall,¹⁰ and other studies of kayak and rafting injuries have found similar infection rates.¹¹

Over one-third (37 percent) of all active-user survey respondents identified poor water quality as a concern. The concern was greatest among respondents in Southern California, and a number of respondents commented that they have gotten ill from water contact after boating on certain waterways. Fewer commercial survey respondents (19 percent) and statewide random survey respondents (8 percent) identified water quality as a concern.

Whether or not a respondent identifies water quality as a concern depends in large part on where they participate in boating. Water quality

was a significant concern among many boaters using the Long Beach area (Mother's Beach, Naples, Alamitos Bay), Marina del Rey, the Oakland Estuary, and the Klamath River.

Acute and Chronic Injuries

Acute and chronic injuries are often unique to a particular non-motorized boating activity. The four areas that have been most studied and documented are whitewater canoeing, rafting, kayaking, and windsurfing.

One study of whitewater injuries identified four injury categories: (1) trauma from striking an object in the river or equipment; (2) trauma resulting from the paddlers' positioning or equipment and the force of the water; (3) overuse injuries; and (4) submersion and environmental injuries.¹² Acute kayak injuries typically included shoulder dislocations and other upper-body injuries, and injuries to the face, head, and neck. Acute rafting injuries were more often the result of being struck by a paddle, or striking an object after being thrown from the raft. Canoeists were more likely to suffer acute injuries to the knee or leg.¹³ Chronic injuries were common among kayakers, mostly involving the shoulder or wrists. Canoeists suffer chronic injuries from the elbow or forearm. Studies have not evaluated chronic injuries of rafting guides.

An on-site and Internet survey of about 300 windsurfers conducted in the late 1990s, found that direct injury from the windsurfing apparatus resulted in 65 percent of acute injuries.¹⁴ Most of these injuries were caused by the boom, footstrap, or mast. Most acute windsurfing injuries occurred when jumping or in high-speed falls. The most common acute injuries, mostly to the lower extremities, consisted of sprains, lacerations, contusions, and fractures. About one-half of the respondents reported chronic injuries, predominantly lower-back pain, neck pain, and tendonitis of the elbow.

Table 7.10
Reasons for Non-Motorized Boating Safety Problems and Accidents

Natural or Environmental Factors

- Weather conditions (winds, changing weather patterns, rain, lightening)
- Water conditions (temperature, hydraulics, high flow rates, rapids, low-head dams, surf)
- Obstacles (rocks, strainers, sieves, logs)

Boater-Related Factors

- Lack of adequate skills
- Lack of adequate equipment (inadequate boat, no life jacket)
- Lack of adequate information (related to weather and/or water conditions)
- Lack of knowledge (related to boating, equipment)
- Poor judgment
- Inattention
- Contact with equipment (ropes, paddles, boom, board)
- Chronic injuries

C. Reasons for Non-Motorized Boating Safety Issues and Accidents

Non-motorized boating safety problems and accidents are typically the combined result of boater's actions or judgment, and natural or environmental factors. For example, a whitewater kayaker that is not aware of current high flows may be more likely to encounter rapids that are too difficult for their skill level, and become trapped or capsize in fast-moving and cold water. **Table 7.10**, above, summarizes common natural and boater-related safety factors.

Table 7.11
Life Jacket Wear Rates for Non-Motorized Boating Types (2005)

Boat Type	Adults, Percentage Wearing Life Jacket	Youths, Percentage Wearing Life Jacket
Kayak	74%	89%
Rowboat/Dinghy	59%	77%
Sailboard	53%*	100%
Inflatable/Raft	44%	67%
Canoe	15%	69%

* This 53 percent figure appears high based on anecdotal observations in California. The figure is based on twenty (20) observations in the USCG life jacket wear rate study.

The ACA identified several unique factors typically associated with non-motorized boating that can increase the risk of these activities:

- The size and shape of canoes and kayaks make them unstable, and more prone to capsizing, particularly in choppy waves or surf.
- Many novice boaters appear to “not take the craft seriously”, having little or no safety skills and not wearing a life jacket.
- Because the craft are small and hand-powered, they are susceptible to weather conditions, indicating a need to check weather and water conditions before boating, and wear proper clothing.
- Whitewater paddlers must be knowledgeable about, and able to maneuver, hazardous conditions such as low-head dams and strainers.
- Coastal paddlers must be knowledgeable about surf conditions and hazards.
- For those paddling in remote locations, it may be difficult to obtain help in the case of an emergency, thus reducing the margin for error.

The comments of paddling representatives in a USCG sponsored discussion related to requiring spousons (stability/flotation devices) in canoes illustrate several perspectives on non-motorized

boating safety and a consensus that regulation is not the answer. One organization representative stated that there was an “innocent canoeist problem” and that education was more appropriate than regulation.¹⁵ Another pointed out that “good judgment could not be replaced with regulation.”¹⁶ Another respondent in the dialog thought that skilled paddler fatalities were “purely due to overconfidence”, and thus regulations would not prevent them. As the director of a canoeing center said, “a large portion of the enjoyment value of the sport comes from matching personal skills with the performance possibility of the various craft.”¹⁷

Non-Motorized Boats and Life Jackets

Use of life jackets is an ongoing boating safety issue, and one that has been extensively studied by the USCG. The USCG conducts an annual observational survey of life jacket wear rates for all boat types.¹⁸ For the last eight years, the USCG has made observations on over 115,000 boats and 300,000 boaters in thirty states, averaging four sites per state (eight in California). About 10 percent of the boats observed each year are in the “other” category, which includes canoes, kayaks, rafts, and sailboards. The overall life jacket wear rate for all ages and boats was 23 percent in 2005.

For adults, kayaks had the highest life jacket wear rate, 74 percent, although this rate was lower than in previous years, when it has been in the mid-80 percent range. In 2005, canoe life jacket wear rates for adults were extremely low, at 15 percent. Life jacket wear rates for youths under 18 in canoes were much higher, 69 percent. Wear rates for youths were higher than for adults in all boat categories.

Table 7.11, above, summarizes life jacket wear rates for non-motorized vessels. The USCG study analyzed a number of factors related to life jacket wear rates, and concluded that the adult life jacket wear rate is the “product of an assessment of risk of falling

Table 7.12
Boat Operators and Life Jacket Habits in California (2002)

Boat Type	Carried enough life jackets for all on board	Carried at least one life jacket	Did not carry a life jacket	“Always” wear a life jacket	“Most of the time” wear a life jacket	“Sometimes” wear a life jacket	“Rarely” wear a life jacket	“Never” wear a life jacket
Canoe	96.8%	3.2%	0.0%	65.6%	3.1%	0.0%	9.4%	21.9%
Kayak	98.4	1.6	0.0	72.3	9.2	6.2	9.2	3.1
Inflatable	73.7	15.8	10.5	38.1	0.0	9.5	4.8	47.6
Rowboat	93.3	6.7	0.0	40.0	33.3	0.0	6.7	20.0
Sailboat (sail only)	91.7	0.0	8.3	36.4	0.0	27.3	0.0	36.4

overboard, or capsizing, plus an assessment of the seriousness of the consequences of falling overboard, or capsizing.”¹⁹ Thus, whitewater kayakers realize the risk of the activity, and almost universally wear life jackets, while a canoeist on a calm lake is less likely to wear a life jacket. However, as the accident data shows, the canoeist is more likely to suffer a fatal accident.

The 2002 *National Recreational Boating Survey*, also conducted for the USCG, interviewed over 25,000 registered and unregistered boat owners, including almost 500 in California. This study asked about life jacket use for several boat types. The results, summarized above in **Table 7.12**, indicate that canoes and kayaks have high life jacket wear rates, while the other three boat types all have relatively low life jacket wear rates. In general, even these low life jacket wear rates are higher than life jacket wear rates for motorized boats.

D. Implications for Improving Non-Motorized Boating Safety

Boaters cannot change weather and water conditions; however, boaters can avoid many accidents by changing their own behavior and how they respond to challenging natural conditions.

The American Whitewater study found that many deaths were preventable by taking one or more of the

following simple precautions: (1) wearing life jackets, (2) better assessing water conditions, or (3) using proper (warm/water proof) clothing.

Both American Whitewater and the American Canoe Association had similar recommendations related to improving non-motorized boating safety. These were essentially to: (1) provide better reporting of accidents; (2) improve coordination and communication between paddling interest groups and government agencies; and (3) increase education efforts.

American Whitewater’s recommendations included: (1) working with the USCG to improve detail reporting and accident descriptions to obtain better information related to paddling and using whitewater class rates,²⁰ or at least “no current”, “fast current”, or “whitewater rapids”; (2) strengthening partnerships between organizations interested in paddling safety, such as American Whitewater, American Canoe Association, USCG, paddling equipment manufacturers, local clubs, states, etc.; and (3) developing safety programs aimed at three distinct target audiences: expert kayakers, recreational kayakers and rafters, and casual canoeists.

The ACA noted a gap in paddling safety education, after the American Red Cross dropped their paddling safety programs ten years ago, coincident with an almost exponential growth in

paddling popularity. The ACA also noted that reducing paddling fatalities will require coordination and commitment by many organizations. The ACA, with others, is developing a *Paddlesports and Safety Awareness National Plan of Action*. The ACA noted a need to target particular populations of boaters, for example, infrequent or casual paddlers (the fishing canoeists not wearing life jackets).

The ACA strategy recommends: (1) improved accident reporting; (2) adequate funding for increasing knowledge about paddlesport safety issues among State boating officials, accident investigators, and boating safety educators; (3) funding for development and testing of new safety messages aimed at the target groups; and (4) funding for signage and other efforts to inform boaters about public hazards (low head dams, high water levels).

The ACA also noted that many canoe accidents occur when boaters stand up or move around in the boats, a problem that can be addressed by education. Safety education is an important component of the ACA's strategy.

This type of education effort is important, and it should be geared toward specific target groups. The USCG has been tracking life jacket wear rates for all boating activities for eight years. During this time, there have been extensive campaigns related to wearing life jackets. Life jacket wear rates for children and youths have increased during this time. There has been essentially no change in life jacket wear rates in adults.

The ACA suggests that education and marketing efforts to increase life jacket wear rates could be modeled after successful anti-smoking and seatbelt campaigns. The DBW has a number of different boating education campaigns and coordinates with national safety campaigns as well. Many of these efforts are directed at motorized boating.

California river managers identified several safety recommendations related to whitewater river use. There was widespread interest in more, and better, education of boaters. A recurring comment was educating inexperienced boaters about water and rapid conditions. Recommendations included more and better use of signs, as well as stationing river patrols on-site at put-ins to educate boaters. Use of appropriate life jackets was also a concern, as some novice private boaters use waterski vests, or other inappropriate life jackets that do not provide adequate protection for whitewater boating.

Most whitewater rivers have river patrols during the busy summer months, although in many cases there is not enough staffing to fully cover a river. River patrols can provide more rapid response in emergencies, as well as educate boaters and enforce requirements along the river to help prevent accidents.

Addressing non-motorized boating safety among experienced whitewater boaters will take a different approach than reaching the casual weekend canoeist. For this experienced group, promoting swiftwater rescue courses (a requirement for many commercial guides) and other advanced skill classes would be beneficial.

Even on non-whitewater rivers, such as the Russian River, proper signage is needed for portaging locations. Paddlers may place themselves in unsafe situations if they are unaware of the need to portage, or of which side of the river they must be on in order to portage. Paddlers also need to be made aware of restricted areas, such as swimming spots, so they can be safely avoided.

As the number of non-motorized boaters grows, so does the need to educate novice boaters about the safety requirements of their new activity. At the same time, many non-motorized boaters expressed a need for increased education and enforcement of motorized boaters.

Section 7 Endnotes

- ¹ Dr. Anita M. Rothblum, "Human Error and Marine Safety," U.S. Coast Guard Research & Development Center, available at: http://www.uscg.mil/hq/gm/risk/E-Guidelines/RBDM/html/vol4/Volume4/Gen_Rec/HumanErr.htm
- ² Potomac Management Group, *The Efficacy of Sponsons on Canoes and Kayaks* (Washington DC: Prepared for USCG, Office of Boating Safety, July 2004).
- ³ USCG, *Boating Statistics 2005* (Washington DC: USCG, August 31, 2006).
- ⁴ *Ibid.*, 2.
- ⁵ American Whitewater, www.americanwhitewater.org/content/accident/view.
- ⁶ Jennifer L. Plyler, Ph.D. American Whitewater's National Accident Study (Cullowhee, North Carolina: American Whitewater, February 6, 2006).
- ⁷ Alison Snow-Jones, Ph.D., and others. *Critical Judgment II Understanding and Preventing Canoe and Kayak Fatalities 1996-2002* (Springfield, Virginia: American Canoe Association (ACA), 2004).
- ⁸ L. Fewtrell et al., "The health effects of low-contact water activities in fresh and estuarine waters." *Journal Inst. Water Environ. Management* 8 (1994): 97-101.
- ⁹ Christopher Van Tilburg, MD, "Editorial: WWW: wilderness, windsurfing, and the web." *Wilderness and Environmental Medicine* 10 (1999): 216-217.
- ¹⁰ Richard G. Schoen, MD, and Micael J. Stano, MSPT, CSCS. "Year 2000 whitewater injury survey." *Wilderness and Environmental Medicine* 13 (2002): 119-124.
- ¹¹ David C. Fiore, MD, "Injuries associated with whitewater rafting and kayaking." *Wilderness and Environmental Medicine* 14 (2003): 255-260.
- ¹² Fiore, 2003.
- ¹³ Schoen and Stano, 2002.
- ¹⁴ Andrew T. Nathanson, M.D., FACEP, and Steven E. Reinert, M.S.. "Windsurfing injuries: results of a paper- and Internet-based survey." *Wilderness and Environmental Medicine* 10 (1999): 218-225.
- ¹⁵ Potomac Management Group, *The Efficacy of Sponsons on Canoes and Kayaks* (Washington DC: Prepared for USCG, Office of Boating Safety, July 2004).
- ¹⁶ Potomac Management Group, 2004, 5.
- ¹⁷ Potomac Management Group, 2004, 2.
- ¹⁸ Thomas W. Mangione, et al., National PFD Wear Rate Observational Study, 2005 (Boston, Massachusetts: JSI Research & Training Institute, Inc. for USCG, 2006). [Note: USCG now uses the term "life jacket" instead of PFD (personal flotation device)]
- ¹⁹ *Ibid.*, 40.
- ²⁰ American Whitewater's International Scale of River Rafting Difficulty provides a six-class system of ranking rivers. The particular ranking of a river can vary based on water flows, and temperatures:
 - Class I is a river with moving water with few riffles and small waves, and no or few obstructions.
 - Class II is a river with easy rapids, waves up to three feet, and wide clear channels.
 - Class III has rapids with high, irregular waves, narrow passages, may require scouting, and requires some experience.
 - Class IV rivers include long, difficult rapids and constricted passages, precise maneuvering, scouting, and requires the boater have the ability to roll a canoe or kayak.
 - Class V rivers are extremely difficult, with long, violent, and congested rapids requiring scouting, and with difficult rescue conditions.
 - Class VI rapids are nearly impossible and very dangerous, for experts only.