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A Study of the Relationship Between the Risk of Fatality and Blood Alcohol Concentration of Recreational Boat Operators

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16. Abstract

A previous study reported that in a data set of recreational boating fatalities 30% of the victims had blood alcohol concentrations above .10% by volume. These data alone did not permit estimation of increased risk of fatality due to intoxication because the prevalence of intoxication among recreational boat operators was unknown. The current study involved interviewing and breath testing recreational boat operators at several boat ramps and marinas in California in order to obtain the "exposure" data needed to estimate the increased risk of fatality associated with intoxication. A large percentage of those people who were approached willingly agreed to the interview and to the breath test. Combining the data from this exposure sample and the fatality data from the previous study enabled computation of a relative risk estimate. The best estimate of relative risk resulting from this research is 10.65, that is, boat operators with a blood alcohol concentration above .10% are estimated to be 10.65 times as likely to be killed in a boating accident than boat operators with zero blood alcohol concentration. A 95% lower confidence bound on this estimate is 4.74. Several possible sources of bias and their effects on the relative risk estimate are considered.

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PREFACE

Alcohol has been suspected of being a major contributor to boating accidents for many years. In a previous study "Alcohol in Fatal Recreational Boating Accidents", reliable data on the blood alcohol concentrations of fatal boating accident victims was assembled and analyzed for the first time. In the present study this data is augmented by data on the blood alcohol concentration of boaters not involved in fatal accidents - i.e. corresponding "exposure" data - enabling estimates of relative risk to be calculated for the first time. The work was performed by the U.S. Department of Transportation, Research and Special Programs Administration, Volpe National Transportation Systems Center (VNTSC) and under contract to VNTSC by Dunlap Inc. This study was conducted for the U.S. Coast Guard, Office of Navigation Safety and Waterway Services; the project was sponsored by the Office of Engineering Logistics and Development.

The authors are grateful to Robert Ulmer and Carol Preusser formerly of Dunlap (now of Preusser Research Group) for their superb work in planning and carrying out the data collection, Paul Hoxie of VNTSC for his many contributions in the early stages of the work and to Dr. Jerome Boden of the Coast Guard for his support, advice and guidance throughout this project.

METRIC / ENGLISH CONVERSION FACTORS

ENGLISH TO METRIC

LENGTH (APPROXIMATE)

1 inch (in) = 2.5 centimeters (cm)
1 foot (ft) = 30 centimeters (cm)
1 yard (yd) = 0.9 meter (m)
1 mile (mi) = 1.6 kilometers (km)

AREA (APPROXIMATE)

1 square inch (sq in, in^2) = 6.5 square centimeters (cm^2)
1 square foot (sq ft, ft^2) = 0.09 square meter (m^2)
1 square yard (sq yd, yd^2) = 0.8 square meter (m^2)
1 square mile (sq mi, mi^2) = 2.6 square kilometers (km^2)
1 acre = 0.4 hectares (he) = 4,000 square meters (m^2)

MASS - WEIGHT (APPROXIMATE)

1 ounce (oz) = 28 grams (gr)
1 pound (lb) = .45 kilogram (kg)
1 short ton = 2,000 pounds (lb) = 0.9 tonne (t)

VOLUME (APPROXIMATE)

1 teaspoon (tsp) = 5 milliliters (ml)
1 tablespoon (tbsp) = 15 milliliters (ml)
1 fluid ounce (fl oz) = 30 milliliters (ml)
1 cup (c) = 0.24 liter (l)
1 pint (pt) = 0.47 liter (l)
1 quart (qt) = 0.96 liter (l)
1 gallon (gal) = 3.8 liters (l)
1 cubic foot (cu ft, ft^3) = 0.03 cubic meter (m^3)
1 cubic yard (cu yd, yd^3) = 0.76 cubic meter (m^3)

TEMPERATURE (EXACT)

[(x - 32)(5/9)] °F = y °C

METRIC TO ENGLISH

LENGTH (APPROXIMATE)

1 millimeter (mm) = 0.04 inch (in)
1 centimeter (cm) = 0.4 inch (in)
1 meter (m) = 3.3 feet (ft)
1 meter (m) = 1.1 yards (yd)
1 kilometer (km) = 0.6 mile (mi)

AREA (APPROXIMATE)

1 square centimeter (cm^2) = 0.16 square inch (sq in, in^2)
1 square meter (m^2) = 1.2 square yards (sq yd, yd^2)
1 square kilometer (km^2) = 0.4 square mile (sq mi, mi^2)
1 hectare (he) = 10,000 square meters (m^2) = 2.5 acres

MASS - WEIGHT (APPROXIMATE)

1 gram (gr) = 0.036 ounce (oz)
1 kilogram (kg) = 2.2 pounds (lb)
1 tonne (t) = 1,000 kilograms (kg) = 1.1 short tons

VOLUME (APPROXIMATE)

1 milliliter (ml) = 0.03 fluid ounce (fl oz)
1 liter (l) = 2.1 pints (pt)
1 liter (l) = 1.06 quarts (qt)
1 liter (l) = 0.26 gallon (gal)
1 cubic meter (m^3) = 36 cubic feet (cu ft, ft^3)
1 cubic meter (m^3) = 1.3 cubic yards (cu yd, yd^3)

TEMPERATURE (EXACT)

[(9/5) y + 32] °C = x °F

QUICK INCH-CENTIMETER LENGTH CONVERSION

INCHES: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

CENTIMETERS: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 25.40

QUICK FAHRENHEIT-CELCIUS TEMPERATURE CONVERSION

°F	-40°	-22°	-4°	14°	32°	50°	68°	86°	104°	122°	140°	158°	176°	194°	212°
°C	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°

For more exact and/or other conversion factors, see NBS Miscellaneous Publication 286, Units of Weights and Measures. Price $2.50. SD Catalog No. C13 10 286.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

A previous study reported that in a data set of recreational boating fatalities 30% of the victims had blood alcohol concentrations above .10% by volume (*Alcohol in Fatal Recreational Boating Accidents* (Reference 1)). These data alone did not permit estimation of increased risk of fatality due to intoxication because the prevalence of intoxication among recreational boat operators was unknown. The current study involved interviewing and breath testing recreational boat operators at several boat ramps and marinas in California in order to obtain the "exposure" data needed to estimate the increased risk of fatality associated with intoxication. A large percentage of those people who were approached willingly agreed to the interview and to the breath test. Combining the data from this exposure sample and the fatality data from the previous study enabled computation of a relative risk estimate. The best estimate of relative risk resulting from this research is 10.65, that is, boat operators with a blood alcohol concentration above .10% are estimated to be 10.65 times as likely to be killed in a boating accident than boat operators with zero blood alcohol concentration. A 95% lower confidence bound on this estimate is 4.74. Several possible sources of bias and their effects on the relative risk estimate are considered.

1. INTRODUCTION

In order to study the severity and extent of the problems associated with alcohol use in recreational boating the Coast Guard established a program with the Volpe National Transportation Systems Center (VNTSC) to collect and analyze exposure data to be used with fatal accident data to estimate the relative risk of intoxication versus being sober for fatal boating accidents. (Relative risk is an estimate of the factor by which the fatality rate is larger for intoxicated boaters than for sober boaters. The concept is more precisely defined in section 6 and examined further in later sections.) Exposure data characterizes the extent and level of intoxication of the recreational boater in non-accident situations. Such data is taken under conditions which are as similar as practical to conditions under which fatal accidents have occurred.

In a previous study entitled *Alcohol in Fatal Recreational Boating Accidents* it was reported that 30% of the recreational boating fatalities available to that study had blood alcohol concentrations (BACs) in percent by volume above .1 (all BAC's referred to in this report are expressed as *percent by volume* although the percent symbol will be omitted) and another 21% had BACs above .04 but below .1. These numbers suggest that alcohol consumption raises the risk of fatality in boating accidents, as it appears that the BAC levels of the fatalities are higher than those usually seen in typical samples of boaters. Further analysis in that report suggested that the types of accidents involving drunk victims could be expected to be influenced by the degree of intoxication. Nevertheless the fatality data alone do not establish a relative risk for alcohol intoxication in recreational boating. Since prior to the present study there was no known data on the BAC distribution of persons involved in recreational boating, a quantitative estimate of relative risk could not be developed at that time.

The need for the distribution of BACs in an exposure sample has long been recognized in the context of highway accidents. In the 1960's R.F. Borkenstein et al (Reference 2) conducted a large study in Grand Rapids, Michigan to determine BAC distributions and relative risk for traffic accidents due to various levels of intoxication. The risk estimates derived from this study were of tremendous value in establishing highway BAC limits and in focussing law enforcement efforts on what was revealed to be perhaps the single greatest source of accident fatalities in the United States.

It must be realized that only as a result of such exposure studies can relative risk be calculated and only with objective estimates of relative risk can the size of the recreational boating alcohol problem be adequately gauged for resource allocation purposes.

The fatal boating accident data used in this report had been assembled and analyzed by VNTSC in a previous report, *Alcohol in Fatal Recreational Boating Accidents* #DOT-CG-D-04-88. This data was gathered primarily from California and North Carolina and includes information on the accident, boaters, vessel, setting, time and date, as well as the BACs of the fatally injured.

The original plan called for collecting exposure data in both California and North Carolina, but budget limitations required that the study be confined to California. Before exposure data could be collected, the program plan was submitted to the Office of Management and Budget (OMB), as is required for any federal survey. OMB approval was granted contingent on using only recreational boat operators as subjects (no passengers).

The remainder of the report documents:

- Rationale for the selection of the sites and times for collecting data
- Sites selected for data collection
- Procedures for interviewing subjects and collecting data
- Risk calculation
- Statistical stability and sources of bias

2. SITE SELECTION

Appropriate site selection is a critical first step in developing exposure data. Unlike the highway situation, it not practical to simply wait at the accident location and solicit breath samples from passing boaters because too few boaters would pass any particular spot. It was determined that sufficient quantities of samples could only be obtained by collecting data on shore at boating ramps and marinas. For the purpose of this study the site is the body of water or segment thereof where the fatal accident occurred. The actual data collection is conducted at the ramp which services the accident location.

In the selection of sites for collecting exposure data the possibility of collecting too much data from sites that have little danger of fatal boating accidents with or without alcohol use constitutes a threat to validity. One solution, which is not perfect theoretically but certainly cuts down on the low risk sites, is to choose only sites where a boating fatality actually occurred. In this case there should be a mix of sites according to the BAC of the victim. That is, some sites should correspond to victims with high BAC, some with moderate BAC, and some with zero BAC. There does not seem to be a theory for the exact mix of sites. The important thing to do is to avoid systematically favoring high or low victim BAC sites.

The study was divided into three units of data collection (described more fully in Section 4). The actual sites for Units 2 and 3 are listed in Appendix A together with the BAC of the associated fatality. These BACs are a representative mix. The first unit was gathered as part of the OMB required pretest procedure. The methodology used in the pretest was successful and was used in the second and third units. Because the methodology proved valid it was possible to use the data from this unit with that of the other two.

The choice of sites which actually had boating fatalities led in most cases to ramps or marinas which had a substantial boating population which could be surveyed. However, in some cases there were few or no boat operators to survey and so the site could not be profitably used.

By timing the data collection to well overlap the time of the fatality it was hoped that representative times would be obtained in the tested BACs. There were very few boat operators leaving the water by the boat ramps after dark although a sizable fraction of the fatalities occurred after dark. Therefore an attempt was made to emphasize night testing in unit 2. Nevertheless, nighttime interviews and BAC data were scarce. This was not because of a higher refusal rate but because the traffic at the boat ramps falls off sharply after dark. In the analysis section a means of correcting for a possible bias due to under-representation of nighttime boating in the exposure sample is applied to the data.

3. DATA COLLECTION PROCEDURES

The details of data collection are given in Appendix A. The data collection was conducted by Dunlap and Associates under contract to VNTSC. Collection was carried out by a team of two. The investigators surveyed the sites, contacted local law enforcement officials, and obtained permission from the site operators to collect data.

The investigators were informally dressed and waited for boat operators to leave the launch ramp after having brought their boat out of the water. The operator was approached in a friendly, low key, reassuring manner. The boat operators were interviewed prior to breath testing. The interview provided data on the boat operator, boating party, boat, and outing (the questionnaire is shown in Appendix A and the resulting data elements are described in Appendix B which contains the resulting data base). The success of this procedure is demonstrated by the fact that only one person refused the interview out of over 350 boat operators approached.

The investigators used an Intoxylizer 5000 (breath analyzer). This relatively large instrument is quite stable and was calibrated before each of the three units (see Section 4) of the study. This device provides a printed record of the measured BAC. The BAC reading was not revealed to the boat operator being tested unless the operator specifically requested it (see Appendix A). The investigators did not look at the results until after the completion of data collection for the day.

The great majority of boat operators (91%) provided valid breath samples. The very high degree of cooperation on the interview and the high degree of cooperation on the breath test is no doubt attributable largely to the skill of the interviewers.

4. SCOPE OF DATA COLLECTION

The data collection consisted of 3 units, each approximately 2 weeks in duration. Each unit involved data collection on approximately 7 days (about 6 hours a day). Each day was at a different site (with one exception no site was visited twice). The first unit was an OMB required pilot study to determine the feasibility of the data collection effort. Because of the success of the procedure the methods were continued unmodified for the second and third units. Therefore the data for all three units could be pooled and used in the analysis. The first unit was conducted in October of 1988, the second in June of 1989, and the third in August of 1989.

The three units of testing are summarized in Table 1. The abbreviated column titles are expanded below:

1. Unit - 1, 2, or 3
2. Month in which unit was performed.
3. How many sites were visited in the unit - each site was visited on a different day.
4. How many total boaters (subjects) were interviewed in the unit.
5. How many of the sites yielded more than 10 boater interviews (subjects).
6. How many boaters refused to take the breath test to determine their true BAC.
7. How many sites were visited on Fridays.
8. How many of the Friday sites had nighttime testing.
9. Number of Saturday sites.
10. How many of the Saturday sites had nighttime testing.

Table 1. Summary of Testing by Unit

Unit	Month	Sites	Subs	Sites with > 10 Subs	BAC Refusals	Friday Sites	Fri. Night Sites	Saturday Sites	Sat. Night Sites
1	10/88	7	118	7	11	0	0	2	0
2	6/89	8	146	6	11	1	1	2	2
3	8/89	7	92	6	7	1	1	2	0
Totals		22	356	19	29	2	2	6	2

5. RESULTS

The results of the data collection effort are presented in Tables 2 and 3. Table 2 summarizes the number of operators surveyed and the breakdown according to the success of the interview and the test. Three hundred fifty-seven boaters were approached; one refused the interview, 28 refused to take the BAC test. Of those who agreed to the breath test, nine provided unusable samples. The unusable samples appeared to be related to equipment or procedural problems. There were consequently 319 good tests.

The 319 good tests are distributed in BAC as shown in Table 3: 244 boaters showed zero BAC. Of the 75 with a BAC greater than zero, 35 had BAC's greater than or equal to .04, 12 had BAC's greater than or equal to .08 and 9 had BAC's greater than or equal to .10.

Table 2. Summary of Number of Boat Operators Surveyed and Tested (California 1988-1989)

Total Boat Operators	Refused Interview	Refused Test	Bad Test	Good Test
357	1	28	9	319

Table 3. Summary of Operator Exposure Data (California 1988-1989)

Zero BAC	BAC > 0	BAC ≥ .04	BAC ≥ .08	BAC ≥.10
244	75	35	12	9

Appendix B lists the complete data base. It presents the BAC related to the characteristics of the boat operators, their passengers, boats, and trips.

In addition to the BAC distribution of the exposure sample (those boat operators interviewed and tested in the course of collecting data during the three units in California) the relative risk calculation requires information on the BAC distribution of boating fatalities. A listing of cases from a data base of California boating fatalities from 1984 and 1985 with known BAC is given in Appendix C. Data on *operator* fatalities will be used in the current study, and that information is briefly summarized in Table 4.

Table 4. Summary of Operator Fatality Data (California 1984-1985)

Total	Unknown	Good Test	Zero BAC	BAC > 0	BAC ≥ .04	BAC ≥ .10
70	17	53	28	25	18	11

Figure 1 shows the observed cumulative distributions of BAC for three populations.

1. The boat operators tested during the data collection (319 observations). This distribution is indicated by small squares.
2. Boat operators killed in fatal boating accidents in California in 1984 and 1985 for whom there was a BAC determination (cases indicated by a downward pointing triangle).
3. Boaters (operators and passengers) killed in fatal boating accidents in California in 1984 and 1985 for whom there was a BAC determination (cases indicated by upward pointing triangle).

Figure 2 is essentially the previous plot turned upside down for ease in visualizing and explaining the relative risk calculations. The lower plot in Figure 2 labelled by small squares shows the percent of boat operators (survey sample) with BACs above a given amount. For example, it is seen that about 23% of the survey sample had BACs over zero while somewhat under 10% of these subjects had BACs over .05.

From Figure 2 it can be seen that all boaters and boat operators in the fatality data had very close to the same BAC distribution while boat operators in the survey sample had relatively much smaller numbers at the higher BACs (For example, for the fatal accident sample about 20% of the boaters, whether operators or passengers, had BACs over .1 while for the survey sample less than 3% of boaters had BACs over .1).

Since at low BACs a given fraction of survey boaters corresponds to a relatively small fraction of the fatal accident boaters while at high BACs a given fraction of survey boaters corresponds to a relatively large fraction of fatal accident boaters, it appears that the chances of being killed in a boat outing goes up with BAC. In the next section we consider estimates of the relative risk of fatality due to alcohol impairment which quantifies this observation. At the same time the factors which could bias our estimate of this relative risk are also considered and their effect is estimated in a later section.

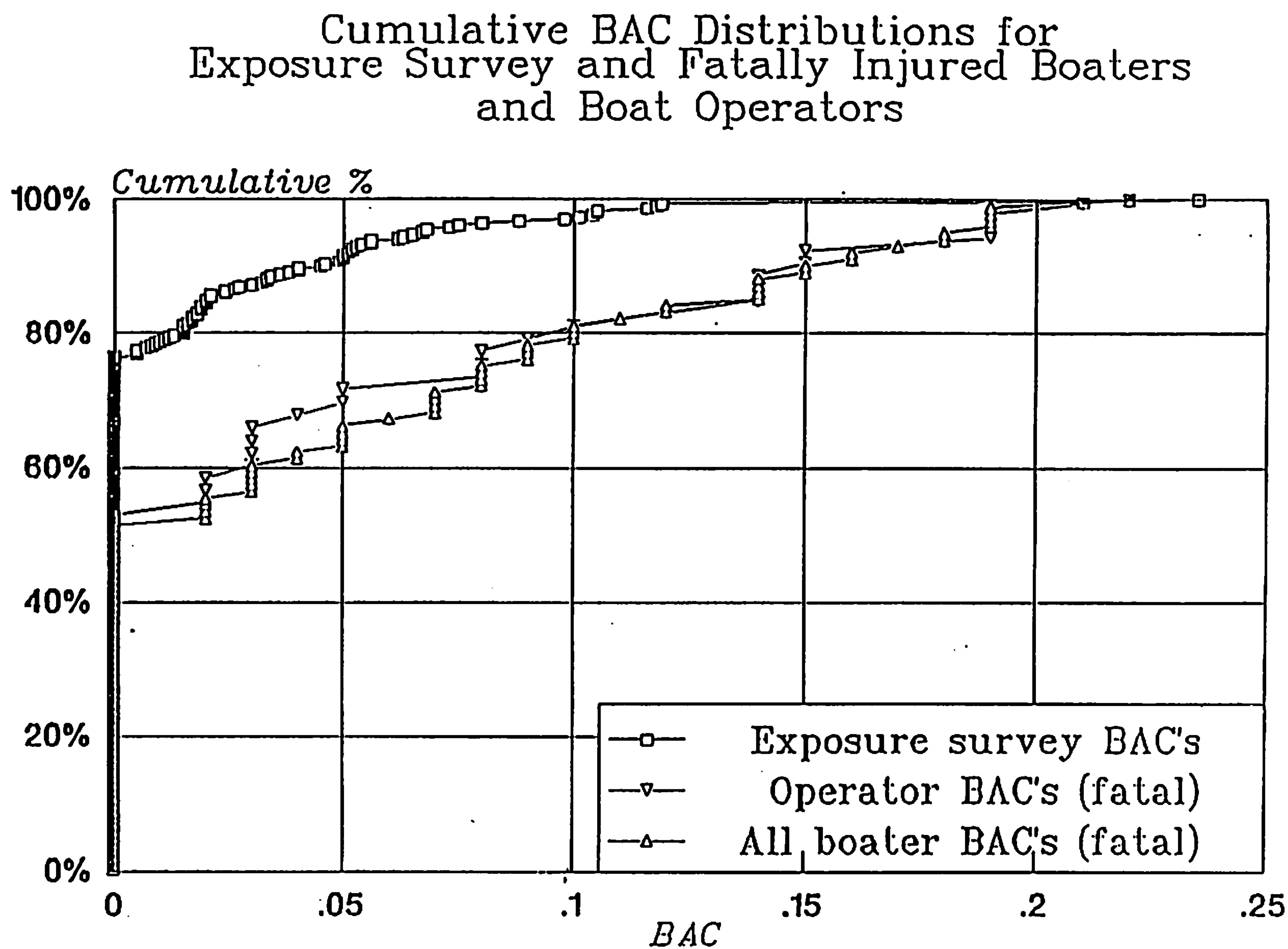
Cumulative BAC Distributions for
Exposure Survey and Fatally Injured Boaters
and Boat Operators
Cumulative %
100%
80%
60%
40%
20%
0%
0
.05
.1
.15
.2
.25
BAC
Exposure survey BAC's
Operator BAC's (fatal)
All boater BAC's (fatal)

Figure 1

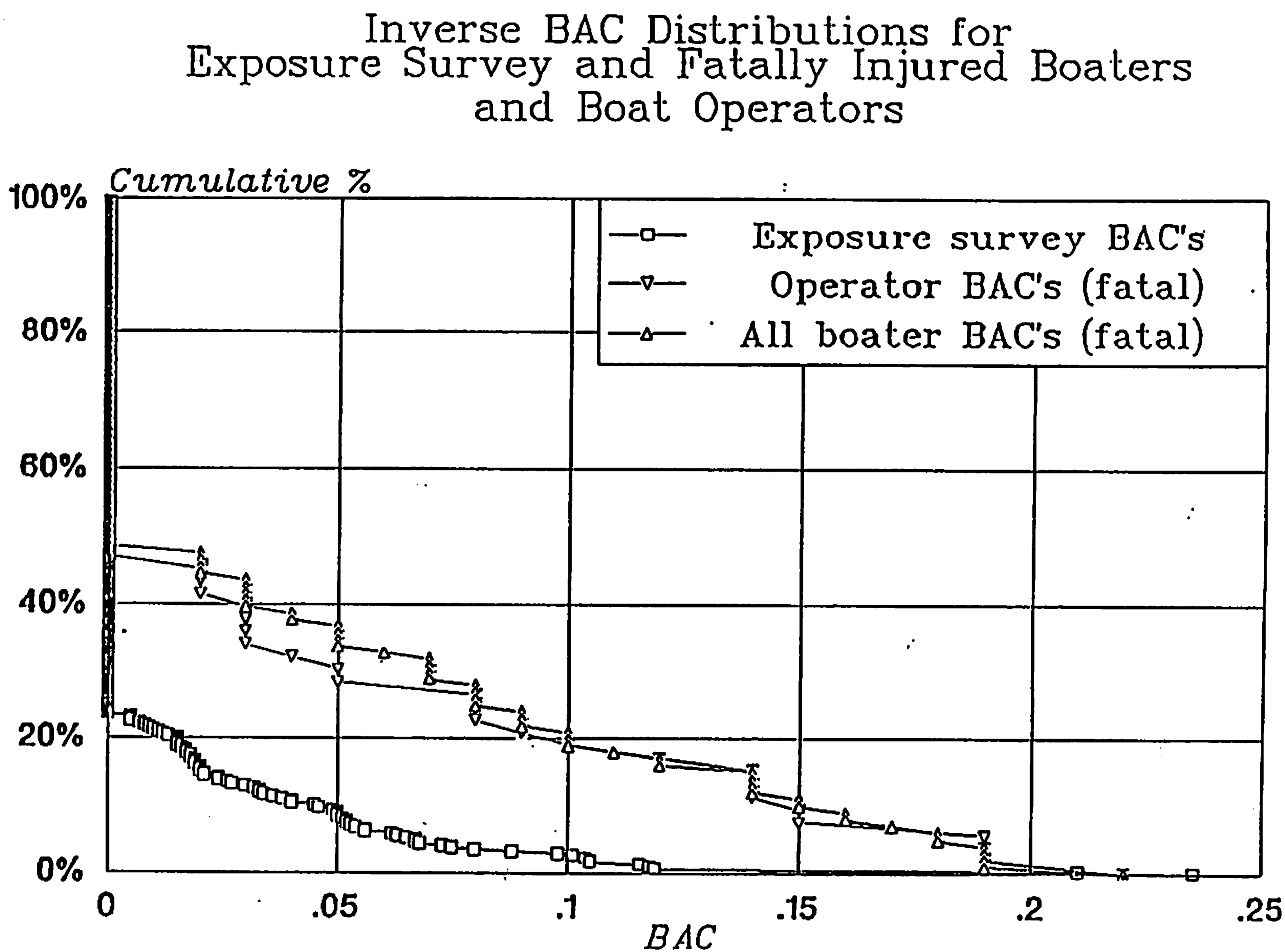
Inverse BAC Distributions for
Exposure Survey and Fatally Injured Boaters
and Boat Operators
Cumulative %
100%
80%
60%
40%
20%
0%
0
.05
.1
.15
.2
.25
BAC
Exposure survey BAC's
Operator BAC's (fatal)
All boater BAC's (fatal)

Figure 2

6. RELATIVE RISK

The relative risk for boat operators for BAC over .1 compared to the risk for BAC equal to zero is defined as follows:

$$R = \frac{(Fatalities \geq .10)/(Exposure \geq .10)}{(Fatalities\ zero\ BAC)/(Exposure\ zero\ BAC)}$$

"Fatalities ≥.10" means the number of boat operators with BAC's greater than or equal to .10 in the fatality data set. "Exposure ≥.10" means the number of boat operators with BAC's greater than or equal to .10 in the exposure data set (the whole survey data set). "Fatalities zero BAC" and "Exposure zero BAC" are defined similarly. These four quantities will be abreviated $F_{\geq .1}$, $E_{\geq .1}$, F_o, and E_o respectively.

If we plug into this formula the appropriate entries from Tables 3 and 4 for California boat operators the result is:

$$R = \frac{(11/9)}{(28/244)} = 10.65$$

This is to be interpreted as meaning that our best estimate is that boat operators with BAC's at or over .10 are about ten and a half times as likely (per outing) to die in a fatal boating accident as boat operators with zero BAC.

Note that the ratio in the numerator of R i.e. (Fatalities ≥.10) / (Exposure ≥ .10) would be a fatality rate for boat operators with BAC ≥ .10 if the exposure were measured over the entire population of boat operators whose fatalities are included. The same holds true of the denominator. The entire population in either case is based on the entire boating population of California. The exposures as measured here are a sample of the total exposure. Therefore the numerator and denominator are both estimates of quantities proportional to the corresponding fatality rates. The constants of proportionality should be the same and cancel. Therefore R should be an estimate of risk defined as the ratio of fatality rates for drunk compared to sober.

The rest of this report will be primarily concerned with assessing the accuracy of this estimate. Specifically we shall address the statistical stability and bias (if any) of the estimate.

7. STATISTICAL STABILITY

There are two aspects of statistical stability in this estimate: Site to site variation and the variation due to the small numbers of accident victims and of exposure subjects.

In this study, site to site variation will be discussed under possible sources of bias. (Since we have 20 sites, if they are representatively chosen, site variability should have a small effect on the result).

The statistical variation in the relative risk due to the finite numbers of observations is readily estimated. Consider first the formula for relative risk and its (natural) logarithm:

$$R = \frac{(F_{\geq .1} / E_{\geq .1})}{(F_o / E_o)}$$

$$\log R = \log F_{\geq .1} - \log E_{\geq .1} - \log F_o + \log E_o$$

Each of the numbers $F_{\geq .1}, E_{\geq .1}, F_o$, and E_o should be approximately independent and Poisson distributed[1]. If N is Poisson distributed and large (much larger than one) then the variance in log N can be estimated by 1/N.[2] Consequently, the variance in log R can be estimated by

$$\widehat{var}\,(\log R) = \frac{1}{F_{\geq .1}} + \frac{1}{E_{\geq .1}} + \frac{1}{F_o} + \frac{1}{E_o}$$

and the standard error in log R is estimated as

$$\widehat{se}\,(\log R) = \left[\frac{1}{F_{\geq .1}} + \frac{1}{E_{\geq .1}} + \frac{1}{F_o} + \frac{1}{E_o}\right]^{1/2}$$

Substituting the appropriate values into the above formula produces an estimate of the standard error of .491765.

Then a lower 95% confidence limit for log R is approximately

$$\log R_{true} \geq \log R_{est} - 1.645\, \widehat{se}\,(\log R_{est})$$

---

1 The arrival of boaters to be interviewed and the occurrence of accidents (in any fixed category) are both of the nature of "arrival" processes which are generally considered to be Poisson (or "completely random") processes unless there is evidence to the contrary (such as evidence of bunching). See Feller (1966) p. 11 and Doob (1953) p. 98.

2 N represents any integer random variable and so this statement is true of $F_{\geq .1}$, $E_{\geq .1}$, F_o, and E_o to the extent that they are much greater than one and Poisson distributed.

or

$$R_{true} \geq R_{est} \exp[-1.645 \, \hat{se}(\log R_{est})].$$

Since $R_{est} = 10.65$ and $\hat{se}(\log R_{est}) = .491765$, this means that with 95% confidence we can assert that the true value of R is greater than 4.74. In other words 4.74 is a lower 95% confidence limit on R_{true}[3].

Of course the most likely value from this point of view is still 10.65 and the true value is as likely to be higher than as lower than 10.65. This analysis ignores bias which will be dealt with in the next section.

---

3 For the most part this report does not distinguish between R_{true} which is the overall true relative risk and R_{est} based only on the data analyzed here. Only in this section are the two quantities distinguished by notation in order to express the confidence limits for R_{true}.

8. BIAS

There are a number of possible sources of bias to the relative risk calculated above:

1. Those who refused the breath test might have had a different BAC distribution from those who took the test.
2. There could be insufficient night exposure data.
3. The sites might possibly be unrepresentative.

In discussing the possible sources of bias particular attention will be paid to estimating how much a particular source could have lead to an overestimate of the relative risk and where possible a lower bound to the relative risk in the face of the particular source of possible bias will be considered.[4]

1. Possible bias in the Relative Risk Estimate due to a Different BAC Distribution for Those 28 Boat Operators Who Refused the Breath Test.

It is necessary to make some assumption about the BAC distribution of those who refused to take the breath test. We prefer to make a conservative assumption in the sense that it is likely to overestimate the number of boat operators above a given BAC and therefore leads to a relative risk which is underestimated, i.e., again we seek a lower bound on the relative risk.

Two different assumptions will be considered leading to two different estimates of the relative risk. It is suggested that both of these may be considered conservative. In the first assumption we make use of observational data that the observers recorded for those operators refusing the breath test. They coded their judgment based on interview and observation of the subject as a rating of 1, 2 or 3 as follows:

Intoxication Ratings:

1. No indication of alcohol impairment.
2. Person not likely impaired by alcohol.

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4 There are many sources which could potentially reduce the accuracy of our estimates of risk. For instance, while all BAC measurements were made at the end of the boat operator's trip, it was impossible to determine the exact timing of the drinking. It was assumed that the BAC measured was a valid estimate of the level of intoxication during the trip. This procedure would result in an underestimate of intoxication only if the boat operator ceased drinking hours before returning to shore. Because that is unlikely, this procedure should either accurately represent the operator's BAC or overestimate it. An overestimation of BAC would lead to a conservative estimate (i.e., an underestimate.) of risk.

3. Possible that person was impaired by alcohol.

The conservative assumption, **assumption 1,** to be made is that all (not tested) boat operators, except those showing no indication of alcohol impairment (category 1), are to be categorized as having BAC over .1.

The observational judgments concerning the sobriety of the BAC non-participants (individuals who were interviewed but would not take the BAC test) were not available for the first unit. In the first unit there were 10 BAC non-participants. We assumed that the distribution of ratings obtained for the second and third units hold in the first unit as well. Of the 18 interviewees who refused the breath test for the second and third units the observations were:

- 16 were given a rating of 1
- 2 were given a rating of 2
- None were given a rating of 3

By our assumption the fraction of BAC non-participants at .1 or above is the fraction rated 2 or 3 i.e., 2/18 = .111. It was more difficult but less important[5] to decide what fraction of the 16 below .1 BAC was at zero. An arbitrary assumption was that 1/2 (ie. 8 of 16) were at zero and the other 1/2 (8 of 16) were between zero and .1. Notice in Table 3 that there were 244 at zero and 66 between zero and .1. Therefore the assumption is conservative because it claims that only 50% of those who were below .1 were at zero versus 80% in Table 3. So of the 18 refusals for which observational judgments are available, 2 are assumed to be above .1 and 8 are assumed to be at zero. Inflating these estimates to the 28 total refusals implies that 3 are assumed to be above .1 and 12 are assumed to be at zero.

If we combine the results with the known data for the tested subjects we get a new expanded set of complete data from which we get a new value of the relative risk (for BAC at .1 or higher).

$$R = \frac{11/(9+3)}{28/(244+12)} = 8.38$$

To summarize and simplify: suppose that **all** (3) non-participants not certified as sober are to be treated as intoxicated (assumption 1). Then relative risk = 8.38.

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5 **Estimation of the number of interviewees who were intoxicated was more critical than estimation of the number who were at zero BAC because the intoxicated interviewees represented a very small portion of the total sample.**

For **assumption 2** we assume that half of all those who refuse the test are intoxicated (i.e., at .10 BAC or higher). This is a very conservative assumption because there are numerous legitimate reasons sober people would refuse the test. Recall also that less than 3% of those who took the test were over .1 and that over 92% of the people took the BAC test. If 1/2 of the refusing people refused because they were unwilling to reveal a high BAC this would mean that only 4% refused for all other reasons - a very small percentage. Therefore, we consider this assumption very conservative. To increase the conservativeness (i.e., further lower the relative risk estimate) we assume that all those who refused the test had BACs above zero. With these assumptions we get a modified estimate of the relative risk:

$$R = \frac{11/(9 + 14)}{28/(244+0)} = 4.17$$

The distortion implied by assumption 2 almost surely goes too far. This is not to say that the relative risk cannot be this low since there are other possible biases and the statistical stability issue which also affect the true value of relative risk. It is only to say that the correction for this type of bias is probably excessive in this estimate.

2. Possible Bias Due to Insufficient Night Exposure

Another possible source of bias is insufficient night testing, i.e., there may be more boating at night than represented in our exposure sample.

In the exposure data there were 28 breath tests taken at night and 319-28=291 breath tests during the day. In the **boat operator** fatalities there are 11 in the night period and 43 in the day period. Therefore the ratio of night to day samples is 28/291=.0962 for the exposure data and 11/43=.256 for the boat operator fatality data. For this purpose define day as the time period 0700 to 1859 and other times as night.

There are two possible reasons for the difference between these ratios:

- The true nighttime exposure may be higher relative to daytime exposure than we have measured (i.e. the night period was undersampled),
- The difference is appropriate: fatality data should show more cases than the exposure data since nighttime boating is inherently more dangerous.

In order to bound the possible bias that may be present in our relative risk estimate due to possible under-sampling at night we develop separate weights for the day and night exposure data.

Let the weight for the day exposure data be W_d and that for the night exposure data be W_n. Since the ratio of night to day cases is .256 for the fatality data and .0962 for the exposure data we require that $W_n/W_d = .256/.0962 = 2.66$.

This will bring the exposure data in line with the accident data in the ratio of day to night quantity of data. We can choose $W_d = 1$ and $W_n = 2.66$ because the relative risk is not affected by an overall normalization of the exposure data. In order to calculate the relative risk the following numbers are relevant:

Total Exposure Sample at Zero BAC Tested After 19:00 = 20

Total Exposure Sample at or Over .1 BAC Tested After 19:00 = 3

Total Exposure Sample at Zero BAC Before 19:00 = 224

Total Exposure Sample At Or Over .1 BAC Tested Before 19:00 = 6

Therefore the relative risk with this type of correction is estimated as:

$$R = \frac{(F_{\geq .1} / E_{\geq .1})}{F_o / E_o} \quad with\ F_{\geq .1} = 11, F_o = 28$$

as before but for $E_{\geq .1}$ and E_o we use the following modified values (only the ratio is intended to be approximately correct).

$$E_{\geq .1} = 3\, W_n + 6 = 13.98$$

$$E_o = 20\, W_n + 224 = 277.2$$

so R = 7.790.

If the nighttime exposure is undersampled by a factor of 2.66 as estimated by the nighttime proportion of fatalities, then this estimate may be more accurate than the original unmodified estimate for this relative risk. However, if nighttime boating is more dangerous in itself than daytime boating, then the nighttime exposure may not be under-estimated so much and a value nearer the original 10.65 would be preferred.

3. Possible Bias Due to Unrepresentative Sites

There could be some concern that the sites were somehow not representative. The sites were all chosen to correspond to accidents in the accident data base. There is no reason to believe they are generally low BAC sites. The BAC values for the accident corresponding to each site is available only for units 2 and 3. In those units, seven of the fifteen sites corresponded to operator fatalities with a BAC of .10 or higher. This is in contrast to the proportion of all operator fatalities in our database which have BACs over .10. This proportion is .20 (based on the known BACs). Thus the proportion of sites corresponding to BACs over .1 is really quite large (7/15 = .467 compared to .2 for the accident sites). This suggests that if the sites are unrepresentative then they are biased towards high alcohol sites. Therefore, we need not calculate a lower bound on the relative risk due to possible bias in site selection - the unadjusted value 10.65 serves this purpose.

9. RELATIVE RISKS AT OTHER BAC LEVELS

So far we have concentrated on calculating relative risk for BAC greater than or equal to .10 compared to BAC equal to zero. Because of the small accident sample and exposure sample it is necessary to compute relative risk for intervals which extend over all BACs higher than a certain level. However, this level can be changed.

Computed relative risks at various levels are plotted in Figure 3. The plotted points have a BAC value as the abscissa and the estimated relative risk for BAC at or over that value (compared to zero BAC) as the ordinate. The estimates become very noisy over a BAC level of .12 (because of small numbers). The plotted curve is only for convenience and is not to be taken as having a precision independent of the plotted points.

Since the cases of BAC above one level are also above any lower level the statistical stability of these estimates is decreasing. In particular the estimates of relative risk at very high BACs (.12 and above) are based on few cases and are therefore potentially quite inaccurate.

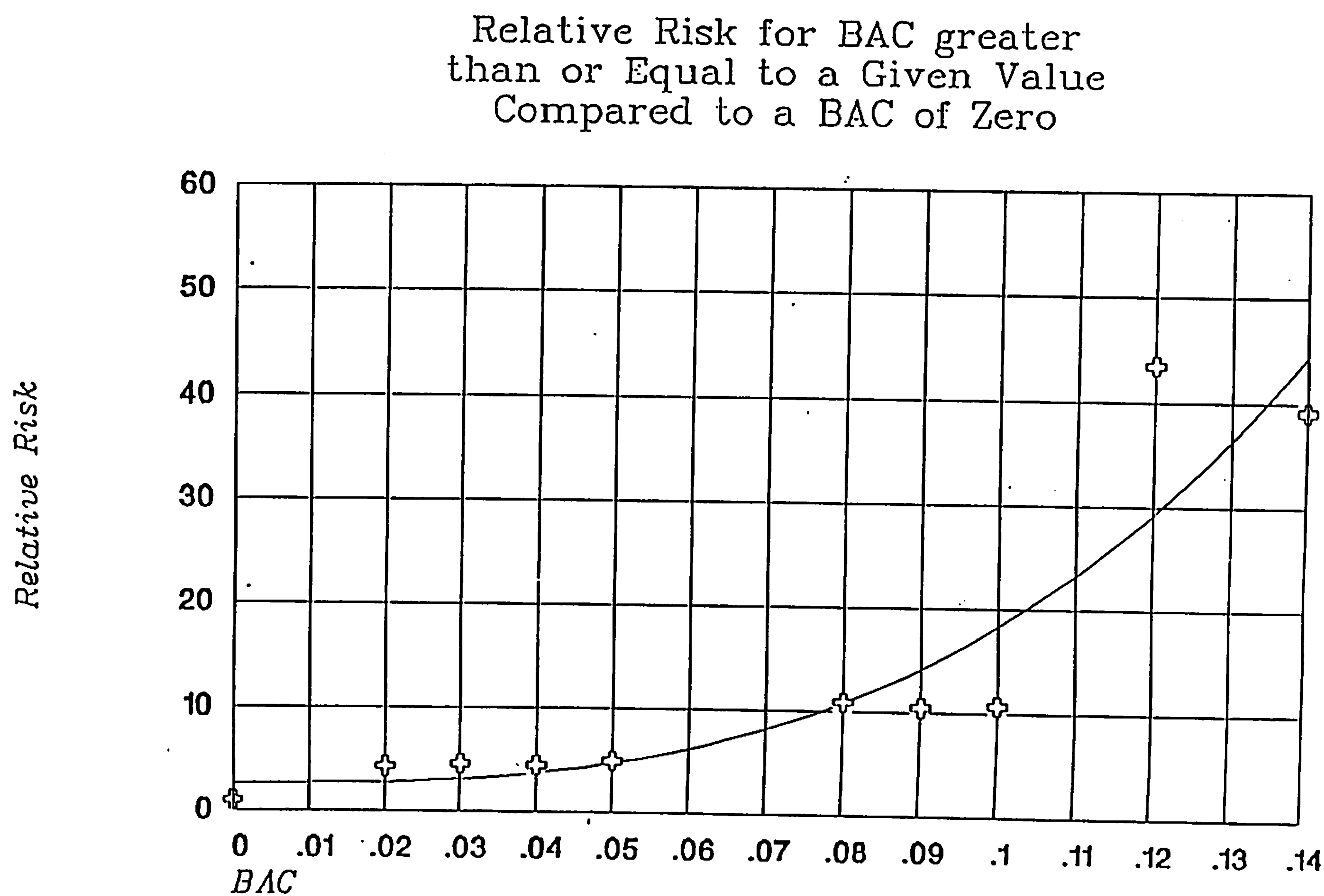
Relative Risk for BAC greater than or Equal to a Given Value Compared to a BAC of Zero
Relative Risk
60
50
40
30
20
10
0
0
.01
.02
.03
.04
.05
.06
.07
.08
.09
.1
.11
.12
.13
.14
BAC

Figure 3

10. COMPARISON WITH HIGHWAY AND PEDESTRIAN RESEARCH

Borkenstein et al (Reference 2) studied the relative risk of intoxication for highway accidents. Although their results are primarily shown in different ways than employed here they may nevertheless be expressed as relative risks of the same type as calculated in this report and as such are shown in Table 5. The relative risk for BAC ≥ .10 is comparable to that calculated in this report for the boating environment (i.e., 8.80 versus 10.65). For BAC ≥.12 or BAC ≥ .15 the agreement is not so good (cf. Figure 3).

One reason the estimated risk for the boating environment is much larger than that for the highway environment for certain high ranges of BAC (≥ .12) could be that the boating environment is especially dangerous to persons with a high level of intoxication. A second reason for the difference could be the very small numbers of boaters surveyed who had very high BACs, resulting in a relatively statistically unstable samples for very high BACs.

Table 5. Highway Risk (based on Borkenstein, et al. p. 230)

BAC Range	≥ .10	≥ .12	≥ .15
Relative Risk	8.80	10.42	18.46

A study conducted by Dunlap Inc. for the National Highway Traffic Safety Administration (NHTSA) (Reference 3) studied the relative risk of alcohol intoxication for pedestrians. Their study used site matching similar to Borkenstein's and to a lesser degree to ours (because of the nature of boating accidents they do not have such precisely defined sites as highway accidents). In addition the Dunlap study also considered age and sex matching (this was not considered in the present study because the exposure sample was not large enough). The relative risks for certain ranges of BACs with and without age/sex matching is shown in Table 6. The basic observation is that the relative risks appear to be smaller than in the boating[6] environment and this may be due to the nature of pedestrian injury accidents compared to fatal boating accidents or it may be due to the statistically unstable nature of the boating risk data at the higher BACs.

6 For example the pedestrian risk exceeds 10 only above .25 compared to above .1 in the boating data.

Table 6. Pedestrian Risk (NHTSA / Dunlap p. 71)

BAC Range	.100 - .149	.150 - .199	.200 - .249	.250 +
Age / Sex / Site Matched	1.72	2.12	5.19	37.86
Site Matched	2.79	5.11	9.04	11.25

11. SUMMARY AND CONCLUSION

Based on boating fatality BAC data from California for the years 1984-1985 and a survey of recreational boat operators' BACs conducted at 21 sites in California, relative risks of fatality as a function of BAC were computed.

- The best estimate of relative risk of a boating fatality for a BAC of .10 or higher, compared to a BAC of zero, is 10.65.
- Assuming Poisson distributions for the data, the lower bound estimate (95% confidence) is 4.74.

Simplifying assumptions (see Section 8 for details) were made to adjust for the following potential sources of bias; these adjustments provide lower bound estimates of relative risk.

- If the non-participants had higher BACs than the boat operators providing samples the adjusted relative risk would be 8.38 (Section 8.1).
- If insuffícent night data were collected, the adjusted relative risk would be 7.79 (Section 8.2)

One potential unadjusted source of bias which may have affected the risk estimate is site selection.

- If the sites selected had higher BACs than average sites (and Section 8.3 shows that the victim BACs tended to be high at the selected sites) the relative risk would actually be higher than calculated.

Compared to the highway situation, relative risk for BACs over .10 compared to zero BAC are about the same if one uses the Borkenstein (Reference 2) data. At higher BACs the present data suggest that the relative risk in the boating context may go up even more rapidly than in the highway context. Relative risks for higher values of BAC are estimated to be larger but are more uncertain because of limited data above .10 (especially the exposure data).

12. RECOMMENDATIONS

The recommendations provided below are based on both the results of this study and a previous study which was concerned with boating fatality data specifically. (The previous study is Reference 1 which resulted from the first part of this project.)

State and local governments should be encouraged to develop and conduct intervention and counter-measure programs to reduce the number of fatalities associated with operating recreational boats while intoxicated.

The results of this project indicate that a recreational boat operator with a BAC in excess of 0.10%, has a fatality risk ten times that of a sober operator.

The effectiveness of these countermeasures and interventions should be measured. This will require more complete collection of boating fatality data.

Complete and unbiased fatality data is critical to any state or other government agency that wishes to measure the effectiveness of its intervention. When the first part of this study was performed, only two states collected blood alcohol data which was useable for assessment of the impact of intoxication on boating fatalities.

Alcohol countermeasure programs should not ignore situations which appear to be relatively benign for boaters who are not intoxicated.

In the first part of this project we found that disproportionatly large numbers of intoxicated boaters as compared to sober boaters died in what should be relatively safe conditions, i.e., in calm protected water as opposed to rough unprotected water, due to simply falling overboard as opposed to collisions or capsizings, and where there were other passengers in the boat who should have been able to provide aid.

It is important to make the public aware that these kinds of apparently innocuous situations can be very dangerous to the intoxicated boater.

APPENDIX A

This appendix consists of two memoranda written by Robert G. Ulmer of Dunlap and Associates Inc. The first gives a detailed description of the second unit of data collection (in June of 1989) and the second gives a similar description of the third unit (in August of 1989). These memoranda contain detailed information on site selection, site description and data collection procedures.

The sites visited during unit 1 (not covered in the succeeding memos) were as follows (also indicated are date in 1989 and abbreviation used in Appendix B):

Abbreviation	Site	Date
DB	Discovery Bay	6/16
BI	Brannan Island	6/17
L	Laritzen's Yacht Harbor	6/18
DR	Delta Resort	6/19
MC	Lake McClure	6/21
M	Milleston	6/22
E	Lake Elsinore	6/24
P	Lake Perris	6/25

July 19, 1989

Memorandum

To: Peter Mengert, Transportation Systems Center

From: Robert G. Ulmer, Dunlap and Associates, Inc.

Subject: Alcohol and Boating Safety Data Collection, June 16 - June 25, 1989

During the latter part of June 1989, R. Ulmer and C. Preusser from Dunlap and Associates were on site in California to collect additional data for the Transportation Systems Center (TSC)/Coast Guard study of alcohol use among recreational boaters. Basically, the data collection activity involved interviewing recreational boaters and obtaining breath tests to determine Blood Alcohol Concentrations (BACs). The purpose of this memorandum is to describe this effort in terms of the procedures employed and the results obtained.

Site Selection

Inherent in the overall study design, is the adoption of a sampling plan calling for data collection to take place at bodies of water that have experienced (or are similar to those that have experienced) fatal boating accidents in which the BACs of the victims are known. Other stated requirements for establishing the sampling plan are:

- o Collection of data on weekends at sites where the associated accident occurred on a weekend, and during weekdays at sites where the accident occurred on a weekday.
- o Collection of data primarily in the hours during which the associated accident occurred. Also, the extension of data collection into the later night hours so that this time period is represented.
- o Employing an approximately equivalent number of sites where the associated accident did or did not involve alcohol use.
- o Avoiding sites related to "open" ocean accidents.
- o Collection of data at launch ramps, marinas and other on-shore facilities so that various power boat types, sizes and use pattern are covered.*

Site selection was based on a listing of fatal boating accidents provided by TSC. This listing is shown in Table 1. The site selection process began by developing various tentative schedules which met the requirements noted above and were feasible in terms of travel distances.

* During early stages of the study, on-the-water testing was considered. Because of cost, logistical and other considerations, and the likely low sample sizes that would be obtained, this approach to data collection was abandoned.

Table 1
California Boating Fatalities
Input Data

Case	Date	Body of Water	Location	County	Day	Time	BA
Operators							
05322	4/8/84	Ocean	Pt. Loma San Diego	San Diego	Sun	unk	ur
05132	4/25/84	Sacremento R.	Alamar Landing	Yolo	Wed	8am	
05151	5/4/84	Sacramento R.	Unk	Yolo	Fri	10pm	0.1
05459	6/8/84	Shasta Lake	Jones Valley	Shasta	Fri	6am	
05437	6/9/84	Salton Sea	70 mi NE San Diego	Riverside	Sat	3pm	
05341	8/11/84	Shaver Lake	40 mi NE Fresno	Fresno	Sat	7pm	0.0
05529	8/13/84	Salton Sea	70 mi NE San Diego	Imperial	Mon	10am	
05129	4/30/85	Ocean	Cabrillo Beach	Los Angeles	Tue	unk	0.0
05178	5/15/85	Sacramento R.	Near Sacto Airport	Sacramento	Wed	11pm	0.0
05355	5/30/85	Old River	Near Tracy Wildlife	San Joaquin	Thu	5pm	0.1
05131	6/6/85	Lake McSwain	Near Merced	Mariposa	Thu	7am	
05298	6/29/85	Salton Sea	70 mi NE San Diego	Imperial	Sat	2pm	0.0
05412	8/11/85	Ocean	Humbolt Bay	Humbolt	Sun	unk	
05665	8/14/85	Yosmite Lake	Near Merced	Merced	Wed	5pm	
05397	8/17/85	Sacramento R.	Sherman Island	Sacramento	Sat	10pm	
05317	5/17/84	San Fran Bay		San Fran	Thu	1pm	0.
05744	9/1/84	Ocean	Santa Cruz	Santa Cruz	Sat	1am	0.
Non-Operator							
05128	3/25/84	Black Butte Lake	Orland	Tehema	Sun	6am	0.
05051	3/31/84	Ocean	Catalina Island	Orange	Sat	noon	
05458	6/29/84	Ocean?		Los Angeles	Fri	5pm	
05380	7/8/84	Lake Elsinore	50mi SE Long Beach	Riverside	Sun	1pm	0.
05407	7/15/84	Lake Irwine	E. of Santa Ana	Orange	Sun	4pm	0.
05516	7/29/84	Unk		Unk	Sun	10am	0.0
05440	8/7/84	Dutch Slough	Near Oakley	Contra Costa	Tue	5pm	
05705	8/12/84	Ocean	Wilmington	Los Angeles	Sun	8pm	0.0
05531	8/18/84	Ocean	Mendocino	Mendocino	Sat	8pm	0.
05629	10/28/84	Ocean	Huntington	Orange	Sun	3am	0.
05068	3/17/85	Lake Perris		Riverside	Sun	1pm	0.0
05087	3/22/85	Ocean	Newport Beach	Los Angeles	Fri	9pm	
05067	3/30/85	Castaic Lake	Valencia		Sat	noon	
05244	4/8/85	Audrey Dam	Morgan Hill	Santa Clara	Mon	4pm	0.0
05138	5/5/85	Ocean	Morro Bay	S. Luis Obispo	Sun	7am	0.0
05372	5/25/85	Shasta Lake	N. of Redding	Shasta	Sat	6pm	
05456	6/8/85	San Joaquine R.	Des Reios	San Joaquine	Sat	4pm	0.0
05409	6/9/85	Suisun Bay	Delta-Winter Isl.	Contra Costa	Sun	3pm	0.
05434	7/3/85	Millerton Lake	Fresno	Madera	Wed	6pm	
05273	7/6/85	San Fran Bay	San Fran	Alameda	Sat	10am	
05397	8/17/85	Sacramento R.	Delta-Sherman Isl	Sacramento	Sat	10pm	0.0

As in the fall 1988 data collection, telephone contacts were then made with officials in the counties in which the various bodies of water were located. This process usually began with the County Sheriffs Department where we spoke with someone knowledgeable (e.g., a boating enforcement officer) regarding the possible use of the body of water for data collection purposes. Recommendations concerning specific collection sites, referrals to persons directly involved with the body of water, and in some cases, recommendations against particular sites resulted from these contacts. Further contacts were then made to obtain specific approvals to use various public and private facilities. As was the case last fall, we found that all of the individuals contacted were extremely interested in the study and willing to cooperate.

Schedule

Table 2 indicates the data collection schedule that was employed. The entries in each cell of the table are as follows:

- The date of data collection
- The TSC case number
- The body of water at which sampling occurred
- The day of week and time of day of the associated accident
- The BAC of the accident victim
- The name or type of facility involved
- Whether data collection was at a marina/ramp type of facility or a ramp (only) facility
- The approximate time period of the data collection
- The number of interviews/the number of breath tests obtained

Data collection on Friday, June 16th took place at Discovery Bay Yacht Club. Discovery Bay is a relatively large, designed residential area approximately 15 miles west of Stockton in the Delta region. Many of the homes have backyard docks for boat mooring. In addition, the yacht club has moorings for larger vessels and dry storage for smaller boats. Hoists are used to launch and retrieve these latter boats when the owners wish to use them. There is also a public launch ramp but the launch fees have been set at $30 and outside use is minimal, therefore. The channel from the yacht club leads to the Old River, which was the site of the associated accident. Discovery Bay was recommended to us by Sgt. Jim Wood of the San Joaquin County Sheriff's Department. Richard Zaro, the Harbor Master, granted permission for use of the site. He indicated that on a Friday most of the traffic would be "after work" boating, so the hours of 2 - 8 pm were selected for data collection. The data collection location was the marina's gas dock and we sought inbound traffic. The weather was sunny and hot. Traffic volume was light and only 6 boaters were interviewed, with all providing a breath test.

On Saturday, June 17th, data collection took place at the Brannan Island State Recreation Area, which is located on the Sacramento River in the Delta region, approximately 10 miles northeast of Pittsburg. The site was known to us as it had been used in the fall 1988 data collection (but selected for a different accident). It was

Table 2
Sampling Schedule

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					6/16 5355 Old River (N. of Tracy Delta) Thursday Time 5 pm BAC .19 Discovery Bay Marina/ramp 2-8 pm 6/6	6/17 5397 Sacramento R. (Sherman Island Delta) Saturday Time 10 pm BAC 0 Brannan Island Ramp 4-10 pm 17/15
6/18 5409 Sacramento R. (Winter Isl. Delta) Sunday Time 3 pm BAC .10 Lauritzen Yacht Harbor Marina/ramp 1-7 pm 27/23	6/19 5440 Dutch Slough (Oakley Delta) Tuesday Time 5 pm BAC 0 Delta Resort Marina/ramp 1-7 pm 13/12	6/20 Off - Travel	6/21 5665 Lake McClure (Near Merced Central Calif) Wednesday Time 5 pm BAC 0 County Rec Area Ramp 1-7 pm 2/2	6/22 5434 Millerton Lake (Near Fresno Central Calif) Wednesday Time 6 pm BAC 0 County Rec Area Ramp 4-10 pm 29/28	6/23 Off - Travel	6/24 5380 Lake Elsinore (S of Riverside South Calif) Sunday Time 1 pm BAC .19 State Rec Area Ramp 4-10 pm 24/22
6/25 5407 Lake Perris (S of Riverside South Calif) Sunday Time 4 pm BAC .16 State Rec Area Ramp 1-7 pm 29/26						

chosen on the present occasion because of its proximity to its associated accident. The District Superintendent for the Delta District, Susan Ross, granted permission to use the site. A nighttime collection period of 4 - 10 pm was employed. The 10 pm end time was chosen because the area closes at that hour. The test site was in a large parking lot near the facility's launch ramp. The ramp area itself was wide and could accommodate at least six simultaneous boat launches or retrievals. The weather was clear and warm until sunset, when the temperature dropped considerably. A total of 17 interviews were completed and 15 breath tests were obtained. Virtually all of the boaters had left the area by sunset, so there were few contacts after dark. Only one boater was contacted between 7:45 and 10:00 pm (a BAC of .104 was later noted for this case).

Lauritzen's Yacht Harbor, located about midway between Antioch and Oakley, was the site of testing on Sunday, June 18th. The facility provides access to the junction of the Sacramento and San Joaquin Rivers. Sgt. Carpenter and Deputy Gray of the Contra Costa Sheriff's Department recommended the site as the most active marina type facility near the associated accident. This was a private establishment with permission for use being granted by the owner, Chris Lauritzen. The facility proved to have covered moorings for those renting slips, as well as a for fee launch ramp with a two-boat capacity. Our collection site was located in a parking lot so that both types of uses could be covered. However, during the 1 - 7 pm sampling period, no boats returned to moorings, and all contacts, therefore, were with those in-bound from the launch ramp. The weather was sunny and hot coupled with the aroma of a nearby paper processing factory. Twenty seven interviews and 23 breath tests were obtained.

The accident which dictated site selection for Monday June 19th, occurred in Dutch Slough, which is part of the Delta waterways east of Oakley. Personnel from the Contra Costa Sheriff's Department recommended the Delta Resort as a busy facility serving both Dutch Slough and the Franks Tract Recreational Area. Delta Resort is a privately owned facility. Gay Salizar, the manager, granted permission for its use. The facility proved to have a two-boat capacity launch ramp, some rental slips, dry storage and public moorings for those who wished to use the property's general store. Because of its layout, the site proved difficult to handle. Ultimately, the Intoxilyzer 5000 was located in an area where it was logical for boaters leaving the launch ramp to stop. As this location was not in view of the water, the study team sat at the head of the launch ramp so that we could observe its use along with activity at the docking area. The S-D2 portable breath tester (see below) was brought into play at this location, as it was unreasonable to expect boaters to walk from the dock area to the site of the Intoxilyzer. When a boater was about to trailer away from the launch ramp, the study team would leave its vantage point and move down a hill to the Intoxilyzer location and attempt to "intercept" the boating party. The Intoxilyzer was used in these instances, while the S-D2 tests came from the dock area. The weather was sunny, warm and very windy. Sampling took place between 1 and 7 pm, with 13 interviews and 12 breath tests being obtained.

Tuesday, June 20 was a travel day as the team moved south from the Delta. The central valley of California and the Sierra Nevada foothills contain numerous natural and man-made lakes that are used for recreation, irrigation and other water supply purposes. These lakes tend to be under the jurisdiction of regional water districts, or state or county recreational districts. The accident to be covered on Wednesday, June 21st occurred in Yosmite Lake near Merced. A Curt Royer of the patrol division of the Merced County Parks and Recreation Department, indicated that the lake is small with little mid-week use. He suggested that a better site would be Lake McClure, a county operated recreational area located about 12 miles away. Bruce Irwin, the Park Manager granted permission for the site's use. On arrival, we learned that there were two possible launch ramps to use. Based on local advice, we chose the northern most of these. The location had a large paved parking area and a steep roadway about 1/4 mile long down to the lake. About two-thirds of the way down, there was a turn around for boats and trailers and some hillside parking. We selected the paved parking lot as the collection site in the hope that most boaters would come all the way up the hill before stopping to attend to their rigs. The weather was sunny and hot with data collection taking place between 1 and 7 pm. The site proved to be a poor choice for study purposes. Only two interviews and two breath tests were obtained. Other boats left the area during this time. However, because of the site layout and distances involved, it was not possible to make contact with these boaters.

The data collection site on Thursday, June 22nd was Millerton Lake, a state recreation area located northeast Fresno. Steven Horvitz of the San Joaquin Valley District granted permission for use of the site. Sampling was carried out at the launch ramp between 3:30 - 10 pm (the closing hour of the facility). At the outset, the weather was sunny, with temperatures topping 105 degrees. After sunset, the temperature declined considerably. The collection location was in a parking lot near a very wide launch ramp area that could accommodate numerous boats simultaneously. A total of 29 interviews and 28 breath tests were obtained.

Friday, June 23rd was a travel day as we moved into southern California. Data collection on Saturday, June 24th took place at Lake Elsinore, located approximately 20 miles south of Riverside. Jack Roggenbuck, the Chief Ranger for this state recreation area granted permission for its use and the use of Lake Perris, the following day. Data collection took place near the relatively wide launch ramp which was capable of handling at least six boats simultaneously. Collection commenced at 3 pm and was to have continued until 10 pm, when the site closed. However, in the late afternoon, the winds became very strong, it turned quite cool and the lake water became rough. We were faced with a mass exodus of boaters until after 6 pm, by which time the parking area was deserted. Collection was terminated at this point, therefore. Twenty-four interviews and 22 breath tests were obtained.

The accident related to data collection on Sunday, June 25th occurred in Lake Irwine which is located in Orange County east of Santa Ana. Personnel from the Orange County Sheriff's Department indicated that this is a private body of water used for irrigation purposes and has a small boat rental concession. Based on this information, we substituted Lake Perris, located about 20 miles to the east, as the collection site. As just noted, this lake is under the same jurisdiction as Lake Elsinore. The facility contains three virtually identical and side-by-side launch areas, each with its own ramp and parking lot areas. We set up in a driveway leading from the launch ramp to the parking lot as boaters were encouraged by signs to use this drive to stow gear after leaving the ramp. The start of data collection was delayed somewhat because of difficulty in finding our point of contact at the site. Data collection continued until approximately 7 pm, with 29 interviews and 26 breath tests obtained.

Data Collection

The basic data collection procedures involved a member of the study team approaching boaters and asking for their anonymous cooperation with a boating safety survey. At launch ramp facilities, this was done with boaters leaving the particular body of water. Based on prior observations, most boaters who trailer, will load their boats onto the trailer at the ramp and then drive a short distance away to stow gear. The interviewer approached the boater at this point. At gasoline and other docks, in-bound boaters were approached once they had tied-up to the facility. At these latter facilities, the operator of the boat was known and approached. At launch ramps, the interviewer sought out the person who had done the primary boat operating during the day. No boater approached, refused to participate in the interview portion of data collection.

The interview form employed was that used previously and is shown in Figure 1. One addition to the form, is the inclusion of the numerals 1, 2, 3 just above the line for recording the reason(s) for breath test refusal. When a boater refused the breath test, the interviewer circled the 1 if the judgment was that there was no indication of alcohol impairment, circled the 2 if it appeared that it was not likely that the person was impaired by alcohol, or circled the 3 if it was possible that the person was impaired by alcohol.

Following completion of the interview, the interviewer sought the cooperation of the boaters in providing a breath test, and for those that agreed, then escorted the persons to the breath test location. Breath testing was accomplished using an Intoxilyzer 5000 powered by a portable generator. The Intoxilyzer was configured so that the test results could not be seen by the boater or the team members. In a small number of cases, breath testing was done using the portable Lion Laboratories Alcolmeter S-D2 device. This is a hand-held instrument of the type used by police in pre-arrest screening in DWI cases. The S-D2 was employed only when an Intoxilyzer 5000 based test could not be obtained. Such instances arose when the distance from the interview site (e.g., at a dock) to the fixed Intoxilyzer location was so great that the boater could not be expected to walk the distance, or when the boater refused to make the walk. In such cases, the S-D2 was employed <u>only</u> when it was clear that the person would not be driving in the near future.

A second use of the S-D2 was on a few occasions when a person agreed to an Intoxilyzer 5000 test only if they could learn the test results. To maintain our stated position that Intoxilyzer 5000 tests could not be read immediately after testing, an S-D2 test was offered if the person was not about to drive a vehicle. This occurred in about four instances. In each case, subsequent comparison of the Intoxilyzer and S-D2 results showed complete agreement to two decimal places.

Each breath test result was recorded on a card by the Intoxilyzer or hand written for the S-D2 tests. Each card contains a code number that corresponds to the related interview form. Interview forms without this code number are breath test refusals. In some cases, more than one member of a boating party who had been operating the boat, volunteered to be tested. In these instances, the same test number was employed followed by an A, B, etc. Note that the test times recorded on the card are correct local California times. All interview forms and test cards have previously been transmitted to TSC. Overall, 147 interviews were completed, with breath tests being obtained in 134 of these (91.2%). Of the 13 persons who refused, 11 indicated they had consumed some alcoholic beverage while boating and two said they had not. (Based on all of the interviews conducted, we believe this self reporting to be highly reliable.) Twelve of the refusals were judged as showing no sign of alcohol impairment (a rating of 1), and one person was judged as not likely to have been impaired by alcohol (rating of 2).

The topic of breath test refusals in the study is an extremely interesting one. A common initial reaction of peers hearing the study's method, is to suggest that persons who have consumed considerable alcohol would be unlikely to provide a breath test, while

Figure 1 Interview Form

Site# _____ 2. Interviewer _____ 3. Date ___________ 4. Current Time ___________

5. Subject sex: M _____ F _____

6. Any signs of alcohol consumption: Y _____ N _____

If yes: Cans/Bottles _____ Alcohol on breath ____ Other __________________

Confidential Interview -- a few minutes

If refused, why: ____

7. Your age: ______

8. Boat type: power _____ sail _____ other ______________________________

9. Boat length: _______

10. Engine horsepower: ______

11. Zip code where you live: _______________

12. Your boating activity today: fishing ____ cruising ____ skiing ____ other ______

13. Water conditions today: calm ____ rough ____ strong current ____

14. How many people in your party: ______

15. What time did you start out today: ____________

16. Did you take any alcoholic beverages out with you: Y ____ N ____

If yes: How many in the party drank: _____

How much did you drink: _____ What units: ____________________

Did others in the party drink more ____ less ____ same ____ as you

Breath Test: Inducement Y _____ N _____ 1 2 3

If no, why: ____

If yes: Have you had a drink within the last 15 minutes: Y ____ N ____
If yes, wait 15 minutes

Have you had a cigarette within the last 3 minutes: Y ____ N ____
If yes, wait 3 minutes

17. Test subject number ____________ (recorded on breath test card)

those who have had little or nothing to drink, would be more inclined to submit to the test (i.e., the suggestion is that selection bias would slant the study results toward finding less alcohol use than actually existed). Based on our experience, the reasons for test refusals are far more varied and complex than this hypothesis.

We have found that more than half of the boaters approached, readily consent to the breath test. Many, but by no means all, in this group have had little or nothing to drink and often express considerable interest in the study and boating safety in general. Others who cooperate readily, express amusement about or interest in being tested ("I've never done this before and I'd like to see how it works"). Still others, who have indicated they have been drinking, wish to know their BAC level as a learning experience (as noted, we began employing an S-D2 to provide this feedback, if the person was not a driver).

A sizeable minority of the boaters approached do not initially agree to be tested. It is at this point that the truly hard work of study begins, as each situation must be handled uniquely, with different approaches, dialogs, cajoling, and occasionally monetary inducement being required. We have come to identify a number of subgroups among those initially disinclined to be tested. These include:

- The affronted - the interview form contains items dealing with how much the boater had to drink. Among those who report little or no alcohol use, there is a sizeable subgroup who feel that the request for a breath test somehow questions the veracity of their answers regarding drinking. A discussion along the lines that the quantitative evidence regarding alcohol and boating safety comes from the breath test and that it is extremely important that those with a zero BAC be represented, often overcomes this initial reaction. This subgroup, however, is among the most difficult to persuade and accounts for a considerable number of refusals.

- The wary - this subgroup includes the naturally suspicious as well as many boaters who have been drinking and who initially react that the request for a breath test is part of a law enforcement activity. A detailed description of the study, the identification of the study team as being from out-of-state and similar conversation usually overcome this reaction. However, this subgroup contains those whose wariness cannot be quelled and leads to refusals. Note for example, that in the present data, there is a refusal based on the belief that there "are too many police around".

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* The appearance of police units in the vicinity of the data collection sites was a relatively common occurrence during this data collection unit. For example, Discovery Bay turned out to be one of the refueling locations for the County Sheriff's marine units; an unrelated disturbance caused nearby police presence at Brannan Island; sheriff and Coast Guard patrol boats were seen in the waters off various test locations. Personnel at the state and county recreation areas were extremely cooperative with the study and recognized the possible negative impact of the appearance of their enforcement units. At these locations, patrol units were instructed to minimize their appearances in our vicinity. At other sites, we had no control over patrol activities. When a patrol unit was judged to be "too close" to elicit boater participation, sampling was suspended until the patrol unit moved away.

- The irate and harried - recreational boating is not always a pleasant experience and a small group of boaters is composed of those who have "not had a good day" (e.g., engines have failed and they have been towed in, the boat is not sitting correctly on the trailer, they are sun burned or injured, there has been disagreement among members of the boating party, etc.). Sympathetic conversation and the monetary inducement are employed here. However, refusals have come from this group because some persons cannot be distracted from their immediate concerns.

- Dissuaders - we have experienced several occasions when a boater being interviewed seems inclined to, or already has consented to the breath test, when another individual intercedes and attempts to dissuade them from participating. The most common instance of this occurs with couples, when one partner appears to become overly protective of the other. In other instances, persons from other boating parties and even passersby have interceded. The success in overcoming this situation depends in part on whether the interviewer can get into a position to continue contact with the boater and deflect the person who is interceding. Another factor here appears to be the distance to the Intoxilyzer. That is, if the distance is short, the person being interviewed seems to be able to say that, "this will only take a few seconds". On the other hand, if the distance is relatively long, they appear to become more equivocal.

- The last, small subgroup is composed of those persons who are generally negative about contacts with strangers (e.g., the type of person who won't give you the time of day). They participate in the interview grudgingly and when asked for the breath test, just say no and break contact.

Information Requests

During the site arrangements, three individuals specifically requested copies of any report stemming from the project. We indicated that it would probably be some time before a final report would be produced and that we would ask the sponsor to include them in report distribution. These persons are:

J. Roggenbuck, Chief Ranger
California Department of Parks and Recreation
Los Lagos District
17801 Lake Perris Drive
Perris, California 92370

Steve Horvitz, Supervising Ranger
California Department of Parks and Recreation
San Joaquin Valley District
Millerton Lake State Recreation Area
P.O. Box 205
Friant, California 93626

Susan Ross, District Superintendent
California Department of Parks and Recreation
Delta District
Brannan Island State Recreation Area
17645 State Highway 160
Rio Vista, California 94571

September 7, 1989

Memorandum

To: Peter Mengert, Transportation Systems Center

From: Robert G. Ulmer, Dunlap and Associates, Inc.

Subject: Alcohol and Boating Safety Data Collection,
August 18 - August 27, 1989

During the latter part of August 1989, R. Ulmer and C. Preusser from Dunlap and Associates were on site in California to collect further data for the Transportation Systems Center (TSC)/Coast Guard study of alcohol use among recreational boaters. This data collection activity involved interviewing recreational boaters and obtaining breath tests to determine Blood Alcohol Concentrations (BACs). The purpose of this memorandum is to describe the effort in terms of the sites selected, the procedures employed and the results obtained.

Site Selection

Inherent in the overall study design, was the adoption of a sampling plan calling for data collection to take place at bodies of water that have experienced (or are similar to those that have experienced) fatal boating accidents in which the BACs of the victims were known. Other stated requirements for establishing the sampling plan are:

- Collection of data on weekends at sites where the associated accident occurred on a weekend, and during weekdays at sites where the accident occurred on a weekday.
- Collection of data primarily in the hours during which the associated accident occurred. Also, the extension of data collection into the later night hours so that this time period is represented.
- Employing an approximately equivalent number of sites where the associated accident did or did not involve alcohol use.
- Avoiding sites related to "open" ocean accidents.
- Collection of data at launch ramps, marinas and other on-shore facilities so that various power boat types, sizes and use pattern are covered.

In addition, the distances between various possible locations had to be considered in developing the sampling schedule. Because of the bulk of the equipment employed, automobile travel was used for transportation to the various sites. This prevented sampling at widely separated locations on consecutive days.

Site selection was based on a compilation of fatal boating accidents provided by TSC. This overall listing is shown in Table 1. This listing was reduced by eliminating sites used in previous data collection, open ocean sites

Table 1
California Boating Fatalities
Input Data

Case	Date	Body of Water	Location	County	Day	Time	BAC
Operators							
05322	4/8/84	Ocean	Pt. Loma San Diego	San Diego	Sun	unk	unk
05132	4/25/84	Sacremento R.	Alamar Landing	Yolo	Wed	8am	0
05151	5/4/84	Sacramento R.	Unk	Yolo	Fri	10pm	0.19
05459	6/8/84	Shasta Lake	Jones Valley	Shasta	Fri	6am	0
05437	6/9/84	Salton Sea	70 mi NE San Diego	Riverside	Sat	3pm	0
05341	8/11/84	Shaver Lake	40 mi NE Fresno	Fresno	Sat	7pm	0.08
05529	8/13/84	Salton Sea	70 mi NE San Diego	Imperial	Mon	10am	0
05129	4/30/85	Ocean	Cabrillo Beach	Los Angeles	Tue	unk	0.02
05178	5/15/85	Sacramento R.	Near Sacto Airport	Sacramento	Wed	11pm	0.03
05355	5/30/85	Old River	Near Tracy Wildlife	San Joaquin	Thu	5pm	0.19
05131	6/6/85	Lake McSwain	Near Merced	Mariposa	Thu	7am	0
05298	6/29/85	Salton Sea	70 mi NE San Diego	Imperial	Sat	2pm	0.09
05412	8/11/85	Ocean	Humbolt Bay	Humbolt	Sun	unk	0
05665	8/14/85	Yosmite Lake	Near Merced	Merced	Wed	5pm	0
05397	8/17/85	Sacramento R.	Sherman Island	Sacramento	Sat	10pm	0
05317	5/17/84	San Fran Bay		San Fran	Thu	1pm	0.15
05744	9/1/84	Ocean	Santa Cruz	Santa Cruz	Sat	1am	0.14
Non-Operator							
05128	3/25/84	Black Butte Lake	Orland	Tehema	Sun	6am	0.18
05051	3/31/84	Ocean	Catalina Island	Orange	Sat	noon	0
05458	6/29/84	Ocean?		Los Angeles	Fri	5pm	0
05380	7/8/84	Lake Elsinore	50mi SE Long Beach	Riverside	Sun	1pm	0.19
05407	7/15/84	Lake Irwine	E. of Santa Ana	Orange	Sun	4pm	0.16
05516	7/29/84	Unk		Unk	Sun	10am	0.07
05440	8/7/84	Dutch Slough	Near Oakley	Contra Costa	Tue	5pm	0
05705	8/12/84	Ocean	Wilmington	Los Angeles	Sun	8pm	0.07
05531	8/18/84	Ocean	Mendocino	Mendocino	Sat	8pm	0.17
05629	10/28/84	Ocean	Huntington	Orange	Sun	3am	0.14
05068	3/17/85	Lake Perris		Riverside	Sun	1pm	0.05
05087	3/22/85	Ocean	Newport Beach	Los Angeles	Fri	9pm	0
05067	3/30/85	Castaic Lake	Valencia		Sat	noon	0
05244	4/8/85	Audrey Dam	Morgan Hill	Santa Clara	Mon	4pm	0.08
05138	5/5/85	Ocean	Morro Bay	S. Luis Obispo	Sun	7am	0.03
05372	5/25/85	Shasta Lake	N. of Redding	Shasta	Sat	6pm	0
05456	6/8/85	San Joaquine R.	Des Reios	San Joaquine	Sat	4pm	0.04
05409	6/9/85	Suisun Bay	Delta-Winter Isl.	Contra Costa	Sun	3pm	0.[illegible]
05434	7/3/85	Millerton Lake	Fresno	Madera	Wed	6pm	0
05273	7/6/85	San Fran Bay	San Fran	Alameda	Sat	10am	0
05397	8/17/85	Sacramento R.	Delta-Sherman Isl	Sacramento	Sat	10pm	0.0[illegible]

and sites already found to be unsuitable (e.g., the Salton Sea). This reduced list is shown in Table 2 and became the basis for the August site selection process.

As in previous data collection, telephone contacts were made with officials in the counties in which the candidate various bodies of water were located. This process usually began with the County Sheriffs Department where we spoke with someone knowledgeable (e.g., a boating enforcement officer) regarding the possible use of the body of water for data collection purposes. Recommendations concerning specific sites, referrals to persons directly involved with the body of water, and in some cases, recommendations against certain sites resulted from these contacts. Further contacts were then made to obtain specific approvals to use various public and private facilities.

In comparison with previous collection units, site scheduling for the August unit proved somewhat difficult. This was due, in part, to the relatively small number of accidents on the candidate list (Table 2) and, in part, to reluctance by some parties to grant us permission to test at certain locations. For example, accident 5244 in Table 2 occurred in Santa Clara County, most likely in Calero Reservoir. After a series of telephone conversations and written requests, county officials indicated that they could not cooperate with the study. The stated reason was that our study team would not be uniquely identified by uniforms, signs, etc., in the manner of such activities as the Coast Guard Auxiliary's voluntary safety inspections. They felt that our presence could be viewed as an intrusion by local boaters.

As another example, Shasta Lake is under the jurisdiction of the U.S. Forest Service and contains several private resorts with marinas and launch ramps, operated under license with the Forest Service. None of the private facilities contacted was willing to serve as a study site. Through the cooperation of the Forest Service, testing at Shasta Lake was conducted at launch ramps under their direct control. It should be noted that this was the only occasion in which we experienced difficulty with privately owned facilities. Testing in previous units and at one of the two marina sites in San Francisco Bay in the August unit, was carried out at private facilities that readily agreed to cooperate. We suspect that marginal economic conditions at the private facilities at Shasta Lake contributed to the reluctance to cooperate.

As a final example, specific permission to test at one of the Sacramento sites was not obtained. In carefully chosen words, we were told that permission would not be given but we would not be stopped from conducting the study.

Schedule

Table 3 indicates the data collection schedule that was employed. The entries in each cell of the table are as follows:

- The date of data collection
- The TSC accident case number
- The body of water at which sampling occurred

Table 2
California Boating Fatalities
Potential Sites for August Unit

Case	Date	Body of Water	Location	County	Day	Time	BAC
Operators							
05132	4/25/84	Sacremento R.	Alamar Landing	Yolo	Wed	8am	0
05151	5/4/84	Sacramento R.	Unk	Yolo	Fri	10pm	0.19
05459	6/8/84	Shasta Lake	Jones Valley	Shasta	Fri	6am	0
05341	8/11/84	Shaver Lake	40 mi NE Fresno	Fresno	Sat	7pm	0.08
05178	5/15/85	Sacramento R.	Near Sacto Airport	Sacramento	Wed	11pm	0.03
05131	6/6/85	Lake McSwain	Near Merced	Mariposa	Thu	7am	0
05317	5/17/84	San Fran Bay		San Fran	Thu	1pm	0.15
Non-Operator							
05128	3/25/84	Black Butte Lake	Orland	Tehema	Sun	6am	0.18
05516	7/29/84	Unk		Unk	Sun	10am	0.07
05067	3/30/85	Castaic Lake	Valencia		Sat	noon	0
05244	4/8/85	Audrey Dam	Morgan Hill	Santa Clara	Mon	4pm	0.08
05372	5/25/85	Shasta Lake	N. of Redding	Shasta	Sat	6pm	0
05456	6/8/85	San Joaquine R.	Des Reios	San Joaquine	Sat	4pm	0.04
05273	7/6/85	San Fran Bay	San Fran	Alameda	Sat	10am	0

Table 3
Sampling Schuedule

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					8/18 5459 Shasta Lake (N. of Redding) Friday Time 6 am BAC 0 Packers Bay Ramp No Testing See Text	8/19 5372 Shasta Lake (N. of Redding) Saturday Time 10 am BAC 0 Jones Valley Ramp 1-7 pm 14/13
8/20 5128 Black Butte L. (Tehema County) Sunday Time 6 am BAC .18 Eagle Pass Ramp 1-7 pm 12/11	8/21 Off-Travel	8/22 5317 San Fran Bay (Berkley) Thursday Time 1 pm BAC .15 Berkley Marina Marina/ramp 2-8 pm 3/3	8/23 5273 San Fran Bay (Sausalito) Saturday Time 10 am BAC .00 Clipper Yacht Harbor Marina/ramp 1-7 pm 10/8	8/24 Off-Travel	8/25 5151 Sacramento R. (Sacramento) Friday Time 10 pm BAC .19 Miller Park Ramp 4-10 pm 13/12	8/26 5178 Sacramento R. (Sacramento) Wednesday Time 11 pm BAC .03 Discovery Park Ramp 1-7 pm 26/26
8/27 5516 Lake Tahoe (Cal/Nev Boarder) Sunday Time 10 am BAC .07 Lake Forest Ramp 1-7 pm 14/14						

- The day of week and time of day of the associated accident
- The BAC of the accident victim
- The name of facility involved
- Whether data collection was at a marina/ramp type of facility or a ramp (only) facility
- The approximate time period of the data collection
- The number of interviews/the number of breath tests obtained

Shasta Lake

Two accidents in the database (5459 & 5372) occurred in Shasta Lake on a Friday and Saturday respectively. These cases, coupled with the accident in Black Butte Lake (5128), formed the basis for planning the first weekend of data collection.

Shasta Lake is located in northern California approximately 175 miles north of Sacramento and is under the jurisdiction of the U.S. Forest Service. With a surface area of 30,000 acres, the lake is the largest man-made reservoir in the state.

Initial contact regarding the lake was with Lt. Tom Hodges of the Shasta County Sheriffs Department. He indicated that there were several private resort/marina/launch complexes around the lake and suggested several that might be suitable for the requirements of our study. A series of phone contacts was then made with a number of these locations but no cooperation was obtained.

Lt. Hodges next noted that there were several public launch ramps around the lake under the direct jurisdiction of the U.S. Forest Service and referred us to R. W. Eddy, a District Ranger with the Forest Service. Following several phone conversations, permission was granted for us to conduct data collection at the Packers Bay launch ramp on Friday, August 18th and at the Jones Valley ramp on Saturday, August 19th.

We arrived in the Shasta Lake area on Thursday, August 17th and checked in with the Rangers, received a description of the lake, inquired about the possibility of encounters with the bears, mountain lions and rattlesnakes that inhabited the vicinity (minimal), and visited the test sites.

Shasta Lake functions as a recreational area, a hydroelectric power generator, as an irrigation source and as the supply for the Sacramento River. A continual flow of water, therefore, is released from the lake's dam, and during the summer months, this causes the lake level to fall dramatically. (At the time of our visit, the lake was down approximately 90 feet from its full level.) To accommodate boaters during periods of declining water levels, the launch ramps at the lake are somewhat unusual. At Packers Bay, the ramp has been paved at low water down the banks of the lake. As the lake level falls, previously underwater sections of the ramp are exposed. At the time we were there, the effect was a many hundred foot long and steep ramp, with a large parking lot at the top.

As testing on Friday the 18th was to have continued into the nighttime hours, we arrived at approximately 3 pm and attempted to set up in the parking lot area above the Packers Bay ramp. Only a small number of trailers were observed in the parking area. Unfortunately at that time, the generator began to leak gasoline and we were unable to solve this problem. We left the lake site and found a dealer in the nearest town but because of work backlog, he was unable to assist us. We located a nearby mechanic who examined the generator and determined that the carburetor assembly had been damaged. However, he did not have the necessary parts to make repairs. Sampling on Friday August 18th had to be abandoned, therefore. The following day, we purchased a new generator, obtaining a trade-in allowance on the damaged unit.

The Jones Valley launch area at Lake Shasta was the data collection site on Saturday, August 18th. It consists of a series of ramps. The first paved ramp area and associated parking were high above the existing water level. The ramp in use was reached by a winding dirt road about a half-mile long that had been bulldozed into the exposed lake bank. A small paved ramp led to the water from this area, and a dirt parking lot was nearby. We understand that there was yet another similar arrangement that would be brought into use when the lake fell even lower. We set up in the parking lot area. The weather was sunny, with temperatures in the 90s. A total of 14 interviews and 13 breath tests were obtained.

Black Butte Lake

Accident 5128 in the database, led to the selection of Black Butte Lake as the collection site for Sunday, August 20th. This body of water is located in Glenn and Tehama counties approximately 70 miles south of Shasta Lake. It is under the jurisdiction of the U.S. Army Corps of Engineers and is one of a system of flood control lakes developed by the Corps throughout northern and central California. The lake covers approximately 4,500 acres, with boating access being gained from three launch ramps around the lake. As the lake also serves irrigation purposes, it is subject to being drawn down in the summer months. However, this effect was not especially noticeable and the primary ramps were in use at the time of our visit.

Initial contact regarding the lake was with a Sgt. Nelson of the Tehama County Sheriffs Department who informed us that the Corps of Army Engineers has the primary jurisdiction for the lake. Contact was then made with James Millert, the Park Manager for the Corps at the lake. Following completion by us of a request for a special use permit, permission was granted for our study.

On Sunday, August 20th, we initially set up at the Buckhorn ramp on the northwestern shore of the lake. Shortly after our arrival, a Corps Park Ranger arrived at the site and after a detailed discussion of our procedures, recommended that the Eagle Pass ramp on the northeastern shore might be more suitable for our purposes. Taking this advice, we moved to the Eagle Pass site. This location consisted of a paved ramp and a long, relatively narrow parking area. Our location was in the first parking position next to the ramp area. The weather was sunny and in the mid 80s. Signs in the area warned against moving into shady areas without first checking for rattlesnakes and cautioned that poison oak was prevalent in the vicinity. Twelve interviews were completed and 11 breath tests obtained.

San Francisco Bay

In the preliminary planning for the data collection unit, it had been hoped that the mid-week locations would be San Francisco Bay (accident 5317) and Calero Reservoir in Santa Clara County (accident 5244). As noted above, Santa Clara County ultimately proved to be unwilling to grant permission for testing. The decision was made, therefore, to substitute a second bay site as the other mid-week locale (accident 5273).

Testing on Tuesday, August 22nd was conducted at the Berkley Marina which is a city owned facility located on the eastern shore of San Francisco Bay, north of Oakland. Permission to use the site was obtained from Kruger Hanson who is the Harbor Master. This is a large marina complex with slips for approximately 1,000 boats. Marina personnel indicated that there is about a 75% to 25% mix of sail to power boats berthed at the facility. Living aboard is not permitted in the bay area.

As our test site, we chose a location near the marina's launch ramp from where we could contact ramp users as well as permanent boaters leaving three of the dock access points. Unfortunately, a weather front crossed the California coast that day. On our arrival, fog and clouds covered the area, the temperature was in the 60s and a strong wind was blowing in from the ocean. Later in the day, the fog lifted. However, wind and temperature conditions did not improve. Boating activity was minimal, with 3 interviews and 3 breath tests being obtained, all from ramp users. No permanent boaters were seen leaving the marina slips we could observe.

At this site, we began to experience minor difficulties with the Intoxilyzer. In its operating cycle, the Intoxilyzer first draws an air blank sample to test. The instrument began to report, "Invalid Test" at this stage and issued a warning to check ambient conditions. We suspected that the outside air temperature may have been low for the instrument. A test immediately following the invalid test, functioned normally. We continued to experience this difficulty on occasion throughout the remaining test sites. No tests were lost, however, and we do not believe that test readings were affected.

Testing on Wednesday, August 23rd was at the Clipper Yacht Harbor. This marina complex is a privately owned facility located in Sausalito, north of the Golden Gate Bridge. Our initial plan was to work at the gas dock until it closed at 5 pm and then seek out boaters returning to permanent moorings. (The gas dock was too far from the mooring area to do both simultaneously.) Upon arrival, we noted the launch ramp was about 100 yards from the gas dock. Due to the layout of the facility, there was no reasonable area in which we could set up the Intoxilyzer near the gas dock. Also, because of the relatively large number of people moving about the area on foot (apparently tourists), we felt it would be unwise to leave the Intoxilyzer and generator unattended in the stopping area used by boaters leaving the ramp while we tested at the gas dock. We, therefore, decided to use the S-D2 for testing purposes and "shuttle" back and forth between the two locations when boaters appeared.

The weather was considerably improved, with sunny skies and temperature in the mid 70s. Between 1 and 5 pm, we had conducted six interviews at the ramp and 4 at the gas dock, with one refusal at each site bringing the number of breath tests obtained, to eight. No high BAC readings were recorded. At 5 pm the gas dock closed and it was noted that the trailer parking area was empty.

Local personnel indicated that we could expect little, if any, traffic in the marina area later in the day. We moved to the berthing area and observed it for an extended time period. No traffic was found and no further interviews resulted.

Sacramento

Accidents 5151 and 5178 led to the selection of two test sites in the City of Sacramento for Friday, August 25th and Saturday, the 26th. Initial contact regarding testing sites for these accidents was with the Marine Unit of the Yolo County Sheriffs Department. Personnel from this agency indicated that sites in Sacramento would be higher volume locations and were basically "just across the river" from Yolo County. They specifically recommended Miller and Discovery Parks as busy launch ramp sites. Both of these facilities are on the Sacramento River and are under the jurisdiction of the City of Sacramento. In the case of Miller Park, the Harbor Master indicated that they would not specifically approve our testing at the site but would not prevent us from doing so. In the case of Discovery Park, Gary Kukkola, the Park Superintendent, approved our use of the site.

On Friday, August 25th, we set up at Miller Park at about 3:30 pm. The day was sunny and mild. Our location was at the side of the roadway leading from the ramp area. The facility also contained a marina mooring area. This could not be reached from our location, however, because of a waterway between the ramp site and the marina. All testing was done at the ramp, therefore. A total of 13 interviews and 12 breath tests were obtained. The last interview/test took place shortly after 8:30 pm. In the ensuing hour and one-half, no boaters used the ramp. As the park officially closed at 10 pm, we left the site at that time. (The few remaining trailers in the parking area were attributed to overnight boating parties.)

Testing on Saturday the 26th, was at Discovery Park during the hours of 1 to 7 pm. We set up across from the launch ramp area; the weather was sunny and in the 80s. A total of 26 interviews and 26 breath tests were obtained.

Lake Tahoe

Because of the small number of cases remaining in the database and their location, we found it impossible to schedule the final weekend day based on an actual accident situation. After considering various alternatives, (e.g., testing for an additional day at one of the Sacramento sites), it was decided to test at Lake Tahoe on Sunday, August 27th. The rational was that this is a large and well known recreational area and would provide the most easterly site used in the study.

Lake Tahoe is located on the California/Nevada boarder approximately 120 miles east of Sacramento. Initial contact about the lake was with the Placer County Sheriffs Department (Lt. Hall), who referred us to the Lake Tahoe Sheriff's substation. Officer Baumgardner there, provided a detailed account of boating on the lake. He recommended using the Lake Forest ramp located on the northwestern shore. Gary Romano of the Parks and Recreation Department granted permission to use the ramp site.

We set up in the parking area adjacent to the ramp. The weather was sunny with temperatures in the mid-70s. A total of 14 interviews and 14 breath tests were obtained.

Data Collection

Data collection procedures were the same as in previous units. They involved a member of the study team approaching boaters and asking for their anonymous cooperation with a boating safety survey. At launch ramp facilities, this was done with boaters leaving the particular body of water when they stopped to stow gear after pulling away from the ramp. At gasoline docks, in-bound boaters were approached once they had tied-up to the facility. At these latter facilities, the operator of the boat was known and approached. At launch ramps, the interviewer sought out the person who had done the primary boat operating during the day. During the August collection unit, no boater approached, refused to participate in the interview portion of data collection.

Following completion of the interview, the interviewer sought the cooperation of the boaters in providing a breath test, and for those that agreed, then escorted the persons to the breath test location. Breath testing was accomplished using an Intoxilyzer 5000 powered by a portable generator. The Intoxilyzer was configured so that the test results could not be seen by the boater or the team members. In some cases, especially at Clipper Yacht Harbor, breath testing was done using the portable Lion Laboratories Alcolmeter S-D2 device.

As in the June unit, the S-D2 was also used on a few occasions when a person agreed to an Intoxilyzer 5000 test only if they could learn the test results. To maintain our stated position that Intoxilyzer tests could not be read immediately after testing, an S-D2 test was offered if the person was not about to drive a vehicle.

Each breath test result was recorded on a card by the Intoxilyzer or hand written for the S-D2 tests. Each card contains a code number that corresponds to the related interview form. Interview forms without a code number are breath test refusals. In some cases, more than one member of a boating party who had been operating the boat, volunteered to be tested. In these instances, the same test number was employed followed by an A, B, etc. Note that the test times recorded on the card are correct local California times. All interview forms and test cards have been previously transmitted to TSC.

Overall, 92 interviews were completed, with breath tests being obtained in 87 of these (94.6%). Of the 5 persons who refused, 3 indicated they had consumed some alcoholic beverage while boating and two said they had not. Four of the refusals were judged as showing no sign of alcohol impairment (a rating of 1), and one person was judged as not likely to have been impaired by alcohol (rating of 2).

Based on those providing breath tests, 69.0 percent of the boaters had a Blood Alcohol Concentration (BAC) of .000, 20.7 percent had a BAC between a trace amount and .049%, 6.9 percent of the boaters had a BAC in the .050% - .099% range, and 3.4 percent had a BAC of .10% or higher.

APPENDIX B

This appendix gives a complete listing of the boat operators survey database constructed for this project. The columns are headed by abbreviations which are intended to designate the following data elements:

1. Observation number
2. Site - abbreviated- see Appendix A for the full site names
3. Date of interview
4. Time of interview
5. Sex of boater (operator)
6. Signs of alcohol consumption yes or no
7. Age of boater
8. Length of boat
9. Horsepower of boat
10. ZIP code of boater's residence
11. Activity
12. Water conditions
13. Persons on board
14. Time that boating started
15. Were alcoholic beverages consumed?
16. Were alcoholic beverages taken with?
17. How much did respondent drink?
18. Blood alcohol concentration measured by breathlyzer - blank if no test

OBS#	SITE	DATE	TIME	SEX	CONS	AGE	LENGTH	HORSE	ZIP	ACTIVITY	WATER	PERS	STTIME	BEV	QUA	SEF	BAC
1	MP	08-25	1820	M		27	20	260	95677	SKIING	CALM	3	1300	Y	3	0	
2	L	6-18	1445	M	N	65	22	200	94550	FISH	CHOPPY	2	0900	N	0	0	
3	SI	102288		M	N	37	19	140	92045	FISH	ROUGH	2	0530	N	0	0	
4	CP	101688	1610	F	N	0	0	0				0			0	0	
5	P	6-25	1620	M	N	27	18	165	91762	SKIING	CALM	7	0330	Y	3	3	
6	SI	102288	1435	M	N	30	17	50	92114	SCUBA	CALM	2	0900	N	0	0	
7	S	08-23	1450	M	N	36	24	235	94132	FISH	ROUGH	2	0730	N	0	0	
8	P	6-25	1514	M	Y	23	18	400	92704	SKIING	ROUGH	4	0700	Y	4	4	
9	BB	102388	1420	M	N	43	15	65	90501	FISH	CALM	4	0900	N	0	0	
10	BI	101488	1334	M	N	66	16	40	95667	FISH	CALM	2	0830	N	0	0	
11	BI	101488	1520	M	N	40	18	175	95242	FISH	CALM	2	1200	Y	2	2	
12	BI	101488	1635	M	N	50	17	140	93313	FISH	CALM	2	1DAY	Y	2	0	
13	L	6-18	1650	M	N	55	20	165	94544	CRUISE	CALM	2	12DB	Y	2	3	
14	P	101588	1700	M	N	37	15	50	94515	FISH	CALM	4	0730	Y	1	3	
15	P	101588	1512	M	N	43	19	200	94559	FISH	CALM	1	1000	N	0	0	
16	E	6-24	1535	M	N	29	15	75	92640	CRUISE	CALM	2	1200	Y	2	1	
17	L	6-18	1455	M	N	48	17	120	94608	CRUISE	ROUGH	1	1230	N	0	0	
18	BB	102388	1428	M	N	42	12	16	92503	FISH	CALM	2	0730	Y	2	2	
19	P	6-25	1555	M	N	29	17	175	92505	ALL	ROUGH	6	1000	Y	4	3	
20	BI	101788	1430	M	N	76	16	25	95227	FISH	CALM	1	0800	N	0	0	
21	E	6-24	1812	M	Y	40	18	120	96370	OTHER	ROUGH	4	1600	Y	3	2	
22	P	101588	1645	M	N	30	15	55	94565	CRUISE	CALM	4	1500	Y	1	2	
23	S	08-23	1555	F	Y	37	17	120	94920	CRUISE	CALM	2	1530	Y	2	1	
24	JV	08-19	1345	M	N	49	17	140	96073	CRUISE	CALM	3	0900	Y	1	1	
25	MP	08-25	1925	M	Y	55	22	310	95630	FISH/CR	CALM	4	1200	Y	2	0	
26	M	6-22	1635	M	N	49	21	350	93727	ALL	CALM	5	1000	Y	3	2	
27	BI	6-17	1747	M	N	35	15	65	94519	FISH/CR	ROUGH	4	1100	Y	2	2	
28	BI	6-17	1755	M	N	46	21	330	94509	CRUISE	CALM	5	1200	Y	2	2	
29	BB	08-20	1612	M	N	34	12	8	95963	FISH	ROUGH	2	1200	N	0	0	
30	P	101588	1646	M	N	30	17	120	94565	FISH	CALM	3	1130	N	0	0	
31	BI	101788	1405	M	N	55	17	85	95237	FISH	CALM	2	1030	Y	1	2	
32	BB	102388		M	N	33	12	10	87114	FISH	CALM	2	0700	N	0	0	
33	P	101588	1403	M	N	32	14	18	94565	CRUISE	CALM	2	0700	Y	2	2	
34	BB	102388		M	N	29	12	18	92234	FISH	STRONG	2	0800	N	0	0	
35	L	6-18	1517	F	N	29	21	230	94561	CRUISE	CALM	4	1030	Y	2	2	
36	CP	101688	1805	M	N	52	21	260	94401	CRUISE	CALM	4	1430	Y	2	1	
37	SI	102288	1825	M	N	21	20	175	92107	TEST M	CALM	2	1730	N	0	0	
38	P	101588	1626	M	N	32	18	65	94565	FISH	CALM	3	1300	Y	3	2	

OBS#	SITE	DATE	TIME	SEX	CONS	AGE	LENGTH	HORSE	ZIP	ACTIVITY	WATER	PERS	STTIME	BEV	QUA	SEF	BAC
39	BI	6-17	1920	M	N	39	17	140	94565	ALL	CALM/R	5	1230	N	0	0	.000
40	BI	6-17	1933	M	N	49	23	330	94619	CRUISE	CALM	4	1030	Y	3	2	.000
41	BI	6-17	1910	F	N	32	19	260	94513	CRUISE	CALM/R	4	1330	Y	2	0	.000
42	DR	6-19	1820	M	N	17	20	225	94561	SKIING	CALM	5	1700	N	0	0	.000
43	BI	6-17	1855	M	N	50	17	175	94583	CRUISE	CALM/R	4	1400	Y	2	2	.000
44	BI	6-17	1816	M	N	30	18	150	94517	FISH	CALM	2	1000	N	0	0	.000
45	BI	6-17	1810	M	N	35	22	300	94564	SKIING	CALM	10	1200	Y	10	3	.000
46	DR	6-19	1750	M	N	28	16	95	94501	CRUISE	CALM	3	1400	N	0	0	.000
47	BI	6-17	1802	M	N	45	19	230	94521	CRUISE	CALM	5	1200	Y	2	2	.000
48	E	6-24	1622	M	N	34	18	120	91701	CRUISE	CALM	4	1000	N	0	0	.000
49	BI	6-17	1740	M	N	39	16	55	94533	CRUISE	CALM	4	1100	N	0	0	.000
50	BI	6-17	1735	F	Y	49	19	200	94565	OTHER	CALM	2	1430	Y	2	2	.000
51	BI	6-17	1715	M	N	34	20	185	94585	FISH	CALM/R	3	0800	Y	0	0	.000
52	MC	6-21	1825	F	N	20	21	275	95380	CRUISE	CALM	2	1330	N	0	0	.000
53	DR	6-19	1415	M	N	45	20	160	94546	FISH	ROUGH	2	2DB	Y	1	0	.000
54	BI	6-17	1710	M	N	36	22	350	94565	CRUISE	CALM	4	1200	N	0	0	.000
55	E	6-24	1710	M	N	31	19	350	91720	CRUISE	ROUGH	5	1500	N	0	0	.000
56	E	6-24	1716	M	N	34	18	125	90630	SKIING	ROUGH	8	1200	Y	4	4	.000
57	BI	6-17	1655	M	N	34	18	205	94565	CRUISE		5	1130	Y	1	1	.000
58	E	6-24	1505	M	N	36	19	230	91701	CRUISE	CALM/R	4	1030	N	0	0	.000
59	E	6-24	1745	M	N	34	17	125	92056	CRUISE	ROUGH	4	1330	N	0	0	.000
60	E	6-24	1520	M	N	31	24	330	92805	CRUISE	CALM	5	0930	N	0	0	.000
61	DR	6-19	1805	M	N	36	16	150	95073	SKIING	CALM/R	4	1300	Y	3	2	.000
62	L	6-18	1425	M	N	53	23	260	95014	CRUISE	CALM/R	3	1100	N	0	0	.000
63	L	6-18	1435	M	N	51	24	180	94550	CRUISE	ROUGH	2	0900	N	0	0	.000
64	L	6-18	1444	M	N	38	19	125	94565	FISH/CR	CHOPPY	3	1100	N	0	0	.000
65	DB	6-16	1605	M	N	25	19	125	94563	CRUISE	CALM	2	1200	N	0	0	.000
66	E	6-24	1540	M	N	23	16	115	92026	SKIING	CALM	4	1030	N	0	0	.000
67	E	6-24	1546	F	N	40	16	100	92543	SKIING	ROUGH	4	1000	N	0	0	.000
68	L	6-18	1505	M	N	43	17	170	94518	FISH	CHOPPY	2	1030	N	0	0	.000
69	E	6-24	1550	M	N	21	16	85	92648	SKIING	CALM	3	1200	N	0	0	.000
70	L	6-18	1510	M	N	62	14	50	94596	FISH	CHOPPY	3	1130	Y	1	0	.000
71	L	6-18	1510	M	N	24	17	65	94566	FISH	ROUGH	2	1100	Y	1	0	.000
72	E	6-24	1555	M	N	31	18	175	92646	SKIING	CALM/R	4	1000	N	0	0	.000
73	L	6-18	1520	M	N	18	22	250	95148	FISH	ROUGH	2	1000	N	0	0	.000
74	DR	6-19	1720	M	N	25	19	175	94550	CRUISE/	CALM/R	4	0900	N	0	0	.000
75	L	6-18	1610	M	N	57	17	140	95116	FISH/CR	ROUGH	4	0900	Y	4	2	.000
76	L	6-18	1617	M	N	25	16	140	94928	SKIING	CHOPPY	5	1200	Y	4	0	.000

OBS#	SITE	DATE	TIME	SEX	CONS	AGE	LENGTH	HORSE	ZIP	ACTIVITY	WATER	PERS	STTIME	BEV	QUA	SEF	BAC
77	L	6-18	1635	M	N	30	20	230	94509	CRUISE	MILD	2	1430	Y	1	1	.000
78	E	6-24	1600	M	N	40	17	115	92628	SKIING	ROUGH	3	1100	N	0	0	.000
79	DR	6-19	1640	M	N	25	18	220	94565	CRUISE	CALM/R	8	1430	N	0	0	.000
80	L	6-18	1652	M	N	27	19	260	94509	CRUISE	ROUGH	2	1300	Y	1	1	.000
81	L	6-18	1655	M	N	28	17	115	94513	CRUISE	ROUGH	3	1500	N	0	0	.000
82	DR	6-19	1620	F	N	24	16	85	94565	CRUISE	ROUGH	2	1400	N	0	0	.000
83	DR	6-19	1610	M	N	59	21	260	95127	SKIING	CALM/R	4	0800	N	0	0	.000
84	DR	6-19	1535	M	N	26	18	185	94561	OTHER	ROUGH	2	1430	N	0	0	.000
85	E	6-24	1620	M	N	29	22	350	92504	SKIING	CALM	4	1100	Y	2	0	.000
86	E	6-24	1635	M	N	49	16	115	91748	SKIING	ROUGH	4	0900	Y	2	2	.000
87	L	6-18	1820	M	N	39	17	175	94127	CRUISE	CHOPPY	6	1300	N	0	0	.000
88	L	6-18	1825	M	N	33	25	265	94509	FISH	ROUGH	3	1200	Y	1	0	.000
89	L	6-18	1850	M	N	40	20	260	94509	CRUISE	ROUGH	2	1200	Y	1	0	.000
90	M	6-22	1540	M	N	19	19	350	93711	SKIING	CALM	3	1100	N	0	0	.000
91	E	6-24	1645	M	N	30	17	150	92665	FISH/CR	CALM	7	1000	N	0	0	.000
92	M	6-22	1620	F	N	59	17	325	93612	SKIING	CALM	5	1315	Y	1	1	.000
93	E	6-24	1650	M	N	30	19	380	92805	CRUISE	CALM	4	0900	Y	3	2	.000
94	DR	6-19	1450	M	N	66	19	175	94565	FISH	CALM	3	0900	N	0	0	.000
95	M	6-22	1648	M	N	32	20	300	93711	SKIING	CALM	3	1200	Y	3	3	.000
96	M	6-22	1650	M	N	39	16	130	95123	SKIING	FAIR	3	0900	Y	2	0	.000
97	M	6-22	1710	M	N	65	20	130	93705	SKIING	CALM	5	1300	N	0	0	.000
98	M	6-22	1710	M	N	24	14	50	93704	CRUISE	CALM	3	1330	N	0	0	.000
99	M	6-22	1714	M	N	29	18	235	93710	SKIING	CALM	3	1300	Y	3	4	.000
100	DR	6-19	1440	M	N	33	17	120	95035	FISH	ROUGH	3	0830	N	0	0	.000
101	DB	6-16	1905	M	N	24	19	300	94583	SKIING	CALM	3	1430	Y	2	2	.000
102	E	6-24	1705	M	N	21	16	105	92227	SKIING	CALM	6	1100	Y	3	3	.000
103	E	6-24	1710	M	N	35	19	150	90638	SKIING	CALM	5	0930	N	1	0	.000
104	M	6-22	1845	M	N	29	20	401	93722	SKIING	CALM	4	1500	N	0	0	.000
105	M	6-22	1922	M	N	47	20	150	93706	SKIING	CALM	6	1800	N	0	0	.000
106	E	6-24	1810	M	N	48	17	120	92507	CRUISE	ROUGH	10	1745	N	0	0	.000
107	M	6-22	2000	F	N	25	17	140	93722	SKIING	CALM	5	1500	N	0	0	.000
108	M	6-22	1940	M	N	28	20	270	93711	SKIING	CALM	3	1545	N	1	0	.000
109	M	6-22	1950	M	N	29	22	460	93706	SKIING	CALM/R	4	1400	N	0	0	.000
110	M	6-22	2000	M	N	26	19	175	93626	CRUISE	CALM	3	1900	N	0	0	.000
111	M	6-22	1935	M	N	40	21	120	93612	SKIING	CALM	11	1500	N	0	0	.000
112	M	6-22	2010	M	N	42	20	400	93727	SKIING	CALM	6	1630	N	0	0	.000
113	M	6-22	2020	M	N	32	18	150	93703	SKIING	CALM/R	3	1730	N	0	0	.000
114	M	6-22	2033	F	N	29	16	120	93612	ALL	CALM/R	5	1700	N	0	0	.000

OBS#	SITE	DATE	TIME	SEX	CONS	AGE	LENGTH	HORSE	ZIP	ACTIVITY	WATER	PERS	STTIME	BEV	QUA	SEF	BAC
115	M	6-22	2036	F	N	41	19	320	93612	CRUISE	CALM	3	1830	N	0	0	.000
116	M	6-22	2050	M	N	31	14	80	93612	SWIMMI	CALM	5	1900	N	0	0	.000
117	L	6-18	1448	M	N	17	21	350	94526	CRUISE	ROUGH	3	1200	Y	2	0	.000
118	P	6-25	1510	M	N	32	17	120	92621	SKIING	ROUGH	6	0900	Y	3	2	.000
119	M	6-22	2130	M	N	34	21	200	93710	CRUISE	CALM	3	1845	N	0	0	.000
120	P	6-25	1440	M	N	29	17	158	92388	CRUISE	ROUGH	5	12	Y	1	2	.000
121	P	6-25	1443	M	N	32	20	350	92324	CRUISE	ROUGH	3	0600	N	0	0	.000
122	P	6-25	1450	M	N	30	24	700	92509	OTHER	ROUGH	3	0930	Y	3	4	.000
123	P	6-25	1430	M	N	28	18	325	92627	CRUISE	CHOPPY	3	0900	Y	1	1	.000
124	P	6-25	1516	M	N	37	20	500	92646	CRUISE	ROUGH	4	0830	Y	1	2	.000
125	P	6-25	1520	M	N	21	18	180	92388	SKIING	ROUGH	5	0600	Y	4	2	.000
126	P	6-25	1535	M	N	45	20	260	92669	CRUISE	ROUGH	3	1100	N	0	0	.000
127	P	6-25	1540	M	N	35	20	270	92503	SKIING	ROUGH	4	0930	Y	1	0	.000
128	P	6-25	1547	M	N	27	17	85	92503	SKIING	ROUGH	5	0930	N	0	0	.000
129	DB	6-16	1454	M	N	56	32	540	95414	CRUISE	CALM	3	1341	Y	0	0	.000
130	BI	101488	1440	M	N	72	15	70	95240	FISH	CALM	3	1000	N	0	0	.000
131	BI	101488	1445	M	N	73	20	190	95240	FISH	CALM	3	0800	N	0	0	.000
132	P	6-25	1615	M	N	26	17	150	92392	SKIING	ROUGH	6	0830	Y	5	4	.000
133	DP	08-26	1520	F		45	17	180	95864	CRUISE	CALM/R	3	0830	N	0	0	.000
134	SI	102288	1850	M	N	34	14	18	92077	FISH	ROUGH	3	1600	N	0	0	.000
135	T	08-27	1640	F		23	19	250	94563	CRUISE/	CALM	8	0800	Y	0	0	.000
136	T	08-27	1713	M		28	17	140	95734	SCUBA	CALM	3	1130	N	0	0	.000
137	P	6-25	1705	F	N	30	20	405	92646	CRUISE	ROUGH	5	0830	Y	1	0	.000
138	T	08-27	1720	M		37	20	200	95737	CRUISE/	CALM	5	1100	Y	1	3	.000
139	P	6-25	1743	M	N	32	25	460	92683	SKIING	CALM	9	0900	Y	3	0	.000
140	DP	08-26	1420	M		54	16	50	95821	FISH/CR	ROUGH	2	1100	Y	2	2	.000
141	P	6-25	1810	F	N	36	19	175	92028	CRUISE	MEDIUM	5	1300	N	0	0	.000
142	DP	08-26	1435	M		56	22	350	95624	CRUISE/	CALM	4	1100	N	0	0	.000
143	P	6-25	1820	M	N	43	18	330	92346	OTHER	ROUGH	3	1600	N	0	0	.000
144	DP	08-26	1440	M		35	18	185	95833	CRUISE	CALM	2	1030	N	0	0	.000
145	P	6-25	1845	F	N	22	20	200	92388	CRUISE	ROUGH	6	1630	N	0	0	.000
146	DP	08-26	1455	F		72	16	50	95691	FISH/CR	CALM	3	0930	Y	1	0	.000
147	SI	102288	1757	M	N	30	17	115	92069	FISH	CALM	3	0730	Y	3	1	.000
148	BB	102388	1640	M	N	50	16	70	92509	FISH	CALM	2	0630	N	0	0	.000
149	SI	102288	1740	M	N	42	20	140	109	FISH	CALM	1	0430	N	0	0	.000
150	BB	102388	1355	M	N	48	19	260	92315	CRUISE	CALM	2	1330	N	0	0	.000
151	BI	101788	1420	M	N	70	17	40	95355	FISH	CALM	2	0800	N	0	0	.000
152	JV	08-19	1500	M		45	18	150	96013	FISH	CALM	2	0530	N	0	0	.000

OBS#	SITE	DATE	TIME	SEX	CONS	AGE	LENGTH	HORSE	ZIP	ACTIVITY	WATER	PERS	STTIME	BEV	QUA	SEF	BAC
153	SI	102288	1821	M	N	57	141	25	92105	FISH	CALM	2	0630	N	0	0	.000
154	JV	08-19	1557	M		31	12	7	96007	FISH	CALM	3	0730	Y	2	2	.000
155	CP	101688	1715	M	N	50	20	5	94086	CRUISE	CALM	3	1030	N	0	0	.000
156	JV	08-19	1735	F		36	16	85	96003	SKIING	CALM	4	1430	N	0	0	.000
157	DP	08-26	1545	M		41	24	235	95630	CRUISE	CALM	2	05DB	Y	2	0	.000
158	JV	08-19	1810	F		50	19	175	96003	OTHER	CALM	2	1300	N	0	0	.000
159	DP	08-26	1600	M		50	16	50	95670	FISH	CALM	1	0600	N	0	0	.000
160	JV	08-19	1820	M		26	20	170	96003	SKIING	CALM/R	3	1500	N	0	0	.000
161	BI	101788	1422	M	N	72	20	185	95240	FISH	CALM	1	0830	N	0	0	.000
162	SI	102288	1615	M	N	49	12	1	92364	FISH	CALM	1	0930	N	0	0	.000
163	DP	08-26	1620	M		26	17	175	95821	CRUISE	CALM	2	1330	N	0	0	.000
164	B	08-22	1510	M		47	25	271	94536	FISH	CALM/R	4	0600	N	0	0	.000
165	DP	08-26	1625	F		50	17	130	95630	LEARNIN	CALM	3	1500	N	0	0	.000
166	SI	102288	1547	M	N	42	20	270	92106	FISH	CALM	3	0900	Y	2	1	.000
167	DP	08-26	1635	M		32	16	70	95842	FISH/CR	CALM	2	1030	Y	2	3	.000
168	S	08-23	1420	M		17	17	85	94941	SKIING	CALM	4	1130	N	0	0	.000
169	P	101588	1726	M	N	50	23	165	95207	FISH	CALM	2	1DAY	Y	2	1	.000
170	DP	08-26	1658	M		34	18	175	95833	CRUISE/	CALM	5	1300	Y	2	2	.000
171	SI	102288	1530	F	N	22	13	10	92032	FISH	STRONG	5	1100	Y	0	0	.000
172	DP	08-26	1702	M		38	17	115	95833	SWIMMI	CALM	2	1630	N	0	0	.000
173	SI	102288	1455	M	N	63	17	115	92064	FISH	CALM	3	0830	N	0	0	.000
174	DP	08-26	1710	M		38	19	230	95630	CRUISE	CALM/R	2	1100	Y	2	1	.000
175	S	08-23	1640	M		50	36	500	95014	CRUISE	CALM	6	0400	Y	5	2	.000
176	BI	101788	1345	M	N	71	15	75	95354	FISH	CALM	2	0900	N	0	0	.000
177	MP	08-25	1735	M		31	17	85	95820	CRUISE	CALM	4	1500	N	0	0	.000
178	DP	08-26	1740	F		30	19	350	95662	CRUISE	CALM	5	1330	Y	0	0	.000
179	SI	102288	1440	M	N	43	21	260	92107	CRUISE	CALM	2	0800	N	0	0	.000
180	BB	102388	1550	M	N	48	12	7	90650	FISH	CALM	2	0900	N	0	0	.000
181	SI	102288	1420	M	N	45	19	130	119	CRUISE	CALM	4	1045	N	0	0	.000
182	MB	102188	1720	M	N	71	25	160	92041	CRUISE	CALM	2	1645	N	0	0	.000
183	CP	101688	1725	M	N	37	16	40	94010	FISH	CALM	2	1000	Y	1	1	.000
184	DP	08-26	1810	M		42	18	170	95991	CRUISE	ROUGH	4	1200	Y	2	2	.000
185	SI	102288	1419	M	N	31	16	115	92109	DIVING	CALM	1	1030	N	0	0	.000
186	DP	08-26	1815	F		43	20	125	95821	OTHER	CALM/R	2	1400	N	0	0	.000
187	MP	08-25	2030	M		39	18	170	95822	FISH/CR	CALM	4	1715	Y	2	3	.000
188	DP	08-26	1825	F		38	18	175	95355	CRUISE	CALM	3	1230	N	0	0	.000
189	BB	08-20	1515	M		43	18	150	94563	CRUISE	CHOPPY	3	1300	N	0	0	.000
190	DP	08-26	1835	M		25	22	500	95610	CRUISE/	CALM	3	1330	Y	3	2	.000

OBS#	SITE	DATE	TIME	SEX	CONS	AGE	LENGTH	HORSE	ZIP	ACTIVITY	WATER	PERS	STTIME	BEV	QUA	SEF	BAC
191	BI	101788	1736	M	N	50	17	50	94513	FISH	CALM	2	1000	N	0	0	.000
192	CP	101688	1707	M	N	49	24	250	94560	FISH	CALM	3	1030	N	0	0	.000
193	BB	08-20	1640	F		36	18	85	95926	SKIING	ROUGH	2	0845	N	0	0	.000
194	P	101588	1755	M	N	50	19	165	94565	CRUISE	CALM	4	1330	N	0	0	.000
195	BB	08-20	1710	M		37	19	260	95926	SKIING	ROUGH	6	1030	N	0	0	.000
196	MB	102188	1555	M	N	33	14	5	92126	FISH	ROUGH	2	0830	Y	2	2	.000
197	BB	08-20	1740	M		33	18	150	95927	FISH/SK	ROUGH	9	1230	Y	1	0	.000
198	BI	101488	1305	M	N	35	14	10	95207	FISH	STRONG	1	0800	N	0	0	.000
199	BB	08-20	1820	M		50	14	35	96021	FISH	CALM/R	2	1300	N	0	0	.000
200	BI	101488	1405	M		68	18	75	95963	FISH	CALM-R	3	0800	Y	1	1	.000
201	T	08-27	1446	M		21	28	300	93065	SKIING	CALM	6	1130	Y	3	1	.000
202	MB	102188	1630	M	N	55	21	50	92040	CRUISE	CALM	4	1300	N	0	0	.000
203	T	08-27	1505	M		52	18	190	95363	REMOVE	CALM	3	1400	N	0	0	.000
204	MB	102188	1527	M	N	38	18	165	92110	CRUISE	CALM	6	1330	N	0	0	.000
205	T	08-27	1530	M		23	17	115	95730	CRUISE/	CALM	1	1300	Y	1	1	.000
206	BB	102388	1603	F	N	58	20	175	92315	CRUISE	CALM	4	1300	N	0	0	.000
207	T	08-27	1540	M		38	19	125	89431	CRUISE	CALM	6	1100	N	0	0	.000
208	BI	101488	1543	M	N	43	17	170	93444	FISH	CALM	2	3DAY	Y	2	12	.000
209	T	08-27	1615	M		46	19	235	91765	SKIING	CALM	5	1130	N	0	0	.000
210	BI	101488	1601	M	N	55	18	202	93449	FISH	CALM	4	1000	N	0	0	.000
211	T	08-27	1635	M		70	20	260	95826	FISH	CALM	2	1000	N	0	0	.000
212	BI	101488	1650	M	N	34	16	50	95240	FISH	CALM	2	1000	N	0	0	.000
213	P	6-25	1750	F	N	28	19	175	91719	SKIING	ROUGH	10	1200	N	0	0	.000
214	MB	102188	1520	M	N	42	18	110	92126	FISH	CALM	2	0600	N	0	0	.000
215	P	6-25	1810	M	N	27	16	125	92335	CRUISE	ROUGH	2	1600	N	0	0	.000
216	BI	101488	1737	M	N	63	16	70	94521	FISH	CALM	2	1300	Y	2	1	.000
217	JV	08-19	1355	M		76	12	15	84767	FISH	CALM	2	0700	N	0	0	.000
218	BI	101488	1751	M		51	14	10	94	FISH	CALM	2	1330	N	0	0	.000
219	BB	102388	1444	M	N	20	18	350	91765	CRUISE	CALM	2	1200	N	0	0	.000
220	CP	101688	1650	M	N	22	11	5	94065	FISH	CALM	3	1200	Y	3	1	.000
221	JV	08-19	1740	M		32	17	131	95926	SKIING	CALM	8	1030	Y	1	0	.000
222	MB	102188	1505	M	N	43	17	50	92071	FISH	CALM	2	0830	N	0	0	.000
223	BB	102388	1459	M	N	39	21	230	92715	SKIING	CALM	8	1000	N	0	0	.000
224	CP	101688	1632	F	N	24	14	50	94017	OTHER	CALM	3	1400	N	0	0	.000
225	B	08-22	1512	M		45	26	150	94596	FISH	CALM	2	0400	N	0	0	.000
226	P	101588	1245	M	N	34	16	50	94565	FISH	CALM	2	1030	N	0	0	.000
227	S	08-23	1425	M		41	17	90	94116	FISH	ROUGH	1	0630	N	0	0	.000
228	P	101588	1255	M	N	44	17	35	94565	OTHER	CALM	2	0600	N	0	0	.000

OBS#	SITE	DATE	TIME	SEX	CONS	AGE	LENGTH	HORSE	ZIP	ACTIVITY	WATER	PERS	STTIME	BEV	QUA	SEF	BAC
229	S	08-23	1615	M		56	26	231	95688	FISH	ROUGH	3	0630	N	0	0	.000
230	P	101588	1310	M		30	12	20	95136	FISH	CALM	2	0730	N	0	0	.000
231	MP	08-25	1805	M		16	14	40	95820	CRUISE	CALM	2	1400	Y	1	0	.000
232	P	101588	1315	M	N	46	18	20	94565	FISH	CALM	2	0730	N	0	0	.000
233	CP	101688	1758	M	N	41	19	230	94089	FISH	CALM	3	1030	N	0	0	.000
234	CP	101688	1415	M	N	40	14	10	95111	FISH	CALM	2	0800	N	0	0	.000
235	MP	08-25	1950	M		34	19	205	95608	CRUISE	CALM	3	1230	Y	2	2	.000
236	CP	101688	1259	M	N	22	16	140	94010	CRUISE	CALM	4	1000	N	0	0	.000
237	BI	101788	1727	F	N	73	18	170	93285	FISH	CALM	2	1000	Y	2	1	.000
238	P	101588	1720	M	N	36	16	55	94565	FISH	CALM	2	0600	N	0	0	.000
239	P	101588	1400	M	N	29	16	55	94521	FISH	CALM	2	0730	N	0	0	.000
240	BI	101788	1530	M	N	45	16	175	95726	FISH	CALM	1	0630	N	0	0	.000
241	P	101588	1405	M	N	42	16	65	95148	FISH	CALM	2	0700	Y	2	1	.000
242	MB	102188	1405	M	N	31	20	125	92109	FISH	ROUGH	3	0700	N	0	0	.000
243	P	101588	1410	M		35	14	40	9610	FISH	CALM	2	1000	N	0	0	.000
244	BI	101788	1449	M	N	80	14	15	92319	FISH	CALM	2	0700	N	0	0	.000
245	P	101588	1412	F	N	58	16	140	94565	FISH	CALM	3	0830	N	0	0	.000
246	T	08-27	1600	F		58	20	240	95864	CRUISE	CALM	3	1130	Y	2	0	.000
247	P	101588	1424	M	N	25	14	10	94561	FISH	CALM	2	0900	N	0	0	.000
248	BB	102388	1440	M	N	46	13	10	92382	FISH	CALM	2	0700	N	0	0	.000
249	P	101588	1426	M	N	45	27	260	94509	FISH	CALM	2	0930	N	0	0	.000
250	P	6-25	1820	M	N	38	17	140	92383	CRUISE	ROUGH	2	0630	Y	2	2	.000
251	P	101588	1440	M	N	26	13	10	94565	FISH	CALM	2	0800	N	0	0	.000
252	SI	102288	1703	M	N	33	20	40	92024	FISH	ROUGH	3	0400	N	0	0	.000
253	P	101588	1445	M		27	20	200	94518	FISH	CALM	3	0800	Y	1	2	.000
254	B	08-22	1445	M		22	17	40	94550	FISH	CALM	3	0700	N	0	0	.000
255	P	101588	1505	M	N	35	19	390	94551	FISH	CALM	3	0800	N	0	0	.000
256	SI	102288	1515	M	N	30	15	65	92045	FISH	CALM	2	0900	N	0	0	.000
257	MB	102188	1415	M	N	27	17	115	92064	FISH	ROUGH	5	1100	Y	3	0	.000
258	MP	08-25	1935	F		31	18	350	95814	SKIING	CALM	4	1700	N	0	0	.000
259	P	101588	1715	M	N	46	15	85	94553	FISH	CALM	3	0900	N	0	0	.000
260	P	101588	1545	M	N	74	16	80	94509	FISH	CALM	1	0800	N	0	0	.000
261	BB	08-20	1644	F		42	20	140	94403	SKIING	ROUGH	5	0900	Y	1	0	.000
262	P	101588	1548	M	N	45	16	140	94521	SKIING	CALM	5	1200	N	0	0	.000
263	T	08-27	1500	F		50	21	260	89510	FISH/CR	CALM	2	1130	N	0	0	.000
264	P	101588	1553	M	N	31	16	85	94565	FISH	CALM	3	0730	N	0	0	.000
265	T	08-27	1620	M		36	17	110	95730	CRUISE	CALM	6	1300	N	0	0	.000
266	P	101588	1558	M	N	46	14	18	94509	FISH	CALM	2	0630	N	0	0	.000

OBS#	SITE	DATE	TIME	SEX	CONS	AGE	LENGTH	HORSE	ZIP	ACTIVITY	WATER	PERS	STTIME	BEV	QUA	SEF	BAC
267	JV	08-19	1445	F	N	46	18	228	96003	FISH	CALM	3	6-DB	Y	1	0	.000
268	P	101588	1616	M	N	21	16	160	94565	CRUISE	CALM	3	1400	N	0	0	.000
269	S	08-23	1402	M		39	25	250	94920	CRUISE	ROUGH	2	0730	Y	1	0	.000
270	MB	102188	1410	M	N	32	17	80	92100	FISH	ROUGH	1	0530	N	0	0	.000
271	MP	08-25	2040	M		34	20	240	95691	CRUISE	ROUGH	4	1830	N	0	0	.000
272	P	101588	1640	M	N	39	21	135	94565	FISH	CALM	2	0800	N	0	0	.000
273	BI	101788	1433	M	N	68	18	0	95326	FISH	CALM	2	0730	N	0	0	.000
274	JV	08-19	1820	M		37	17	125	96003	SKIING	CALM	5	1600	N	0	0	.000
275	SI	102288	1445	F	N	46	17	85	92019	SKIING	ROUGH	4	1100	N	0	0	.000
276	BB	08-20	1745	M		38	17	131	95927	CRUISE	CALM/R	7	1330	N	0	0	.000
277	P	6-25	1755	M	N	23	18	455	92388	SKIING	ROUGH	3	1600	N	0	0	.000
278	CP	101688	1255	M	N	43	17	90	95051	FISH	CALM	1	0530	N	0	0	.000
279	P	101588	1650	M	N	39	19	260	94583	FISH	CALM	3	0700	Y	3	3	.000
280	P	101588	1655	M	N	25	17	240	94565	FISH	CALM	2	0830	Y	2	3	.000
281	BB	102388	1628	M	N	28	15	40	92370	FISH	ROUGH	2	0900	N	0	0	.000
282	P	101588	1710	M	N	48	16	50	94521	FISH	CALM	3	1030	Y	2	0	.000
283	DR	6-19	1655	F	Y	36	16	90	94511	FISH/CR	ROUGH	3	1200	Y	2	2	.005
284	MC	6-21	1705	M	N	33	18	120	95386	FISH	CALM	4	1130	Y	1	4	.005
285	S	08-23	1410	M		24	27	180	94965	CRUISE	CALM	4	1400	N	0	0	.005
286	SI	102288	1747	M	N	16	14	60	92129	FISH	CALM	4	1600	N	0	0	.007
287	DP	08-26	1848	M		28	21	200	95823	SKIING	CALM	4	1400	Y	3	6	.008
288	BB	08-20	1835	M		44	17	120	95926	SKIING	ROUGH	4	1500	Y	2	2	.009
289	DP	08-26	1525	M		35	24	400	95864	CRUISE	ROUGH	4	1200	N	0	0	.010
290	M	6-22	1730	M	N	53	16	120	93612	FISH	CALM	2	1400	Y	2	1	.011
291	P	101588	1355	M	N	49	18	155	94580	FISH	CALM	2	0830	Y	2	3	.012
292	JV	08-19	1520	M		19	21	200		SKIING	CALM	3	1100	N	0	0	.013
293	L	6-18	1730	M	N	43	22	400	94561	CRUISE	ROUGH	4	1330	Y	1	4	.015
294	P	6-25	1640	M	N	50	19	165	92069	CRUISE	ROUGH	7	0930	Y	2	2	.015
295	P	6-25	1655	F	N	25	20	305	92383	CRUISE	CHOPPY	7	1130	Y	1	0	.015
296	M	6-22	1615	M	N	30	19	250	93664	CRUISE	CALM	2	1500	Y	2	4	.015
297	BI	101788	1335	M	N	73	17	140	95240	FISH	CALM	2	0800	N	0	0	.015
298	MB	102188	1435	M	N	44	24	225	92107	FISH	CALM	2	0830	Y	2	2	.016
299	MP	08-25	1930	M		40	16	115	95818	CRUISE	CALM	2	1830	Y	2	1	.017
300	SI	102288	1655	M	N	40	17	85	92154	FISH	CALM	3	1100	N	0	0	.017
301	JV	08-19	1415	F		40	20	365	96003	CRUISE	CALM	2	0830	N	0	0	.017
302	DP	08-26	1845	M		52	18	175	95663	CRUISE	CALM	2	1030	Y	1	3	.018
303	L	6-18	1505	M	N	47	19	115	94561	CRUISE	CHOPPY	3	1000	Y	2	1	.018
304	P	101588	1350	M		59	17	175	94565	FISH	CALM	2	0700	Y	2	3	.019

OBS#	SITE	DATE	TIME	SEX	CONS	AGE	LENGTH	HORSE	ZIP	ACTIVITY	WATER	PERS	STTIME	BEV	QUA	SEF	BAC
305	L	6-18	1710	M	N	30	16	80	94561	SKIING	ROUGH	4	1200	Y	2	4	.019
306	BI	101488	1530	M	N	35	23	200	209	FISH	CALM	2	0630	N	0	0	.019
307	S	08-23	1610	M		36	22	175	95355	FISH	CALM	2	0800	N	0	0	.02
308	BB	08-20	1540	M		42	14	50	95926	CRUISE	ROUGH	4	12	N	0	0	.020
309	DB	6-16	1944	M	N	28	19	250	94	SKIING	CALM/R	3	1200	Y	3	6	.020
310	MP	08-25	1655	M		34	22	240	95223	SKIING	CALM	3	1230	Y	0	5	.021
311	T	08-27	1510	M		33	16	35	89511	CRUISE	CALM	1	1000	Y	1	2	.021
312	P	101588	1625	M	N	55	17	140		FISH	CALM	2	0900	N	0	0	.024
313	P	6-25	1610	M	N	46	20	270	91790	SKIING	CALM	3	0900	Y	1	2	.024
314	E	6-24	1735	M	N	26	18	455	92346	CRUISE	ROUGH	2	1430	Y	2	6	.026
315	M	6-22	1800	M	N	32	19	240	93722	OTHER	ROUGH	2	1530	Y	2	2	.027
316	E	6-24	1615	M	N	22	20	100	90650	SKIING	CALM/R	7	1000	Y	3	1	.030
317	JV	08-19	1640	M		45	18	205	94089	OTHER	CALM	18	WEEK	Y	9	0	.032
318	E	6-24	1655	M	N	23	17	110	92635	CRUISE	ROUGH	3	1200	Y	3	6	.033
319	M	6-22	1645	M	N	30	18	454	93710	OTHER	CALM	3	1530	Y	3	2	.033
320	BI	6-17	1840	M	N	37	19	305	94585	SKIING	CALM	4	1100	Y	1	3	.034
321	BB	08-20	1540	M		27	17	85	95963	SKIING	CALM	3	1030	Y	2	2	.036
322	T	08-27	1535	M		19	19	410	95711	SKIING	CALM	2	1400	N	0	0	.038
323	E	6-24	1740	M	N	34	19	425	90044	CRUISE	ROUGH	2	1700	N	0	0	.040
324	CP	101688	1712		N	42	26	260	94087	FISH	CALM	5	0900	Y	3	2	.040
325	L	6-18	1800	M	N	29	23	365	94558	CRUISE	ROUGH	6	0900	Y	3	8	.045
326	BB	08-20	1720	M		33	13	25	95926	CRUISE	ROUGH	1	1300	Y	1	0	.046
327	BI	101488	1725	M	N	52	20	180	95240	FISH	CALM	2	1200	Y	2	4	.049
328	BB	102388	1435	M	N	58	18	175	90041	FISH	CALM	3	0700	Y	3	3	.050
329	S	08-23	1355	M		62	31	280	94903	FISH	WINDY	4	0600	Y	0	0	.050
330	M	6-22	2105	M	N	27	17	85	93704	CRUISE	ROUGH	3	1700	N	0	0	.050
331	DP	08-26	1800	M		34	18	110		SKIING	ROUGH	4	1400	Y	1	0	.051
332	L	6-18	1743	M	N	32	15	70	94002	CRUISE	ROUGH	2	1300	N	0	0	.052
333	L	6-18	1743	M	N	32	15	70	94002	CRUISE	ROUGH	2	1300	N	0	0	.052
334	BI	6-17	1945	M	N	54	18	175	95691	FISH/CR	CALM	1	0700	Y	1	6	.053
335	P	6-25	1647	M	N	24	19	350	92509	CRUISE	MEDIUM	2	0800	N	0	0	.054
336	MB	102188	1631	M	N	52	15	18	92110	FISH	CALM	2	1130	Y	2	1	.056
337	DP	08-26	1613	F		28	16	200	95842	CRUISE/	CALM	6	1000	Y	3	2	.056
338	P	6-25	1550	M	Y	21	19	289	9253	SKIING	ROUGH	3	5DB	Y	3	10	.062
339	DB	6-16	1830	M	N	45	27	205	94517	ALL	CALM	3	0900	Y	2	3	.063
340	MP	08-25	1815	M		31	19	225	95833	CRUISE/	CALM	3	1500	Y	3	8	.065
341	P	101588	1758	M	N	27	16	130	94565	CRUISE	CALM	1	1600	Y	1	2	.067
342	DP	08-26	1730	M		37	17	140	95833	CRUISE	ROUGH	2	1400	Y	2	3	.067

OBS#	SITE	DATE	TIME	SEX	CONS	AGE	LENGTH	HORSE	ZIP	ACTIVITY	WATER	PERS	STTIME	BEV	QUA	SEF	BAC
343	DP	08-26	1514	M		24	12	10	95820	FISH/CR	ROUGH	2	0730	Y	2	1	.068
344	DB	6-16	1508	M	Y	40	32	520	94514	CRUISE	CALM	1	1300	Y	1	2	.073
345	JV	08-19	1845	M		70	19	75	96008	FISH/CR	CALM	2	15DB	Y	2	0	.075
346	L	6-18	1650	M	Y	37	16	25	94516	CRUISE	CALM	2	1400	Y	2	3	.080
347	SI	102288	1559	M	N	55	24	165	92107	FISH	CALM	3	0700	Y	3	3	.088
348	CP	101688	1655	M	N	31	19	260	94403	FISH	CALM	3	1330	Y	3	2	.098
349	P	6-25	1630	F	N	33	21	400	92345	OTHER	CHOPPY	2	0600	Y	2	3	.101
350	BI	6-17	2044	M	Y	26	16	351	94509	CRUISE		2	1400	Y	0	0	.104
351	DP	08-26	1750	M		21	17	115	95842	SKIING	CALM/R	4	1400	Y	4	3	.105
352	L	6-18	1550	M	N	37	24	260	94561	CRUISE	ROUGH	3	7DB	Y	2	2	.105
353	M	6-22	1928	M	Y	38	18	125	93612	SKIING	CALM	8	1300	Y	8	4	.116
354	MP	08-25	1945	M		27	19	260	95831	SKIING	CALM	2	1430	Y	2	6	.118
355	MP	08-25	1825	M		26	19	375	95822	CRUISE	CALM	2	1400	Y	2	2	.119
356	M	6-22	1750	M	Y	38	18	453	93617	SKIING	CALM	3	1400	Y	3	0	.210
357	M	6-22	1820	M	Y	35	19	300	93711	CRUISE	CALM	4	1200	Y	2	4	.235

APPENDIX C

This appendix gives an abbreviated listing of the boating accident database developed earlier by VNTSC under this project. The columns contain the following data items:

1. Observation Number

2. Age of victim (0 = unknown)

3. Sex of victim (0 = unknown)

4. Was this victim the operator? (0 or 9 = unknown)

5. Length of boat (99 = unknown)

6. Month in which accident occurred

7. Number of persons on board (99 = unknown)

8. Time of day (99 = unknown)

9. BAC of victim (999. = unknown)

This listing is limited to California (1984 and 1985) and to the above 8 data items.

Obs	Victim Age	Victim Sex	Operator	Length	Month	P-O-B	Time	BAC
1	18	M	-0-	14	11	04	14	0.
2	15	M	-0-	14	11	04	14	0.
3	22	M	N	18	05	06	18	0.
4	33	M	N	12	01	03	12	0.
5	49	M	Y	16	12	02	16	0.
6	47	M	Y	16	02	03	13	0.
7	40	M	Y	13	05	01	13	0.
8	67	M	Y	16	06	03	09	0.
9	-0-	M	Y	17	08	01	10	0.
10	52	F	N	16	08	05	22	0.
11	70	-0-	N	18	02	03	99	0.
12	70	M	Y	18	02	03	99	0.
13	29	M	Y	10	01	03	99	0.
14	-0-	M	Y	40	01	03	16	0.
15	20	F	N	20	10	09	03	0.
16	56	M	Y	19	12	05	99	0.
17	53	M	N	40	03	05	12	0.
18	32	F	Y	07	07	02	13	0.
19	31	F	Y	18	03	02	99	0.
20	59	M	-0-	15	06	04	15	0.
21	56	M	N	14	08	03	17	0.
22	32	M	Y	12	12	02	09	0.
23	30	M	Y	27	02	03	14	0.
24	85	M	Y	12	04	02	07	0.
25	99	M	-0-	16	06	03	09	0.
26	80	M	N	18	07	03	10	0.
27	24	M	N	14	03	04	12	0.
28	22	M	Y	06	06	02	11	0.
29	68	M	Y	15	04	02	08	0.
30	07	M	N	15	03	03	21	0.
31	12	M	N	15	03	03	21	0.
32	14	M	-0-	14	11	04	14	0.
33	30	M	N	18	06	04	17	0.
34	64	M	Y	09	06	01	06	0.
35	65	M	-0-	15	06	04	15	0.
36	70	M	Y	17	06	01	07	0.
37	53	M	Y	99	02	02	99	0.
38	30	M	-0-	99	08	99	11	0.
39	59	M	N	16	03	03	07	0.
40	39	M	Y	18	08	01	99	0.
41	67	M	-0-	12	04	02	07	0.
42	25	M	Y	99	07	03	18	0.
43	35	M	Y	99	04	01	18	0.
44	16	M	Y	16	12	03	14	0.
45	27	M	Y	10	08	01	17	0.
46	26	M	Y	15	06	02	14	0.
47	54	M	Y	14	04	03	13	0.
48	18	M	Y	99	06	02	18	0.
49	50	F	N	18	07	14	18	0.
50	19	M	N	99	06	02	18	0.
51	47	M	N	19	12	05	99	0.
52	17	M	Y	14	08	02	99	0.
53	48	M	Y	36	04	07	16	0.02

54	34	M	Y	16	04	04	99	0.02
55	18	M	Y	14	11	03	99	0.02
56	99	M	-0-	16	06	03	09	0.02
57	82	M	Y	99	10	01	16	0.03
58	63	M	N	20	05	03	07	0.03
59	27	M	Y	16	03	03	13	0.03
60	23	M	Y	99	11	02	11	0.03
61	61	M	Y	14	05	03	23	0.03
62	48	M	Y	16	02	03	13	0.04
63	20	F	N	18	06	01	16	0.04
64	27	M	Y	14	12	04	08	0.05
65	24	M	N	16	03	03	13	0.05
66	24	M	Y	13	05	99	17	0.05
67	20	M	N	16	08	05	22	0.05
68	61	M	N	16	03	03	07	0.06
69	20	M	N	99	07	02	13	0.07
70	30	M	N	27	02	03	14	0.07
71	25	M	N	23	07	04	10	0.07
72	24	F	N	44	08	03	20	0.07
73	24	M	Y	18	08	01	19	0.08
74	51	M	Y	15	06	04	15	0.08
75	32	M	N	99	04	03	16	0.08
76	52	M	Y	33	03	05	99	0.08
77	27	M	N	20	02	04	10	0.09
78	64	M	Y	14	06	01	14	0.09
79	24	M	N	20	10	09	03	0.09
80	23	M	Y	16	11	02	15	0.1
81	-0-	M	N	18	06	03	15	0.1
82	22	M	N	20	10	09	03	0.1
83	27	M	N	20	10	09	03	0.11
84	42	M	-0-	17	02	02	99	0.12
85	84	M	Y	21	01	01	14	0.12
86	20	M	Y	06	07	02	15	0.14
87	47	M	Y	44	09	06	01	0.14
88	19	M	Y	17	01	02	17	0.14
89	24	F	N	20	10	09	03	0.14
90	41	M	Y	26	05	01	13	0.15
91	50	M	Y	08	10	02	99	0.15
92	55	M	-0-	17	02	02	15	0.16
93	36	M	N	15	07	06	16	0.16
94	-0-	M	N	12	08	02	20	0.17
95	33	M	N	16	03	05	06	0.18
96	25	M	N	14	12	02	19	0.18
97	28	M	Y	16	08	05	22	0.19
98	67	M	Y	12	05	01	17	0.19
99	-0-	M	N	19	07	02	13	0.19
100	36	M	Y	12	05	02	22	0.19
101	63	M	Y	45	11	06	07	0.22
102	58	M	N	33	03	05	99	999.
103	32	M	Y	14	02	01	16	999.
104	12	F	N	17	05	06	17	999.
105	32	M	Y	18	06	01	06	999.
106	55	M	Y	16	06	03	21	999.
107	-0-	F	N	40	01	03	16	999.

108	33	M	N	20	02	04	10	999.
109	13	M	N	21	09	13	06	999.
110	13	M	N	26	03	12	13	999.
111	31	M	Y	12	05	02	03	999.
112	53	M	N	33	03	05	99	999.
113	24	M	Y	15	03	04	12	999.
114	13	M	Y	07	03	01	14	999.
115	62	M	N	16	08	06	19	999.
116	71	M	N	36	10	06	13	999.
117	43	M	Y	12	01	01	99	999.
118	65	M	N	14	08	02	03	999.
119	26	M	-0-	06	08	02	99	999.
120	38	F	Y	18	03	02	99	999.
121	47	M	Y	12	05	01	16	999.
122	42	M	Y	99	03	99	99	999.
123	25	M	9	13	10	02	99	999.
124	22	M	9	13	10	02	99	999.
125	27	M	-0-	22	09	02	99	999.
126	33	M	Y	99	11	01	12	999.
127	49	M	N	12	05	02	22	999.
128	28	M	Y	99	04	01	19	999.
129	58	M	N	18	06	02	14	999.
130	56	M	N	33	03	05	99	999.
131	44	M	Y	32	11	01	99	999.
132	22	F	N	18	05	06	18	999.
133	28	M	N	21	08	03	17	999.
134	-0-	M	-0-	32	09	04	22	999.
135	62	-0-	Y	16	02	03	13	999.
136	53	M	Y	23	05	02	22	999.
137	27	M	Y	16	01	02	99	999.
138	50	M	N	27	09	03	15	999.
139	45	M	N	12	11	02	14	999.
140	67	M	N	30	11	07	15	999.
141	03	M	N	15	07	06	16	999.
142	22	M	N	14	11	03	99	999.
143	21	M	N	14	11	03	99	999.
144	49	M	Y	12	03	01	16	999.
145	19	M	N	33	03	05	99	999.
146	39	M	N	19	12	05	99	999.

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