Boating Safety Survey – Stage I

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FEBRUARY 2000

Centre Report Series No. 46
ISSN 1174-5371

This study was jointly funded by The Alcohol Advisory Council of New Zealand and the Maritime Safety Authority. The researchers acknowledge the assistance given by Ron Tustin (ALAC) and Sharyn Marshall (MSA). The IPRC is jointly funded by Health Research Council and the Accident Rehabilitation and Compensation Insurance Corporation. Additional funding related to dissemination activities is provided by the Health Funding Authority.

BOATING SAFETY SURVEY – Stage I

Study Aims

The aim of this study was to collect baseline data on alcohol use among boaters in the Auckland Region. Data was collected as part of preparations for developing and evaluating an intervention study that addressed alcohol use on the water during events surrounding the America's Cup and other activities around the Millennium celebrations in Auckland. This baseline survey sought to provide information on current practices with regard to drinking on the water, and the beliefs and attitudes among boaters towards the risk of alcohol use on the water.

Rationale

A number of overseas studies have suggested that alcohol is an important factor in boating fatalities and other drownings (Howland et al 1988, 1993, 1995, Smith et al 1988, 1995, 1998). However, little is known regarding the extent of the problem in New Zealand (Cairns et al, 1984). Previous telephone surveys conducted for the Maritime Safety Authority (MSA) have provided useful data on boating attitudes and practice but have ignored the issue of alcohol and boating safety (CM Research 1995, Colmar Brunton 1995). An earlier study which was carried out for Alcohol Advisory Council of New Zealand demonstrated that alcohol involvement was more common in drowning and boating fatalities in the Auckland area, than was previously realised (Smith et al, 1999). No information on alcohol use was available, however, for the general population of boaters out on the water that did not die.

Nor is information available on knowledge, attitudes and practices regarding alcohol use on the water, or if boaters believe alcohol is a problem on the water.

Central to this current study and subsequent follow-up studies was the ability to take advantage of the natural experimental conditions afforded by the America's Cup and other activities in Auckland surrounding the Millennium celebrations. These events provided a unique opportunity to design, implement and evaluate innovative public health education strategies to better inform the public of the risks of alcohol use while boating. This was also an opportunity to simultaneously emphasise other boating safety messages. An important follow-up from this study will be the formal evaluation of the effectiveness of the prevention program and its ability to actually reduce drinking on the water. The current study, described in this report, provides the important baseline data used to develop education strategies to enable us to make these efforts even more effective and answer a number of important questions regarding alcohol use on the water. The study has been funded as a collaborative effort between the Maritime Safety Authority and the Alcohol Advisory Council of New Zealand.

The first phase of the programme involved collecting baseline data on alcohol use on the water in the Auckland Region at the end of March and beginning of April (the Easter holiday period) 1999. The baseline data collection effort involved interviewing boaters in order to obtain information regarding risk factors and present alcohol use on the water in the Auckland Region. The information from this part of the study provided the important background information needed for planning the campaign that took place over the 99/00 New Zealand summer.

Funding is currently being sought to conduct the first of two follow-up studies to evaluate the effectiveness of the current campaign to reduce the use of alcohol on the water. The campaign has been focussed on events around The America's Cup and Millennium activities.

Methodology

Brief interviews of boaters were conducted and their breath alcohol level tested with a hand held breath analyser. Primary data collection took place over the last weekend in March (March 27 & 28, 1999) and for four days over Easter (April 2-5, 1999, a total of six days). A total of 11 interviewers and one supervisor conducted the field interviews. Surveys were conducted from 12 noon to 8 p.m. Originally it had been planned to use two separate teams to collect data over 12 days but it was considered more efficient to hire more interviewers for a shorter time period. This also allowed for a much larger sample size of boaters to be studied for the funds available.

Land based teams were used for collecting data at ramps and marinas. The interviewers who conducted the study were all either experienced interviewers who have worked with us on other studies or hand picked students from Dr. Coggan's Health and Society course. These students were medical or other public health students who were familiar with research methods and survey design and we have an on going relationship with them. Two separate training sessions of three and then one hour periods were conducted after students had read the detailed interviewer manual prepared for the course. In addition, both the principal investigator and the full time study coordinator visited interviewers on the first weekend to

conduct further on-site training. The following weekend data collection was supervised by the full time study coordinator who was also available at all times by cell phone to answer any questions from the interviewers. Thus our interviewers had more experience and background in research than most interviewers hired by commercial market research firms.

A random sample of boat ramps and marinas was selected in the Auckland region after consultation with harbour masters and boating experts. Teams were sent out to the sites and selected boats returning from boating activities. One water-based crew used a boat to travel to other areas where boating activity was taking place. The assistance of crew from Auckland Water Safety was greatly appreciated. Sites for sampling were selected at random after consultation with knowledgeable people such as the Coast Guard, Harbour Master, and water police. Within each of the specified sites, specific locations at which boats are known to anchor, dock, berth or be launched, were identified. Positioning themselves such that they could observe boats travelling to these locations, observers followed selected returning boats to one of the stopping points without having to follow them a long distance.

For both data collection methods, interviewers were instructed to select the first vessel that reached the location after the specified start time. This helped ensure that the selection of vehicles was essentially random. Once a vessel was randomly selected, it was followed to its destination, e.g. anchorage, slip, launch ramp. Boats anchored for fishing or other reasons were also included but information was collected on how long ago they were underway.

Interview Procedure and BAC measurement

In carrying out the interview, the observers approached the selected vessel on the water or at the boat ramp/marina and introduced themselves to the individual observed to be operating the vessel. Interviewers all wore Auckland University identification badges and identified themselves as being from Auckland University Injury Prevention Research Centre Boating Safety Project. The observer's vessel also had an "Auckland University Boating Survey" placard on the side. The interviewers announced that they were conducting a survey of recreational boating and asked for a few minutes of the operator's time. If the operator refused, they asked if they could return in a few minutes when it might be more convenient. The survey was anonymous and no identifying names or addresses were requested, or recorded.

When the operator agreed to the interview, the observer explained that the survey was anonymous. Respondents had to be at least 18 years old. Observers did not attempt to board vessels but simply got close enough to be able to conduct the interview. If it appeared appropriate (e.g. with larger boats) the observer inquired if it would be more convenient if they came aboard the boat. A self-administered questionnaire was given to the boat operator and to a randomly chosen passenger. The questionnaire was designed to be self-administered but could also be given verbally if the person wished. In order to ensure compliance the questionnaire was kept short. The survey questionnaire sought the following information: age, gender, boating activity, time on the water on that day, swimming ability, boating experience, frequency of boat operation, prior safety training, alcohol consumed on that trip, knowledge and attitudes towards drinking on the water and it's safety and several boating practice questions used in earlier MSA surveys done by CM Research (1995). This provided

an important opportunity to obtain data on alcohol use that had not been collected in earlier surveys. This questionnaire was developed in consultation with MSA, ALAC and boating safety groups.

When the interview was completed, the observer thanked the subject for completing the interview and asked permission for a breath sample. This would allow the maximum possible time for any alcohol in the mouth to dissipate if alcohol had been consumed just prior to the interview. Breath alcohol was tested with a handheld Intoxilizer 400 and the interviewer wrote down a number assigned by the machine. Individual BAC results were stored internally and were blind to interviewer and respondents. One passenger was also interviewed and BAC tested. Passengers were randomly selected from a compilation of a numbered line list of all passengers and the use of random number tables. Upon completion of the interview, the observer thanked the boat occupants and moved on to the next selected vessel.

At the close of the study, observers turned over their breath testers to the study co-ordinator. Data in the breathalyser was later read into a computer. Readings were linked to the interview by interview time and by the number generated by the breathalyser at the time of the testing.

While the response rates for collecting breath alcohol samples were high (79% - see results), there were problems with some of the breathanalizer machines. It appears that the recording of data was altered or damaged somehow for some machines, possibly in transporting the machines from the USA as the airlines lost the checked box of machines for a day when they were brought out. As a result of this some machines appeared to be recording unintelligible units, even though the readings shown on the readout appeared correct. After much delay, the

manufacturer of the breathanalizer was able to help sort out the problem. The results are now reliable for all but two machines which either did not record or the data was lost. The data from these two machines is excluded from analyses of BAC. The questionnaires to determine alcohol knowledge, attitudes and practice are however not affected by these findings. In addition, the lack of data from the two machines is unlikely to bias results in any way.

Residual mouth alcohol from recent drinking can artificially elevate BAC readings if interviewers do not wait for 10 minutes from the time of the last drink for subjects to give a breath sample. It appears this was the case for some cases which caused abnormally high levels in some people with no signs of intoxication and who only reported low levels of consumption. In order to report results that had policy relevance and were interpretable, we re-classified those cases with a breath alcohol equivalent to a blood alcohol concentration (BAC) 250 mg/dl or above and no signs of intoxication, as having only a positive blood alcohol (coded as –1). Almost all persons with a BAC of over 250 mg/dl are likely to show at least some signs of intoxication. Three cases with readings 250 mg/dl up to 350 mg/dl and signs of intoxication were considered valid. One case with a very high BAC (only possible from breath alcohol) and clear evidence of intoxication was coded as intoxicated (re-coded as over 100 mg/dl without reporting the level). As a result of the considerable checking and work on breath alcohol data we now feel confident in the results obtained. In future studies we will rely only on direct readouts from the machine of the actual BAC. Since there is no legal limit for driving a boat in New Zealand it is not as important to have the results blinded to the interviewers as it is in the United States. This will enable the interviewers to detect abnormally high readings and repeat the test after waiting an appropriate time interval for mouth alcohol to be cleared.

Data Analysis

Data was entered into a Microsoft Access database for data management and cleaning and then analysed in SAS version 6.12.

Results

Study population

The survey of boaters was successfully conducted in the Auckland region over the 1999 Easter weekend and the weekend preceding it. Boaters were surveyed at boat ramps, marinas, fuel stations and out at popular boating locations. Of the 394 boats approached by the interviewers to do the questionnaire, 346 (88%) of the operators completed questionnaires. Only 48 of the boats approached refused outright to participate (46 male operators and 2 female). The reasons for refusal were generally that they were too busy; rushing to get the boat out or did not have time. Comparisons of boats refusing and agreeing to interviews found no difference between the two groups. A total of 607 people were interviewed of which 346 (57%) were the boat operators or skippers and 261 were passengers. Overall 77.1% of boaters were men (94.7% of the operators (skippers) and 53.9% of passengers) (Table 1).

The majority of the boats studied (66.5%) were trailer motor boats, 13.8% were motor launches, 13.1% keel yachts, 2.3% inflatable motorboats, 2.1% trailer yachts, 1.3% dinghies and 0.8% other, including one jet ski.

The ages of boaters ranged from 18 to 76 years with a median age of about 40 years of age for operators and 35 for passengers. (Boaters under age 18 were not interviewed in the study). More detailed demographic characteristics of respondents are shown below in table 1.

Table 1: Demographic characteristics of survey sample (N= 607): percent of respondents by category

		Operator	Passenger	All boaters
Gender	Male	94.7	53.9	77.1
	Female	5.3	46.1	22.9
Ethnicity	Maori	5.9	7.8	6.7
	European/Pakeha	87.6	83.6	85.9
	Pacific	4.2	3.9	4.0
	Asian	2.1	3.9	2.9
	Other	0.3	0.8	0.5
Education	No qualification	13.8	14.7	14.2
	School Certificate	27.0	19.9	23.9
	6^{th}-7^{th} Form Certificate	20.5	24.7	22.3
	Tertiary Qualification	38.7	40.6	39.5
Household Income	<$29,000	6.6	11.0	8.6
	$30,000-49,999	23.5	27.5	25.3
	$50,000-75,000	27.2	24.2	25.9
	$75,000 +	42.8	37.3	40.3
Age Group	18-19 years	0.0	1.6	.7
	20-24 years	3.5	7.1	5.1
	25-29 years	6.3	14.6	10.0
	30-34	14.3	19.8	16.7
	35-39	17.5	14.6	16.2
	40-44	15.9	11.9	14.1
	45-49	13.7	13.0	13.4
	50-54	10.5	8.3	9.5
	55-59	9.2	5.5	7.6
	60-64	5.4	2.8	4.2
	65+	3.8	.8	2.5

Comparison of our study population with other profiles of boaters

In November, 1995, CM Research (1996) surveyed by telephone 300 pleasure boaters in the Auckland free-calling telephone area. Because of their telephone sampling strategy, CM Research cannot estimate the proportion of boaters by gender. They however interviewed 65% males compared to our study where 77% were male. Their ethnic breakdown was 3% Maori and 93% European, while our study had 7% Maori and 86% European. The lower proportion of Maori in the telephone survey may reflect under representation of this group in telephone surveys. The income distribution was remarkably similar in our study to the distribution by socioeconomic status in the CMR study.

A national study of boat owners conducted for the MSA between January 1997 and March 1998 found that 40% of all boats owned were trailer powerboats, 7% were motor launches, 4% keel yachts, 7% trailer yachts, 24% dinghies, and 13% other (Pleasure Boat Safety Advisory Group, 1999). Our study did not examine boat ownership but rather boat use and found a higher proportion of trailer powerboats (67%), motor launches and keel yachts. The earlier mentioned CM telephone survey in the Auckland region (CM Research 1996) asked about the boat mainly used and found 45% were powerboats less than 6m, 11% sailboats less than 6m, 19% powerboats more than 6m, 22% sailboats more than 6m and 4% other, i.e. dinghy. Our corresponding figures in the same order are – 67%, 2%, 14%, 13% and 4% other.

Boater characteristics

For all boaters surveyed only 1.3% said they could not swim at all (98.7% said they could swim); 25.2% were poor to fair swimmers and the remaining 73.5% rated themselves as good to excellent swimmers.

Boaters generally had considerable boating experience with 76.2% having gone out 10 or more days in the past 12 months (operators 86.6% and passengers 63.5%) - and 40.5% having gone out 30 or more days in the past 12 months (operators 51.6% and passengers 25.9%).

Among operators 50.6% had had no formal boating course, 12.3% had only the day skipper course, 22.2% boatmaster, and 15.0% coastal skipper or above. Only 34.2% of operators were members of the Coast Guard (i.e. paid subscription). Because of concerns regarding the potential number of boats to be out on the water during the America's Cup races we also asked "Are you likely to watch the America's Cup races". A total of 79.1% of boaters said they were planning to watch the America's Cup races (9.1% said don't know); 47.9% of all boaters said they planned to spend some of this time watching the races on a boat on the water and 42% of these (20% of all boaters) said they only planned to watch on the water by boat, while others included a mix of viewing from shore and TV.

Drinking practice

Overall 21.8% of boaters reported having something alcoholic to drink on the day of boating (up to the time of the survey): 23.8% of passengers and 20.2% of boat operators, and a similar proportion had had a drink in the past 2 hours (Table 2a). The drink of choice for most boaters was beer.

Table 2: Drinking patterns on the day reported by boaters (percent in category)

	Operator Drinks					Passenger Drinks					All boaters Drinks				
	Any*	0	1-2	3-4	5+	Any *	0	1-2	3-4	5+	Any *	0	1-2	3-4	5+
Drinks on day	20.2	79.8	11.4	4.7	2.9	23.8	76.2	13.5	4.2	3.5	21.8	78.2	12.3	4.5	3.2

Drinks past 2 hours	20.2	79.8	9.1	2.4	.3	23.5	76.5	12.7	2.3	0	21.6	78.4	10.7	2.3	.2

* Categories may not add up as exact quantity was not always specified

Among operators 13.2% had drunk 2 or more alcoholic drinks on the day of boating and up to the time of the survey, 7.6% had drunk 3 or more and 2.9% had drunk 5 or more drinks. The corresponding figures for passengers are 15.0% (2+), 7.7% (3+), and 3.5% (5+drinks).

Over the preceding 2 hours, 6.2% of operators had had 2 or more drinks (7.7% for passengers and 6.8% for all boaters); 2.6% of operators and 2.3% of passengers had had 3 or more drinks in the past 2 hours.

When they go out boating 34.1% of all boaters never drink alcohol, 27.9% rarely, 25.3% sometimes, 9.0% most of the time, and 3.7% always. Among skippers, the proportions were 35.8% never, 27.0% rarely, 25.2% sometimes, 8.5% most of the time and 3.5% always.

Safety knowledge and practice

Because of the short interview time available, only a single question was asked on general boating safety knowledge. General safety knowledge seems high overall as indicated by the fact that 84.5% knew to stay with the boat if it capsized 1km from the shore. In addition to the self-report interviews, we also separately asked the skippers of the boats if they actually had safety equipment on board. Almost all the time the skippers pointed out the equipment (or lack of it to us). In addition, the interviewer made observations regarding life jacket use.

Only 3.4% of boats did not have life jackets on board which is consistent with telephone surveys on life jackets. Among the 282 children under 18 on the boats 44.7% were actually wearing the lifejackets. However, only 12.2% of the 1252 adults 18 and over were actually wearing their lifejackets.

Five extinguishers were carried by 76.1% of boats surveyed, flares by 78.5%, but only 23.0% had an EPERB emergency locator. Most boats had either a radio or cell phone for communication (92.0%).

Alcohol knowledge

Most boaters were very aware of the effects of alcohol on the body as only 3.4% thought alcohol "will help you maintain body temperature if you fall overboard", and only 9.6% thought that alcohol affected you less outdoors when boating compared to being inside. However only about half (50.7%) thought that alcohol use on or near the water would increase the chances of drowning "very much", 29.6% "somewhat", 14.1% "a little" and 5.6 % believed that alcohol would not increase their risk at all (Table 3). Among all boaters surveyed 35.7% had not heard anything about the risks of drinking on the water from any source over the past 12 months (64.3% had heard about it from one or more sources). More detailed examination of the sources was provided for planning the ALAC campaign and will be used for comparison on the follow-up evaluation.

Table 3: Knowledge and attitudes to alcohol use while boating (all boaters percent agreement)

	Very much	Somewhat	A little	Not at all

Alcohol increases chances of drowning	50.7	29.6	14.1	5.6
Alcohol adds to enjoyment on water	6.6	18.2	31.1	44.2
Restricting alcohol decreases enjoyment	5.6	10.8	21.6	62.0

Alcohol adds to enjoyment of boating "very much" for 6.6% of boaters, "somewhat" 18.2%, 31.1% "a little" and "not at all" for 44.2%. Similarly if alcohol use were restricted on the water only 5.6% said it would decrease enjoyment "very much" 10.8% "somewhat", 21.6% a little, and 62.0% "not at all". (Table 3)

Knowledge and attitudes regarding drinking and boating laws

There is no law specifically prohibiting boating and drinking in New Zealand but some other countries do have such laws (Budge, 1994 a & b). Knowledge regarding any laws on boating and drinking is low among Auckland boaters. Most boaters (63.2%) said they did not know if there was a law, only 13.8% knew that there was no law against drinking and boating, and the rest (23.0%) thought that there was some kind of law. When boaters were asked: "Some countries have laws that make it illegal to operate a boat when intoxicated. How do you feel about laws that make it illegal to operate a boat when intoxicated?" - overall 86.8% of boaters said they would support a law making it illegal to operate a boat while intoxicated (54.2% strongly support), and only 13.2% would strongly or somewhat oppose a law (5.3% strongly oppose)(Table 4).

Table 4: Support for laws that make it illegal to operate a boat when intoxicated

	Operator %	Passenger %	All Boaters %

Strongly support	53.2	55.5	54.2
Somewhat support	31.4	34.3	32.6
Somewhat oppose	9.1	6.3	7.9
Strongly oppose	6.3	3.9	5.3

Safe drinking levels

The beliefs as to what are safe drinking levels on the water vary greatly between what boaters think the operators or passengers can safely drink, and how much it is safe to drink when the boat is moored (Table 5). Only 4.3% think it is safe for the operator to drink 5 or more drinks immediately before or during a two hour outing, while 10.5% think it is safe for the passenger to do so. However, 21.0% think it is safe to drink 5 or more drinks while the boat is moored (even though there is still a risk of falling overboard and drowning). The corresponding figures for a safe level of 3 or more drinks are 14.7% for skippers, 37.3% for passengers and 47.9% when moored.

Table 5: Maximum number of drinks considered safe to drink for operator, passenger or when moored (per cent in category)

	Safe number of drinks			
	0	1-2	3-4	5 or more
Operator(skipper)	51.5	33.8	10.4	4.3
Passenger	23.8	38.9	26.9	10.5
When tied up	21.6	30.5	26.9	21.0

Many think that it is safe for the passengers to drink as long as the skipper stays sober; 49.6% of boaters agree strongly or somewhat that it is safe for the passenger to drink as long as the

operator does not (Table 6). There is no difference in beliefs by whether the respondent was the operator or a passenger.

Table 6: Is it safe for passengers to drink alcohol as long as the skipper does not drink? (percentage agreement by operator or passenger respondents)

	Operator	Passenger	All boaters
Agree	49.4	49.8	49.6
No opinion	18.1	19.1	18.5
Disagree	32.6	31.1	31.9

Influence of formal boating courses on knowledge, attitudes and practice

When the extent of training, as indicated by boating courses taken, was examined there was no difference in the proportion of boaters having had any alcoholic drink on the day (Table 7). Formal training meant having taken any of the Coast Guard approved training courses. It was decided to do analyses by 'any' versus 'no training' as more advanced courses are directed more at boating skills rather than increased knowledge of the effects of alcohol on the water.

Table 7: Difference in attitudes and knowledge by whether person has had a formal training course in boating safety.

Question	**Boat Operators**			**All boaters**		
	No formal training	Formal training	P value	No formal training	Formal training	P value
Drinking on day	19.6	19.3	ns	20.7%	20.9%	ns
Hear risk drinking boating last 12 months	61.3	72.4	.03	56.6%	75.6%	.001

Stay with boat if capsises	83.3	92.6	.03	79.0	93.4	.001
Alcohol increases risk of drowning very much	53.4	55.9	ns	49.2	54.0	ns
Safe for passengers to drink if skipper sober	29.9	36.3	ns	28.2	38.1	.02

ns-not significant

Those with any formal training were significantly more likely to have heard information about the risks of drinking and boating in the past 12 months (76% vs. 57%, p value = 0.001) – 79.0% of those with advanced training (boatmaster or above) compared with 67.3% of day skipper trained people and 56.6% of those with no training. Those with more training were also significantly more likely to report they would stay with the boat if it capsized 1 km. from the shore (93% vs. 79%, p=0.001) (96.2% advanced, 85.2% day skipper, and only 79.2% with no training). There was no difference by training however in the belief among operators (skippers) that alcohol increased the risk of drowning or if it is safe for the passengers to drink as long as the skipper is sober. However, among all boaters, those with formal training in boating safety were somewhat more likely to think that it was safe for passengers to drink if the skipper was sober. These findings suggest that there is a need to incorporate information on the risks to passengers when training boaters on the risks of alcohol use on the water.

Influence of age on knowledge, attitudes and practice

Boaters aged 35-49 years were the least likely to drink compared to those 18-34 and persons 50 years and over, however this difference was only significant for all boaters combined (Table 8) (below age 18 was not studied). The small numbers of boaters between 18-24 years (only 33 cases) make definitive statements about their drinking habits difficult although they were more likely to have drunk 5 or more drinks on the day (6.1% vs. 2.9% for 25-39 year

olds and 1.4% 40+ years). However, none of the 18-24 year olds reported drinking 3 or more drinks in the past 2 hours (the highest here was 25-39 year olds at 3.3%).

Younger persons (18 – 34 years) were less likely to have heard anything about the risks of drinking and boating (47.4% vs. 66-83% for other age groups). Older people are also more likely to know that alcohol increases the risk of drowning.

Table 8: Differences in drinking practice, attitudes and knowledge by age (percent agreeing with question)

Question	Boat operators age (% agree)				All boaters age(% agree)			
	18-34	35-49	50+	pvalue	18-34	35-49	50+	pvalue
Drinking on day	25.0	15.7	25.0	ns	25.4	16.7	25.8	.04
Hear risk drinking boating last 12 months	47.4	66.0	83.3	.001	47.8	64.0	85.0	.001
Stay with boat if capsizes	72.6	90.5	95.6	.001	74.0	86.2	94.0	.001
Alcohol increases risk of drowning very much	39.2	56.9	58.1	.02	39.6	54.7	55.8	.01
Safe for passengers to drink if skipper sober	25.3	31.5	36.1	ns	23.8	32.9	38.0	ns

Compared with older age groups, young boaters generally held different views on boating and alcohol use. They considered that drinking alcohol added to their enjoyment of boating; that any restrictions on alcohol use would decrease their boating enjoyment; that it is safe to drink alcohol when the boat is moored; that it is safe for passengers to drink alcohol (although the differences are only statistically significant looking at the age group 18-24 years – 61% 18-24 years vs. only 45% 40+ years); and they perceived a higher safe limit of alcohol consumption for both operators and passengers. There is little difference in support for a drinking and boating law by age. These findings suggested that the most important group to target in the safe drinking campaign was younger persons.

Breathalizer data

For those boaters who completed an interview, 79% (n=482) gave a breath sample (81% of operators (n=281), 77% of passengers (n=201)). In addition, on the first weekend, at one

busy boat ramp, we also experimented with not giving questionnaires but concentrated on getting breath tests. As a result of this activity, an additional 164 boaters had breath tests without completing the self-report questionnaire. However, the Boating Information Form (BIF) was completed on all boats which obtained basic details on the boaters, including BAC, but not the gender of the person (which was in the interview questionnaire).

Comparison of the boaters refusing to do the breath test with those in the overall study found that those who refused were no more likely to appear intoxicated than the general sample of boaters (based on observations made by the interviewers on all cases). This finding has been confirmed in our other studies in the USA.

Reliable BAC data was obtained on 646 boaters. Overall 8.5% of all boaters had a positive BAC (7.2% of skippers and 10.5% of passengers) (Table 9). Among all boaters 4.2% are over the legal BAC driving level in New Zealand (0.8 or 80 mg/dl) and 3.0% over 100 mg/dl (intoxicated). There was no statistically significant difference between operators and passengers with regard to BAC.

Table 9: Blood alcohol by operator and passenger

Blood alcohol concentration	**Operators**		Passengers		**All Boaters**	
	No.	%	No.	%	No.	%
Zero BAC	**362**	**92.8%**	**229**	**89.5%**	**591**	**91.5%**
Recorded positive only	3	0.8%	10	3.9%	13	2.0%
1-49 mg/dl	6	1.5%	4	1.6%	10	1.5%
50-79 mg/dl	3	0.8%	2	0.8%	5	0.8%
80-99 mg/dl	5	0.3%	2	0.8%	7	1.1%
100+ mg/dl	11	2.8%	9	3.5%	20	3.0%
Positive BAC - Total	**28**	**7.2%**	**27**	**10.5%**	**55**	**8.5%**
Over 80 mg/dl	16	4.1%	11	4.3%	27	4.2%
Total	**390**	**100%**	**256**	**100%**	**646**	**100%**

A BAC of 100 mg/dl is considered intoxicated in most studies (80 mg/dl is the legal drinking limit in New Zealand). These results are comparable with our findings in the United States. For Maryland 5% of boaters were over 100 mg/dl and 2% in North Carolina, compared to 3% for Auckland. Similar studies of drivers on the highway find that at night 3-4% are over 100 mg/dl and less than 1% during the day.

The proportion of female boaters with positive BAC was actually higher than for men (11.6% vs 9.4%) but the examination by more detailed categories is not possible due to small numbers of women (Table 10). This finding is initially surprising but is consistent with our studies in the US where, using a much larger sample size, women were found to have the same BAC levels as men.

Table 10:Blood alcohol by gender (gender not recorded for 171 persons)

BAC	**Male**		**Female**		**Total**	
	No	%	No.	%	No.	%
Zero BAC	**329**	**90.6**	**99**	**88.4**	**428**	**90.1**
Recorded positive	5	1.4	7	6.3	12	2.5
1-49	7	1.9	3	2.7	10	2.1
50-99	10	2.8	2	1.8	12	2.5
100+	12	3.3	1	.9	13	2.7
Any positive - Total	**34**	**9.4**	**13**	**11.6**	**47**	**9.9**
Total	**363**	**100**	**112**	**100**	**475**	**100**

An important determinant of the likelihood of drinking, and also that for having a positive BAC, is the time of day. For example many more drivers on the highway are drunk at 10 p.m. than at 10 a.m. For this reason we examined the BAC results in boaters by time of day (Table 11). The interesting observation was that BAC levels were more likely to be positive from 3 p.m. to 4.59 p.m. and few were positive after 5 p.m., although the number in our study was small, making statistically valid comparisons by time of day not possible, especially for small sub-groups.

Table 11:Blood alcohol by gender and time of day – Percent positive

	Male			**Female**			**Total**		
	No.	**No. +ve**	**% +ve**	**No.**	**No. +ve**	**% +ve**	**No.**	**No. +ve**	**% +ve**
11 a.m.-2.59 p.m.	200	17	8.5	57	10	17.5	334	28	8.4
3 p.m. – 4.59 p.m.	98	15	15.3	28	2	7.1	178	23	12.9
5 p.m. +	65	2	3.1	27	1	3.7	134	4	3.0
Total	363	34	9.4	112	13	11.6	646	55	8.5

As can be seen from Table 12, the higher proportion of elevated BAC from 3 to 4.59 p.m. was due to the higher positive BAC rates in those tested on the water at this time, a number of whom were anchored or tied up. It was surprising that higher BACs were not found later in the day but it is possible that these were likely to remain at anchor for the night. Many of the 'on the water' interviews took place at anchor. It should be noted also that a much higher proportion of on the water surveys were positive (22% vs. 3%) and with a BAC over 100 mg/dl (7.3% vs. 2.5%). This may be due to small sample size and a larger and more representative sample is needed.

Table 12: Alcohol use by land based (boatramps/marinas) or on the water (from boat) surveys

	Land Based			On the Water		
Time	No. Tested	% positive	% 100+	No. Tested	% positive	% 100+
11a.m. to 2.59 p.m.	281	2.9	1.4	53	24.5	5.7
3 p.m. to 4.59 p.m.	159	3.8	5.7	19	26.3	15.8
5 p.m.+	124	2.4	.8	10	0	0
Total	564	3.0	2.5	82	22.0	7.3

Correlation of BAC with drinking self-reports

Self-reported drinking patterns cannot be expected to compare exactly with measured BAC as there are wide variations in the metabolism of alcohol both between people and at different times in the same individual. There was, however, good correlation between self-reported drinking and measured BAC. All boaters with positive blood alcohol levels reported drinking alcohol on the day of the survey except for two cases (one male and one female). Similarly all of the cases who reported consuming more than 5 drinks on the day had positive blood

alcohol, except for one case who had a zero BAC but reported drinking 5 drinks over the course of the day and two in the past two hours but showed no signs of intoxication (Table 13). This is quite possible especially if food has been consumed at the same time. There are also wide variations in individual differences in the absorption of alcohol. Other factors that influence BAC for the same amount of alcohol drunk, include having food in the stomach, body size and the time over which the drinks were consumed.

Table 13: Correlation of BAC and self reported drinking

a. Drinks consumed in last two hours

	BAC reading									
	Zero		Any positive		1-49		50-99		100+	
Self reported number of drinks in last two hours	No.	%	No.	%	No.	%	No.	%	No.	%
Zero	365	85.3	0	0	0	0	0	0	0	0
Any drinks*	63	14.7	46	100	10	100	12	100	14	100
1-2	24	5.6	26	56.5	7	70	7	58.3	7	50.0
3+	0	0	12	26.1	2	20	3	25.0	6	42.9
Total	428	100	46	100	10	100	12	100	14	100

* numbers may not always add up as some responses were unspecified for number of drinks. Two cases (1 male and 1 female) who denied drinking at all on the day but had positive BAC were excluded from analyses.

b. All drinks consumed on day

	BAC reading									
	Zero		Any positive		1-49		50-99		100+	
Self reported number of drinks	No.	%	No.	%	No.	%	No.	%	No.	%
Zero	364	85.1	0	0	0	0	0	0	0	0
Any drinks*	64	14.9	46	100	10	100	12	100	14	100
1-2	46	10.8	21	45.7	6	60	4	40	5	35.7
3-4	8	1.9	12	26.1	2	20	3	25	4	28.6
5+	1	0.2	12	26.1	2	20	5	41.7	4	28.6
Total	428	100	46	100	10	100	12	100	14	100

As shown in Table 13, a small number of people with high BAC reported consuming only one or two alcoholic drinks. However, for most cases, the dose response relationship of number of drinks by BAC was strong, regardless of whether total drinking on the day or drinks in the past two hours were considered.

Comparison of drinking levels and BAC by specific variables

As can be seen by the following analyses, there was also excellent correlation between the information provided by both approaches (questionnaire and breathalizer) to assessing alcohol use. For example, those aged 35-49 years had the lowest proportion with a positive BAC (7.5%) (Table 14), while the same group had the lowest proportion (16.7%) reporting any drinking (Table 15). The small numbers involved meant that more detailed breakdowns are not statistically reliable.

Table 14: Blood alcohol levels by age

	BAC (percent in category)			
Age	**Number**	**Zero**	**Any positive***	**100+**
18-34	148	86.5	13.5	6.1
35-49	188	92.6	7.5	1.1
50+	115	88.7	11.3	2.6
Total	451	89.6	10.4	3.1

*includes 100+

Table 15: Self reported drinking by age

	Percent in category				
Age	**Number**	**Zero**	**Any drinks**	**1-2**	**3+**
18-34	185	74.6	25.4	12.4	10.8
35-49	246	83.3	16.7	9.4	6.1
50+	132	73.5	26.5	18.9	5.3
Total	563	78.2	21.8	12.6	7.5

Blood alcohol levels also varied by activity (Table 16) with cruising having the highest percent positive BAC (8.8%) and self reported drinking (24.9%) (Table 17).

Table 16: Blood alcohol levels by main activity

Activity	**BAC (Percent in category)**			
	Number	**Zero**	**Any positive***	**100+**
Cruising	183	84.7	8.8	5.5
Fishing	316	97.2	2.3	1.3
Other	125	89.6	5.6	2.4
Total	624	92.0	4.8	2.7

* any positive includes 100+

Table 17: Self reported drinking by activity

a) Total drinks on the day

Activity		**Percent in category**				
	Number	**0**	**Any drinks***	**1-2**	**3-4**	**5+**
Cruising	193	75.1	24.9	17.1	3.6	3.1
Fishing	260	79.6	20.4	9.2	5.0	3.9
Other	134	82.1	17.9	10.4	4.5	1.5
Total	587	78.7	21.3	12.1	4.4	3.1

b) Drinks in past 2 hours

Activity	**Percent in category**				
	Number	**0**	**Any drinks***	**1-2**	**3 or more**
Cruising	193	75.1	24.9	14.5	2.1
Fishing	260	79.6	20.4	8.9	1.5
Other	134	82.1	17.9	8.2	3.7
Total	587	78.9	21.1	10.6	2.2

*categories may not add up as exact quantity not specified

Variation in alcohol by area and day of survey

As expected, there was also variation in alcohol detection by the area surveyed as indicated by Table 18 showing variation by interviewers. Each interviewer covered similar areas during the study. While small numbers make exact comparisons difficult, the same trends seen earlier persist. Interviews in areas with little drinking also had lower rates of positive BAC.

Table 18: Self –reported Drinking Patterns of Respondents by Interviewer

	Total Interviewed	**No. Who Drank on day**		**No. of boaters by Drinks Consumed on day**						
				1-2 drinks		3 or more drinks		Not Specified		BAC +ve
Interviewer		No.	%	No.	%	No	%	No	%	%
Andrew	26	6	23.1	2	7.7	4	15.4	0	0	13.9
Asim	52	8	15.4	7	13.5	0	0	1	1.9	0
David	8	3	37.5	3	37.5	0	0	0	0	N/A
Genivieve	97	16	16.7	5	5.2	9	9.4	2	2.1	6.3
Hamilton	55	6	10.9	0	0	6	10.9	0	0	N/A
K.H.	82	34	42.5	24	30.0	6	7.5	4	5.0	21.3
Kevin	51	4	7.9	3	5.9	1	2.0	0	0	7.1
Maria	32	12	37.5	7	21.9	5	15.6	0	0	18.8
Matt	53	10	19.2	3	5.7	6	11.5	1	1.9	6.1
Nada	122	31	25.6	20	16.5	8	6.6	3	2.5	9.1
Sue	29	1	3.6	0	0	1	3.6	0	0	2.7
Total	607	120	20.0	74	12.3	46	7.7	11	1.8	8.5

NOTE: Percentages are for those responding
N/A indicates breathalyzers that did not record

Weather conditions

There was some concern that the weather was not typical summer weather for a number of the days selected for the survey and that it may influence drinking.. The following describes the weather on the days of the survey.

Saturday March 27 Moderate wind, mix clear and cloudy, max temp 25.0 C

Sunday March 28 Moderate wind, mix clear and cloudy, max temp 24.2 C

EASTER

Friday April 2 Moderate wind, mix clear and cloudy, max temp 20.9 C

Saturday April 3 Calm, mix clear and cloudy, max temp 22.0 C

Sunday April 4 Calm, clear sunny, max temp 22.8 C

Monday April 5 Windy, wet or cloudy, weather advisory issued, boats came in early, max temp 20.6 C.

The drinking patterns did appear to vary by day of the survey but the variation was not significant. (Table 19). The normal temperature range for March was 15-21 C and 13-20 C for April. Thus while the weather was not hot, calm and sunny on all days the weather was not that atypical for this time of the year.

Table 19:Self-reported Drinking Patterns by date of Survey and comparison with BAC results.

	Total Interviewed	**No. Who Drank on day**		**No. of boaters by Drinks consumed on day**						**Pro-portion BAC +ve**
				1-2 drinks		3 or more drinks		Not Specified		
Date		No.	%	No.	%	No.	%	No.	%	%
March 27 (Saturday)	130	25	19.4	10	7.7	11	8.5	4	3.1	6.1
March 28 (Sunday)	136	26	19.4	14	10.5	10	7.5	2	1.5	9.6
April 2 (Good Friday)	16	6	37.5	4	25.0	2	12.5	0	0	8.9
April 3 (Saturday)	149	31	21.1	18	12.2	10	6.8	3	2.0	19.6
April 4 (Sunday)	132	33	25.2	22	16.8	10	7.6	1	0.8	6.8
April 5 (Monday)	44	10	22.8	6	13.6	3	6.8	1	2.3	5.6
Total	607	120	20.0	74	12.3	46	7.7	11	1.8	8.5

NOTE: Percentages are for those responding

For the purposes of further analysis the weather was grouped into these groups, moderate wind, mix clear and cloudy (March 27, 28, April 2) calm weather (April 3 and 4) and stormy

(April 5). When time of day was considered there did not seem to be much variation in both measured BAC and self-reported drinking (Table 20).

Table 20: Alcohol use by weather conditions

a) Breathalizer tests

	Calm		Moderate		Stormy		Total	
Time	%+ve	% 100+	%+ve	% 100+	%+ve	% 100+	% +ve	% 100+
11.00a.m. to 2.59 p.m.	3.3	1.3	12.5	2.8	13.5	2.7	8.4	2.1
3.00 p.m. to 4.59 p.m.	11.1	7.8	11.1	3.7	57.2	28.6	12.9	6.7
5 p.m. +	6.1	1.5	0	0	0	0	3.0	.8
Total	9.1	3.3	9.2	2.4	19.5	6.5	8.5	3.1

b) Drinks consumed

	Calm (%)	Moderate (%)	Stormy (%)	Total (%)
Any Drinks*	20.7	24.6	29.4	21.8
0	79.3	75.4	70.6	78.2
1-2	10.6	17.2	17.7	12.3
3-4	4.0	4.7	2.9	4.5
5+	3.5	1.4	5.9	3.2

*may not add up as some reported drinking but not amount

The frequency with which boaters reported drinking while boating varied both by the amount they reported drinking on the day and by their BAC (Table 21).

Table 21: How often boaters usually drink alcohol while boating, by drinking patterns or BAC on day of survey

	Operator	Passenger	All Boaters				
				Drinking on day		BAC	
	% in group	% in group	% in group	None %	Any %	Zero %	+ve %
Always	3.5	3.9	3.7	14.3	85.7	55.6	44.4
Most of the time	8.5	9.7	9.0	42.6	57.4	62.8	37.2
Sometimes	25.2	25.3	25.3	66.9	33.1	85.6	14.4
Rarely	27.0	29.2	27.9	85.0	15.0	95.0	5.0
Never	35.8	31.9	34.1	97.0	3.0	100	0

Table 22: Self reported drinking by gender

	Percent in Category								
	Total Interviewed	**No. who drank on day**		**1-2 drinks**		**3 or more drinks**		**Not Specified**	
Gender		**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Male	456	96	21.0	47	10.3	39	8.6	10	2.2
Female	136	32	23.5	27	19.9	4	2.9	1	0.7
Total	592	128	21.6	74	12.5	43	7.3	11	1.9

Table 22 shows that there was little difference between males and females in the percentage who said they drank alcohol on the day. The number of alcoholic drinks consumed did vary by gender, with a higher percentage of males drinking 3 or more drinks. Similar findings were found when actual BAC was measured.

Table 23: Presence of lifejackets on board boat, by any drinking alcohol on the day or by positive BAC

		Skippers		All Boaters	
	% of boats	% drinking on day	% Positive BAC	% drinking on day	% Positive BAC
No Lifejackets aboard	3.4	0	0	0	0
Lifejackets on board	96.6	20.5	7.3	21.8	8.6
Total	100	20.1	7.0	21.4	8.4

Those carrying life jackets on board had a significantly higher percentage of boaters who said that they drank on the day ($p<0.05$) (Table 23). However, note that only a very small percentage of boats (3.4%) did not carry life jackets Nearly all of the boats not carrying life jackets were trailer or inflatable motor boats. There was no significant difference in the percentage of positive BAC readings. Of the 8.6% boaters who had a positive BAC reading and who had lifejackets on board, a third had a BAC level of 100 mg/dl or more.

The use of alcohol while boating influenced many of the responses to the alcohol and safety questions (Table 24). A significantly higher percentage (89.7%) of those who had not consumed any alcohol on the day said that they would strongly/somewhat support a law against intoxicated operators, compared to those who had consumed alcohol (77.0%). Non-drinkers (45.3%) were less likely to agree strongly/somewhat that it is safe for passengers to drink alcohol if the operator remains sober, compared to those who did drink alcohol (64%).

Table 24: Responses to questions, by whether people reported drinking alcohol or had an elevated BAC

Question	All boaters						
	Reported drinking on day			BAC			
	% agreement			% agreement			% agreement
	Zero	Any	p-value	Zero	Any	p-value*	100+
Alcohol helps maintain body temperature in water	2.8	4.7	ns	3.5	10.6	ns	30.8
Alcohol increases risk of drowning very much	56.2	30.8	<.001	56.5	29.2	<.001	35.7
Alcohol adds to boating enjoyment very much/somewhat	17.6	50.0	<.001	19.8	63.8	<.001	71.4
Alcohol restrictions would decrease boating enjoyment very much/somewhat	12.5	30.8	<.001	13.5	33.3	<.001	28.6
Heard about risk of alcohol & boating in last 12 months	60.8	76.9	<0.01	65.5	75.0	ns	64.3
Would strongly/somewhat support law against intoxicated operators	89.7	77.0	<.01	89.6	75.6	<.05	61.5
Safe for operator to drink 3 or more drinks	9.73	31.8	<.001	13.4	34.1	<.001	57.1
Safe for passenger to drink 3 or more drinks	32.4	55.5	<.001	35.6	63.8	<.001	78.6
Safe to drink 3 or more drinks when boat moored	43.2	65.6	<.001	45.7	76.6	<.001	85.7
Agree strongly /somewhat that it is safe for passengers to drink alcohol if operator sober	45.3	64.0	<.001	47.5	63.8	<.05	57.1
Would stay with boat if it capsizes	85.2	83.7	ns	88.7	81.3	ns	64.3

*significance testing only compares zero vs positive

Concluding comments

This study provides valuable information on boaters' knowledge, attitudes and practice with regard to alcohol use and boating safety practices on the water. It is an important addition to our understanding of the role of alcohol and boating. An important feature of our study is that it is the first attempt to collect information on alcohol and boating safety measures from people actually participating in boating activities. Other studies by market research firms have relied on telephone surveys to identify boaters, which may not be the best measure of those actually exposed to the risks of boating. Exposure to the activity is probably the greatest risk factor in any drownings (Smith & Howland 199).

The America's Cup and Millennium activities provided an important event around which to focus prevention activities to better inform the public about the risks of alcohol use while boating and to reinforce other more traditional boating safety measures. The data from this study was used to inform the development of a comprehensive effort to raise awareness of the hazards of drinking while boating. Up until this present campaign, there has been little awareness of the importance of alcohol as a risk factor for boating accidents, especially fatalities. Our study provides important information on knowledge, attitudes and practice regarding alcohol use on the water among a group of boaters sampled during the study period. The preliminary data from earlier interim reports and data runs has been used to guide, in part, the "Don't go overboard with the booze" campaign which is part of a much broader "Safe Summer 2000" safety campaign over this summer. Details are available on the ALAC website (ALAC, 1999). An important follow-up from our study will be to evaluate the actual effectiveness of the program that has been launched by ALAC with the cooperation of other groups.

This project had the support of a variety of groups concerned with boating safety and their input was sought on the study design. It will be important to work with these same groups in the planned evaluation of the "Don't go overboard with the booze campaign" as they are the groups that are likely to be the most effective in implementing long-term changes in the boating community. The results of our previous work (Smith et. al., 1999) have already been used by harbour masters around the country, including those in Queenstown, Taupo and Rotorua, to promote the importance of reducing alcohol consumption on the water. It is hoped that this report will also be of use in planning and evaluating on-going prevention programmes to prevent alcohol related injuries and deaths on the water.

Our study had a high response rate with 88% of the operators completing questionnaires. This response rate is high particularly when compared to the results from telephone market surveys. There was no difference in the characteristics of the refusals compared to those interviewed, including any evidence of drinking or signs of intoxication. Thus, we believe our respondents are a reliable cross-section of boaters on the days we did the survey. Because our survey was of those actually boating, the results may not be directly comparable with telephone surveys that only collect data on all boaters regardless of how often they go out.

Overall, 22% of boaters reported drinking any alcoholic drinks on the day up to the time of the survey. However only 8% reported drinking three or more drinks on the day and only 3% reported drinking five or more drinks on the day. Only 2.5% reported drinking three or more drinks in the past two hours. Thus, only about 3% or less of people are drinking at hazardous levels that are likely to result in significant increases in blood alcohol and risk of injury. This

finding is confirmed by the breathalyzer data that measures blood alcohol concentration (BAC). The same percentage of boaters (3%) were intoxicated as indicated by a BAC of 100mg/dl or over (4% were over the legal limit for drinking in New Zealand of 80mg/dl or 0.08%). While 22% of boaters reported any drinking of alcohol on today or within the past two hours, only 8.5% had a positive BAC, which is consistent with our knowledge of the metabolism of alcohol in the body. Small amounts of alcohol are rapidly metabolized by the body and so do not result in elevation of blood alcohol or of risk. The important issue is the heavy drinker who drank at levels that exceed the body's ability to metabolize it.

It is also interesting that there was no significant difference in drinking patterns or BAC levels between operators and passengers, or between men and women. This last finding has also been confirmed in our studies in the United States and is very different to drink driving where a larger proportion of male drivers are intoxicated. It is important to collect additional data in follow-up surveys to confirm if this relationship holds when larger numbers permit more stable estimates to be made. Additional data would also permit more detailed breakdowns of alcohol involvement in other sub-groups such as those surveyed on the water versus at boat ramps. Future studies should include measurement of BAC in a wide cross-section of environments on the water.

More detailed studies of drinking patterns and practices found that only 4% of boaters reported "always" drinking alcohol when they went boating and a further 9% "most of the time". The largest group was those who "never" drank alcohol while boating (34%). These findings further highlight the issue that the problems of drinking alcohol on the water are only

focused on a small group of boaters but when they do drink to excess, the risks associated with it are high.

The finding that only about 3-4% of boaters have evidence of heavy alcohol drinking (and also always drink alcohol while boating) is important in understanding the risks of drinking and boating. An earlier study by our group that 27% of boating deaths in Auckland over the period 1980-1997 had BACs over the legal drinking limit while only 4% of the sample of living boaters surveyed had the same blood alcohol level. Thus, those with high BACs illustrate the importance of alcohol as a risk factor for boating fatalities.

The largest single hazard from boating is drowning and few fatalities result from boat collisions. Other studies overseas have shown that alcohol is an important risk factor for drowning (Howland et. al, 1988, 1993, 1995; Smith et. al, 1988, 1995, 1999). Our own studies of all drownings in Maryland suggest that alcohol increases the risk of drowning both at low levels of BAC (20 fold for BAC 1-99) and by over 200-fold for BAC over 100mg/dl for those participating in water activities in Maryland. These findings adjust for a number of other risk factors. An older and less well designed US Coast Guard study also found a 10-fold risk of high BACs for boating fatalities and our ongoing study in Maryland seeks to provide more comprehensive estimates in the near future (US Coast Guard, 1999). While these studies were not done in New Zealand, it is likely that similar risks apply for alcohol abuse on the water in New Zealand.

National data sources in New Zealand report that only about 15% of drownings or boating deaths involve alcohol. Figures from our earlier study however found that alcohol

involvement in boating deaths in the Auckland region was much higher (43% positive and 27% over the legal driving limit). As discussed in the Report and Fact Sheet (Smith, Coggan IPRC, 1999), the reasons our estimates are higher is because we exclude children and have a very high testing rate. The most important factor in studies of alcohol and injuries is to have a high testing rate. Without a high testing rate any comment on alcohol involvement is nothing more than conjecture. An earlier study of all drownings throughout New Zealand published by the Injury Prevention Research Unit in Dunedin found that only 30% of cases are tested nationally for BAC (Warner, Smith, et. al, 1998). Of those tested, 50% had a positive BAC. However, if the cases not tested are assumed to be zero (an all too common practice) then only 12% would be BAC positive (which is closer to other national estimates). Thus the study concluded that the true answer lies somewhere in between 12% and 50% as many of those not tested would have had a positive BAC. Thus the findings from our earlier study are consistent with the 15% National figure quoted in the PBSAG report (Pleasure Boat Safety Advisory Group, 1999), if the issues of testing are considered. There is a need to establish a national alcohol testing programme for boating and all other injury fatalities in order to better understand the role of alcohol in other parts of the country.

An important feature of the earlier Auckland study is that, because of the high testing rates, we are able for the first time to say something meaningful about the role of alcohol in boating fatalities and other drownings. A major strength of our study was that we had high BAC testing rates and we excluded those not tested or with an invalid sample in order that our results would be valid. Our overall figure of 43% alcohol involvement on boating fatalities for men 15-64 years of age (18 out of 45 boating deaths) is considered reliable because of the numbers involved. The findings are also consistent with overseas studies (US Coast Guard,

1999; NIAA, 1997; Howland et. al., 1988, 1993, 1995). It is interesting to note that the study of boating fatalities found that alcohol was as much a problem on the water as it is on the highway with the proportion of boaters and car drivers who are intoxicated when they die being very similar (Smith, Coggan, et. al., 1999; Land Transport Safety Authority, 1996). Our findings are also consistent with older studies in New Zealand that include data on alcohol and drownings (Cairns et. al., 1984; Gwyn, 1980). We also found that those fatalities involving falls overboard were much more likely to be intoxicated (about two-thirds). While the number of falls from boats in our study in Auckland was small, they represent all the cases that fell overboard, and not just a sample of cases. Falls overboard can also occur even if the skipper is sober and, unlike driving, a sober operator cannot always protect drunk passengers (Howland, Smith, 1993). Falls from boats are the most relevant injury type relating to the America's Cup as this category of boating accidents is the most likely scenario for fatalities among spectators at the America's Cup.

Safety Practices

Overall, safety knowledge seemed high as assessed by the fact that most people (85%) knew to stay with the boat if it capsized. Also only 3-4% of boats did not have life jackets on board (most of these were trailer or inflatable motor boats). None of the people on these boats reported any alcohol use or had any evidence of elevated BAC. The finding that alcohol use (self-reports or elevated BAC) was not related to having life jackets on board or knowing that it was safer to stay with the boat suggests that alcohol use is not related to general safety knowledge or practices.

Our findings regarding attitudes to safety are also similar to those given by a self-selected sample of 10,000 boaters nationwide (out of 200,000 questionnaires distributed) that was conducted in early 1999 by the Pleasure Boat Safety Advisory Group. Overall 92% of the respondents reported owning a life jacket compared to 97% of the boats in our survey which were found to have life jackets on board. Auckland is one of the few regions that has a by-law mandating the carriage of life jackets. The same national survey found that 64% of those who mailed in forms considered legislation for blood alcohol limits to be acceptable. This contrasts with our survey which found that 87% of boaters "strongly" or "somewhat" support laws that make it illegal to operate a boat while intoxicated (54% strongly, 33% somewhat).

In addition to providing important data on alcohol use, the survey also provided useful information on a cross-section of boaters who actually go boating. It is interesting to note that the vast majority of boaters could swim and 74% rated themselves as good to excellent swimmers. In addition, 52% of skippers reported having gone out 30 or more days in the past 12 months. Almost half (49%) of skippers had had some formal boating course with 15% having taken the advanced coastal skippers course or above. As expected, most boaters (79%) were planning to watch the America's Cup with 48% of all boaters planning to spend some of this time watching the race on the water. With the large number of boats in the Auckland area, this could obviously prove to be a congestion hazard to organizers of the America's Cup. With the finals of the Cup coming up, it will be important to continue to promote the safe drinking message (along with other safety messages such as wearing life jackets) among spectators out on boats, and also among those at the Cup Village, if we are to prevent alcohol-related tragedies.

References:

Alcohol Advisory Council of New Zealand (ALAC). Alcohol and boating. www.alcohol.org.nz accessed December 10, 1999.

Budge J. Current legislation relating to recreational boating in New Zealand. Wellington, New Zealand Water Safety Council, 1994a.

Budge J. Evaluation of international registration and licensing systems for recreational boating: A research investigation conducted for the New Zealand Water Safety Council. Wellington, New Zealand Water Safety Council, 1994b.

Cairns FH, **Koelmeyer TD, Smeeton WM**. Deaths from drowning. New Zealand Medical Journal. 1984:97(749):65-7

CM Research. Sea Safety Week Evaluation Research. Auckland: Maritime Safety Authority of New Zealand, December 1996.

Gwyn JF. Alcoholism and Mortality in Otago. New Zealand Medical Journal 1980; Sept 10: 209-210.

Howland J, Hingston R. Alcohol as a risk factor for drownings: a review of the literature, 1950-1985. Accident Analysis and Prevention 1988; 20(1): 19-25.

Howland J, Mangione T, Hingson R, Smith GS, Bell N. Alcohol as a Risk Factor for Drowning and Other Aquatic Injuries. In: Watson RR (Ed). Drug and Alcohol Abuse Reviews, Alcohol, Cocaine and Accidents. Humana Press Inc, Totowa, NJ, 1995; 7: 85-104.

Howland J, Smith GS, Mangione T, Hingson R, DeJong W, Bell N. Commentary: Missing the boat on drinking and boating. Journal of the American Medical Association, 1993; 270(1): 91-92.

Injury Prevention Research Centre (IPRC). Alcohol use: An important factor in Auckland boating fatalities. IPRC Fact Sheet No. 25. 1999. www.auckland.ac.nz/ipc.index.htm

Land Transport Safety Authority. Motor accidents in New Zealand: Statistical Statement Calendar Year 1995. Land Transport Safety Authority Wellington, September 1996

National Institute on Alcohol Abuse and Alcoholism. Ninth Special Report to the U.S. Congress on Alcohol and Health: from the Secretary of Health and Human Services. National Institutes of Health. NIH Publication No. 97-4017 June, 1997.

Pleasure Boat Safety Advisory Group (PBSAG). Final Report. Maritime Safety Authority of New Zealand. December 1999.

Smith GS, Howland JH. Declines in drowning: exploring the epidemiology of unfavorable trends. JAMA. 1999;281:2245-2247.

Smith GS, Bannis CC, Miller TR. Fatal injuries involving alcohol: a meta-analysis. Annals of Emergency Medicine 1999; 33:659-668.

Smith GS, Brenner RA. The Changing Risks of Drowning for Adolescents in the US and Effective Control Strategies. Adolescent Medicine: State of the Art Reviews, 1995; 6(2): 153-168.

Smith GS, Coggan C, Koelmeyer T, Patterson P, Fairnie V, Gordon A. The role of alcohol in drowning and boating deaths in the Auckland Region. Boating (1980-1997) All Drownings (1988-1997). An Updated Report to the Alcohol Advisory Council of New Zealand of New Zealand. Auckland: Injury Prevention Research Centre, 1999.

Smith GS, Kraus JF. Alcohol and residential, recreational, and occupational injuries: A review of the epidemiological evidence. Annual Review of Public Health, 1988; 9: 99-121.

Smith GS, Langley JD. Drowning surveillance: how well do E codes identify submersion fatalities. Injury Prevention, 1998; 4:135-139.

U.S. Coast Guard. Coast Guard launches campaign to protect boaters and passengers. www.USCGboating.org accessed December 10, 1999.

Warner M. Smith G. Langley J. Quality and completeness of alcohol data for drowning in coronial files. Injury Prevention Research Unit Report no IHR 62 University of Otago Medical School. March 1998.