

Hostile Waters

**The Impacts of Personal Watercraft
Use on Waterway Recreation**



By David Jenkins



**American
Canoe
Association**

Windsurfer killed by an illegally speeding jet ski

PWCs: Unlicensed Mayhem

Jet skis are unsafe for people, a menace to the environment

Illinois woman killed in collision on water

Swatting Those Buzzing ‘Wet Bikes’

Death on jet ski linked to teen’s inexperience

Out of control on the water

Personal Watercraft: The Noise that Annoys

Warning out for hoons on jet skis

Woman feared dead after boat, jetski crash

Jet skis kicking up a lot of ill will

Riding a Wave of Pollution, Noise, and Danger

Time to silence the death rattle

Woman dies in water scooter crash

Watercraft Operator Dies in High-Speed

Collision With a Flying Duck

Nature Versus Noise

Turning the watercraft tide around

Death, Injury in the Wake

Big Lake collision hurts girl

Increase in water scooters churns up safety concerns

(actual newspaper headlines)

TABLE OF CONTENTS

About the American Canoe Association			
I. Introduction	1		
<i>Sidebar: Personal Watercraft Defined</i>			
II. The Impacts	2		
<i>Sidebar: The Numbers</i>			
Unsafe Waters	3		
PWC Accident Types	4		
Collisions with Vessels			
Collisions with Objects			
Collisions with People			
Other Accidents			
PWC Accident Causes	7		
Inattention/Inexperience			
<i>Sidebar: Flawed By Design</i>			
Excessive Speed			
Reckless Operation/Harassment			
Drug/Alcohol Impairment			
Additional Risk Factors	11		
Crowded Waterways			
Enforcement Difficulty			
Exposure			
Education			
Summary of Findings	16		
Unenjoyable Waters	17		
Disturbing Design			
Speed & Maneuverability			
Noise			
Shallow Draft			
Visible Pollution			
Corrupting Influence?			
No Escape			
<i>Sidebar: Conflicting Ideas of Fun</i>			
		Damaged Waters	24
		Water Pollution	
		Air Pollution	
		Near-Shore Impacts	
		Impacts on Wildlife	
		III. The Regulatory Environment	30
		State & Local Government	30
		Federal Government	32
		National Park Service	
		US Fish & Wildlife Service	
		United States Coast Guard	
		USDA Forest Service & Bureau of Land Management	
		US Army Corps of Engineers	
		National Oceanic and Atmospheric Administration	
		Environmental Protection Agency	
		<i>Sidebar: The Political Landscape</i>	
		Recommendations	37
		IV. Conclusions	41
		Appendix A: State PWC Regulations At A Glance	42
		Appendix B: National Level Stakeholder List	44
		References	45
		Acknowledgments	Inside Back Cover



**American
Canoe
Association**
7432 Alban Station Blvd.
Suite B-232
Springfield, VA 22150
703-451-0141
www.acanet.org

Cover photo: PWC running whitewater rapids on Ottawa River. Photo by Dan Gavere



Photo by Dr. Neal Schroeter



Mission: The American Canoe Association (ACA) is a national nonprofit membership organization dedicated to promoting canoeing, kayaking and rafting as safe and enjoyable lifetime recreation, while working to protect and preserve the waterways on which those activities depend.

History: Founded in 1880 by a small group of avid outdoorsmen in the State of New York, today ACA is the nation's oldest and largest nonprofit organization serving the paddlesport community. ACA also holds the distinction of being the oldest recreation-based waterway conservation organization in America and ranks among the country's oldest sporting organizations.

Membership: ACA currently has more than 50,000 individual members enrolled in a variety of membership categories, with an additional 50,000 individuals affiliated through a nationwide network of local ACA-affiliated paddling clubs. During the past decade, ACA experienced a tenfold increase in its membership base as the Association expanded its marketing and programs.

Program Areas: The primary mission-based programs and services provided by ACA include: waterway conservation and access; safety education and instruction; athletic competition, recreation and public education.

Waterway Conservation Activities: ACA is dedicated to the preservation and protection of America's natural areas, focusing primarily on rivers, streams, lakes, coastal waterways and their surrounding environments. ACA is active in a wide variety of efforts from promoting stewardship to advocacy on issues important to paddlers. ACA weighs in on resource management plans, public land funding and policy issues, water quality standards, pollution limits, user conflicts, and recreation related fee and access issues. Since 1995 ACA has been one of the nation's leading enforcers of the Federal Clean Water Act through environmental litigation on behalf of its members.

Safety Education & Instruction Activities: Historically, ACA has been at the forefront of promoting boating safety, providing safety education and maintaining a nationally recognized program of paddlesport instruction and certification. Working in concert with the U.S. Coast Guard, American Red Cross, National Safe Boating Council and others, ACA provides a comprehensive range of programs, publications and other materials toward this end. ACA currently certifies approximately 4,000 ACA Instructors in various types of canoeing, kayaking and rafting. Each year ACA Instructors deliver the ACA program to an estimated 125,000 individuals participating at the student level.

Programs & Special Events: With the support of a full-time professional staff, ACA sanctions and/or directly produces more than 700 paddlesport events annually. ACA's Programs and Special Events department also recruits and services corporate sponsors associated with such events. ACA events range from instructional clinics and other small local events to many of the largest, most visible event properties in paddlesport.

Publishing Activities: Working both independently and through its subsidiary, Paddlesport Publishing, Inc., ACA currently publishes a wide range of periodicals, books, videos and other paddlesport-related media. Its lead publication, bimonthly *Paddler* magazine, is published through PPI and currently has an estimated readership of 225,000 readers per issue. A full-color publication, *Paddler* is provided as a benefit to ACA members and is also sold on newsstands and to individual subscribers. PPI also publishes a quarterly trade magazine (*Paddle Dealer*) and an annual fly-fishing magazine (*The Drake*). In addition to the publications produced through PPI, ACA currently publishes 16 book titles, 7 videos, a quarterly Association newsletter (*The American Canoeist*) and a variety of other informational and educational literature.

INTRODUCTION

Since first receiving complaints from its members in 1995, the American Canoe Association (ACA) has worked to address the adverse impacts of personal watercraft (PWC) on other waterway users. ACA's efforts evolved from initial negotiations with the Personal Watercraft Industry Association (PWIA) to firm advocacy for stronger PWC laws and common sense limitations on where PWC are allowed to operate.

In recent years the controversy surrounding PWC use has grown. Numerous environmental and community groups actively oppose PWC use. National groups such as the Bluewater Network, the Izaak Walton League of America, the National Parks and Conservation Association, Friends of the Earth and the Natural Trails and Waters Coalition have all taken strong positions seeking to better regulate PWC use. PWC advocates such as PWIA, the American Watercraft Association (AWA), the National Marine Manufacturers Association (NMMA), the American Recreation Coalition (ARC) and the Blue Ribbon Coalition respond vigorously with increased lobbying efforts and counter every assertion by their opponents.

In such a contentious environment, it is often difficult to find well-documented and accurate information on the true impacts of PWC use. In this report, ACA presents evidence about PWC use, describes how PWC use is affecting other waterway recreation and reviews the current regulatory environment. Utilizing these facts, ACA proposes a well-reasoned approach to making the nation's waterways safer and balancing the recreational needs of all waterway users.

ACA is not a neutral party when it comes to personal watercraft. People who recreate in canoes and kayaks – including ACA's 50,000 members — are heavily impacted by PWC use. The presence of nearby PWC use is one of the most unnerving experiences a canoeist or kayaker can have on the water. Fear for personal safety is often cited, as is disturbance by PWC noise, the smell of smoke and gas and the witnessed impacts of PWC use on wildlife. However, it is worth noting that ACA is a boating organization and places a high value on recreational access, navigability rights on the

nation's waterways and the right of individuals to accept risk in pursuit of recreational activities.

Even though this report represents an honest, fair and common sense analysis of factual information, ACA realizes PWC advocates may try to challenge its content and conclusions. ACA welcomes this scrutiny and is confident the accuracy of the information presented and value of the report's findings will be validated by additional efforts.

Personal Watercraft Defined

The commonly used term personal watercraft and its definition are both products of the personal watercraft industry. Many people still refer to this type of craft as a jet ski. Jet Ski® is the trademarked name of a particular model of personal watercraft manufactured by Kawasaki. Since any vessel designed for use by one person can be legitimately called a personal watercraft, ACA petitioned the USCG to adopt new, more descriptive terminology to refer to water-jet powered craft. ACA favors the adoption of terms such as *personal jet craft* or *personal water jet* to identify these vessels. Since such terminology is not yet widely recognized, this report will still employ the term personal watercraft and its abbreviation, PWC.

The International Standards Organization (ISO) defines personal watercraft as "...an inboard vessel less than 4 meters (13 feet) in length which uses an internal combustion engine powering a water jet pump as its primary source of propulsion, and is designed with no open load carrying area which would retain water. The vessel is designed to be operated by a person or persons positioned on, rather than within the confines of the hull."

ACA views the ISO definition as too narrow because any water-jet powered craft 13 feet or longer, or with an "open load carrying area" would fall outside the definition. This is a significant issue since the PWC manufacturers are constantly modifying PWC and are now selling water-jet powered craft that confine the operator and occupants within the hull, but which still retain the speed, draft, and maneuverability characteristics of typical PWC.

THE IMPACTS

The impacts of PWC use have been well documented through boating accident statistics, law enforcement reports, newspaper articles and eyewitness accounts. Still, there is a significant amount of additional data collection and scientific research into PWC impacts that needs to be done.

Some question why PWC are singled out for scrutiny since all types of vessels can be involved in accidents and any motorized vessel of sufficient horsepower can put other waterway users at risk, adversely affect their enjoyment or cause harm to the environment. PWC are singled out because their use is disproportionately responsible for more on-water accidents, more reports of near accidents, more claims of intentional harassment and more complaints of disturbance due to noise, air and water pollution than any other vessel type.

PWC are also unique in design and purpose. They are neither designed for nor marketed as a method of transportation from one place to another. Instead they are designed and marketed almost exclusively for a specific form of high-speed recreation. The design of these craft gives them a unique ability to be operated at high speeds in shallow or confined areas, where they are more likely to threaten the safety and enjoyment of other waterway users, especially those involved in activities such as canoeing, kayaking, fishing, windsurfing and swimming.

The visible and audible pollution from PWC also impact other recreational activities, wildlife and waterway quality. PWC emit a large amount of noxious blue smoke that can hang in the air for long periods of time. In their wake they leave a prominent oily sheen on the water. The characteristic noise associated with PWC use has prompted many complaints from waterway users and waterfront property owners. While other types of motorized watercraft also emit pollution, operational characteristics of PWC use — such as staying in one area for long periods of time and the frequent acceleration and deceleration — increase the impacts of PWC pollution.

The Numbers

How many PWC operate on U.S. waters? Nobody really knows for sure. Based on an assessment of all current estimates, ACA believes that PWC constitute less than 10 percent of all vessels. However, what is not clear is how much less than 10 percent. The National Marine Manufacturer's Association (NMMA) estimates that in 2001 only 6.2 percent of all vessels were PWC. The USCG, using sales figures from PWIA, estimates that in 2000 there were about 1.1 million registered PWC -- 8.6 percent of all registered vessels.

However, the USCG can only verify 543,168 registered PWC nationwide out of a total of 12,782,143 registered vessels (4.2 percent). This is because 21 states do not treat PWC as a distinct type of vessel for the purpose of reporting boat registrations. The USCG compensates for this by relying solely on sales figures reported by PWIA. PWIA estimates that between 1987 and 2000, approximately 1.5 million PWC were sold. If these estimates are accurate, it is still impossible to know how many of those are still in operation.

The other big unknown is the total number of vessels on U.S. waters. Each state has different requirements for which types of vessels must be registered. For example, most states do not require the registration of human-powered watercraft such as canoes and kayaks. Since the total boating population is larger than the registration numbers suggest, the percentage comprised by PWC is almost certainly below 8 percent.

ACA believes the NMMA estimate of 6.2 percent is the most accurate because it takes into account at least some portion of unregistered boats — although not unregistered canoes and kayaks. When evaluating accident rates, it is misleading to simply cite the number of registered vessels. Doing so can hide the disproportionate accident rates attributable to some vessel types.

While accounting for less than 10 percent of all vessels in the United States (see sidebar: The Numbers, page 2), the impact of PWC use on the safety of other waterway users is far greater than any other boating activity. Accident data reveal that PWC account for roughly one-third of all on-water accidents nationwide and, in almost every state, the accident rate of PWC is much greater than that of other types of watercraft. Research for this report reveals the full extent of the threat posed to other waterway users by PWC use.

When trying to assess the threat a particular on-water activity poses to others, the total number or percentage of accidents does not reveal much. There are many different types of accidents, some of which only place the individual operator at risk. Falling overboard is one type of accident that would typically pose little or no risk to other waterway users. Accident factors such as not wearing a PFD or succumbing to hypothermia, while serious, are risk factors largely within the control of the individual.

Recognizing this, ACA decided to conduct research on those accident types and risk factors that clearly place other waterway users at risk. ACA examined accidents involving collisions and looked at risk factors such as speed, reckless operation, operator inattention and drug/alcohol use. Once focus is limited to only that portion of

accidents likely to place others at risk, the true threat PWC pose to public safety can be better understood.

The research involved reviews of published boating accident data, boating accident reports, existing boating studies, media coverage of accidents involving PWC, phone interviews with state boating officials and an in-depth analysis of the USCG Boating Accident Report Database (BARD) for the years 1996-2000.

It should also be noted that the accident figures contained in this report are exceedingly conservative. The USCG's Recreational Boat Casualty Reporting System is limited in scope and only includes accidents that exceed \$500 in property damage, that involve a bodily injury serious enough to require medical treatment beyond first aid or that result in a death.* Additionally, many accidents fail to get reported due to both ignorance of the reporting requirement and difficulty enforcing it. The USCG readily acknowledges this, stating in its *Boating Statistics* reports, "we believe that only a small fraction of all nonfatal boating accidents occurring in the United States are reported to the Coast Guard, State or local law enforcement agencies."

*Note: As of 2002 the property damage amount required for federal reporting will increase to \$2,000. This will likely result in fewer reported accidents, but will not necessarily reflect an actual reduction in the number of accidents.

Figure 1
PWC involvement in Accidents and Collisions
1996-2000

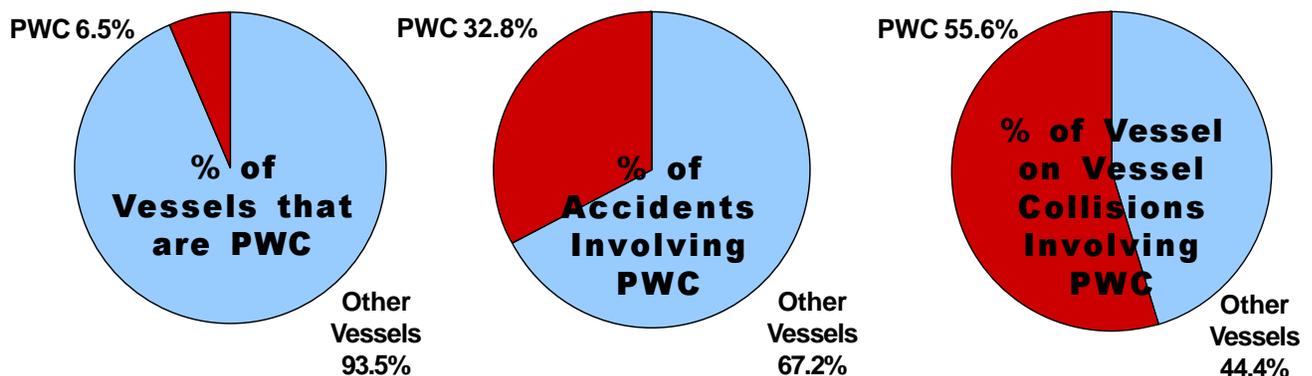


Figure 1 compares PWC as a percentage of all registered vessels with the proportion of PWC involvement in all accidents and in vessel-on-vessel collisions. *Source: USCG BARD and NMMA*

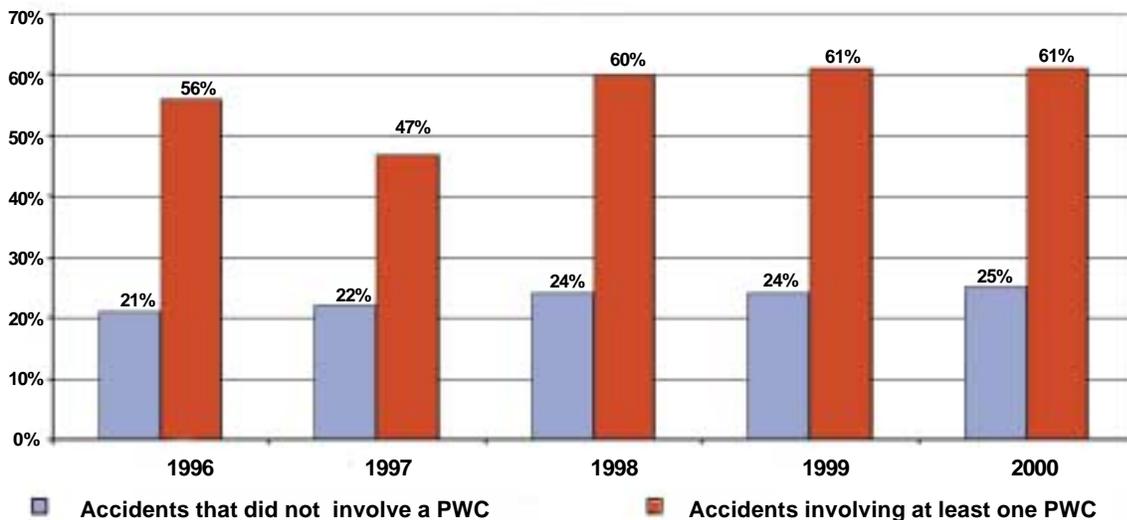
PWC Accident Types

A collision is the accident type most indicative of a general threat to all waterway users. Of particular interest are vessel-on-vessel collisions, where at least one of the operators involved in the accident behaved in a manner that places others at risk. Accident statistics have shown for some time that PWC are involved in a disproportionate amount of the nation's boating accidents, but the extent of PWC involvement in collisions has not been as clear. Over the past five years hundreds of canoeists and kayakers have expressed to ACA their fear of being struck by a PWC. Eyewitness accounts provide strong anecdotal evidence that these fears are indeed justified. Research conducted for this report examines the available accident data about PWC involvement in collisions.

Collisions with Vessels

Research conducted on the BARD database revealed a number of important findings. Between 1996 and 2000, 12,218 PWC were involved in collisions with other vessels. Over that five-year period, PWC - comprising less than 10 percent of all vessels - have been involved in over 55 percent of all vessel-on-vessel collisions reported to USCG (see figure 1). For the past three years vessel-on-vessel collisions have accounted for 60 percent of all reported PWC accidents. For accidents that did not involve PWC, collisions with other vessels never accounted for more than 25 percent of the total. The average difference of 34 percentage points translates into a 150 percent higher frequency of collisions with vessels among PWC-involved accidents (see figure 2).

Figure 2
Proportion of Reportable Accidents Classified as Collisions With Another Vessel
1996-2000



Source: USCG BARD

Figure 2 shows that reportable accidents involving at least one PWC were much more likely to involve a collision with another vessel compared to reportable accidents not involving at least one PWC. The average difference of 34 percentage points translates into a 150 percent higher frequency of collisions with vessels among PWC-involved accidents.

Due to the inconsistent reporting of accident details and difficulty obtaining detailed accident descriptions, there is no reliable way to statistically assess responsibility for vessel-on-vessel collisions nationwide. A sampling of accident report narratives indicated that the PWC operator was most often at fault. This conclusion is backed up by other research. According to a 1999 report from the California Department of Boating and Waterways, "In collisions between personal watercraft and vessels other than PWC, the PWC operator was nearly 3 times as likely to be exclusively at fault." A study by Chester A. Jones (2000) published in *Accident Analysis and Prevention*, found that 79 percent of PWC collisions that occurred on Arkansas waterways between 1994 and 1997 involved at least one PWC and another moving vessel. This study, using boating accident reports from the Arkansas Game and Fish Commission, also found that in most cases the operator of the PWC was responsible

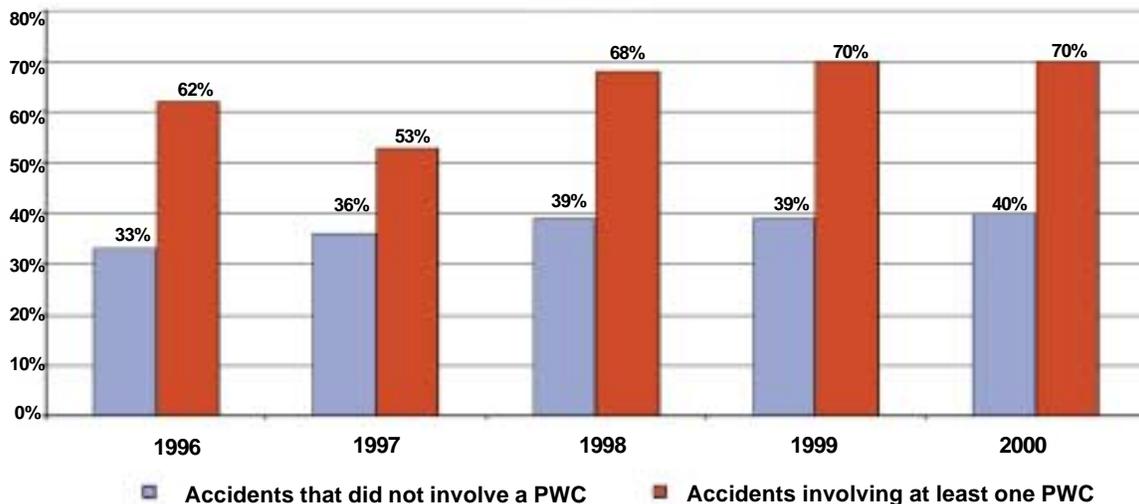
for the collision. The study also found that 48 percent of all PWC collisions were between two PWC.

Collisions with Fixed or Floating Objects

ACA also examined collisions with fixed or floating objects. A collision with a fixed or floating object almost always indicates an operator acting in a manner that could place others at risk. Responsibility for such accidents typically accrues to the operator of the vessel involved. As with vessel-on-vessel collisions and accidents in general, PWC are involved in a disproportionate share of collisions with fixed or floating objects.

When collisions with a fixed or floating object and vessel-on-vessel collisions are combined, collisions consistently constitute about 70 percent of all PWC accidents. Over the five-year period

Figure 3
Proportion of Reportable Accidents Classified as Collision With a Vessel or Any Other Fixed or Floating Object 1996-2000



Source: USCG BARD

Figure 3 shows the same comparison as Figure 2, but includes ALL collisions, including those with other vessels as well as fixed or floating objects. The pattern seen in this figure is very similar to that seen in the previous figure. The difference of roughly 30 percentage points on average means that the proportion of reportable accidents among PWC-involved accidents that involve any type of collision is eighty percent higher on average than that among non-PWC-involved accidents.

(1996-2000) collisions accounted for between 53 percent and 70 percent of PWC accidents, averaging near 70 percent for the last three years (see figure 3). This unusually high proportion of accidents that are collisions appears unique to PWC, as no other vessel type has similar collision/accident ratios.

Collisions with People

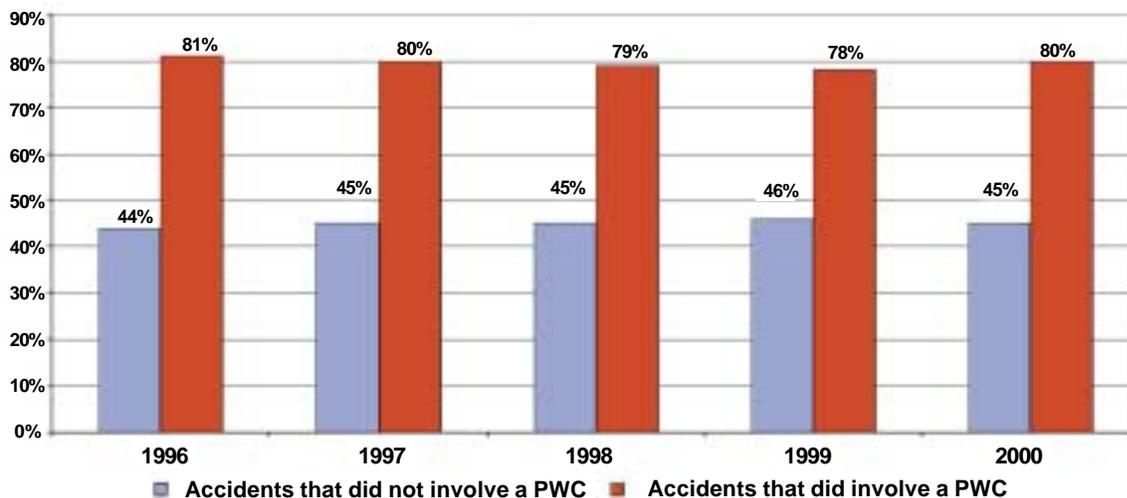
Across all vessel types, a boat striking people swimming in the water (or otherwise outside of a boat) — identified in accident reports as “struck by boat” — was indicated as the accident type in a relatively small percentage of total accidents during the five years studied. However, the degree of statistical difference between PWC and all other vessel types was greater than in any other accident category. Accidents involving at least one PWC were more than three times as likely to be described as “struck by boat” than were accidents not involving a PWC.

In accidents not involving PWC between 1996 and 2000, “struck by boat” was cited in less than 2 percent of all accidents. Over the same period, for accidents involving at least one PWC, “struck by boat” was cited in roughly 7 percent of all accidents. For both 1999 and 2000, the most recent two years of data, 7.4 percent of all accidents involving at least one PWC were categorized as “struck by boat.” Over the five-year study period PWC were involved in more “struck by boat” incidences than all other vessel types combined. Although not termed a collision by USCG, like other collisions this accident type indicates a threat to other waterway users.

Other Accidents

After collisions, falls overboard was cited most often – sometimes in conjunction with a collision. Other non-collision accident types account for only a small portion of PWC accidents. In each year

Figure 4
Proportion of Reportable Accidents for Which Cause Involved Reckless Operation, Operator Inexperience, Drugs or Alcohol 1996-2000



Source: USCG BARD

Figure 4 provides a comparison of the proportion of reportable accidents that involved reckless operation, operator inexperience or inattention, excessive speed, rules of the road infractions, drugs or alcohol. In all five study years, the difference in reportable accidents that involved at least one PWC is almost 80 percent higher when compared to the proportion of similarly caused accidents among reportable accidents that did not involve at least one PWC.

studied, accident types such as “capsizing,” “fire or explosion,” “flooding,” “falls in boat,” “struck submerged object” and “sinking” all combined represented less than 15 percent of all accidents involving PWC.

PWC Accident Causes

ACA found that certain behavior-related accident causes are significantly more prevalent in accidents involving PWC than in accidents not involving PWC. During the past five years roughly 80 percent of accidents involving at least one PWC were reported to involve careless/reckless operation, operator inexperience or inattention, excessive speed, rules of the road infractions, or drug/alcohol use (see figure 4). This compares to about 45 percent for all other vessel types.

NOTE: A number of factors are often involved in PWC accidents, and whether an investigator decides to cite excessive speed or careless/reckless is often a subjective decision. In Figure 4 ACA eliminates some of this subjectivity by combining the common behavior-related accident causes that typically play a role in on-water collisions.

Operator Inattention/ Inexperience

ACA research found that operator inattention is frequently cited as a cause by investigators when reporting collisions involving PWC. This appears to be the case even when careless/reckless and excessive speed were also cited as contributing causes. According to the Nevada Division of Wildlife (NDOW), the nature and purpose of PWC contribute to accidents being caused by operator inattention. David Pfiffner, supervising boating officer for NDOW, states, “Quite simply, one of the biggest problems we face with personal watercraft is the operator’s search for a good time. They become so focused on what they are doing — spinning, jumping or just going fast — that they tune out everything and everyone else. The next thing they know they’re in front of another boat or have just run over somebody.”



Photo courtesy of Lee Brown

ACA also found that operator inexperience was often cited as the primary accident cause when careless/reckless and excessive speed were also cited as contributing causes. Operator inexperience appeared to be commonly cited in any accident circumstance where the operator had less than 100 hours of experience, regardless of other contributing causes. ACA research found a number of cases where operator inexperience was cited as an accident cause even though the operator had over 100 hours of experience or the level of experience was listed as unknown.

A 1998 National Transportation Safety Board (NTSB) study included a detailed examination of PWC accidents from January to June 1997. Operator inattention was the most common cause cited in those accidents, followed by operator inexperience. According to state boating officials, both causes are likely to be cited in accidents where the PWC’s lack of off-throttle steering is a contributing factor. Off-throttle steering is the ability of a vessel to maintain steerage when not under power (see sidebar: *Flawed by Design*, page 8).

The problems with off-throttle steering become clear when specific details of PWC related accidents are explored. On July 4, 1998, a typical loss-of-steering accident took the life of Deborah Boles on Texas’ Lake Texoma. Ms. Boles, 16 years old, met a friend at the lake. The teenagers went out for rides on two PWC. Deborah’s friend, who was bearing down on her, let off the throttle in an attempt to avoid a collision and tried to turn away. Despite her desperate efforts to steer, the vessel

continued in a straight line and broad sided Deborah at 30 miles per hour. Deborah suffered massive head injuries and died on the way to the hospital. According to a recounting of the accident in an article called *Why PWC Kill* by Paul Rockwell, a witness noted that Deborah's friend, in shock, kept saying: "It wouldn't turn; it wouldn't turn." Deborah's mother, Nita Boles, cofounded a group called "Parents and Families for Personal Watercraft

Safety" made up of family members of PWC accident victims seeking to improve PWC safety.

Another steering-related accident recounted in the Rockwell article involved the son of the group's other cofounders, Jim and Connie Hues. "Twenty-one-year-old Justin Hues was visiting Lake Lewisville in Texas. When he and his friend rented two jet skis from a Polaris outlet, they received no

FLAWED BY DESIGN *PWC Off Throttle Steering & Braking*

The absence of off-throttle steering and braking are well-known characteristics of PWC. Once a PWC operator lets off of the throttle (stops accelerating), the craft can no longer be effectively steered or stopped. PWC do not have rudders to control steering. Instead, steering is controlled by turning the water jet nozzle that provides thrust for the craft. If no thrust is coming from the jet, the craft cannot be steered. PWC also have no braking mechanism or other design feature to slow momentum.

By failing to have off-throttle steering capability, PWC require operators to react contrary to human nature. When presented with an imminent collision the natural human instinct is to both alter course and reduce speed. A PWC operator in such a situation must choose only one. The absence of a braking mechanism on this high-speed craft means that PWC require longer distances to stop than many traditional vessels, further increasing the risk of collision.

Since the release of a 1998 National Transportation Safety Board (NTSB) study highlighting steering problems as a significant factor in PWC accidents, the PWC industry has come under increasing public pressure to make design changes that will improve off-throttle steering. In conjunction with its study, NTSB recommended that the USCG and the PWC manufacturers develop

appropriate standards for steering and braking on jet-pump propelled vessels.

Manufacturers have made some modest steps in that direction. Most are working to incorporate "throttle reapplication" systems designed to provide thrust when an operator simultaneously lets off of the throttle and turns the steering column. The effectiveness of throttle reapplication, or other systems such as the one used on some Bombardier models, in avoiding collisions is not yet fully known.

In research to develop off-throttle steering standards, sponsored by USCG, Underwriters Laboratories, Inc. (UL) recently tested a variety of off-throttle steering systems that included PWC manufacturer prototypes and some aftermarket products. The research indicated that rudder systems perform better than throttle reapplication systems. The effectiveness of throttle reapplication systems was sporadic and fell off significantly at speeds above 30 mph. Kawasaki's Smart Steering™ throttle reapplication system, for example, avoided the test obstacle 100% of the time at 20 mph (as did many stock craft), but the success rate quickly fell off to 50 percent of the time at 30 mph, 13 percent of the time at 40 mph and 0 percent of the time at 55 mph. A rudder system called Surfrax™ seemed to produce the best results, missing the

obstacle 80 percent of the time at 50 mph — but none of the PWC manufacturers plan to utilize it.

The USCG has no plans to develop mandatory off-throttle steering standards (also called collision avoidance performance standards), but through the UL research and the work of a Society of Automotive Engineers' (SAE) PWC Subcommittee, the agency has been pursuing voluntary standards. The standards proposed by UL — while not very strong — represent a reasonable starting point in the opinion of many safety advocates. The work of the SAE PWC Subcommittee, comprised largely of PWC industry representatives, has been sharply criticized.

Non-industry members of the SAE Subcommittee have been critical of both the process and the move toward a weak standard. One such member, Ron Simner of Ride Technology has protested the PWC industry's "hijacking of the process." According to Simner, "The industry constantly had its attorneys present and refused to provide any test data for discussion." The lax standard favored by the PWC industry would not have any significant impact in reducing the number of PWC off-throttle steering collisions and it would certainly not prevent any off-power accidents."

instruction. PWC are known for sharp turns, bursts of speed and skittish maneuverability. Suddenly Justin turned in front of his friend, who was riding in the second vessel behind him. The young man quickly let up on the gas to slacken speed and turn away. But without thrust, the water rocket would not steer. He smashed into Justin, who died on life support.”

Excessive Speed

PWC are designed and marketed for speed. It should be no surprise that excessive speed is consistently one of the most frequently reported causes of PWC accidents. In the 1998 NTSB study, excessive speed was the third most often cited PWC accident cause. In California, a state where PWC accidents have been carefully reviewed, excessive speed is the second most often cited cause for accidents involving PWC.

The ACA review of PWC accident data revealed that excessive speed was a likely factor in well over half of all PWC accidents. ACA found many accidents where excessive speed was clearly indicated by the accident narrative, but not officially cited as a cause of the accident. Other accident causes such as careless/reckless and operator inattention were often officially cited as causes of accidents involving excessive speed.

The PWC accident data indicate that PWC are more than twice as likely to be traveling in excess of 40 mph at the time of an accident than other vessel types. Injury data also point to speed as a prominent factor in PWC accidents. The injuries most often resulting from PWC accidents involve blunt-force trauma resulting from collisions.

The USCG accident data for the year 2000 show that trauma accounted for over 90 percent of the reported injuries resulting from PWC accidents. The injury types -- amputation, broken bones, head injury, internal injury, contusions, spinal/back injury and laceration -- accounted for 1,214 of the 1,341 PWC related injuries identified. An additional 239 injuries were not identified. It should be noted that

the number of PWC related injuries is significantly underrepresented. The USCG has estimated that only about 10 percent of PWC related injuries are reported as required by law.



Photo by David Jenkins

A 1997 study by the National Center for Injury Prevention and Control confirmed that the vast majority of PWC-related injuries are not reported to boating or law enforcement officials. The study, entitled *Personal Watercraft-Related Injuries, A Growing Public Health Concern*, found that PWC-Related injuries increased from an estimated 2,860 in 1990 to more than 12,000 in 1995. By comparison, the number of PWC-related injuries reported by USCG for 1995 was 1,617. The study also found that the rate of Emergency Department-treated injuries related to PWC was about 8.5 times higher than the rate for injuries from motorboats.

Speed may be an even greater problem in the future as PWC manufacturers continue to increase PWC power. In recent years 130-145 horsepower engines have powered most PWC. These engines, which provide more horsepower than many car engines, power a craft that often weighs less than 600 pounds. The 2001 Sea-Doo RXX has a 160 horsepower two-stroke engine, and the 2002 Sea-Doo GTX 4-Tec has a 155 horsepower four-stroke engine. Honda's motorcycle division recently unveiled a new 165 horsepower, turbocharged PWC called the AquaTrax F-12X.

Careless/Reckless Operation & Harassment

During the past five years ACA has received hundreds of complaints from canoeists and kayakers about PWC use. The majority of those complaints cite being threatened by reckless operation or intentional harassment. While such complaints are anecdotal, their persistence – along with an absence of a pattern of similar complaints about other vessel types – bolsters the argument that PWC operators are more likely to engage in such behavior than the operators of other vessels.

Harassment by PWC operators is a very serious problem for people in small craft such as canoes and kayaks.

Careless/reckless operation is also one of the most frequently reported causes of PWC accidents. Just as with excessive speed, a review of accident data found many accidents where careless/reckless was indicated by the accident narrative but not officially cited as a cause of the accident. Careless/reckless was also a likely factor in well over half of all PWC accidents.

Accident data from Florida – the state with the highest number of PWC accidents - for 2000 cites careless/reckless as the primary accident cause in 226 of the state's 382 reported PWC accidents. Careless/reckless was by far the leading cause cited in Florida PWC accidents. The next highest cause was cited in only 35 accidents. For the same year California reported zero instances where careless/reckless was cited as a primary accident cause. This disparity exists because California does not cite careless/reckless as an accident cause. California officials view behaviors such as recklessness or alcohol impairment as contributing factors and do not report them as accident causes. They maintain that USCG should offer another way to report these factors. Since California - the state with the second highest number of PWC accidents – does not report incidents of reckless operation, the USCG data significantly under represents this as an accident cause.

One form of reckless operation often associated with PWC use is intentional harassment. Harassment by PWC operators is a very serious problem for people in small craft such as canoes and kayaks. Kayakers often describe such harassment as the most disturbing and frightening experience they have ever encountered on the water. The vast majority of these incidents do not result in a reportable accident under USCG guidelines and thus are not reflected in accident data. A typical scenario, based on the many incidents ACA is familiar with, involves a PWC operator riding in circles around a canoe or kayak in an effort to capsize it. Once successful, the PWC operator leaves and is long gone by the time the paddler gets back into his or her boat and travels to shore.

In 2000 there was a series of particularly disturbing incidents on the Hudson River in New York City. An article in the *Village Voice* reported these incidents and described one in vivid detail.

It was a bright Sunday afternoon when Michael Glass paddled out of the 79th Street Boat Basin on the Hudson River for a solo kayak trip to the Downtown Boathouse on Pier 26 in Tribeca. Such outings, once an exotic treat for daredevils, have become routine pleasures as local waterways get cleaner. But the menace he encountered went way beyond outdated fears about infection. "I was opposite the Intrepid, heading south, and I saw two jet skis heading north toward me. They seemed to be coming perilously close. I raised my paddle to signal to them that I was there, in case they didn't see me," Glass recalls. He might as well have raised a red flag to a bull. "They proceeded to come at my boat one at a time. The first came at me at about 35 miles per hour and then spun away, maybe 10 or 12 feet from the boat," he says. "Then the second one came, and he kept coming. He looked like he was going to hit. I dove off and actually heard a clunk, like the jet ski was grazing the boat." After he got back into his kayak, he

paddled over to a sailboat and immediately called the police. Both the police and Coast Guard were there literally “within minutes,” Glass says, but his attackers were long gone.

That was September 2000. Little did Glass know that he’d witnessed the birth of a new extreme sport -- kayak hunting. But when he was attacked last month in Inwood, battling rogue jet skiers became a cause. “There have never been more than one or two such incidents, if that, until this year,” says Ralph Diaz, a paddler who chairs the Human-Powered Boating Group. But this summer alone, he has counted over a dozen documented attacks, most against kayakers, but some against dinghies in mooring fields. Glass thinks those numbers, culled largely from members of an email listserve for New York City kayakers, are hugely conservative.

The “kayak hunting” incidents on the Hudson River were nothing less than criminal assaults. The PWC operators likely viewed these assaults as fun, but that “fun” was at the expense of the kayakers’ right to safety, security, peace of mind and enjoyment. Such incidents of intentional harassment are not at all rare. While ACA learns mostly of those that involve canoeists and kayakers, it is also aware of cases where PWC operators have harassed divers, swimmers, sailors, windsurfers and fishermen. Although some incidents of harassment are more severe

than others, all such incidents are assaults and inflict harm on the victims.

While intentional harassment is the most serious type of reckless behavior from a standpoint of intent, any type of reckless or careless behavior at high-speeds places others at serious risk. With PWC, simple horseplay often proves more deadly than intentional incidents of harassment.

Drug/Alcohol Impairment

An examination of USCG accident data did not reveal a disproportionate correlation between accidents involving PWC and accidents where drug or alcohol impairment was cited as a cause. However, a number of cases were found where drug or alcohol impairment was not cited as an official cause, but the narrative description of the accident did indeed indicate that the operator was likely under the influence of drugs or alcohol. More consistent accident reporting would help better evaluate this correlation in the future.

Drug and alcohol impairment is a serious problem across all vessel types, including canoes and kayaks. In many impairment-related boating accidents the impaired individual is the primary one placed at risk of injury or death. This is definitely not the case when an impaired person is operating a motorized vessel, or worse yet, a high-speed vessel such as a PWC. Just as with automobiles, driving while under the influence of drugs or alcohol places others at extreme risk.

Additional Risk Factors

Crowded Waterways

A review of water body and location data for accidents involving PWC, conversations with boating and law enforcement officials and newspaper accounts of PWC accidents, has confirmed what seems obvious: overcrowded waters play a role in many PWC accidents – especially vessel-on-vessel collisions.



Photo by David Jenkins

Each year the nation's waterways become more and more crowded. While crowded waterways increase the risks associated with all types of waterway recreation, crowded waters become more dangerous when high-speed recreation mixes with other types of waterway use. PWC with their unique high-speed design, maneuverability, and shallow draft, pose the greatest threat of any vessel type because they are the most likely vessel to be operated at high-speeds in shallow or confined waters. The disproportionate involvement of PWC in vessel-on-vessel collisions underscores this threat.

A congested waterway often resembles a busy highway - except without lanes, markers, a consistent direction of travel or a stable surface. Add to that a diverse selection of vehicles ranging from kayak to yacht. Then, to this already chaotic environment, add a high-speed craft free to engage in stunts and horseplay, but only capable of being steered while under acceleration. Despite the occasional buoy and boating's "rules of the road," this is the situation on many waterways.

Enforcement Difficulties

With approximately 80,000 square miles of surface water in the U.S., adequate boating enforcement presents a massive challenge. Insufficient funding of many marine law enforcement programs makes this challenge even more difficult. In conversations with ACA, a majority of state boating agencies claimed current funding levels were inadequate to meet their enforcement needs. Most agencies acknowledged that enforcement coverage was seriously inadequate. A 2000 U.S. General Accounting Office (GAO) report cites the same enforcement problems regarding the management of federally protected waters. This report (RCED-00-243) in a section on restrictions noted "...many unit managers reported insufficient personnel to adequately enforce restrictions."

This lack of enforcement coverage is particularly problematic when it comes to managing PWC use. PWC pose a number of unique enforcement

PWC Demographics

According to PWIA, the average PWC owner/operator is very similar to the owner/operator of other vessel types. On its website PWIA states, "The typical personal watercraft owner is a middle-aged, highly educated and successful business person." More specifically PWIA asserts the average age of PWC purchasers during the past five years is 41 years old, 85 percent are male, 71 percent are married, 69 percent have owned a powerboat prior to their most recent PWC purchase, 66 percent have taken or completed college-level course work. PWIA also maintains that 73 percent of the time the PWC owner is the operator of the craft and that PWC owners typically have "substantial boating experience."

ACA has not conducted a demographic study of PWC owners and operators, but a review of the demographic information contained in the BARD database suggests that the average age of PWC operators involved in accidents is much younger than the reported average age of PWC purchasers. In the year 2000 (the most recent year available) the average age of PWC operators involved in accidents was 26. The average age of operators of other motorized vessel types involved in accidents was 41.

The BARD data also shows that, when operator experience was reported, 75 percent of PWC operators involved in accidents had less than 100 hours of experience, and 33 percent had less than 10 hours of experience. For operators of other vessel types involved in accidents, 25 percent had less than 100 hours of experience and only 10 percent had less than 10 hours of experience.

The PWIA's reported demographic profile for age and experience of PWC owners is quite different from the PWC operator information reported in the USCG accident data. This disparity, combined with the higher average age of operators of other types of motorized vessels involved in accidents reported to USCG, suggests that younger PWC operators may be at greater risk for boating accidents than their same-age counterparts in other motorized vessels.

problems. These include the capability and likelihood of PWC to be operated at very high-speeds, the ability of PWC - because of their shallow draft - to be more widely disbursed and to more frequently mix with near shore activities. The tendency of PWC operators to engage in activities such as wake jumping and chasing each other at high speeds and the unusually high number of reports of waterway users being

harassed by PWC operators further increases the law enforcement burden.

Additionally, many of the current laws governing PWC use, such as minimum distance requirements and speed limits, are difficult to enforce. From a distance it is difficult for a law enforcement officer to determine whether a PWC is 50 feet from another vessel or 100 feet, or whether a PWC is traveling at a speed of 30 or 40 miles per hour. Zoning high-speed PWC use to specific areas would be easier to enforce, but few have embraced this regulatory approach.



Photo by David Jenkins

Inadequate enforcement coverage also reduces the deterrent effect of laws and the penalties for violating those laws. Leniency and the tendency of some law enforcement officers to cite operators for lesser violations likewise reduces deterrent. In conversations with ACA, several state boating officials commented on reluctance by law enforcement officers to cite violations such as reckless operation because of the stiff penalty such a violation carries in those states.

These enforcement problems inevitably lead to greater danger on the nation's waterways and most likely bear some responsibility for accident rates, deaths and injuries. Without adequate enforcement, responsible waterway users are left with little protection against the irresponsible or criminal actions of others. Incidents of harassment, reckless operation and speeding occur with little chance of the perpetrators ever being caught.

Exposure

Exposure is essentially the amount of time a vessel operator spends operating a certain vessel. The USCG and the PWIA have supported studies to assess the safety risk associated with each vessel type by comparing the number of accidents and fatalities with the total exposure (hours/days of operation). Two factors play a role in the exposure associated with a particular vessel type. One is the total number of vessels of the type that are in operation. The other is the amount of time operators of the vessel type spend operating the vessel.

PWIA maintains that PWC operators spend more time on the water than the operators of other vessels. It has supported exposure studies in an attempt to confirm its long-standing claim that PWC have a higher accident rate because they have a higher exposure rate and, when adjusted for exposure, PWC compare more favorably to other vessel types.

While it seems reasonable that a vessel with a disproportionate level of exposure could have a disproportionate accident rate, this appears to be a moot point for PWC. A 1999 study conducted by Heiden Associates, Inc. (using a PWC industry sponsored survey) found that in 1997 PWC had less exposure than the other vessel-types studied, open motorboats and canoes/kayaks. The study found the total annual PWC riding time to be approximately 291 million hours, the total annual canoe/kayak riding time to be 318 million hours, and the total annual open motorboat riding time to be 2.0 billion hours.

The Heiden Associates study also found the average annual riding time for PWC-owning households to be 112 hours, less than the 120 hours annual riding time for open motorboat owning households. A 2000 study by JSI Research & Training Institute, Inc. found that in 1998 the mean number of days of operation for PWC was 15.22 days, less than open motorboats (22.95) and cabin motorboats (24.88). Based on the results of these two studies, there is no reason to believe that a

high exposure rate explains the disproportionately high PWC accident rate.

Note: It is acknowledged by both JSI Research and Training Institute, Inc. and USCG that the sampling method used for the JSI study relied heavily on registered boat owners and thus failed to accurately assess canoe and kayak exposure data. Since only a small portion of canoes and kayaks are required to be registered, a survey of registered boat owners would primarily capture motorized boat owners that also happen to own a canoe or kayak. These owners would probably spend less time in a canoe or kayak than those who only own a canoe or kayak.

Education

Lack of education is often blamed for many boating accidents. This theory is based on the assumption that if operators are taught proper safe boating practices they will be less likely to have an accident. It is argued that this is especially the case for PWC operators due to the unique



Courtesy of NPCA

operational characteristics of PWC. No one can dispute the value of safety education. Proper safety education is important for all boaters, and ACA works constantly to educate canoeists and kayakers in boating safety. However, it is less clear what number of PWC accidents are due to a lack of safe boating knowledge versus the number due to irresponsible behavior and intentional disregard of safe boating knowledge. Education can only work if the operator willingly incorporates the knowledge into his or her boating practices. While

Hang on and keep telling yourself, "It's just a leisure activity." (Kawasaki)

With this many horses you might need some help around the ranch. (Kawasaki)

Remember when your dad used to spin you around? Faster. Harder. Faster. Harder. And it was all you could do to just hold on. And even though you thought you would fly away at any moment, you still wanted more. And he turned you faster and tighter. Until all you could hear was the sound of your heart pounding? We did the same thing to our engineers before they designed our new RX™D1.

GREED (SEA-DOO)

...a sandwich in its cooler was clocked at record speed. (Kawasaki)

With this much power you could bring the Dead Sea back to life. (Polaris)

This summer, hot dogs will actually have a little meat. (Polaris)

If it could belch it would have other watercraft on its breath. (Kawasaki)

Compromise is such an ugly word. (Kawasaki)

It's enough to make webbed toes curl. (Polaris)

Lust (SEA-DOO)

Thumb your throttle at the world. (Polaris)

Suddenly the bats out of hell are getting fitted for wetsuits. (Kawasaki)

UNSAFE WATERS

the PWC industry often cites its support of educational programs that teach safe boating and proper PWC operation, that same industry spends millions of dollars on advertising campaigns that send a very different message.

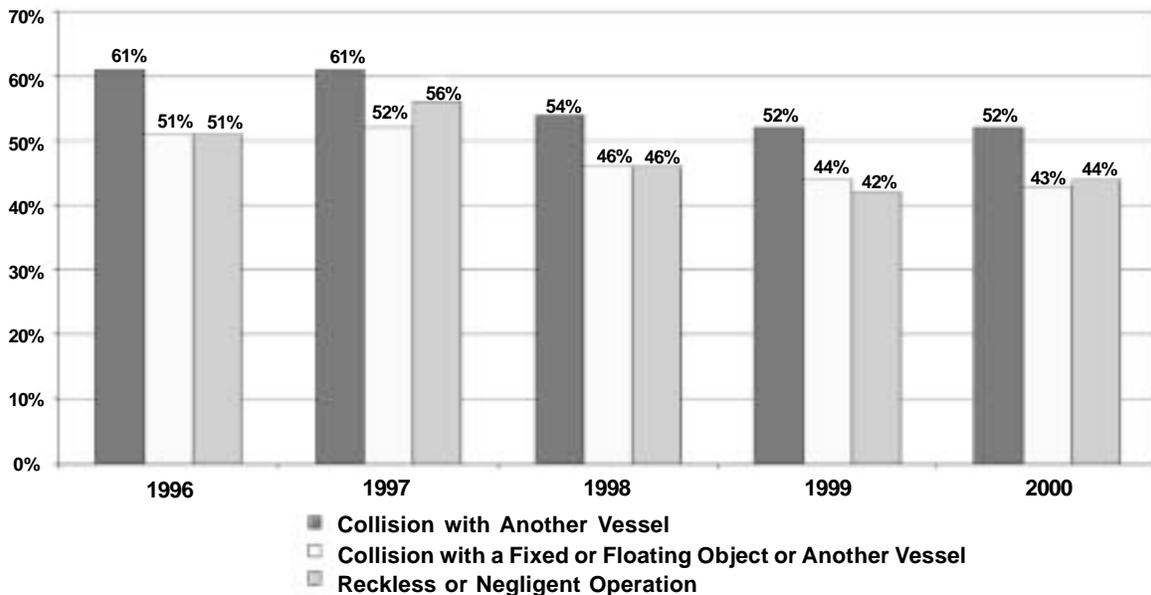
PWC industry ads also educate PWC operators. They teach that speed, power and attitude are the reasons to own and operate a PWC. A review of PWC industry advertising over the past several years found many ads that send messages seemingly at odds with efforts to teach responsible riding. On the previous page are some samples of text found in these ads.

This type of marketing is designed to appeal primarily to people seeking a high-speed experience. An in-your-face attitude is a common characteristic of PWC advertising. This attitude promotion is not limited to the actual PWC manufacturers; many after market equipment ads are more blatant in this regard. Even PWC

insurance ads choose to promote attitude over safety. A McGraw Insurance ad reads “SARAH SLAMMED INTO A DOCK AT TOP SPEED. FORTUNATELY SHE KEPT HER HEAD ABOVE WATER. You know the story. Everyone’s heard one. She was looking the wrong way, the sun got into her eyes, some guys whistled at her. And pow! Fortunately she had insurance from McGraw.”

Operator education is not limited to state education programs, it consists of a variety of messages and influences. The messages sent by PWC industry advertising are at odds with messages of safe, responsible operation. By marketing PWC with messages of speed, power and attitude, the PWC industry compromises its own efforts to promote safe boating practices. Such marketing is likely to have direct and adverse affects on PWC accident rates and undermine the objectives of other education efforts.

Figure 5
Proportion of Reportable Accidents that Involved at Least One PWC By Type or Cause of Accident 1996-2000



Source: USCG BARD

Figure 5 shows the proportion of accidents by type and cause that involved at least one PWC. In all years, 50% or more of all collisions with another vessel involved at least one PWC. PWC operators also appear to account for a large share of all accidents attributed to reckless or negligent operation.

Summary of Findings

The PWC accident data and related information examined in this report provide clear and compelling evidence that PWC operation poses a significantly greater threat to the safety of other waterway users than does the operation of other vessel types. Not only is the overall accident involvement of PWC disproportionately high, but for those accident types that put other waterway users at highest risk, the PWC role is even greater.

The proportion of reported boating accidents that involve PWC is higher than the proportion of reported automobile accidents that involve drunk driving.

This one vessel type -- comprising less than 10 percent of all vessels -- is involved in 55 percent of all collisions between vessels. In addition, recent data indicates that 70 percent of all PWC accidents are collisions with other vessels, fixed objects or floating objects. When combined with collisions with people swimming or otherwise outside a boat (struck by boat) that percentage climbs even higher.

A careful examination of both the types and causes of accidents involving PWC leads to the conclusion that the unique operational characteristics of PWC play a primary role in most PWC accidents. The unusually high percentage of PWC accidents that are collisions points to the inherent speed and handling characteristics of the craft as key factors. The 1998 NTSB study found that operator control problems due to the absence of off-throttle steering and braking capabilities contribute to many PWC accidents. ACA found that narrative PWC accident accounts from 1999, 2000 and 2001 also indicate that speed

and operator control problems play a key role in many PWC accidents.

The most prominent causes cited in PWC accidents are those directly tied to reckless and inattentive operation of the craft. Analysis of USCG and state accident data found that PWC accidents are much more likely to be caused by operator inattention, operator inexperience, excessive speed and careless/reckless operation than accidents not involving PWC. While in no way exonerating the operators involved, PWC accident data and descriptions

reveal a link between the speed and handling characteristics of the craft and the operator behaviors cited as causing the majority of PWC accidents.

Whether one looks at accident volume, accident rate, accident type, accident cause, nature of injuries or risks posed to others, the safety record for PWC is disproportionately poor -- and unique among watercraft. No other vessel type has a similar record. **In fact, the proportion of reported boating accidents that involve PWC is higher than the proportion of reported automobile accidents that involve drunk driving.**

The evidence clearly shows that PWC operation poses a serious safety risk to PWC operators and an unacceptable threat to all other waterway users. With more and more people flocking to the nation's waterways, failure to adequately address these safety concerns will result in increased risk of injury and trauma to all waterway users.

UNENJOYABLE WATERS EXPERIENCE

The impact of PWC use on the ability of others to enjoy recreational activities, especially non-motorized activities, is a significant nationwide problem. While the potential for user conflict exists with many activities, PWC use has become notorious for its conflicts with a wide variety of other activities. In fact, PWC use often prevents other waterway users from enjoying the nation's recreational waterways, thus monopolizing the recreational opportunity afforded by these waters.

The safety concerns raised earlier in this report also play a role in the propensity of PWC use to conflict with other activities. Based on the accounts of canoeists, kayakers, windsurfers, fishermen, sailors, surfers and swimmers, many waterway users feel threatened by high-speed PWC use. They feel threatened by the possibility of being struck by a PWC, harassed by a PWC operator or capsized by a PWC wake. This concern for their own safety, because it is generated by a threat entirely beyond their control, is a preoccupation that greatly reduces the enjoyment and relaxation people can derive from their preferred form of recreation.

The impacts of PWC use on other waterway users, however, go beyond safety concerns. Millions of people rely on water-related recreation to relieve stress, relax, and escape from the noise and hassles of everyday life. The noisy, polluting, high-speed nature of PWC use is not compatible with such an escape, and is at odds with the recreational goals of many waterway users. The fact that PWC have a unique ability to operate at high speeds in shallow or confined waters greatly increases this incompatibility. Too often, PWC operators are fueling their own enjoyment by siphoning it away from those who enjoy other types of activities.

The clearest evidence of this problem can be found in the huge and disproportionate volume of complaints about PWC use lodged by other recreational users. While ACA has received hundreds of complaints about PWC use in recent years, it has received less than a dozen such complaints about the use of other vessel types.



Photo by David Jenkins

Unsolicited PWC complaints from canoeists and kayakers prompted ACA's initial involvement in the PWC issue. Other recreational groups have experienced similar complaints from their members. Organizations such as U.S. Windsurfing, Izzak Walton League of America, Federation of Fly Fishers, Adirondack Mountain Club and American Whitewater have all received complaints from members about PWC use.

Below are just a sample of the incidents brought to ACA's attention.

- On a Boy Scout troop canoe outing, three PWC speeding around a blind bend in the river almost collided with each of the six canoes.
- A PWC traveling at a high rate of speed collided with two children kayaking on a river and caused a broken collarbone.
- A man on a morning lake paddle witnessed a PWC run over a loon nest - killing an adult female and a newborn loon.
- A kayak teacher reports PWC driving through the class and running in circles around the students on numerous occasions.
- A couple spent several thousand dollars and two days paddling to reach a remote kayaking destination only to discover that the once pristine wilderness was now frequented by noisy PWC.

This type of disruption by PWC use is not at all limited to canoeists and kayakers. A vivid account of PWC operators harassing a catamaran operator appeared in the San Diego Union Tribune. The

EXPERIENCE UNENJOYABLE WATERS

catamaran operator recalled, “We were heading out the Mission Bay Channel when five of them roared through the 5 mph zone at speeds well over 50 mph. I stopped counting the number of Coast Guard regulations they violated, as they spread out across the channel and bore down on us. My wife screamed as two of them strafed us, passing inches away on either side, spraying water over us that reached six feet up my mast. I quickly tacked, set a course for home and will never again sail on Mission Bay between May and September.” A similarly disruptive PWC encounter is recalled by Ron Brooks, Saltwater Fishing Guide at About.com (<http://saltfishing.about.com>). As Brooks fished on Florida’s Hairpin Creek - a shallow, narrow and twisting stream near Jacksonville - he first heard, and then saw, four PWC heading up the creek toward him.

“As I watched in disbelief, these four idiots...came at us wide open. The distance between my boat and the shallow bank we were fishing was about twenty feet. We could easily cast all the way into the grass bank. Without slowing, smiling or even looking at us, they ran between my boat and the bank, taking one of our lines with them!” Then recounting the PWC pass on their way back out of the creek Brooks wrote “...the last one to go by smiled as he turned and looked at us over his shoulder – and then gave us a one finger salute! Needless to say, the fish left us. Even the deeper side of the creek was turned off.”

Waterfront residents have also experienced widespread disturbance from PWC operation. Waterfront residents experience PWC disruption of both on-water recreation and the leisurely enjoyment of the water from their homes or docks. Lakefront property owner associations have advocated for limits on PWC use in many states. In letters to state and local officials urging more PWC regulation, these associations and their members typically cite noise and safety concerns. Below is a posting to a PWC Internet newsgroup by a PWC owner and new lakefront property owner which illustrates the impacts PWC have on waterfront residents.



Photo by David Jenkins

“I am in the last stages of escrow on a house...and went there for a walk through on Sunday...the house is right by a 5mph/no wake zone and is slightly sheltered by a point, which holds 2 houses in a semi-cove...During the whole time I was there, about 8 PWC’s went by and about 12-13 boats. Only 1 boat violated the no wake 5mph zone. EVERY PWC violated the no wake zone, many using the 5mph buoy as a turn buoy. Many of the PWC’s zoomed into the cove at speeds exceeding 30 mph and came within 10’ of the docks. It really was a bummer to see this through the eyes of a property owner for the first time. All I could think about was how I was going to handle it when my kid was swimming in the cove. The people that buzzed the cove did it without a care in the world, a guy on a stand up did a heavy hairpin turn which sent all the docks shaking. I was honestly depressed after leaving there. I know this is going to be an unpopular statement, but I really have to say that if I had grown up with a lake house I would probably be all over a PWC ban if this is the normal behavior that goes on there.”

These types of PWC encounters are very common among a wide variety of water-related recreational activities. While it is impossible to know exactly how many people each year have disruptive encounters with PWC operation, the sheer volume of complaints alone indicates a widespread problem that adversely impacts many people.

UNENJOYABLE WATERS EXPERIENCE

Disturbing Design

Just as the unique design characteristics of PWC contribute to a disproportionately poor safety record, evidence suggests that these characteristics also result in a greater degree of PWC-related conflict with other recreational activities. Based on a review of actual complaints and media accounts of PWC-related conflicts over the past five years, ACA found that complaints about PWC use are most frequently related to the speed, noise, pollution and typical operation of the craft.

Speed and Maneuverability

The primary purpose of PWC is high-speed recreation. This is evidenced by the design and marketing of PWC. Observations of PWC in use, as well as data on citations and PWC accident causes, indicate that PWC are frequently operated at speeds in excess of 40 mph. A vessel operating at high speeds in close proximity to other types of recreation is often disruptive.

Additionally, the exceptional maneuverability of PWC — and the recreational objectives of their operators — encourages frequent and unpredictable changes in direction that is not typical of other vessel types. Because of this maneuverability, PWC users are more likely to perform stunts near other boaters and less likely to confine high-speed operation to a center channel or other open water areas. This characteristic greatly increases the likelihood of PWC to adversely impact other recreational activities.



Photo by David Jenkins

A REALLY BAD BUZZ!



Noise

Noise pollution is one of the most frequent complaints lodged against PWC. The noise of PWC alone can render a waterway unsuitable for a variety of recreational activities. PWC noise destroys natural solitude and displaces wildlife (which hampers viewing opportunities), thus eliminating the ability of people to enjoy two desirable natural qualities of waterways on which activities such as canoeing, kayaking, rafting, fishing, hiking and camping depend.

While the PWC industry maintains that PWC emit less noise than other motorboats — even though study after study continues to show otherwise — the manufacturers also claim to be developing quieter watercraft. In postings to Internet news groups PWC riders have noted that the new four-stroke PWC models, when at or near full-throttle, make about the same amount of noise as PWC with conventional two-stroke engines. Only time will tell how much quieter future models become, but due to typical patterns of PWC operation such as lingering in one area and the fact that the million or so older PWC will continue to be operated for many years to come, the prospect of a significant change on the water anytime soon is remote.

In a 1994 issue of *LakeLine*, Kenneth J. Wagner, Ph.D. reported in an article titled “Of Hammocks and Horsepower,” the findings of a noise study on Rhode Island’s Watchaug Pond. The study found that PWC were 10 decibels louder on average than other motorboats. He concluded “...jet skis are

EXPERIENCE UNENJOYABLE WATERS

louder as a function of short hull length and greater transfer of sound waves to the air than to the water.” He also noted that one of the reasons PWC annoy more people than other watercraft is “the changes in loudness and pitch for jetskis are far greater than for most other watercraft.”

A study by the Noise Pollution Clearinghouse showed that PWC noise reduces the value of a beachgoer’s experience by 25 percent, with an estimated nationwide cost to beachgoers of \$908 million annually. The study also concluded the costs to canoeists and kayakers would be far greater than the costs to beachgoers, stating “The impacts are clearly most severe for users of human-powered craft...no one suffers jet ski noise more keenly than a paddler whose exploration of placid coves and inlets is shattered by the roar of jet skis.”

Shallow Draft

The hull and engine design of PWC gives them a unique ability to operate in shallow or confined areas where they are more likely to threaten the safety and enjoyment of other waterway users. This is a major reason PWC inflict a far greater impact on activities such as fishing, canoeing, kayaking and camping than traditional motorboats. The shallow draft of PWC allow them to operate in as little as one foot of water.

Most vessel types travel at higher speeds in open and deep-water areas such as a main waterway channel, avoiding areas where they could accidentally run aground or damage the boat on barely submerged objects. This preference has tended to separate high-speed boating from near-shore activities easily disrupted by vessels traveling at high speeds. PWC operation, however, is rarely confined to deep and open waters. High-speed PWC use occurs near shore, next to docks, in shallow coves, narrow streams, small lakes, ponds, marshes, estuaries and even in whitewater rivers.



PWC Ad Encourages PWC Use on Whitewater

Visible Pollution

While water and air pollution emitted by jet skis impact the natural environment, this pollution also impacts the recreational experiences of other waterway users. Many of the canoeists and kayakers who have contacted ACA about PWC impacts witnessed clouds of blue smoke, an intense smell of fuel and an oily sheen left on the water in the wake of PWC. Based on these paddlers’ complaints, and similar complaints from windsurfers and fishermen, it is clear that pollution associated with PWC use can diminish the enjoyment of other waterway users.

The PWC industry has manufactured a few cleaner burning four-stroke models; however, this will not significantly change PWC pollution impacts to other waterway users. Since the industry has introduced only a few such models, the majority of PWC sold will continue to have two-stroke engines. In addition, PWIA estimates that there are over 1 million older-model PWC still in operation.

Regardless of whether a PWC has a two-stroke or four-stroke engine, the constant engine revving, acceleration and high-speed operation characteristic

UNENJOYABLE WATERS **EXPERIENCE**

of PWC use increases the amount of visible pollution emitted from these craft, as does the tendency of PWC operators to remain in one area for long periods of time. These inherent operational characteristics increase both the levels of pollution emitted and the impacts of that pollution on other forms of recreation.

Analyses conducted by both the Environmental Protection Agency (EPA) and the National Park Service (NPS) indicate decreased visibility and increased particulate matter in areas with concentrations of two-stroke engines. PWC emissions can also have adverse health impacts on other waterway users. PWC emissions contain carbon monoxide, formaldehyde, benzene and other harmful air pollutants. Exposure to these emissions can result in carbon monoxide poisoning, the most common symptoms of which are headaches, dizziness, nausea and impaired judgment.

Yellowstone National Park employees have experienced these symptoms after exposure to similar emissions from snowmobiles. Carbon monoxide levels at Yellowstone's entrance stations were found to exceed the National Ambient Air Quality Standard (NAAQS) for carbon monoxide and the personnel who man these entrances have been given respirators to protect their health.



Photo by David Jenkins

Corrupting Influence?

Some believe PWC operators buy or rent PWC simply for the thrill factor and are more predisposed to engage in irresponsible behavior than other boaters. In *Trade Only*, Marine Retailers Association of America President Phil Keeter stated people “buy the personal watercraft as a thrill thing and they love that part of it...they are not a boat buyer at all.” Others are convinced PWC operators are not predisposed to irresponsible behavior, but rather are drawn into such behavior by the craft's design characteristics. Such is the opinion of Lieutenant Robbie Cox of the Jackson County Mississippi Sheriff's Department, who stated in the Clarion-Ledger newspaper, “You can put a Ph.D. on a personal watercraft and they become an instant idiot.”

Anecdotal evidence suggests the combination of power, speed, shallow draft and maneuverability designed into PWC influences operator behavior. Evidence of this ability to tempt responsible people into behaving irresponsibly is found in the number of instances where otherwise responsible law enforcement officials have been seen recklessly operating PWC. ACA is aware of such incidences in New York, Texas, California and Oregon. In one such incident on the Columbia River a sheriff deputy on a PWC, who was supposed to be a safety boater, began performing stunts and almost capsized ACA's Director of Safety Education and Instruction who was paddling nearby in a canoe.

Regardless of the mechanism by which it occurs, there is ample evidence that PWC operators are more likely than other boaters to engage in reckless or harassing behaviors. Based on conversations ACA has had with marine law enforcement officials from Alaska, Arkansas, California, Colorado, Florida, Maine, Minnesota, Montana, Nevada, New Hampshire, New York, Vermont, Washington and Utah, PWC use generates more complaints of harassment and reckless behavior than the operation of other vessel types. A four-year study by NPS of warnings and tickets written for reckless operation along the Mississippi portion of Gulf Islands National Seashore showed that 59 percent

EXPERIENCE UNENJOYABLE WATERS

of them were issued to PWC riders, even though PWC comprise only 6.7 percent of the area's registered vessels.



Photo by David Jenkins

No Escape

Based on surface water data from the United States Geological Survey (USGS) and a review of federal, state and local regulations, ACA estimates that over 98 percent of the nation's surface waters are currently available to PWC use.

The United States has 79,481 square miles of inland surface water. This is a conservative figure that does not include rivers, streams or canals under one-eighth of a mile wide; lakes of less than 40 acres; or lands partially covered by water. The United States also has 12,383 miles of general

coastline with ocean waters used by motorized recreational vessels within one mile of shore and often utilized much further from shore.

A review of all known surface waters with PWC prohibitions in place found that nationwide less than 1,000 of the more than 79,481 square miles of inland surface waters are off-limits to PWC use. Furthermore, a majority of those off-limit waters are in remote areas. Some are water supply reservoirs and off limits to all boating. In addition to being allowed on over 78,500 of the 79,481 square miles of inland waters, PWC are also allowed on well over 99 percent of U.S. ocean waters. The exact ocean water percentage depends on the distance from shore the total square mileage is based on. The ACA estimate is based on a calculation of only one mile out from shore. US territorial waters extend 12 miles out from shore. Combine these statistics with the ability of PWC to operate in shallow and/or confined areas, and it becomes clear that high-speed PWC use has the ability to dominate the vast majority of US surface water. Consequently, there are few areas where other forms of waterway recreation — activities such as canoeing, kayaking, fishing, sailing, windsurfing and wildlife viewing — can escape the potential impacts of PWC use. PWC use has already rendered many waters across the nation unsuitable for these other activities.

UNENJOYABLE WATERS EXPERIENCE

A Broader Problem: Conflicting Ideas of Fun

The impacts of PWC use on the public's ability to enjoy the nation's waters is, in many ways, similar to the impacts of other types of off-highway vehicle (OHV) use on the public's ability to enjoy the nation's public lands. All terrain vehicle (ATV) and off-road motorcycle use frequently disrupts the recreational experiences of hikers and backpackers. Cross-country skiers and other winter travelers are likewise besieged by snowmobile use.

These divergent recreational activities engage in a national struggle over use of the nation's public lands and waters. At the heart of this struggle reside conflicting ideas of fun. For canoeists, kayakers, hikers, backpackers, cross-country skiers and other non-motorized travelers, enjoyment is often dependent on the quality of the natural environment and its wildness. Having clean air and water, seeing wildlife, listening to the sounds of nature and escaping from the noise of everyday life are essential parts of these activities. Those who enjoy fishing and hunting often seek these environmental qualities also. The presence of loud, high-speed, motorized recreation can entirely deny any of these outdoor enthusiasts the recreational experience he or she is seeking.

According to organizations that represent hikers, backcountry skiers and fishermen, their members' complaints regarding motorized use are almost identical

to those raised by canoeists and kayakers. Those complaints include noise, speed, the intentional harassment of people and wildlife, air pollution, water pollution and various other types of resource destruction. Three primary issues of concern appear in these complaints: the individual's safety, damage to the environment and the loss of the recreational experience being sought.

In general, the experiences sought by motorized users are very different from the experiences sought by non-motorized users. ACA recently reviewed dozens of articles on motorized recreation web sites or in motorized recreation magazines and monitored postings to Internet groups dedicated to PWC, ATV and snowmobile use. The articles and postings indicated that the recreational enjoyment of PWC, ATV, and snowmobile users is mostly centered on the machine and its performance — not the natural environment. In fact, of the articles and postings reviewed, a significant portion expressed disdain for environmental protection or enjoyment over the environmental damage caused by themselves or others.

In newspaper articles and conversations with ACA, public land managers have cited major problems with intentional resource damage from motorized-users. Many of the complaints about intentional resource damage involve ATV users who ignore speed and route regulation, create illegal

trails, drive through streambeds or litter.

George Buckingham, ecosystem planner for Colville National Forest, described such incidents in a *Sportsman Review* article. "Off-roaders drove through the meadows as well as through seasonal streams. They did considerable damage to the vegetation and soil. They left a lot of trash in the meadows and near the Middle Fork of the Calispell. It's just a mess."

The reports of intentional resource damage regarding snowmobile and PWC use typically involve wildlife harassment and violations of regulations designed to protect ecologically sensitive areas.

These seemingly irreconcilable recreational objectives and disparate views on the proper use of the nation's public lands and waters will likely shape the struggle over these protected resources for the foreseeable future. The view that off-highway motorized use is inappropriate is most often attributed to environmental groups. The conflict is portrayed as a battle between recreation and the environment or between those who want to use the resource and those who want to "lock it up." These characterizations of the conflict are mostly inaccurate and designed to benefit the motorized-use advocates. A huge part of the dispute regards incompatible recreational needs, very different stewardship ethics and conflicting ideas of fun.

ENVIRONMENT **DAMAGED WATERS**

In addition to its impacts on safety and recreational enjoyment, PWC use also has significant impacts on the environment. PWC contribute unacceptable amounts of pollutants into the water and air. They damage sensitive near shore environments. And their use often displaces, disrupts or otherwise injures wildlife. While many of these environmental impacts were mentioned previously in this report as recreational impacts, such impacts also have a detrimental affect on the waterways themselves and on associated ecosystems.

The rhetoric employed by groups on both sides of the debate regarding PWC use and the environment does not always lead to an accurate impression of the facts. The PWC industry has made many erroneous claims that are intended to deflect criticism, including that PWC are less threatening to wildlife than canoes and kayaks because they make noise and cannot sneak up on animals. Some environmental advocates have stated that PWC and other two-stroke powered vessels dump 15 times more fuel into America's waters than did the Exxon Valdez oil spill. While this statement appears reasonably accurate with respect to volume of fuel, an unburned oil/gasoline mixture dispersed by many PWC over a wide area and during the course of a year has significantly different impacts than a 165 million gallon spill of raw crude oil.

The Environmental Protection Agency (EPA) asserts that a typical PWC discharges between 50 and 60 gallons of unburned gasoline into the environment annually.

After wading through the rhetoric, what remains is significant and compelling evidence that PWC have specific environmental impacts, unique impacts that degrade the nation's waterways, reduce air quality and harm wildlife. In addition to an abundance of anecdotal evidence from people who observe the visible and audible pollution emitted by PWC, as well as the impacts of their use on wildlife, a good number of scientific studies have been conducted that confirm and provide insight into the environmental impacts of PWC use.

Water Pollution

The amount of water pollution generated by PWC use is due, in part, to the inefficient two-stroke engines utilized in most of these craft. Both conventional (carbureted) and newer direct-injected two-stroke engines run on a mixture of oil and gasoline, the conventional versions have been shown by numerous studies and reports to discharge as much as one-third of this gas/oil mixture unburned into the water. Bluewater Network, an organization that has extensively studied two-stroke engine pollution, estimates that an average two-hour ride on a PWC can dump between 3 and 4 gallons of gas and oil into the water. The Environmental Protection Agency (EPA) asserts that a typical PWC annually discharges between 50 and 60 gallons of unburned gasoline into the environment.

A 2002 National Research Council (NRC) report, noting that the two stroke engines found on many PWC and other recreational boats were purposely designed to discharge gasoline and oil, found that land runoff and recreational boating account for nearly three-quarters of the petroleum released into the sea each year through human



Photo by David Jenkins

DAMAGED WATERS ENVIRONMENT

consumption. The report — titled “Oil in the Sea: Inputs, Fates, and Effects” — concluded that these discharges may inflict more damage than previously thought, and that adverse effects on marine species can occur at very low concentrations.

Due to pressure from EPA, the PWC industry has begun placing direct-injected two-stroke and four-stroke engines in some PWC models. These new technology engines pollute less than the widely used carbureted two-stroke engines; however, several factors raise doubts about the effective impact of these newer engines at reducing PWC pollution.

One obvious factor is that the PWC industry is only employing these newer engines on some PWC models and continues to produce and sell PWC with carbureted two-stroke engines. Another is that there are over 1 million PWC with older two-stroke engines that will continue to operate on the nation’s waters for the foreseeable future. However, perhaps the biggest problem is that PWC pollution also results from the specific design and operational characteristics of PWC.

With most PWC models having engines in the 130-160 horsepower range, the amount of fuel burned and pollution created is greater than that of most outboard marine motors, which are typically not as powerful. The high-speed operation, constant acceleration and engine revving that is typical of PWC operation also causes PWC to pollute more than most other vessel types. With any currently-utilized engine technology, the unique design and operation of PWC is likely to compromise the environmental benefits. When answering the question of whether PWC pollute more than other existing technology two-strokes, PWIA’s only response is “outboard engines and

The high-speed operation, constant acceleration and engine revving that is typical of PWC operation also causes PWC to pollute more than most other vessel types.

personal watercraft engines operated at the same power level emit similar amounts of emissions.”

The adverse effects of fuel discharges into waterways are significant. In its “Motorized Watercraft Environmental Assessment” for Lake

Tahoe, the Tahoe Regional Planning Agency cited scientific studies that found that one-gallon of fuel is capable of tainting one million gallons of sea water. According to EPA, the gasoline constituents emitted by PWC into the water include MTBE (methyl tertiary butyl

ether), benzene (a known human carcinogen), toluene, zylene, and acetone/hexane.

MTBE is a suspected carcinogen that is very soluble and difficult to remove from water. The other toxic chemicals, once released, float on the water’s surface and eventually settle within estuarine and shallow ecosystems where aquatic life is often in developmental phases and most vulnerable. EPA also believes that due to *bioaccumulation* and *biomagnification*, these pollutants can endanger recreationists as well as threatened species of wildlife such as the Bald Eagle.

In 1999 the Water Operations Branch of the National Park Service (NPS) produced a report titled “Water Quality Concerns Related to Personal Watercraft Usage.” The report found that concentrations of MTBE and polycyclic aromatic hydrocarbon (PAH) are present in waters with heavy PWC usage. The report noted that PAHs are considered dangerous to aquatic organisms and may pose a risk to human health in waters where fish are caught and eaten or in waters utilized as a drinking water source.

Perhaps the best case study regarding the impacts of PWC use on water quality is Lake Tahoe. The water quality of Lake Tahoe has been declining for years due to variety of causes.

ENVIRONMENT DAMAGED WATERS

Elevated levels of MTBE and toluene were discovered in the lake. The impacts of motorized recreation, namely two-stroke engines, were identified as the likely culprit. In its "Motorized Watercraft Environmental Assessment" the Tahoe Regional Planning Agency estimated that in 1994 two-stroke engines discharged 775 gallons per day of raw-fuel into Lake Tahoe, while four-stroke engines discharged 154 gallons per day.

In 1999, after pressure from groups such as The League to Save Lake Tahoe, a ban on PWC and other boats with carbureted two-stroke engines went into effect on the lake. The result has been a huge drop in gasoline related pollution. One year after the ban went into effect, scientists from UC Davis, University of Nevada Reno, and US Geological Surveys sampled the waters of Lake Tahoe for gasoline pollutants. They found MTBE levels had dropped by 95 percent and toluene levels had dropped by 88 percent after only one year. The scientists concluded that the dramatic drop in the levels of these toxic pollutants is directly related to the ban on two-stroke engines.

Air Pollution

For many of the same reasons PWC emit large amounts of water pollution, they also emit high levels of air pollution. The inefficiency of two-stroke engines and the operational characteristics of the craft remain the key factors. According to EPA, two-stroke engines are responsible for over 1.1 billion pounds of hydrocarbon emissions each year.

According to the California Air Resources Board (CARB), an average one-hour ride on a PWC emits the same amount of smog-forming air pollution as driving a modern car for a year. A study conducted for CARB found that a typical PWC produces 2,210 lbs. of emissions per 1,000 gallons of fuel used. The disproportionately high emission rate of PWC means that PWC contribute more than most other recreational activities to broader pollution problems such as smog and the associated health consequences of poor air quality.



Photo by David Jenkins

Some of the adverse impacts caused by PWC-related air pollution were addressed in the *Unenjoyable Waters* section of this report. The disproportionately high emission rate of PWC also means that PWC contribute more than most other recreational activities to broader pollution problems such as smog and the associated health consequences of poor air quality.

An EPA report to the United Nations entitled, *Climate Action Report 2002*, underscores the threat posed by such emissions, finding that "Greenhouse gases are accumulating in Earth's atmosphere as a result of human activities, causing global mean surface air temperature and subsurface ocean temperature to rise." The report went on to predict future consequences that include drought conditions, rising ocean levels, heat waves, wetland loss, floods, and reduced farming output.

NOTE: Additional PWC air pollution consequences related to recreational enjoyment were identified on page 20.

Near Shore Impacts

Because of their unique design, PWC are often operated at high-speeds in very shallow waters close to shore. As mentioned in the recreational impacts portion of this report, PWC can operate in as little a 1 foot of water. Near-shore areas are often ecologically critical and are more sensitive

DAMAGED WATERS ENVIRONMENT

to disturbance. The extreme thrust from a PWC operating at even moderate speeds can violently disturb the bed of the waterbody and any flora or fauna that resides there. The EPA, in a letter to the Superintendent of the Missouri National Recreation River commenting on a proposed PWC ban, drew connections between riverbank erosion and PWC use.

Lyle Raymond Jr., a water resources specialist for 30 years, noted in his comments supporting a proposed statewide 5 mph zone extending 200 feet from shore for New York, "A growing body of scientific evidence clearly indicates that severe environmental impacts can occur in shallow near-shore areas from operation of high-powered watercraft at greater than 5 mph speeds." He went on to note that the state's existing 100' speed limit zone was inadequate and that "Increased turbidity, which adversely affects growing conditions for shallow aquatic plants and the ecosystem associated with them, and the mixing of bottom sediments, which often contain substances that reenter the food chain, are but two examples of such impacts."

Dr. Russell Long of Bluewater Network points out that shallow and remote areas, which are critical to a water body's health, are the most sensitive to environmental pollution. He goes on to note, "When the petrochemicals in gas and oil that are released from two-stroke motors settle within shallow ecosystems they pose a significant threat to many organisms at the base of the food chain: fish eggs, algae, shellfish, and zooplankton. Many of these toxins are believed to *bioaccumulate* and scientific research has found that chromosomal damage, reduced growth, and high mortality rates in fish occur at extremely low levels of hydrocarbon pollution."

Impacts on Wildlife

In addition to the detrimental affects on wildlife caused by the water pollution, air pollution and disruption of near-shore aquatic environments that is associated with PWC use, the noise and typical operation patterns of PWC have been found to



PWC Industry Ad Acknowledges Wildlife Impacts

disrupt and pose serious threats to a wide variety of wildlife. A growing body of reliable scientific research and official determinations have documented these impacts.

- A 2001 study entitled "Short-Term Effects of Boat Traffic of Bottlenose Dolphins in Sarasota Bay" found changes in dolphin behavior are "more likely to occur in response to a PWC than to an outboard at slow and fast speeds." The study found the erratic characteristics of typical PWC operation, such as frequency of turns and likelihood of changing engine speed, cause greater disturbance. It also points to the ability of PWC to travel in extremely shallow water as a greater risk to dolphins by "invading" their safehavens from traditional boat traffic and disturbing their use of shallow, protected waters to feed and calf rearing.

- Joanna Burger, author of a Rutgers University PWC study, observed PWC impacts on Common Terns in New Jersey's Barnegat Bay. Burger's study implicated PWC use as the likely cause of an almost total nesting failure in 1996. The nesting

ENVIRONMENT **DAMAGED WATERS**

failure correlated with a more than 30 fold increase in PWC traffic. In her study, Burger found that approximately three times as many Terns were flushed by PWC as were flushed by traditional boats. In conducting her study she also witnessed PWC running over Tern nests containing either eggs or chicks.

- A study of PWC along Washington's San Juan Islands, conducted by the Woods Hole Oceanographic Institute, found that

PWC pose a unique threat to surfacing birds or marine mammals. PWC lack the low-frequency long distance sounds needed to adequately signal these birds or mammals of their presence, thus failing to warn the animals of the approaching danger until they are almost on top of them, causing undue panic and disturbance.

- In California, biologists observed the separation of seal pups from their mothers as a result of nearby PWC operation. Studies show that seals are quite skittish, and marine mammal experts have expressed concern that PWC activity near seals and sea lions disturbs normal rest and social interaction on haul outs, causing stampedes into the water that can separate seal pups from adult mothers.

PWC use presents a unique and significant threat to many species of wildlife.

- A paper entitled *Impacts of Boats and Personal Watercraft on Loons and other Waterbirds in New Hampshire*, prepared by Harry Vogel, executive director of the Loon Preservation Committee of the Audubon Society of New Hampshire, concluded that the unique design of PWC "cause significant damage because PWC closely

approach nests and shorelines at high speed." The paper cited personal observations, reports and studies that documented the "adverse effects of personal watercraft on

loons and other waterbirds" and noted that significantly healthier loon populations have been observed on lakes where PWC are banned than on lakes with significant PWC use. Judy McIntyre, researcher and director of the North American Loon Fund, is convinced that PWC currently represent the greatest single threat to breeding loon populations. These findings coincide with the more than a dozen eyewitness accounts of loon disruption that have been reported to ACA.

- Dr. John Rogers, of the Florida Game and Freshwater Fish Commission, reports data showing that Brown Pelicans, which often approach other vessels, maintain a large distance from PWC.

- Local officials in Alaska's Matanuska-Susitna Borough prohibited PWC use on local lakes after finding that such use had displaced the swan population on several Borough lakes.

- Tom Wilmers, a U.S. Fish and Wildlife Biologist at Key Deer National Wildlife Refuge, has observed significant PWC impacts on nesting osprey. He observed a jet ski repeatedly flush an osprey from its nest site 11 times in less than one hour. Wilmers found that the tendency of PWC to operate continuously in one location for extended periods of time exacerbates the disturbance factor by reducing opportunities for displaced birds to return to feeding or nesting areas.



Photo by David Jenkins

DAMAGED WATERS ENVIRONMENT

- Officials with both the U.S. Fish and Wildlife Service (USFWS) in Alaska and the Washington State Department of Fish and Wildlife have expressed concern that PWC operation has adverse impacts on spawning salmon.

Equally as compelling as scientific research and official observations are the many accounts of specific incidences of PWC impact on wildlife. Eyewitness accounts exist of PWC operators destroying loon and tern nests, stampeding seals and sea lions, colliding with manatees, harassing sea otters, and colliding with ducks and swans.

A Michigan man was officially charged with “taking a protected species” after three witnesses observed him intentionally run over a beloved local swan known as Elliot.

One such case, reported by Associated Press (AP) on 7/12/2001, illustrates the widespread problem of PWC operator harassment of wildlife. In this

case a Michigan man was officially charged with “taking a protected species” after three witnesses observed him intentionally chase down and run over a beloved local swan known as Elliot. The PWC operator was also cited for allowing his underage daughter to drive the

PWC. The swan first arrived at Clifford Lake, near Staunton seven years ago. A year after its arrival the swan was struck by another personal watercraft but survived.

Another incident reported by AP on 11/20/01, this time in Florida, illustrates the role speed can play in PWC encounters with wildlife. According to the article, “a man dashing across a lake on a customized personal watercraft at about 55 mph was killed in an apparent collision with a flying duck.” Florida boating officials indicated that the PWC operator flushed the duck and, despite the fact that ducks are fast flyers, the bird could not avoid the speeding PWC. An owner of the PWC dealership where the watercraft operator was employed was quoted by AP as saying that at the speed the man was traveling, the 10- to 15-pound duck “might as well have been a cinder block.”

The research, observations and reports cited above, while in no way exhaustive on the matter, do present an abundance of evidence that PWC use presents a unique and significant threat to many species of wildlife. PWC-specific characteristics such as noise levels and pitch, shallow draft, high-speed design, maneuverability result in disproportionate impacts, as does the propensity of PWC operators to be inattentive, indifferent or malicious towards wildlife and its habitat.



Photo by Ken Madsen

THE REGULATORY ENVIRONMENT

The current regulatory environment regarding PWC use, while showing some signs of positive change, does not adequately protect waterway users from the safety threats posed by PWC use. Nor does it sufficiently safeguard the quality of the waterways and the recreational experiences of other waterway users. While ACA strongly supports the right of individuals to challenge themselves and take risks, and is in no way advocating for an overly burdensome regulatory environment that strives to eliminate risk from outdoor activities, ACA is also convinced that when one user group imposes a disproportionate amount of risk and disruption on other users and the environment, additional regulation is needed.

The most obvious indication of regulatory failure is the PWC accident data. The level of PWC regulation has thus far proved insufficient to address the disproportionate accident rate of PWC. In fact, the proportion of PWC accidents that are collisions has actually increased over the past five years. Some PWC accident data have shown slight improvement over time, as does most boating accident data, but that progress is not very consequential given the scope of the problem.

Due to the sparse coverage of on-water law enforcement and the reluctance of state and local boating officials to separate high-speed PWC use from other waterway recreation, much of the public is left completely exposed to the whims of PWC operators. In addition, the penalties for offenses such as speeding, reckless operation, and intentional harassment are often not severe enough to significantly deter such behavior. On

most waterways, a PWC user can recklessly speed across the water, harass people or wildlife, and even intentionally ram a kayak, with little chance of ever being caught and even less likelihood of being adequately punished.

State and Local Government

State level PWC regulations have, for the most part, evolved in directions where PWC industry opposition is either weak or nonexistent. The most prevalent regulations are minimum age requirements, mandatory PFD wearage, restrictions on night operation, and limitations on wake jumping. Other types of regulation are not very common. According to information available from the National Association of State Boating Law Administrators (NASBLA), 14 states have specific statewide protections for swimming areas, 12 states have PWC specific speed limits, 10 states have PWC speed/wake restrictions within a certain distance of shore and eight have PWC distance requirements from other vessels (see Appendix A).

The growing frustration with PWC-related problems has in recent years prompted several state legislators to champion more significant PWC limitations. Hawaii, Maine, New Hampshire, New York and Vermont recently passed laws that protect certain waters from PWC use and/or give specific PWC regulatory authority to local jurisdictions. New York also passed a law establishing noise limits for PWC. Each of these laws passed over the strong objections of the PWC Industry.

State boating agencies have the strongest influence over state boating laws and this is where the PWC lobby has focused much of its attention. While there are many good and dedicated state boating officials, much of the regulatory failure in managing PWC use can be traced to these agencies. ACA has found a strong regulatory bias among many state boating officials to treat all vessel types equally, irrespective of accident data



Photo by David Jenkins

THE REGULATORY ENVIRONMENT

or impacts on other waterway users. This doctrine of equal treatment and access is the cornerstone of the PWC industry's position, and it results in a regulatory approach unwilling to segregate exclusively high-speed activities from other types of waterway recreation.

ACA and other organizations have encountered resistance from some states in trying to gather accurate PWC accident data. In these cases, state boating officials proffered excuses for the nationwide PWC accident record and

repeated the official arguments and policies of Personal Watercraft Industry Association (PWIA). A significant number of state boating law administrators, in conversations with ACA, refused to acknowledge that PWC pose a unique safety threat to other waterway users. This automatic defense of PWC and reluctance to share information on the part of the agencies most directly responsible for boating regulation raises significant concerns about the level influence of the personal watercraft industry lobby on state boating officials — and the toll that influence has on public safety.

Through ACA's efforts to collect PWC accident data from states, ACA found that a majority of states do not adequately collect and study PWC accident data. Notable exceptions include Florida, California and Nevada. These states collect significant PWC specific accident information and are happy to share it. Another shortcoming ACA discovered is that 20 states fail to even report the number of registered PWC to the USCG, choosing instead to simply lump PWC into another vessel category.

Inadequate law enforcement coverage is another serious concern. Multiple factors conspire to create this enforcement problem. By failing to restrict high-speed activities to limited areas, states allow the dispersal of those activities over all or most of the state's surface waters. The result is a

sacrifice in ability to control the activities that are most likely to place other boaters at risk. Funding also plays a significant role. State boating agencies frequently point to insufficient funding for marine enforcement, which results in fewer officers on the water, as a critical problem.

State boating agencies have the strongest influence over state boating laws and this is where the PWC lobby has focused much of its attention.

Given the issues with enforcement coverage and the subjective nature of the legal system, ACA was unable to determine the extent to which statutory penalties for legal infractions such as speeding, reckless operation, harassment and boating under the

influence are severe enough to deter those activities. It seems clear that there is not an adequate level of deterrence, but given the differences in law from state to state and variances in the tendencies of judges and law enforcement officers, it is difficult to assess exactly where the breakdown is.

State law and the amount of authority given to state boating agencies has a great impact on the ability of local government to regulate PWC use. States that currently allow the local regulation of PWC use include California, Florida, Idaho, Maine, New York, North Carolina and Washington. Localities such as San Juan County in Washington; Mendocino County, San Francisco County, and the city of Malibu in California; Monroe and Walton Counties in Florida; and the city of Raleigh in North Carolina have all adopted local ordinances that limit the areas open to PWC use.

Most of these local ordinances strive to protect beach goers and other water users by keeping PWC use far away (up to 1200 feet) from shore. In the case of Mendocino County, PWC are prohibited on all coastal estuaries, including associated bays and rivers for seven miles upstream from mouth. San Juan County has a total prohibition on PWC use on waters within the county. Courts, for the most part, have upheld local

THE REGULATORY ENVIRONMENT

PWC restrictions. A PWC ban in Marin County, California that was overturned when a Superior Court judge ruled the County had not adequately established cause was later upheld on appeal.

Due to legal threats from PWIA, some localities have been reluctant to prohibit PWC use on waterways where federal dollars have been used to create or maintain improved access facilities. The PWIA threats are based on its interpretation of language in the Federal Aid in Sport Fish Restoration Act (FASFRA) which provides monies for boating access (see the discussion of FASFRA under Federal Government). Despite the questionable legal merits of these threats, there are numerous ways for states and localities to construct regulations that steer clear of the FASFRA issue.

Federal Government

The federal regulatory treatment of PWC varies greatly from agency to agency. The National Park Service (NPS) decision to prohibit PWC use in most National Park Units is the single most significant government action taken to date to protect the public and the environment from the impacts of PWC use. Individual resource units of NPS, the U.S. Fish and Wildlife Service, and the National Oceanic and Atmospheric Administration have also enacted PWC prohibitions. Other federal land management agencies such as the U.S.D.A. Forest Service, the Bureau of Land Management, the Bureau of Reclamation, and the U.S. Army Corps of Engineers have taken little, if any, action to address the impacts of PWC use. Furthermore, the United States Coast Guard — the agency that most directly oversees boating activities — has not taken any significant regulatory action to address PWC accident rates or the impacts of PWC on other waterway users.

National Park Service

On March 21, 2000, the National Park Service (NPS) adopted a landmark PWC policy that prohibits PWC in 66 of the 87 national park units.

In the remaining 21 units, the policy left much of the decision making to the individual units. Under the policy, PWC use was to be phased out in 11 of the remaining park units in April of 2002 unless these units adopt a special regulation specifically permitting personal watercraft use. These units were primarily National Seashores or Lakeshores. In the other 10 park units, mostly National Recreation Areas, the policy allows PWC use to continue unless the units adopt a special regulation prohibiting PWC use.



Photo by David Jenkins

When the April 2002 deadline passed, PWC use was permanently prohibited in 5 of the 11 units where use was to be phased out. The other 6 units in this category temporarily prohibited PWC use, but planned to make a final determination on PWC use in the near future.

As a result of a lawsuit by the Bluewater Network, the 10 units where NPS envisioned PWC use would be allowed now also must evaluate the appropriateness of PWC use. Bluewater brought suit against the NPS for not banning PWC use in all 87 park units, arguing that PWC operation in any NPS unit violated the Park Service's legal mandate to leave park resources unimpaired. In a settlement finalized by the Bush Administration, NPS agreed to prohibit PWC use at all 21 remaining park units unless the agency undertakes a park-specific rulemaking process for each that complies with the National Environmental Policy Act. The settlement stipulates that the process must be completed no later than the fall of 2002.

THE REGULATORY ENVIRONMENT

United States Fish & Wildlife Service

The United States Fish and Wildlife Service (USFWS) has prohibited PWC use in many wildlife refuges. According to a General Accounting Office (GAO) report (RCED-00-243) provided to Congress in September of 2000, PWC use is prohibited in approximately 183 USFWS units and allowed in approximately 167. In responding to the GAO survey, 109 USFWS units reported PWC use. USFWS claims that 69 percent of these refuges remain exposed to PWC impacts because USFWS lacks total jurisdiction to regulate use. The GAO report also found that USFWS had not adequately assessed PWC impacts to refuges and that USFWS lacks the necessary personnel to sufficiently enforce the existing regulations on PWC use.

USFWS is also responsible for managing the Federal Aid in Sport Fish Restoration Act (FASFRA) monies, which are part of the Wallop-Breaux Trust Fund. Trust fund receipts consist of Federal excise taxes attributable to motorboat and small-engine fuel use and on sport fishing equipment, along with import duties on fishing equipment, yachts and pleasure craft. In its regulatory language for FASFRA, the USFWS bowed to marine industry pressure and included wording not in the legislation. Wording formerly interpreted by some judges as limiting the ability of states and localities to prohibit PWC use where federal Sport Fish Restoration monies have been used. The wording states:

“Though a broad range of access facilities and associated amenities can qualify for funding under the 10 percent provision, power boats with common horsepower ratings must be accommodated, and, in addition, the State must make reasonable efforts to accommodate boats with larger horsepower ratings if they would not conflict with aquatic resources management.”

The legal interpretation of this wording has been mixed. In 1995 a U.S. Appeals court ruled that any public boat launch ramp built with FASFRA

funds must allow access to all craft within similar given horsepower sizes, including PWC (*Patrick Buckley; Personal Watercraft v. City of Redding, California*: 66 F.3d 188; 1995 U.S. App. LEXIS 33286). However, in a more recent Florida case (1999), *Kissimme River Valley Sportsman Association v. The City of Lakeland* (60 F. Supp. 2d 1289), the U.S. District Court in Florida ruled that FASFRA language does not create a federal right for boats of common horsepower ratings to have equal access at boat launch facilities that have been constructed or maintained under the Act.

Despite its evolving legal interpretation, this regulatory language — and/or the threat of legal action by PWIA and NMMA — has made some states and localities reluctant to prohibit PWC use on certain water bodies. While ACA agrees with interpretation of the court in the Florida case and believes it more in keeping with the enacting legislation, by changing the FASFRA language USFWS would create a more favorable atmosphere for addressing PWC impacts. In all likelihood, PWC were not even contemplated in FASFRA.

United States Coast Guard

The United States Coast Guard (USCG) is responsible for regulating PWC safety and establishing appropriate safety standards. As is the case with many state boating agencies, the USCG approach to PWC regulation is influenced



Photo by David Jenkins

THE REGULATORY ENVIRONMENT

greatly by the view that all vessel types should be treated equally. The problem with this one-size-fits-all approach is that PWC are very different from other vessel types. So different in fact, that the USCG decided to exempt PWC from a number of the safety standards required of most other vessel types. That decision prompted a rebuke from the National Transportation Safety Board (NTSB) in its 1998 report on PWC safety.

In that report, NTSB recommended that USCG end its practice of simply exempting PWC from the safety standards designed for “conventional” vessels and adopt safety standards specific to PWC. NTSB noted, “...the exemption process does little in terms of evaluating possible safety risks that may be associated with the unique operating characteristics of PWC.” It also pointed out, “the fact that PWC do not ‘fit’ existing standards for open hulled vessels does not release the Coast Guard from its responsibility to regulate the safety of these vessels...”

In response to a formal petition for rulemaking from PWIA asking that USCG end the exemption process and adopt the personal watercraft industry’s own manufacturing standards, USCG began addressing the exemption issue [USCG-1998-4734]. The ACA petition opposing the use of the term “personal watercraft” to describe these jet-powered vessels and requesting the USCG adopt specific definitions for jet-powered vessels was added to this petition action. On July 3, 2002 USCG issued a request for comments on the ACA petition (Federal Register Vol. 67, No. 128, pp. 44662-44665).

The 1998 NTSB report observed “some portion of operator control problems may be attributed to the operating design of personal watercraft,” and called on USCG to — within two years — “determine, through research, the feasibility of providing PWC operators more control in off-throttle steering situations.” Four years have passed and USCG has yet to adopt an off-throttle steering standard for PWC. As noted in the sidebar *Flawed By Design* on page 8, USCG is currently pursuing the creation

of a voluntary standard through a committee comprised largely of personal watercraft industry representatives and advocates.

The ACA research for this report on PWC accidents revealed serious shortcomings in the USCG accident reporting system. Simple facts, such as the number of registered PWC, the primary cause of an accident or the vessel responsible in a collision, were extremely difficult to ascertain. Many of these shortcomings appear to stem from USCG’s reluctance to require states to report accidents in a uniform manner. States are afforded wide latitude in what they choose to report and how they choose to categorize accidents.



Photo by David Jenkins

USDA Forest Service and Bureau of Land Management

The GAO (GAO Report RCED-00-243) found that of the 111 Forest Service units reporting use (includes only those units that responded to GAO survey) only 29 reported prohibitions on PWC use. Of the 58 Bureau of Land Management (BLM) units reporting use, only 2 reported prohibitions. Most of those prohibitions result from specific legislative mandates or state actions, not regulatory action by the Forest Service or BLM.

In response to the GAO survey most Forest Service and BLM units expressed the opinion that

THE REGULATORY ENVIRONMENT

The Political Waters

To understand the politics of the PWC debate, one must realize a person's opinion on PWC regulation has very little to do with party affiliation or political philosophy. Opinions on the need for greater PWC regulation are primarily a product of a person's own experience with PWC use. Evidence of this can be found in survey results and though a review of comments submitted by the thousands of people who have weighed in on this issue.

ACA has been copied on over 1,000 letters sent by recreational waterway users to agencies and lawmakers urging stronger PWC regulations. A review of these letters, as well as email and telephone conversations, indicates that the senders represent very diverse political philosophies, party affiliations, financial positions and recreational interests. This should not be surprising given that anyone who recreates on or lives near the water is subject to the impacts of PWC use.

Political pressure from the pro PWC lobby has never come from any broad public support for PWC use. It comes primarily from the PWC industry and rental operations claiming economic and employment advantages arising from PWC sales and use. These claims, while rarely substantiated with independent research, are effective with some lawmakers. PWC advocacy also relies on a few other assets. There is a small but vocal group of avid PWC riders willing to write letters or attend

public meetings, and the PWC lobby's powerful political friends include some state boating officials and a handful of lawmakers who are off-highway motorized use advocates.

The PWC industry has focused a great deal of effort on influencing the views of state boating regulators and the USCG. PWIA and its allies are constantly promoting their agenda and philosophy at the meetings of boating related agencies and organizations.

PWC manufacturers also donate PWC to state agencies and other marine law enforcement entities. While not passing judgment on the motives behind such donations, the result is the establishment of a popular perk that could possibly influence the relationship between regulators and industry. An obvious result of PWC donations is that it turns law enforcement officers into PWC operators.

The biggest disadvantage facing PWC advocates is that public opinion is clearly against their pro-PWC position. Surveys conducted by Colorado State University, the National Parks and Conservation Association, and the Minnesota Star-Tribune all found that more than 75 percent of the American public supports stronger PWC regulation and/or outright bans. Additionally, PWC operators represent a very small portion of the recreating public. PWIA reports that in 2001 there were only about 1 million (1,053,560) PWC owned in the United States. By comparison,

ACA estimates the number of canoes and kayaks owned to be at least five times that of PWC.

This huge disadvantage in constituency size is not lost on PWC advocates. They compensate for this by attaching themselves to the broader motorboating community. The most strongly held position of PWC advocates is that PWC should not be singled out or treated differently than other motorized vessels, knowing that separation from the broader boating community would be politically fatal. An argument they frequently put forward in an attempt to draw other boaters to their defense is that regulation of PWC is only the tip of the iceberg, that everyone who has concerns about the impacts of PWC use is conspiring to eliminate all motorized boating.

The "tip of the iceberg" argument is a flawed one. It ignores the facts that other types of boating do not share the disproportionate accident rate of PWC nor does their operation generate the same volume of complaints. Equally bold is the propensity of PWC advocates, particularly PWIA, to turn on the very motorboat industry they depend on for support. On the few occasions when PWIA discovers a safety statistic about another type of boating that could potentially deflect criticism of PWC, it is quick to use it.

The political clout of PWC advocates is very similar to PWC use on the nation's waters – their numbers are relatively small, but their impact is disproportionately high.

THE REGULATORY ENVIRONMENT

the agency did not have clear authority to regulate use of personal watercraft. GAO questioned the validity of that opinion. Both the Forest Service and BLM reported that they typically defer regulatory action on PWC to the state the unit resides in. A majority of units in both agencies indicated that the number of law enforcement personnel is not adequate to enforce existing regulations.

GAO concluded that both the Forest Service and BLM have not adequately evaluated the impacts of PWC and are neither complying with federal regulations nor fulfilling their responsibility to protect the lands and waters they manage.

Bureau of Reclamation

The Bureau of Reclamation manages 348 reservoirs in the western U.S. ACA found no evidence that the Bureau of Reclamation has taken any action to study or address PWC use on the reservoirs it manages.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (Corps) manages 541 reservoirs throughout the nation. The Corps has initiated some efforts to educate PWC operators and try to improve PWC safety. ACA found no evidence that the Corps has taken any action to specifically regulate PWC use on Corps managed reservoirs.

National Oceanic and Atmospheric Administration

The National Oceanic and Atmospheric Administration (NOAA) has prohibited PWC use at the Monterey Bay National Marine Sanctuary and the Gulf of Farallones National Marine Sanctuary. Due to an oversight in writing the regulations, the prohibition at Monterey Bay does not include PWC designed for multiple riders. NOAA has cited

jurisdictional obstacles to addressing PWC use at Marine Sanctuaries in Florida.

Environmental Protection Agency

The Environmental Protection Agency (EPA) has the authority to regulate PWC engine emissions and to weigh in on federal agency decisions in accordance with its responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act.

In 1996 EPA established new air emission standards for gasoline marine engines, including the engines utilized in PWC. This rulemaking was in response to Section 213 of the Clean Air Act as amended in 1990. Those new standards require, over a nine-year phase-in period (1998-2006), a 75 percent reduction in the sum of hydrocarbon (HC) and oxides of nitrogen (NO_x). While generally positive, this is not as significant a change as it sounds.

The 75 percent reduction is to be achieved as a corporate-wide emission average. This means that PWC manufacturers can continue to produce some models with carbureted two-stroke engines, as long as the total mix of vessels produced achieves the desired reduction. Bombardier, for example, could reduce the number of four-stroke PWC models it must produce by selling four-stroke jet powered boats.

EPA responded directly to PWC impacts by providing official comment on agency decisions regarding the appropriateness of PWC use. In one such case, EPA submitted comments to the NPS regarding its proposed ban of PWC use on the Missouri National Recreation River. EPA supported the PWC ban, citing "adverse impacts from PWC to water quality, aquatic organisms and their habitat, and air quality." EPA's comments also noted "Personal watercraft use appears to conflict with the anti-degradation goals of the National Wild and Scenic Rivers Act."

ACA proposes a regulatory approach to PWC use that it believes will greatly reduce PWC impacts to other waterway users and to the environment, while still providing ample opportunity for the operation and enjoyment of PWC.

Recognizing the inherent problem of mixing a high-speed activity with a variety other recreational uses, ACA supports regulations that separate high-speed PWC play from other waterway uses. Doing so will effectively manage safety risks, reduce opportunity for user conflicts and make law enforcement easier. ACA recommendations also reflect the high priority ACA places on protecting pristine waters and sensitive wildlife habitat.

By any objective measure, the current regulatory environment has failed to effectively diminish the variety of impacts PWC use is having on other waterway users. The disproportionate involvement of PWC in collisions has not improved over the past six years. As a result, the operation of these craft continues to pose a clear threat to all waterway users. The instances of PWC use diminishing or denying other waterway users the opportunity to enjoy the nation's waterways continue to increase, and PWC impacts on the environment and wildlife are well documented.

This can only change when lawmakers and regulators recognize that PWC are unique craft with very unique impacts and regulate them accordingly. Strong and decisive action is needed in order to reduce PWC impacts to a more reasonable level. For many federal, state and local agencies, this will require a significant change in their current regulatory approach to PWC use. Given the safety threat PWC use currently presents to other waterway users, agencies failing to take such action share responsibility for the resulting accidents.

The problems associated with PWC use will become even more severe as the number of PWC increase. Some are projecting that PWC will

eventually comprise 30 percent of all vessels. Given the impacts of a PWC population that represents less than 10 percent of all vessels, the ACA believes the time for action is now.



Photo by David Jenkins

State and Local Government

Minimum Distance from Shore – PWC operation be limited to no wake (or 5 mph) speed within at least 500 feet of shore on all waterways.

Minimum Distance from Motorized Vessels – PWC operation be limited to no wake (or 5 mph) speed within 200 feet of other motorized vessels.

Distance could be reduced within specific, well-demarcated, high-speed zones.

Minimum Distance from Anchored or Non-Motorized Vessels - PWC operation be limited to no wake (or 5 mph) speed within 500 feet of anchored or non-motorized vessels.

High-Speed Use Zones – On all waterways determined to be congested or to support a wide variety of uses, PWC play be restricted to specific High-Speed Use Zones in open water and clearly marked by buoys.

This provides other waterway users the opportunity to avoid areas where high-speed use and erratic maneuvering is permitted. The establishment of

High-Speed Use Zones also improves the efficiency and ease of enforcement by limiting the area where high-speed oriented activities occur. Currently these high-speed uses are allowed virtually anywhere, which complicates effective enforcement considering that states have limited numbers of marine law enforcement personnel available.

Small Waterway Restrictions – PWC operation be prohibited on all lakes and reservoirs of less than 500 acres and either prohibited or limited to no wake speed on all river or stream segments less than 1,000 feet wide.

Sensitive Waters Restrictions – States should be proactive at prohibiting PWC use and other high-speed motorized activities from sensitive waters where such use would likely endanger critical habitat and wildlife.

Age Restrictions – Prohibit PWC operation by any person less than 16 years of age.

Time Restrictions - PWC operation be prohibited between the hours of sunset and sunrise.

Local Authority – Local jurisdictions that have a water body solely within their boundaries should have the authority to prohibit PWC use by referendum.

Enforcement/Penalties for Violations – Agencies should strictly enforce all PWC regulations and when necessary distribute fines and penalties for the illegal operation of PWC sufficient to deter irresponsible behavior.

For harassment or reckless/negligent operation that places others at immediate risk, the offense should be considered a felony and the penalties should include mandatory jail time. Additional funding or law enforcement is greatly needed. In areas of known violations, undercover operations should be utilized to catch the offenders.

Federal Government

National Park Service

Use Restrictions - PWC use should be prohibited on all waters within National Park, National Seashore, National Lakeshore boundaries and on all designated Wild and Scenic River segments. PWC use in National Recreation Areas should be prohibited unless the unit was specifically established for motorized water recreation. In cases where the unit was specifically established for motorized water recreation, PWC use should be limited to well marked high-speed zones.

United States Fish and Wildlife Service

Use Restrictions - PWC use be prohibited on all waters within National Wildlife Refuges.

FASFRA – Rewrite FASFRA regulations to eliminate the wording “*power boats with common horsepower ratings must be accommodated, and, in addition, the State must make reasonable efforts to accommodate boats with larger horsepower ratings if they would not conflict with aquatic resources management.*” The ACA recommended wording is “*power boats should be accommodated if they do not present an unacceptable safety hazard to other waterway users and do not conflict with the protection and management of aquatic resources, including wildlife.*”

United States Coast Guard

Safety Standards – Establish mandatory manufacturing standards for off-throttle steering capability.

Such standards should be established using independent research of actual accident scenarios. PWC industry involvement in the development or recommendation of these standards should be limited to an advisory,

nonvoting role. An independent scientific body comprised of individuals without past or present ties to the PWC industry should make the recommendation of off-throttle steering standards to USCG. ACA does not consider the SAE PWC Subcommittee an independent scientific body. Mandatory horsepower limits for PWC should also be considered.

Accident Reporting and Statistics – Require more information from states regarding the cause of PWC accidents (off-throttle steering difficulty should be specifically noted).

Establish consistent and precise categories for accident type and accident cause, including a more specific breakdown within the careless/reckless category. Require all states to report the number of registered PWC.

PWC Terminology and Definitions – Establish new terminology to better identify and describe jet thrust powered watercraft.

The phrase “personal watercraft” can describe any single person watercraft, be it canoe, kayak, catamaran, rowboat, airboat or some other craft. It is confusing to limit the use of this terminology as only specific to jet pump powered watercraft. ACA requests that the USCG phase out the use of the term “Personal Watercraft” to refer to a specific type of jet pump powered watercraft and replace it with a more descriptive term such as “Personal Water Jet” or “Personal Jet Craft.” USCG should also adopt specific terminology to refer to any jet-powered vessel that confines the operator and occupants within the hull. ACA recommends terms such as “Jet Boat,” “Jet Craft,” or “Water Jet” to identify these watercraft.

USCG should establish formal definitions for the craft currently referred to as “personal watercraft” and for other jet powered craft. ACA recommends that the definition for craft currently referred to as “personal watercraft” read as follows:

The term _____ means any watercraft that uses an engine powering a water-jet pump, or other form of jet thrust, as its primary source of propulsion, and which is designed to be operated by a person/persons sitting or standing on or astride the craft, rather than within the confines of the hull. These craft are typically designed specifically for high-speed use and performance, and are often capable of carrying multiple passengers and gear. The term _____encompasses but is not limited to such trade and brand names as: Sea-Doo, Kawasaki, Polaris, Yamaha, Arctic Cat, Jet Ski, JetBike, Waverunner, Tigershark, Wet Jet, etc.

ACA recommends that the definition for jet-powered craft that confine the operator and occupants within the hull read as follows:

The term _____ means any watercraft that uses an engine powering a water-jet pump, or other form of jet thrust, as its primary source of propulsion, and which is designed to be operated from within the confines of the hull or cockpit. These craft are typically designed specifically for high-speed use and performance, and are often capable of carrying multiple passengers and gear. The term _____encompasses but is not limited to such trade and brand names as: Sea-Doo, Kawasaki, Polaris, Yamaha, Arctic Cat, Jet Ski, JetBike, Waverunner, Tigershark, Wet Jet, etc.

Use Restrictions – Establish a 5-year goal to greatly reduce PWC involvement in on-water collisions. At the end of the 5-year period, if PWC are still involved in a disproportionate number of collisions (10 percent or more greater than the percentage of registered vessels comprised by PWC), limit PWC use on all federally navigable waters to areas specifically designated for their use.

USDA Forest Service

Research – Correct the research deficiencies cited in GAO Report RCED-00-243 by evaluating the impacts of PWC use on visitors and natural resources.

Use Restrictions – Prohibit PWC use on all agency managed river segments designated under the Wild and Scenic Rivers Act, on all lakes of 500 acres or less located within National Forest boundaries, and on any water body where the agency has determined that PWC use is having disproportionate and adverse impacts on visitors and the resource.



Photo by David Jenkins

Bureau of Land Management

Research – Correct the research deficiencies cited in GAO Report RCED-00-243 by evaluating the impacts of PWC use on visitors and natural resources.

Use Restrictions – Prohibit PWC use on all agency managed river segments designated under the Wild and Scenic Rivers Act, on all lakes of 500 acres or less located within Bureau of Land Management boundaries, and on any water body where the agency has determined that PWC use is having disproportionate and adverse impacts on visitors and the resource.

United States Army Corps of Engineers

Research – Study PWC use and its impacts on visitors and natural resources, giving special attention to visitor safety.

Use Restrictions – Adopt use restrictions recommended for state waters.

Bureau of Reclamation

Research – Study PWC use and its impacts on visitors and natural resources, giving special attention to visitor safety and water quality.

Use Restrictions – Adopt use restrictions recommended for state waters.

Consider additional restrictions if needed to protect drinking water supplies.

National Oceanic and Atmospheric Administration

Use Restrictions – Prohibit PWC use on all waters within National Marine Sanctuaries.

Environmental Protection Agency

Emissions Standards – Strengthen the air emission standards for gasoline marine engines adopted in 1996 to completely phase out the manufacture of carbureted two-stroke marine engines by 2006.

Research the emissions of PWC during typical operation as compared to emissions from other vessel types and create additional PWC-specific standards if needed. Such standards could include phasing out the use of direct injection two-stroke engines in PWC and/or requiring the use some type of emission control device.

Establish water emission limits for gasoline marine engines protective of water quality.

CONCLUSIONS

The information presented in this report supports a conclusion that PWC operation has significant and adverse impacts on others who recreate on the nation's waters. These impacts include posing a serious safety threat to other waterway users, diminishing the enjoyment of other forms of waterway recreation, and degrading the quality of recreational waters. While many activities can have adverse impacts on other users or on the environment, the amount and severity of impacts attributable to PWC use is both disproportionate and unacceptable.

ACA undertook the initial research for this report in order to determine if the complaints, allegations and fears that ACA members and others have expressed regarding PWC use were valid. After carefully examining all available information, ACA concludes that the many concerns raised regarding PWC impacts are supported by factual data, not just opinion and anecdotal evidence. Findings of fact contained in this report include:

- PWC are involved in 55 percent of all vessel-on-vessel collisions, even though they comprise less than 10 percent (6.2 percent is best estimate) of vessels.
- Collisions with vessels, people and other objects account for over 70 percent of PWC accidents.
- PWC are more than 3 times as likely to have accidents that involve striking a person swimming in the water than other vessel types.
- About 80 percent of PWC accidents are attributed to careless/reckless operation, excessive speed, operator inattention, or operator inexperience – almost double the rate for accidents not involving PWC (45 percent).
- PWC industry advertising promotes speed, power and attitude as the reasons to own and

operate a PWC, and is often at odds with the safe and responsible operation messages promoted in rider education programs.

- PWC use is currently allowed on over 98 percent of U.S. surface waters.
- The acceleration tendencies and constant high-speed operation that characterize PWC use increases the amount of visible and audible pollution emitted from these craft, as does the tendency of the operators to stay in one place for long periods of time.
- A typical PWC discharges between 50 and 60 gallons of unburned gasoline into the environment each year.
- PWC use presents a unique and significant threat to many species of wildlife.

These facts alone reveal the unique and destructive impacts of PWC use. Add to this the huge volume of complaints from waterway users about incidents of harassment and other threatening or disrupting encounters with PWC, and the urgent need for better regulatory control of PWC operation should be crystal clear. Too often, however, calls to better regulate PWC use and protect other recreational opportunities are rejected or ignored.

ACA hopes this report will help lawmakers and other decision makers better understand and appreciate the problems and threats PWC use imposes on the vast majority of citizens who seek to enjoy America's waterways, and on the natural qualities that make these waters so appealing. The policy recommendations contained herein, although certain to draw protests from PWC advocates, are common sense solutions that will protect the safety and enjoyment of others while continuing to allow PWC use on a majority of U.S. waters.

APPENDIX A

STATE RESTRICTIONS ON PWC OPERATION

State	Minimum Age	PWC Specific Speed Limit	Statewide Waterway Restrictions on PWC Operation <i>NOTE: Restrictions listed by some states are not PWC specific</i>
AL	12	NO	NONE
AK	NONE	NO	NONE
AZ	12	NO	NONE
AR	14	Yes	NONE
CA	16	NO	NONE (Local Jurisdictions Can Restrict Use)
CO	16	NO	NONE (Use Can Be Restricted Through Lake Management Plans)
CT	12	NO	Restricted to 6 mph speed within 200 ft. of shore, dock, pier, float or anchored vessel
DE	14	Yes	Use restricted within 100 ft. of docks, piers and boat ramps; 300 ft. from swimmers & ocean front
FL	14	NO	NONE (Local Jurisdictions Can Restrict Use)
GA	12	NO	Use restricted within 100 ft. of people, structures, shoreline, moored or anchored vessels
HI	15	NO	Use prohibited in Ocean Recreation Management Areas and restricted within 500 ft. of shore or fringing reef
ID	NONE	NO	NONE (Local Jurisdictions Can Restrict Use)
IL	12	NO	NONE
IN	15	NO	Restricted to idle speed within 200 ft. of shore
IA	12	NO	NONE
KS	12	Yes	NONE
KY	12	NO	NONE
LA	13	Yes	NONE
ME	16	NO	Banned on approximately 300 lakes classified by the Maine Land Use Regulation Commission
MD	16	Yes	Restricted to 6 mph speed within 100 ft. of shore, vessels, or people in the water
MA	16	NO	Use prohibited within 150 ft. of bathing areas; restricted to 6 mph within 150 ft. of shore
MI	12	NO	NONE
MN	13	NO	Restricted to no wake speed within 150 ft. of shore, swimmers, docks and anchored vessels
MS	12	NO	Use restricted in designated swimming zones
MO	14	NO	NONE
MT	12	NO	Use restricted to no wake speed within 20 ft. of dock, swimmer, swimming raft, non-motorized vessel, or anchored vessel
NE	14	NO	NONE
NV	12	Yes	Use restricted to flat wake within 5 lengths of longest vessel
NH	16	Yes	Two-person PWC use prohibited on water bodies of 75 acres or less
NJ	16	NO	Use of rental PWC confined to marked boundaries
NM	13	NO	NONE
NY	10 (w/ed.)	Yes	Use prohibited within 500 ft. of swimming areas; PWC noise limits (Local Jurisdictions Can Restrict Use)
NC	12 (w/ed)	NO	Use restricted to no wake speed within 100 ft. of anchored or moored vessels, shoreline, dock, pier, swim float, marked swim area, swimmers, surfers, persons engaged in angling, or any manually propelled vessel (Local Jurisdictions Can Restrict Use)
ND	12	NO	NONE
OH	16	NO	NONE
OK	12	NO	NONE
OR	16	Yes	Must maintain 200 ft. distance behind waterskiers
PA	12	NO	NONE

State	Minimum Age	PWC Specific Speed Limit	Statewide Waterway Restrictions on PWC Operation <i>NOTE: Restrictions listed by some states are not PWC specific</i>
RI	16	Yes	Use restricted to headway speed within 200 ft. of shore, moored boats, swimmers and divers
SC	NONE	NO	NONE
SD	14	Yes	Restricted to no wake speed within 150 ft. of swimmers, docks and non-motorized vessels
TN	12	NO	NONE
TX	13	NO	Use restricted to headway speed within 50 ft. of another vessel, person, stationary platform, or shore.
UT	12 (w/ed.)	NO	NONE
VT	16	NO	Use prohibited on most water bodies under 300 acres
VA	14 (w/ed.)	NO	Use restricted within 50 ft. of swimmers, boat ramps, docks and other vessels
WA	14	NO	NONE (Local Jurisdictions Can Restrict Use)
WV	15	NO	NONE
WI	12	Yes	Use restricted within 100 ft. of any other vessel; 200 ft. of any shoreline
WY	16	NO	Use restricted within 100 ft. drifting boats or boats underway

Additional Regulations

Most states require PWC operators to wear personal flotation devices and prohibit PWC operation between sunset and sunrise. Many states have specific regulations regarding wake jumping and the towing of skiers by PWC. Some states have adopted specific PWC education requirements.

For a complete review of all state boating laws, consult the Reference Guide to State Boating Laws, published by the National Association of State Boating Law Administrators (NASBLA).

APPENDIX B

NATIONAL LEVEL STAKEHOLDER LIST

(Limited to National or Regional Organizations With Known Involvement In PWC Issues)

Non-PWC User Groups

American Canoe Association

7432 Alban Station Blvd., B-232
Springfield, VA 22150
703-451-0141
www.acanet.org

Izaak Walton League of America

707 Conservation Lane
Gaithersburg, MD 20878
301-548-0150
800KE-LINE (453-5463)

US Windsurfing

326 East Merritt Island Causeway
Suite 300
Merritt Island, FL 32952
321-453-7765
www.uswindsurfing.org

Federation of Fly Fishers

P.O. Box 1595
Bozeman, MT 59771
406-585-7592
www.fedflyfishers.org

Adirondack Mountain Club

814 Goggins Road
Lake George, NY 12845
518-668-4447
www.adk.org

Surfrider Foundation

P.O. Box 6010
San Clemente, CA 92674-6010
949-492-8170

Appalachian Mountain Club

5 Joy Street
Boston, MA 02108
617-523-0636
www.outdoors.org

North American Lake Mngmnt Society

PO Box 5443
4513 Vernon Blvd., Suite 100
Madison, WI 53705-0443
608-233-2836
www.nalms.org

Natl Parks and Conservation Assn

1300 19th Street, NW, Suite 300
Washington, DC 20036
800-628-7275
www.npca.org

Environmental Organizations

Bluewater Network

311 California, Suite 510
San Francisco, CA 94104
415-544-0790
www.bluewaternetwork.org

Natural Trails and Waters Coalition

c/o The Wilderness Society
1615 M Street, NW
Washington, DC 20036
202-833-2300

Friends of the Earth

1025 Vermont Ave., NW
Washington, DC 20005
202-783-7400
www.foe.org

Sierra Club

85 Second St., Second Floor
San Francisco, CA 94105-3441
415-977-5500

Wilderness Society

1615 M St, NW
Washington, DC 20036
800-843-9453

Victims Advocacy Organizations

Coalition of Parents and Families for Personal Watercraft Safety

P.O. Box 940553
Plano, TX 75094
214-906-8575
www.pwcwatch.org

PWC User Groups

American Watercraft Assn (AWA)

27142 Burbank
Foothill Ranch, CA 92610
949-598 5860
www.watercraftassociation.com

Blue Ribbon Coalition

PO Box 5449
Pocatello, ID 83202
208-524-3062
www.sharetrails.com

PWC Industry Trade Associations

Personal Watercraft Industry Association (PWIA)

1819 L Street NW, Suite 700
Washington, DC 20036
202-721-1621

National Marine Manufacturers Association (NMMA)

200 E. Randolph Dr. Suite 5100
Chicago, IL. 60601 U.S.A.
312-946-6200

American Recreation Coalition (ARC)

1225 New York Avenue NW, Ste 450
Washington, DC 20005
202-682-9530
www.funoutdoors.com

PWC Manufacturers

Bombardier Recreational Products (Sea-Doo)

www.seadoo.com

Kawasaki Motors Corp., U.S.A. (JET SKI)

www.kawasaki.com

Yamaha Motor Corp., U.S.A. (WaveRunner)

www.yamaha-motor.com

Polaris Industries Inc. (Genesis, Virage, Freedom, Octane)

www.polarisindustries.com

American Honda Motor Co., Inc. (AquaTrax)

www.hondamotorcycle.com/models

Quasi-Governmental Boating Safety Organizations

National Safe Boating Council

P.O. Box 1058
Delaware, OH 43015
740-666-3009
www.safeboatingcouncil.org

National Association of State Boating Law Administrators

1500 Leestown Road, Ste 330
Lexington KY 40511
859.225.9487

REFERENCES

- United States Coast Guard (USCG), Boating Accident Report Database (BARD) 1996-2001
- United States Coast Guard (USCG), Boating Statistics: 1996 (COMDTPUB P16754.10), 1997 (COMDTPUB P16754.11), 1998 (COMDTPUB P16754.12), 1999 (COMDTPUB P16754.13), 2000 (COMDTPUB P16754.14), 2001 (COMDTPUB P16754.15)
- California Department of Boating and Waterways, 1999 California Boating Safety Report, 2000 California Boating Safety Report
- Florida Fish and Wildlife Commission, Boating Accident Statistics 1996, 1997, 1998, 1999, 2000, 2001
- National Transportation Safety Board (NTSB), Personal Watercraft Safety, Safety Study, May 1998 (NTSB/SS-98/01 PB98-917002)
- Nevada Department of Conservation and Natural Resources, Division of Wildlife, Boating Accident Investigation Reports for 2001
- Nevada Department of Conservation and Natural Resources, Division of Wildlife, website (www.nevadasafeboating.org/watercraft.html)
- Jones, CS (2000). Epidemiology of personal watercraft-related injury on Arkansas waterways, 1994-1997: identifying priorities for prevention. *Accident Analysis and Prevention*. 32:373-6.
- Colavecchio, Bill, and Will Moss. "Off Throttle Steering of Jet Pump Propelled Craft" Underwriters Laboratories, July, 2001.
- Simner, Ron, Personal Communication, March 7, 2002.
- Branche, Christine M., Judith M. Conn, and Joseph L. Anest. (1997). Personal Watercraft-Related Injuries: A Growing Public Health Concern. *Journal of the American Medical Association*. 278(8):663-5.
- 2002 Showroom, Sea-Doo (Bombardier, Inc.) Website, May 17, 2002 ([http:// www.seadoo.com](http://www.seadoo.com)).
- 2002 Aqua Trax F-12X Homepage, Honda Motorcycle (American Honda Motor Company, Inc.) Website, June 3, 2002 (www.hondamotorcycle.com).
- National Marine Manufacturers Association (NMMA), Boating Statistics 1997, 1998, 1999, 2000, 2001 (www.nmma.org).
- Schmidt, Bruce (USCG), Personal Communications, May 2001 – April 2002.
- Personal Watercraft Background, Personal Watercraft Industry Association (PWIA) Website, May 27, 2002 (www.pwia.org/background.html).
- Rockwell, Paul, "Why Jet Skis Kill," *In Motion Magazine*, August, 2001
- Coalition of Parents and Families for Personal Watercraft Safety, Website (www.pwcwatch.org)
- Baard, Erik, "Collision Course," *Village Voice*, September 11, 2001.
- U.S. General Accounting Office (GAO) Report (RCED-00-243), September 2000.
- Heiden Associates, Inc., "1997 Boating Exposure Survey Results", October 1999.
- JSI Research & Training Institute, Inc., "National Recreational Boating Survey" (1998), 2000.
- Jet Sports*: June, 1999, pp. 12-17; August, 1999, pp. 20-21; September, 1999, pp. 5; September/October, 2000, pp. 12-13; January/February, 2001, pp. 10-11; March/April, 2001, pp. 14-15.
- PWC Magazine*: January/February, 1999, pp. 2-3; May/June, 1999, ad insert.
- Traffic Safety Facts 2000 (DOT HS 809 323), US Department of Transportation National Highway Safety Administration, National Center for Statistics and Analysis, Website, April 2002 (<http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSF2000/2000alcfacts.pdf>).
- Stats and Resources, Mothers Against Drunk Driving, Website, April 2002 (<http://www.madd.org/>).
- Smith, Gary. "A sailboat on a balmy spring day — then personal jet-craft and death" *San Diego Union Tribune*, Letters to the Editor, June 3, 2000.
- Brooks, Ron. "Holiday Madness" Saltwater Fishing Guide at About.com, June 5, 2001 (<http://saltfishing.about.com>).
- Frazier, S. "Losing my faith in PWC riders" *rec.sport.jetski* (Internet Newsgroup), April 15, 2002.
- Wagner, Kenneth J. "Of Hammocks and Horsepower: The Noise Issue at Lakes", June, 1994, pp. 24-28.

REFERENCES

- Komanoff, Charles, and Howard Shaw. *Drowning In Noise, Noise Costs of Jet Skis In America* Noise Pollution Clearinghouse, April 2000.
- Flannery, Jim, and Gary Beckett. "Jacobs: No more sleeping with the enemy," *Trade Only*, December, 1997, pp. 1,14.
- Van Zandt, Franklin K., "Boundaries of the United States and the Several States," *Geological Survey Professional Paper 909*, United States Government Printing Office, 1976.
- van der Leeden, Frits, Fred L. Troise, and David Keith Todd. *The Water Encyclopedia*, Second Edition, Lewis Publishers, 1990.
- Maine State Bureau of Parks and Lands, *2001 Safe Boating Guide*, pp. 9-15.
- Landers, Rich. "Off-roaders tear through the Colville" *Sportsman Review*, June 10, 2001.
- Mele, Andre. *Polluting for Pleasure*, Norton, New York, 1993.
- Jetski Position Paper, Bluewater Network Website, April 4, 2002 (www.bluewaternetwork.org/jetskipos.shtml).
- California Air Resources Board, "Fact Sheet: New regulations for gasoline marine engines," February 1999.
- Environmental Protection Agency (EPA), Air Pollution Control; Gasoline Spark-Ignition Marine Engines; 40 CFR Parts 89, 90, 91, *Federal Register*, October 4, 1996.
- United States Environmental Protection Agency (EPA), Region 8, Campbell, Carol L. Letter to Paul Hedren, Superintendent, Missouri National Recreation River, September 29, 2000.
- National Park Service (NPS), "Water Quality Concerns Related to Personal Watercraft Usage," 1999.
- Raymond, Lyle Jr. Letter to John Miller, President of New York State Federation of Lake Associations, July 5, 1997.
- National Research Council, "Oil in the Sea III: Inputs, Fates, and Effects," National Academy Press, 2002.
- Tahoe Regional Planning Agency, *Motorized Watercraft Environmental Assessment*, June 1997.
- League to Save Lake Tahoe, "Jet Ski Ban Proves Effective," *Keep Tahoe Blue*, Winter, 2000 (www.keeptahoeblue.com/newsletters/NLWnt00.htm).
- Williams, Ted "The Jet Set," *Audubon*, July-August, 1998, pp. 34-39
- Nowacek, Stephanie M., Randall S. Wells and Andrew R. Solow. "Short-Term Effects of Boat Traffic on Bottlenose Dolphins, *Tursiops truncatus*, In Sarasota Bay, Florida," *Marine Mammal Science*, 17(4):673-688 (October 2001).
- Osborne, Richard, Curator of Science Services & Resident Scientist, Whale Museum, Friday Harbor, WA. "Testimony and Exhibits Submitted to Board of County Commissioners Regarding Restrictions on Use of Jet Skis in San Juan County," *Superior Court of Washington for Whatcom County*, Jan. 15, 1996. Study conducted with Dr. Johnson of Woods Hole Oceanographic Institute
- Vogel, Harry. "Impacts of Boats and Personal Watercraft on Loons and Other Waterbirds in New Hampshire" Loon Preservation Committee of the Audubon Society of New Hampshire.
- Williams, Joanne, and Bob Bowlus. "Personal Watercraft Threaten Loons on Michigan Lakes," Michigan Loon Preservation Association, Website.
- Milius, Susan. "Oh, not those jet-ski things again!" *Science News*, Aug. 15, 1998, Vol. 154, No. 7, p.107.
- Burks, Margaret, Executive Director, Marine Mammal Center. Letter to San Francisco, CA. Supervisor Gavin Newsom. March 17, 1998; Jim Doyle. "Anger Over Plan to Limit Jet Ski Use," *San Francisco Chronicle*, July 19, 1996
- Rogers, J.A., and H.T. Smith. "Set-Back Distances to Protect Nest Bird Colonies from Human Disturbances in Florida," *Conservation Biology*, February, 1995. 9:89-99;
- Burger, Joanna. *Effects of Motorboats and Personal Watercraft on Flight Behavior Over a Colony of Common Terns*, Nelson Biological Laboratories, Rutgers University, 1998.
- National Association of State Boating Law Administrators (NASBLA), *Reference Guide To State Boating Laws*, Sixth Edition, pp. 37-40.
- National Park Service (NPS), Personal Watercraft Use Within the NPS System, Final Rule; 36 CFR Parts 1, 3 and 13, *Federal Register*, March 21, 2000.

ACKNOWLEDGMENTS

The American Canoe Association and the author wish to thank the following individuals for their invaluable assistance in the preparation of this report.

**Nita Boles
Eugene Buchanan
Virgil Chambers
Alison Snow Jones
Chad Kirtland
Katherine Mull
Amy Rigby
Paul Rockwell
Bruce Schmidt
Ron Simner
Sean Smith
Tanya Wikstrom
Leslie Woodard**



Making the World a Better Place to Paddle