A Comparative Analysis of Recreational Boating Policies: "Quick Phase-In" Education vs. Other Education Policies

Conducted for the United States Coast Guard's Office of Boating Safety

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Table of Contents

List of Figures

List of Tables

Executive Summary

In an effort to reduce the number of recreational boating accidents, injuries, and fatalities, many States have implemented various types of education and licensing requirements in recent years. This analysis uses several approaches to compare the States using these policies:

- Literature review of studies concerning the effectiveness of education.
- Analysis of accident data submitted from each State contained in the United States Coast Guard's Boating Accident Report Database (BARD).
- Analysis of State recreational boating education legislation.
- Analysis of the recreational boating education policies of Alabama and Connecticut, which employ a Quick Phase-In (QPI) approach.

Our search of literature on education's effectiveness as an intervention revealed that selection of an appropriate policy for mandating education/licensing and the manner in which it is implemented is vital to its success. The analysis of BARD data from 1995-2005 indicates the national median age of operators using vessels equipped with propulsion machinery who were involved in fatal accidents is forty years of age. Thus, the majority of these operators are not adequately addressed by youth-based policies.

Using an eleven year analysis period that compared the first five years to the last six years (pre versus post phase-in completion), we observed a decline in fatalities between the two periods and tested results for statistical significance. Alabama and Connecticut, who have QPI education requirements, have experienced a 31 percent decline in fatality rates (fatalities per 100,000 registered motorized vessels). This exceeded the national level of 15 percent since 1995. There was a 27 percent fatal accident rate (fatal accidents per 100,000 registered motorized vessels) reduction for these QPI States (AL and CT) versus an 11 percent reduction for the rest of the country. Similarly, the decline in both States individually exceeds those of their combined bordering States. Grouping the States based on policy type showed that over the same period, QPI States experienced a greater reduction in fatality rates than the others.

The results indicate that, following the phase-in period, States implementing QPI requirements may observe a greater reduction in fatalities when compared to the rest of the country. We would expect that such a decline would be more pronounced than that seen from States implementing different education policies. Our analyses also show that the decline in fatality rates for that QPI State would be greater than their bordering States. In the coming years, as more QPI periods are completed, it will be useful to reevaluate this analysis based on the results observed in Washington, Oregon, New Hampshire, New Jersey as well as States which adopt different education requirements.

Introduction

The 2002 National Recreational Boating Survey conducted for the U.S. Coast Guard shows that 37.9 percent of propeller driven boat operators and 30.7 percent of water jet driven boat operators reported having taken a boating safety course (Strategic Research Group, 2003). In the same year, only 11.1% of operators involved in fatal accidents reported having received formal boating safety education. This snapshot shows that in 2002 a disproportionately larger number of boat operators who did not complete a boating education course were involved in fatal accidents. We have seen recreational boating fatalities [associated with vessels equipped with propulsion machinery] decline almost 50 percent from 1981 to 1995. However, over the past eleven years, fatalities involving these same type of vessels have hovered between 500 and 650, with a good deal of annual variation.

As a result of such statistics and trends, most states and territories (47 out of 56) have pursued motorboat operator education requirements as a way to reduce the current level of fatalities. Historically, there have been no requirements for recreational vessel operators to demonstrate: (1) their knowledge of safe boating practices or (2) their application of the regulatory and statutory rules that govern the safe operation and navigation of their vessel. The belief is that a more aware and informed recreational boating population is more likely to take safety precautions while on the water and thus, reduce their risk of being in a fatal accident.

In this analysis, we grouped policies together based on similarities in their manner of implementation and the population affected. Our primary categories are requirements based on: (1) the operator's Date of Birth (DOB); (2) Operator Age; (3) the use of a Personal Watercraft (PWC); and (4) requiring operators to obtain an education certificate within a short period of time. Our analysis suggests that this last approach (4) will be the most effective in reducing the number of fatal accidents by rapidly targeting a wider age range of operators.

The structure of these Quick Phase-In (QPI) approaches has been relatively similar across the States that have implemented them, with each year of the phase-in period covering a large set of ages. The primary variation has been the length of time over which education requirements are phased-in, for instance, Alabama and Connecticut have completed their five year phase-in programs, while other States have chosen slightly longer phase-in periods that are still in progress. Considerations such as the national age distribution of motorized vessel fatal accidents – only 5 percent of operators were between ages two and eighteen – along with other information leads us to believe that QPI education requirements will be the most effective in reducing fatalities among States. Using eleven years of detailed data, our analysis and results support this hypothesis.

Effectiveness Variability among Education Policies

Different types of mandatory education/licensing programs for recreational boaters can have varying results. As previously stated, we believe that QPI requirements are more effective than other formats of mandatory education. Studies from other

activities/industries have shown the importance of properly selecting and implementing education policies. The studies we examine below had a range of conclusions about the effectiveness of education on operator behavior. Differences in the subject and manner of implementation underscore the importance of matching the right education policy with the right goal.

Automobile driver education and licensing policies have not proven to be wholly successful. Scientific studies were not able to show that basic driver training was an effective safety measure, likely due to a failure in adequately addressing age/experience factors that cause youths to be at a higher risk of accidents (Mayhew and Simpson, 2002). Evidence does suggest that provisional licensing and graduated licensing programs, that allow teenaged drivers to gain experience before driving unsupervised, are effective at reducing teen crash risk (Masten, 2005). One study concluded that visually-impaired older drivers may benefit from educational interventions by reducing their driving exposure and increasing their avoidance of visually challenging driving situations (Owsley, Stalvey, and Phillips, 2003). Thus, it appears that automobile driver education has the potential to be effective, provided it is correctly implemented.

Other studies on education policies for diverse segments of public safety have shown a variety of results. A National Institute for Occupational Safety and Health (NIOSH) study concluded that worker training policies which provide opportunities for applying the knowledge gained through incentives or other means produce the best results (Cohen and Colligan, 1998). An Australian study showed that safety classes did not reduce the risks of bicycle injury in children and may have produced harmful effects in some children by encouraging risk taking; suggesting there is a need to monitor the implementation of the course more closely (Carlin, Taylor, and Nolan, 1998). Evaluation of pedestrian safety education programs revealed that they can change observed road crossing behavior, but the overall results varied considerably (Duperrex, Bunn, and Roberts, 2002). Again, it appears that education has the potential to be effective, but the manner in which the policy is implemented can impact the results.

All of these education programs from other activities/industries support the need for proper education program selection. We believe that the varying results reported in the available literature can be compared to the variation in mandatory boat operator education programs across the United States and its Territories. Essentially, it is not good enough to implement any type of education/licensing program. In order to achieve the desired end state, the appropriate policy for mandating education/licensing must be selected.

Data Sources and Analysis

In this analysis, we have worked primarily with the U.S. Coast Guard's Boating Accident Report Database (BARD) System. The Coast Guard believes that nearly all fatal recreational boating accidents are captured by the BARD System. According to the Code of Federal Regulations, Title 33, Part 173.55:

> (a) The operator of a vessel shall submit the casualty or accident report prescribed in Sec. 173.57 to the reporting authority prescribed

> in Sec. 173.59 when, as a result of an occurrence that involves the vessel or its equipment:
> (1) A person dies; or
> (2) A person is injured and requires medical treatment beyond first aid; or
> (3) Damage to vessels and other property totals $2,000 or more or there is a complete loss of any vessel; or
> (4) A person disappears from the vessel under circumstances that indicate death or injury.

In addition to compiling boating casualty statistics, the Coast Guard's Office of Boating Safety annually compiles statistics on registered boats that are equipped with propulsion machinery in the fifty States, five Territories and the District of Columbia. All States and Territories include the registration of such vessels in their respective systems. We have utilized boat registration data in this analysis to provide a level field among States that had different magnitudes of fatalities as a result of larger or smaller boating populations. Since education policies focus on motorized vessels, whenever possible in our analysis, we have removed non-motorized vessels from the dataset. Registration data from 1996 through 2005 are detailed enough to allow removal of non-motorized vessels.

Limitations of the Analysis

The limitations of our analysis can be grouped into three primary categories: the data source, variables and the sample size. BARD is the only viable and credible data source for recreational boating fatalities, but it is not random and only represents the set of reported negative outcomes (i.e. fatalities and fatal accidents) associated with the use of recreational boats. Our study is also limited by the variables, such as demographics, geology, weather, and policy differences among the fifty-six (56) States and Territories. We also did not have data regarding operator compliance for QPI requirements or any of the education policies. Finally, only a few States had fully phased in requirements during the eleven year period of this analysis, creating a small sample size.

Methodology

To provide a thorough analysis based on the available BARD data, we have employed several methods of analysis. Only looking at the beginning and ending-years of the analysis would not allow for a thorough investigation of policy effects over time, therefore, we used multiple-year periods for comparison. Separating the eleven years of data into a five year pre phase-in completion period versus a six year post phase-in completion period, we have observed the decline in fatalities between the two periods and tested the results for statistical significance. In addition we used rolling averages over the eleven year time period to develop trend analyses looking at the trajectory of State

fatality rates. In both analyses, QPI States were compared to the rest of the country, their bordering States, and States aggregated by policy type.

Decline in Fatal Accident Rates – Statistical Significance and Interpretation

To find an observable effect of QPI requirements on Fatal Accident Rates (FARs), we used the U.S. Coast Guard's Boating Accident Report Database (BARD) as our primary data source. Since most education requirements apply only to motorized recreational vessels, we removed non-motorized vessels from the data set. Connecticut's QPI period was completed in late 1997 and Alabama's was completed in early 1999. Oregon and New Hampshire are still in the process of implementing QPI requirements, which are scheduled to be completed in 2008 and 2009 respectively. We divided the data set into the approximate "pre" (1995-1999) and "post" (2000-2005) QPI completions for Alabama and Connecticut (Table 1). We established FARs by using the number of annual motorized vessel fatal accidents reported in BARD per 100,000 registered vessels, excluding non-motorized vessels:

$$\left(\frac{motorized\ vessel\ \ fatal\ accidents}{100{,}000\ motorized\ vessels} \right) \Rightarrow FAR$$

Registered vessels are reported by States annually, data from 1996 and later is detailed enough to isolate the motorized vessel data. We chose to use fatal accidents as the representative statistic to better focus on the effect of QPI requirements through operator behavior.

When analyzing the QPI States from 1995 through 2005 (AL and CT aggregated), we observed a larger reduction in the FARs compared to the rest of the nation. Similarly, a larger reduction was also apparent when comparing Alabama and Connecticut to their neighboring States. Table 1 (below) compares average FARs from the pre phase-in completion to the post phase-in completion on national and regional levels:

$$100 - \left(\frac{average\ FARs\ \ from\ 2000\ to\ 2005}{average\ FARs\ \ from\ 1995\ to\ 1999} \right) \times 100 = \%\ reduction\ in\ FARs$$

Table 1. Comparison of Fatal Accident Rates for Pre/Post Phase-In Completion (AL, CT)

Quick Phase-in vs. All Other States	Per Hundred Thousand Registered Motorized Vessels*			
	Avg. 1995-1999 Fatal Accident Rates	Avg. 2000-2005 Fatal Accident Rates	% Reduction in Fatal Accident Rates	Average Annual Registered Motorized Boats
QPI	5.7	4.2	**27%**	363,834
Rest of U.S.	4.5	4.0	**15% Worse than QPI****	11,646,545
Alabama	7.0	5.3	**25%**	260,509
MS, FL, GA, TN	5.6	4.7	**9% Worse than AL****	1,680,447
Connecticut	2.4	1.6	**34%**	103,325
NY, MA, RI	3.4	2.6	**10% Worse than CT**	692,467

* 1995 includes all boats registered

** Indicates statistically significant results

As noted in Table 1, the sizeable reduction in the FAR of the QPI group (AL and CT) relative to the rest of the country was statistically significant. Likewise, Alabama appeared to show a statistically significant reduction in its FAR relative to its neighboring States. Connecticut did not show statistical significance in FAR changes relative to its neighbors due to the large annual fluctuation in FARs; particularly in 1998 (*Appendix A contains tables displaying the decrease in fatal accident rate*).

Along with the FAR (the number of accidents resulting in any fatalities per 100,000 vessels) we analyzed Fatality Rates (FR) (the total number of fatalities per 100,000 vessels). As illustrated in Table 2, the FRs were slightly higher than the FARs from Table 1, given that more than one fatality can occur per fatal accident (*Appendix B contains tables displaying the decrease in fatality rate*). The difference in reductions between QPI and non-QPI States is similar to that found in Table 1 (*Appendix C contains a table displaying the calculation of statistical significance*).

Table 2. Comparison of Fatality Rates for Pre/Post Phase-In Completion (AL, CT)

	Per Hundred Thousand Registered Motorized Vessels*		
	Avg. 1995-1999 Fatality Rate	Avg. 2000-2005 Fatality Rate	% Reduction in Fatality Rates
QPI	6.5	4.5	**31%**
Rest of U.S.	5.3	4.5	**16% Worse than QPI****
Alabama	7.8	5.6	**29%**
FL, GA, MS, TN	6.5	5.2	**10% Worse than AL****
Connecticut	3.0	1.9	**37%**
MA, NY, RI	4.2	3.1	**12% Worse than CT**

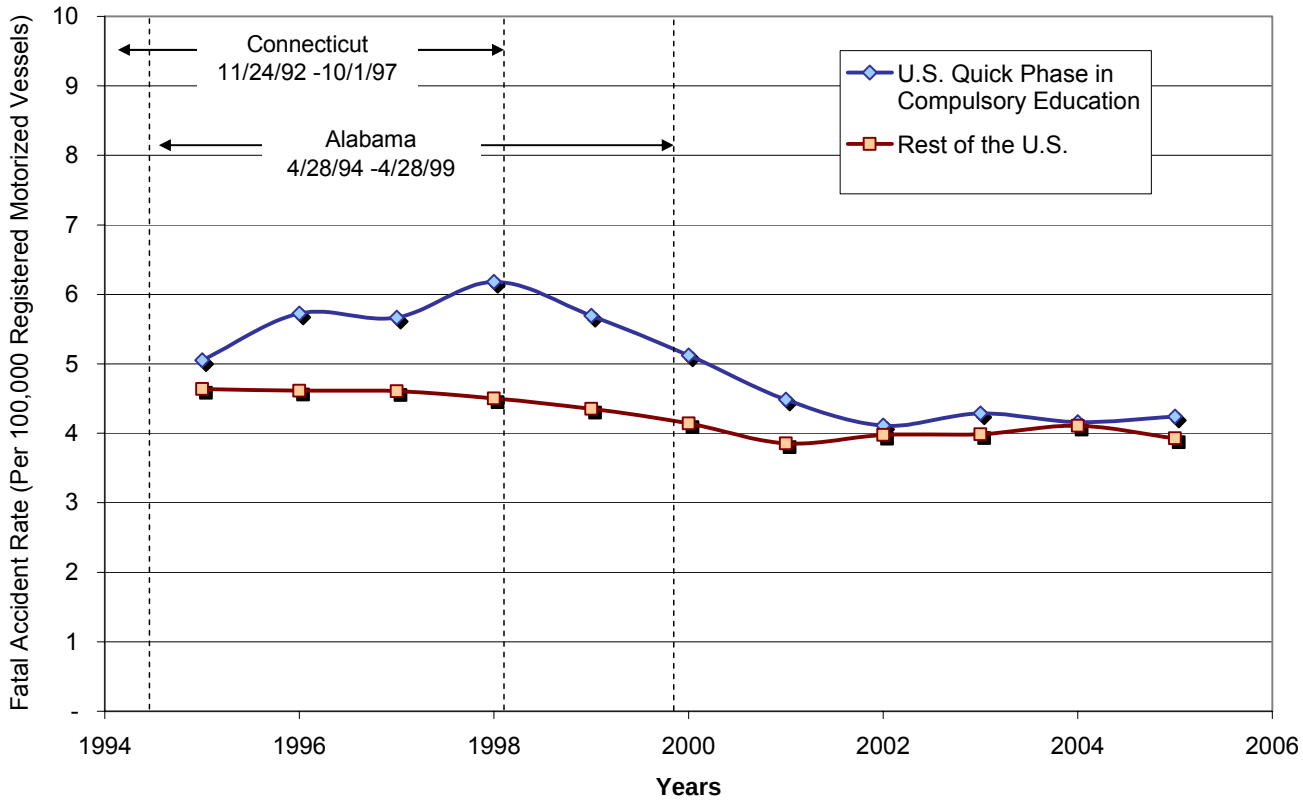
* 1995 includes all boats registered

** Indicates statistically significant results

Fatal Accident Rate Trends

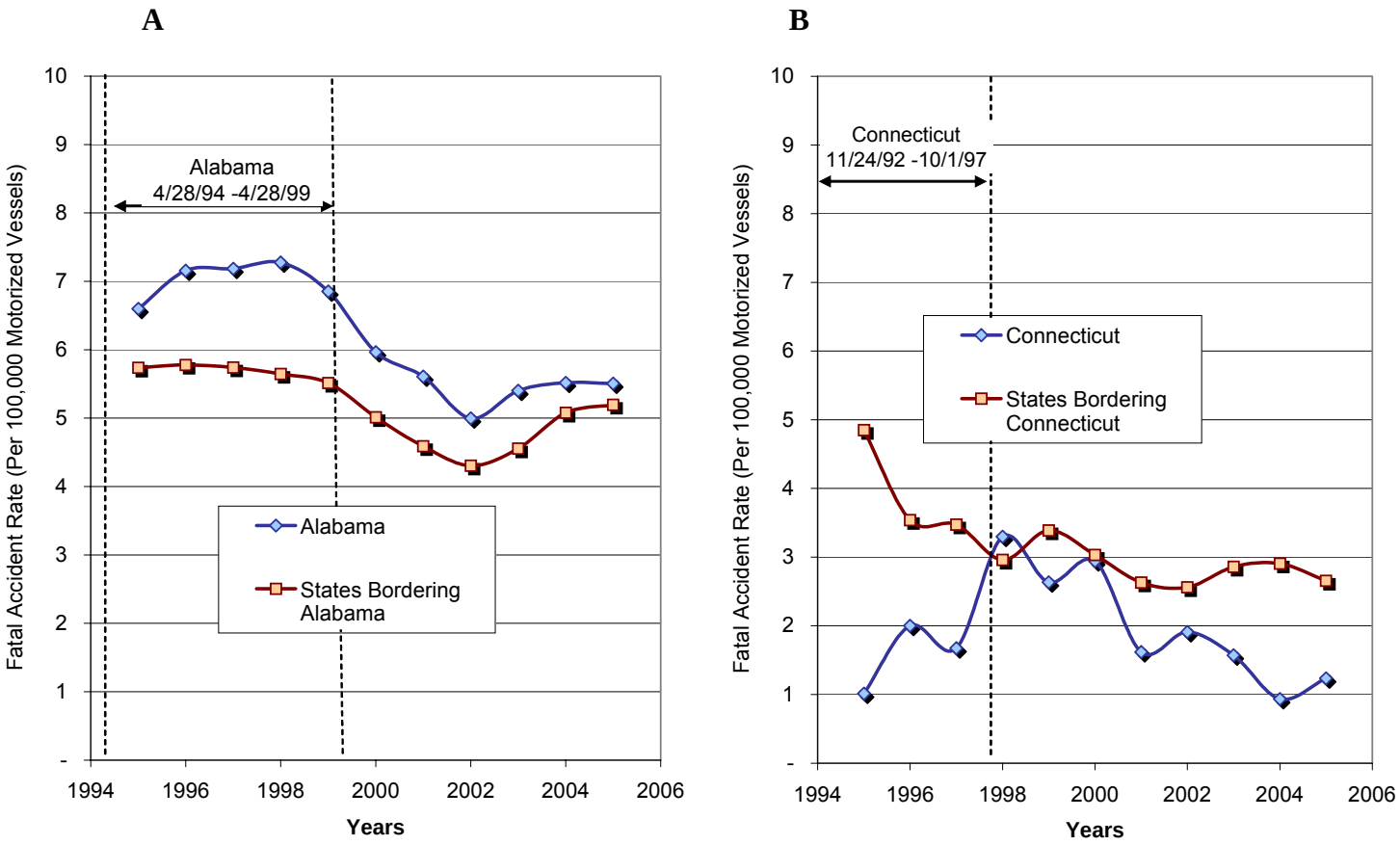
Using FAR (fatal accidents per 100,000 registered vessels), we plotted the eleven year period of 1995 through 2005 for Alabama, Connecticut, and all other U.S. States. We used a three year rolling average to display a smoother trend that visually assists in comparisons by averaging each year with the two years prior to it before plotting the resultant value on the graph. As shown in Figure 1, following a spike in 1998 driven by an abnormally high number of fatal accidents, AL and CT showed an overall decrease in FAR through the remaining years of the study. This decline corresponds with the end of the QPI period for both States, it also appears to be pronounced and sustained relative to the FAR for the rest of the country.

Figure 1. Fatal Accident Rates (1995-2005) – QPI States Compared to the Rest of the United States (3 Year Rolling Average)



We also plotted the three year rolling average for both Alabama and Connecticut on the same graph as the three year rolling average of their neighboring States (Figures 2A and 2B). In Figure 2A, Alabama follows a pattern similar to the States bordering it, suggesting that some factors affecting the FAR are regionally influenced. From Table 1 we can see that Alabama has managed to narrow the gap with its bordering States, reducing its FAR by 10% more than the other States. Figure 2B shows that Connecticut's FAR trend did not match that of its bordering States, primarily because the low number of motorized vessel fatal accidents in CT leads to a large variance from year to year in the FAR. The chart also shows CT's FAR trend increased through 1998 before experiencing a pronounced and sustained decline with some of the annual variation observed throughout CT's timeline. The States bordering Connecticut showed a FAR decline, but it was neither sustained nor as great as either of the QPI States. From these charts we are able to conclude that on a regional level, the two States with QPI requirements (AL and CT) over the last five years have seen a greater and more sustained reduction in fatal accidents relative to their neighboring States.

Figure 2. Fatal Accident Rates (1995-2005) – AL and CT Compared to their Bordering States (3 Year Rolling Average)



Historical Trends in Connecticut and Alabama vs. the Rest of the U.S.

To establish long term trends and differences between QPI States (AL and CT) and the rest of the U.S., we have taken historical fatal accident data from the USCG Annual Boating Statistics Reports dating back to 1981. Figure 3 shows the FAR trends from 1985 through 2005 as a three year rolling average. There was not enough detail in the Annual Boating Statistics Reports prior to 1995 to exclude non-motorized vessel data from this analysis. A comparison of the trends in the latter half of Figure 3 to the QPI trends excluding motorized vessels (Figure 1) established that while the magnitude grew when non-motorized vessels are included the trend changed very little, if at all. This implies, as expected, that any impact on the FAR has an even greater impact on the FR, reducing total fatalities by a higher percentage.

Figure 3. Fatal Accident Rates (1985-2005) – QPI States Compared to the Rest of the United States (3 Year Rolling Average)

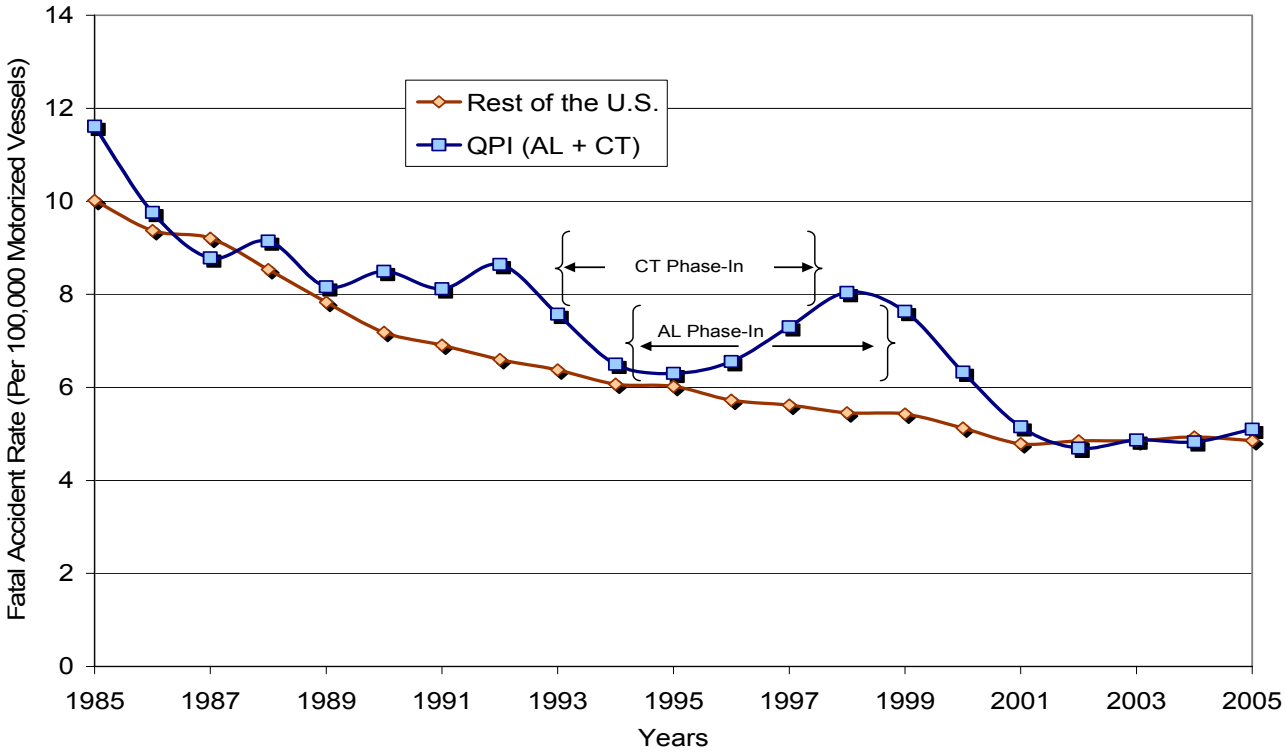


Figure 3 shows that from the late 1980's through 1992 (the first year of Connecticut's QPI program), the FAR for the QPI States remained between eight and nine, declining only slightly. During this period the rest of the U.S. experienced a steady decline in their FAR, indicating that CT and AL were performing more poorly than the rest of the country. A pronounced decline in the QPI States relative to the U.S. followed for the next 3 years as both Alabama and Connecticut began phasing in their education requirements. In 1996 the FAR began an upward trend that lasted until1998. Connecticut and Alabama requirements were completely phased in by late 1997 and early 1999 respectively; around the same time the FAR began to decline. This decrease – 1998 to 2001 - was more pronounced than the overall U.S. downward trend and the FAR seems to have stabilized at a lower rate since 2001.

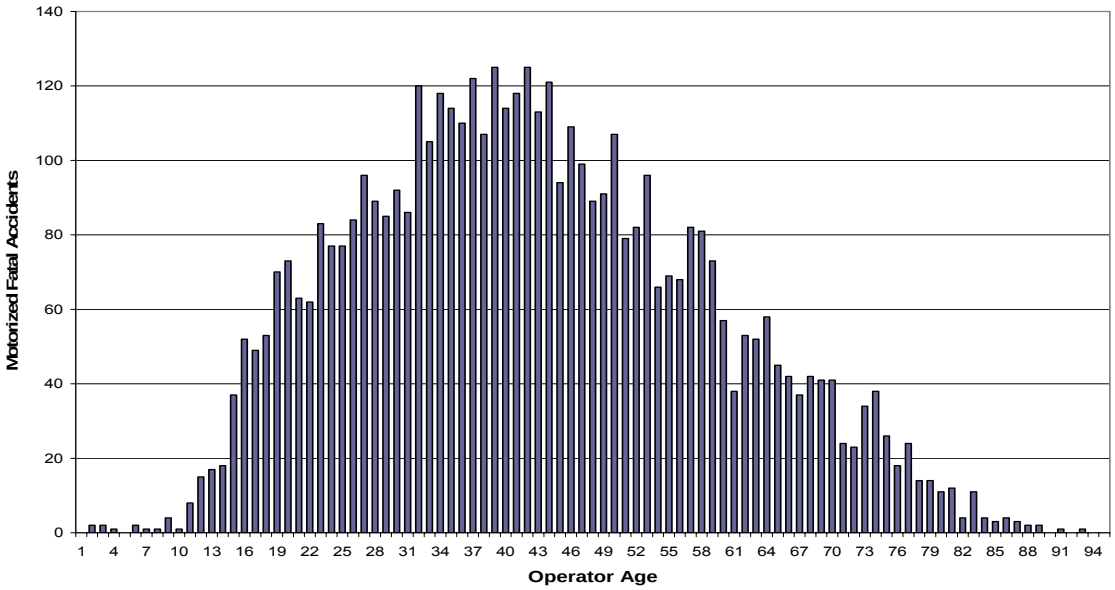
Education Policy and Operator Age Considerations

The primary advantage of QPI requirements is that they target wide ranging age of boat operators over a short period of time. By contrast, there are seventeen States that have a youth-based Operator Age requirement and fourteen States that have a DOB cut-off for mandatory education. The youth-based Operator Age requiring States generally set a range – i.e. twelve to seventeen year olds – for which education is mandatory. The

DOB cut-off policies establish a date after which anyone born will require boating safety education (*Appendix D contains tables displaying types of State boating safety education policies*).

Figure 4 displays the total number of recreational motorized vessel accidents involving a fatality by the operator's age from 1995 through 2005. Nationally, the median age of operators involved in a fatal accident is forty years of age. This means that in approximately 50 percent of the fatal motorized vessel accidents, the operator was over the age of forty. Thus, the seventeen States with youth-based Operator Age requirements, that also have a similar median age, are not reaching the majority of boaters involved in fatal accidents.

Figure 4. Motorized Fatal Accidents by Operator Age from 1995 through 2005



The fourteen States DOB cut-off will have a long wait before they begin reaching boaters that are forty years of age; consequently, they are delaying the intervention. For instance, Maryland has the earliest DOB cut-off – 7/1/1972 – meaning that Maryland will not even reach approximately 50 percent of its presumed target audience until 2012. Similarly, New Mexico and Tennessee have the latest DOB cut-off year – 1989 – as a result the boat operators in those States will not be forty years of age until 2029. Thus, the main drawbacks of education programs that do not require a QPI for all ages are either a failure to address the majority of operators or the delay that occurs in educating the wide ranging age group of operators who are involved in fatal accidents.

Historical Effectiveness of Differing Policies

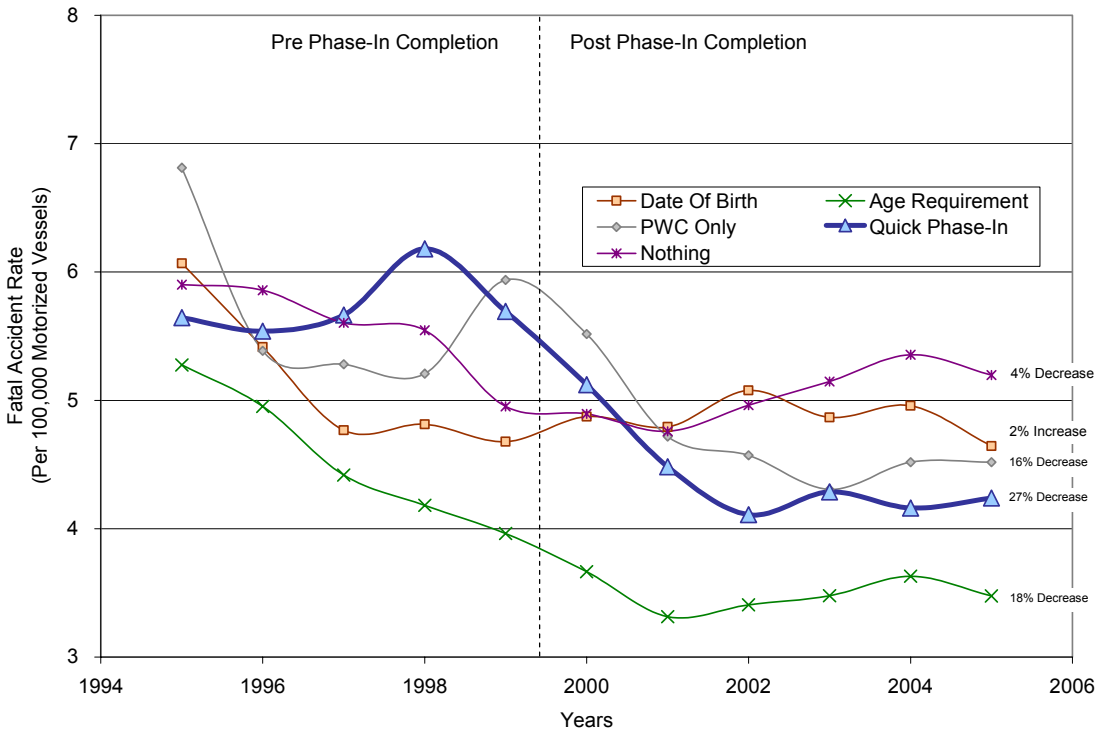
Grouping States by their education policies, we have done an analysis similar to the regional analyses discussed earlier, with the trends shown in Figure 5 verifying the conclusions above. Clearly the QPI States (AL and CT) have the highest reduction in

FAR, beginning the eleven year period with the second highest FAR on average for the first five years and dropping to the second lowest FAR by the end of the analysis period.

While States with Operator Age Requirement policies have a lower FAR in the later years, they had a similarly low FAR in the earlier years, before policies for most States had come into effect. In addition, the smaller reduction and recent rise in FAR suggests that States with QPI policies may soon achieve a FAR lower than those with Operator Age Requirement policies.

Although States pursuing only PWC policies did see some FAR reduction over time, it is not on the scale of QPI States. Moreover, as shown below, the variance in annual FAR has made determining a trend for this group particularly difficult. The States with Date of Birth policies show little or no real decline over the eleven year span, and those States with no education policy mostly follow the national trend, though at a higher average FAR. *(As previously mentioned, Appendix D contains tables displaying types of State boating safety education policies*).

Figure 5. Fatal Accident Rates (1995-2005) – Grouped by Education Policy Type (3 Year Rolling Average)



A statistical analysis of these trends, shown below in Table 3, further illustrates our conclusions derived from Figure 5. The analysis indicates that for States with Date of Birth, Operator Age Requirement or no educational policies, the trends that we observe are statistically significant. Unfortunately, as we can see from Figure 5, the variance in the FAR for States with PWC policies prevents us from drawing similarly meaningful

conclusions. In addition Table 3 shows quantitatively the difference in FAR reductions between States with different types of education policies. This difference shows once again that States with QPI requirements (AL and CT) have experienced a much larger reduction over the last eleven years than States with other education policies.

Table 3. Comparison of Fatal Accident Rates for Pre/Post Phase-In Completion (Grouped by Education Policy Type)

Quick Phase-In vs. All Other States	Per Hundred Thousand Registered Motorized Vessels*		
	Avg. 1995-1999 Fatal Accident Rates	**Avg. 2000-2005 Fatal Accident Rates**	**% Reduction in Fatality Rates**
Quick Phase-In	5.70	4.18	**27%**
Date Of Birth	4.74	4.86	**-2%** *(29% Worse than QPI**)*
Age Requirement	4.20	3.44	**18%** *(9% Worse than QPI**)*
PWC Only	5.40	4.55	**16%** *(11% Worse than QPI)*
No Education Policy	5.30	5.08	**4%** *(23% Worse than QPI**)*

* 1995 includes all boats registered

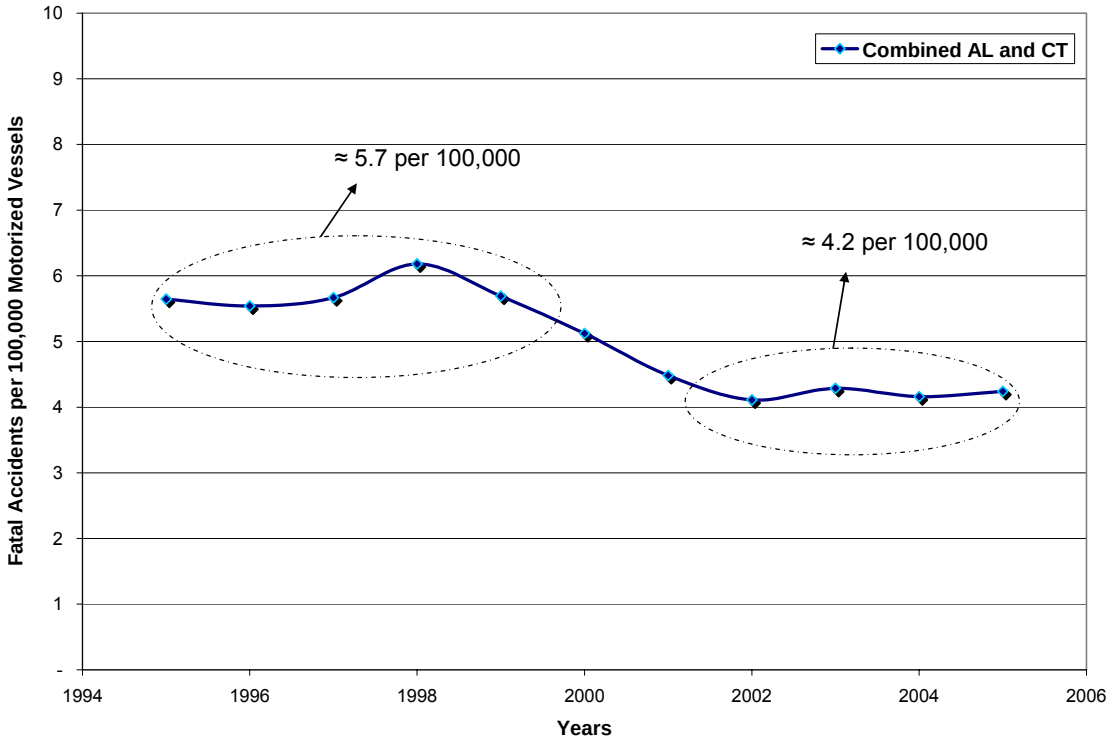
** Indicates statistically significant results

Predicting the Trend for Future Quick Phase-In (QPI) Requiring States

Earlier in this analysis, we established that States which have elected to implement a QPI requirement have shown a greater improvement in FAR when compared to the rest of the United States. In this discussion, we use Alabama and Connecticut as models to predict what other States with QPI requirements can expect in the future. One assumption is that QPI requirements are the primary factor in the decline of the FAR for Alabama and Connecticut. Another assumption is that Alabama and Connecticut are following a trend that other States would also follow if they implemented QPI requirements. Figure 6 presents the combined three year rolling average of Alabama and Connecticut, portraying what States seeking to implement QPI requirements could expect, given the aforementioned assumptions.

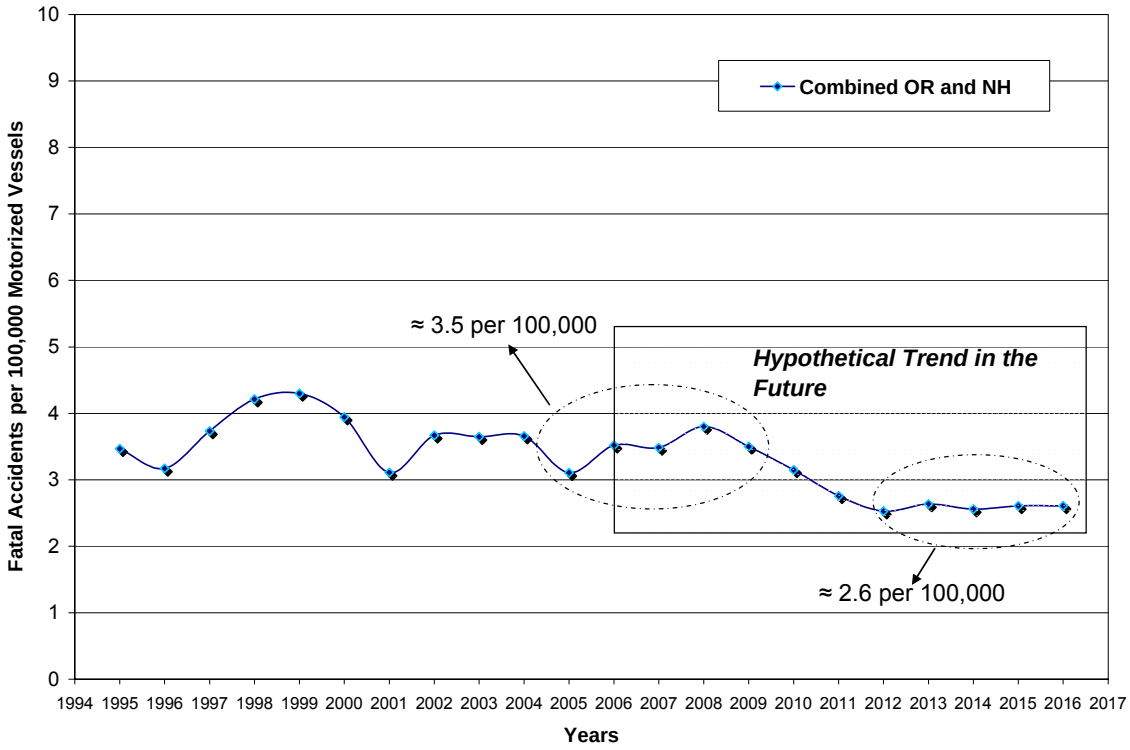
Figure 6 shows that during the QPI period FAR remained level and even rose somewhat, likely due to normal yearly fluctuations. After the QPI period was complete (1998/1999), FAR declined and then leveled off at a lower FAR. The overall decline in FAR represented a decrease in approximately 1.5 fatal accidents per 100,000 registered motorized vessels and this represents a 25 percent decline in FAR. Therefore, jurisdictions that plan on implementing QPI requirements could first expect normal fluctuations in the FAR. After the QPI period, the FAR would decline for a few years before leveling off at a value that is approximately 25 percent lower.

Figure 6. Fatal Accident Rates (1995-2005) – QPI States' Overall Decline in FAR (3 Year Rolling Average)



Oregon and New Hampshire will be interesting States to observe during the next ten years. New Hampshire's mandatory QPI education requirement began in 2002 and Oregon's started in 2003. They are both nearing the completion of the QPI period (2008 and 2009) and could provide support for the discussion above, if their FAR starts declining in the years thereafter. Figure 7 illustrates what type of decline would be expected if Oregon and New Hampshire followed the same trend as Alabama and Connecticut.

Figure 7. Prediction of the Future FAR for Oregon and New Hampshire (3 Year Rolling Average)



Conclusions and Recommendations

Given the limitations of our dataset and the study period, it would be difficult to determine whether QPI requirements implemented in CT and AL were the primary cause of their precipitous decline in fatalities over the last six years. However, we have been able to show that AL and CT have fared better in terms of fatalities over the last eleven years than other States in regional, policy-based, and national comparisons. Among the same groups the eleven year trend analyses led to similar findings.

Overall, the results seem to indicate that States implementing QPI requirements can expect a steep decline in fatalities upon completion of the phase-in. Based on our research, we would expect that such a decline would be more pronounced than that seen from States implementing different education policies. In addition, our analyses show that the decline would be greater than the national and regional trends for that state.

In the coming years, as more QPI requirements are completed, it will be useful to reevaluate this analysis based on the results observed in WA, OR, NH, NJ as well as States which adopt different education requirements (*Appendix E contains policy summaries for QPI States*). The continued collection of data in the BARD database will be crucial to the ongoing evaluation of the States above as well as CT and AL. At this time, a thorough Recreational Boating Survey is planned, which will potentially provide another useful resource in future analysis. Data such as “hours on the water”, formal

boating education received for which a certificate was earned, and experience will allow for a non-biased dataset in the future which includes positive results (i.e., boat operators who received and did not receive education who were NOT in an accident, hours in which no boating accidents occurred) as well as negative.

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Appendix A – Decrease in Fatal Accident Rates (1995-1999 period compared to 2000-2005 period)

Table 4. All States - Decrease in Fatal Accident Rates

State	Fatal Accidents Per Hundred Thousand Motorized Vessels				Average Annual Registered Motorized Boats*	P-Value vs. QPI States
	Avg. 1995-1999 Fatal Accident Rate	Avg. 2000-2005 Fatal Accident Rate	% Reduction in Fatal Accident Rates	Average Annual Total Fatal Accidents		
US	**4.6**	**4.0**	***13%***	**509**	**12,010,379**	**-**
CT	2.7	1.5	***45%***	2	103,325	N/A
HI	18.9	5.6	***71%***	1	186,119	0.16
DE	7.5	2.7	***65%***	2	58,505	0.10
ID	9.3	4.5	***52%***	5	81,641	0.03
KS	3.9	1.9	***50%***	3	46,461	0.47
PR	4.2	2.2	***47%***	1	51,706	0.30
IN	3.8	2.1	***47%***	6	213,177	0.44
MT	6.9	3.9	***43%***	3	363,123	0.46
NH	2.8	1.6	***41%***	2	249,667	0.13
IA	2.7	1.6	***40%***	4	96,807	0.40
OK	7.6	4.7	***38%***	13	326,563	0.39
NV	12.1	7.5	***38%***	5	50,063	0.40
WV	5.9	3.7	***37%***	2	14,179	0.33
UT	9.1	6.0	***34%***	5	342,595	0.47
GA	5.1	3.4	***33%***	12	310,111	0.39
SC	5.3	3.7	***30%***	16	234,791	0.34
NY	3.4	2.4	***30%***	14	509,330	0.24
MO	5.6	4.0	***27%***	15	321,812	0.43
VI	23.8	17.9	***25%***	1	3,575	0.43
AR	7.1	5.4	***25%***	11	186,126	0.32
AL	7.1	5.4	***24%***	16	260,509	N/A
NC	5.2	4.0	***24%***	15	58,046	0.43
IL	3.9	3.0	***24%***	11	93,094	0.17
FL	7.2	5.5	***24%***	51	166,626	0.42
ND	4.7	3.7	***23%***	2	45,792	0.28
NJ	4.5	3.6	***20%***	8	94,834	0.16
WI	2.8	2.4	***15%***	14	195,177	0.01
VA	6.2	5.3	***14%***	13	344,981	0.37
CA	4.8	4.2	***13%***	37	565,796	0.02
KY	6.5	5.7	***12%***	10	75,206	0.46
NE	4.3	3.8	***12%***	3	72,275	0.15
RI	6.0	5.5	***9%***	2	54,126	0.29
OR	4.6	4.2	***9%***	8	32,347	0.10
TX	6.2	5.7	***9%***	37	619,014	0.24
PA	1.5	1.4	***8%***	5	224,246	0.07
MS	4.0	3.8	***4%***	10	197,076	0.09
AK	41.7	41.3	***1%***	13	838,691	0.10
MN	2.0	1.9	***4%***	12	255,189	0.01
VT	0.0	2.4	***N/A***	1	35,933	0.05
AS	0.0	0.0	***N/A***	0	119	0.00
GU	0.0	17.6	***N/A***	0	2,962	0.04
MP	0.0	68.4	***N/A***	0	928	0.19
AZ	4.5	4.6	***-4%***	7	149,131	0.01
MD	4.6	4.9	***-5%***	9	197,125	0.01
NM	2.6	2.8	***-5%***	1	346,281	0.07
MA	2.9	3.1	***-10%***	4	145,066	0.21
LA	9.6	10.7	***-12%***	32	38,071	0.02
CO	3.0	3.4	***-12%***	3	629,885	0.06
WA	4.9	5.7	***-18%***	14	842,530	0.09
MI	1.4	1.9	***-30%***	16	26,292	0.00
TN	3.7	5.3	***-43%***	13	281,978	0.03
WY	2.9	4.3	***-45%***	1	312,845	0.30
OH	2.5	3.9	***-57%***	12	953,089	0.01
ME	1.9	3.7	***-94%***	3	113,152	0.01
SD	1.7	3.3	***-99%***	1	48,932	0.02
DC	4.1	26.1	***-529%***	0	2,650	0.06

*1995 includes all boats registered

Table 5. States Grouped by Education Policy Type - Decrease in Fatal Accident Rates

Policy Type	Fatal Accidents Per Hundred Thousand Motorized Vessels				Average Annual Registered Motorized Boats*	P-Value vs. QPI States
	Avg. 1995-1999 Fatal Accident Rate	Avg. 2000-2005 Fatal Accident Rate	% Reduction in Fatal Accident Rates	Average Annual Total Fatal Accidents		
Date Of Birth	4.7	4.9	-2%	48	2,467,077	0.00
Age Requirement	4.2	3.4	18%	38	5,812,884	0.09
PWC Only	5.4	4.5	16%	49	765,745	0.27
Quick Phase-In	5.7	4.2	27%	49	363,834	N/A
No Education Policy	5.3	5.1	4%	52	1,113,409	0.01

*1995 includes all boats registered

Note: results are considered significant at a p-value below 0.1 (or tested at a 10 percent level of significance)

Table 6. QPI States vs. Bordering States - Decrease in Fatal Accident Rates

State Grouping	Fatal Accidents Per Hundred Thousand Motorized Vessels				Average Annual Registered Motorized Boats*	P-Value vs. QPI States
	Avg. 1995-1999 Fatal Accident Rate	Avg. 2000-2005 Fatal Accident Rate	% Reduction in Fatal Accident Rates	Average Annual Total Fatal Accidents		
QPI	5.7	4.2	27%	18	363,834	0.03
Rest of U.S.	4.5	4.0	11%	491	11,646,545	0.03
Alabama	7.0	5.3	25%	16	260,509	0.04
MS, FL, GA, TN	5.6	4.7	15%	87	1,680,447	0.04
Connecticut	2.4	1.6	34%	2	103,325	0.45
NY, MA, RI	3.4	2.6	24%	21	692,467	0.45

*1995 includes all boats registered

Note: results are considered significant at a p-value below 0.1 (or tested at a 10 percent level of significance)

Appendix B – Decrease in Fatality Rates (1995-1999 period compared to 2000-2005 period)

Table 7. All States - Decrease in Fatality Rates

State	Fatalities Per Hundred Thousand Motorized Vessels				Average Annual Registered Motorized Boats*	P-Value vs. QPI States
	Avg. 1995-1999 Fatality Rate	Avg. 2000-2005 Fatality Rate	% Reduction in Fatality Rates	Average Annual Total Fatalities		
US	**5.3**	**4.5**	***15%***	**588**	**12,010,379**	**-**
DE	7.8	2.4	***69%***	2	46,461	0.10
HI	17.9	7.8	***56%***	2	14,179	0.16
WV	7.5	3.4	***55%***	3	58,505	0.33
ID	9.4	4.4	***53%***	5	81,641	0.03
IA	3.0	1.5	***52%***	4	186,119	0.40
PR	4.9	2.6	***48%***	2	51,706	0.30
AK	70.5	39.8	***44%***	17	32,347	0.10
SC	6.4	4.0	***38%***	18	363,123	0.34
KS	4.2	2.6	***38%***	3	96,807	0.47
NC	6.3	4.0	***37%***	17	342,595	0.43
CT	3.0	1.9	***37%***	2	103,325	N/A
NV	14.2	9.1	***36%***	6	58,046	0.40
MO	6.5	4.3	***34%***	17	321,812	0.43
GA	5.3	3.5	***34%***	13	310,111	0.39
IN	4.0	2.7	***33%***	7	213,177	0.44
MT	7.2	4.9	***33%***	3	50,063	0.46
NY	4.2	2.9	***31%***	17	509,330	0.24
VA	8.1	5.7	***30%***	16	234,791	0.37
AL	7.8	5.6	***29%***	17	260,509	N/A
NH	2.7	1.9	***29%***	2	93,094	0.13
FL	8.1	5.8	***28%***	58	838,691	0.42
AR	7.7	5.7	***27%***	12	186,126	0.32
UT	9.1	6.8	***26%***	6	75,206	0.47
OK	8.1	6.1	***25%***	16	224,246	0.39
KY	8.0	6.2	***22%***	12	166,626	0.46
PA	1.7	1.4	***20%***	5	326,563	0.07
IL	4.2	3.4	***19%***	13	344,981	0.17
MA	3.7	3.0	***18%***	5	145,066	0.21
ND	6.0	5.0	***18%***	2	45,792	0.28
TX	7.6	6.3	***17%***	43	619,014	0.24
OR	5.5	4.7	***14%***	10	195,177	0.10
AZ	5.9	5.2	***11%***	8	149,131	0.01
NE	4.6	4.1	***9%***	3	72,275	0.15
MS	4.8	4.5	***8%***	11	249,667	0.09
WI	2.9	2.8	***6%***	16	565,796	0.01
CA	5.1	5.0	***2%***	42	842,530	0.02
AS	0.0	0.0	***N/A***	0	119	0.00
GU	0.0	20.5	***N/A***	0	2,962	0.04
MP	0.0	79.7	***N/A***	0	928	0.19
NM	3.1	3.2	***-3%***	2	54,126	0.07
MN	2.2	2.3	***-5%***	14	629,885	0.01
NJ	4.2	4.4	***-6%***	9	197,076	0.16
WA	6.2	6.5	***-6%***	16	255,189	0.09
WY	6.2	6.8	***-9%***	2	26,292	0.30
RI	5.9	6.6	***-12%***	2	38,071	0.29
LA	10.9	12.4	***-14%***	37	312,845	0.02
MI	1.8	2.1	***-16%***	19	953,089	0.00
CO	3.5	4.1	***-18%***	4	94,834	0.06
MD	5.0	5.9	***-19%***	11	197,125	0.01
TN	4.7	6.0	***-27%***	15	281,978	0.03
VI	19.0	24.9	***-31%***	1	3,575	0.43
OH	3.2	4.3	***-32%***	13	346,281	0.01
ME	2.4	4.1	***-72%***	4	113,152	0.01
SD	1.7	4.2	***-145%***	2	48,932	0.02
VT	1.1	3.0	***-181%***	1	35,933	0.05
DC	3.3	30.4	***-817%***	0	2,650	0.06

*1995 includes all boats registered

Table 8. States Grouped by Education Policy Type - Decrease in Fatality Rates

Policy Type	Fatalities Per Hundred Thousand Motorized Vessels				Average Annual Registered Motorized Boats*	P-Value vs. QPI States
	Avg. 1995-1999 Fatality Rate	Avg. 2000-2004 Fatality Rate	% Reduction in Fatality Rates	Average Annual Total Fatalities		
Date Of Birth	5.5	5.6	-1%	55	2,467,077	0.01
Age Requirement	5.0	3.9	22%	44	5,812,884	0.12
PWC Only	6.6	4.9	27%	57	765,745	0.44
Quick Phase-In	6.5	4.5	30%	54	363,834	N/A
No Education Policy	6.5	6.0	8%	65	1,113,409	0.01

*1995 includes all boats registered

Note: results are considered significant at a p-value below 0.1 (or tested at a 10 percent level of significance)

Table 9. QPI States vs. Bordering States - Decrease in Fatality Rates

State Grouping	Fatalities Per Hundred Thousand Motorized Vessels				Average Annual Registered Motorized Boats*	P-Value vs. QPI States
	Avg. 1995-1999 Fatality Rate	Avg. 2000-2004 Fatality Rate	% Reduction in Fatality Rates	Average Annual Total Fatalities		
QPI	6.5	4.5	31%	20	363,834	0.05
Rest of U.S.	5.3	4.5	15%	570	11,646,545	0.05
Alabama	7.8	5.6	29%	18	260,509	0.07
MS, FL, GA, TN	6.5	5.2	19%	97	1,680,447	0.07
Connecticut	3.0	1.9	37%	2	103,325	0.49
NY, MA, RI	4.2	3.1	25%	25	692,467	0.49

*1995 includes all boats registered

Note: results are considered significant at a p-value below 0.1 (or tested at a 10 percent level of significance)

Appendix C – Calculation of Statistical Significance

Table 10. P-Value Calculation - Decrease in Fatality Rates

Yr	QPI	Rest of U.S.	Pre (Rate Change)	Yr	QPI	Rest of U.S.	Post (Rate Change)	P-value
1995	5.05	4.64	0.41	**2000**	3.84	3.96	-0.12	
1996	6.39	4.59	1.80	**2001**	4.68	3.46	1.22	
1997	5.55	4.59	0.96	**2002**	3.81	4.51	-0.71	Pre vs. Post
1998	6.60	4.32	2.28	**2003**	4.37	3.99	0.38	Phase-In
1999	4.93	4.15	0.78	**2004**	4.30	3.82	0.48	
-	-	-	-	**2005**	4.04	3.97	0.08	
AVG	**5.70**	**4.46**	**1.25**	**AVG**	**4.18**	**3.95**	**0.22**	**0.02**

Yr	Alabama	MS, FL, GA, TN	Pre (Rate Change)	Yr	Alabama	MS, FL, GA, TN	Post (Rate Change)	P-value
1995	6.60	5.74	0.86	**2000**	4.58	4.16	0.43	
1996	7.71	5.82	1.90	**2001**	5.80	4.18	1.62	
1997	7.24	5.66	1.58	**2002**	4.60	4.57	0.04	Pre vs. Post
1998	6.88	5.45	1.42	**2003**	5.80	4.92	0.88	Phase-In
1999	6.44	5.43	1.01	**2004**	6.15	5.75	0.40	
-	-	-	-	**2005**	4.57	4.92	-0.36	
AVG	**6.97**	**5.62**	**1.35**	**AVG**	**5.25**	**4.75**	**0.50**	**0.02**

Yr	Connecticut	NY, MA, RI	Pre (Rate Change)	Yr	Connecticut	NY, MA, RI	Post (Rate Change)	P-value
1995	1.01	4.85	-3.84	**2000**	1.95	2.27	-0.32	
1996	2.99	2.23	0.76	**2001**	1.91	2.10	-0.19	
1997	1.02	3.35	-2.32	**2002**	1.87	3.31	-1.45	Pre vs. Post
1998	5.89	3.30	2.59	**2003**	0.93	3.16	-2.23	Phase-In
1999	0.99	3.52	-2.53	**2004**	0.00	2.24	-2.24	
-	-	-	-	**2005**	2.77	2.56	0.21	
AVG	**2.38**	**3.45**	**-1.07**	**AVG**	**1.57**	**2.61**	**-1.04**	**0.49**

Note: results are considered significant at a p-value below 0.1 (or tested at a 10 percent level of significance)

Appendix D – Types of State Boating Safety Education Policies

Table 11. Age Requirement and No Education States

State	Effective Date	Age Requirement	Boat
CO	01/01/1998	14-15 YOA	MB
FL	10/01/2001	< 22 YOA	MB >9 HP
GA	07/01/1998	12-13 YOA; 14-15 YOA	MB <31 HP & all HP PWC
IA	07/01/2003	12-17 YOA	MB>10 HP
IL	07/29/1999	12-17 YOA	MB
IN	01/01/1996	15 YOA	MB>10 HP
KY	01/01/1999	12-17 YOA	MB>10 HP PWC
MA	04/09/1990	12-15 YOA; 12-17 YOA	MB; PWC
MI	05/24/1995	12-15 YOA	MB>6 HP
MN	01/01/1991	12-17 YOA	MB>25 HP
MT	05/01/2000	13-14 YOA	MB>10 HP
ND	UNKNOWN	12-15 YOA	MB>10 HP
NE	01/01/2004	14-17 YOA	MB
NY	01/01/2000	ALL AGES; 10-17 YOA	PWC; MB
OK	01/01/2007	12-15 YOA	MB>10HP; SB>16' & PWC
SC	05/06/1997	<16 YOA	MB>14 HP
TX	09/01/1997	<18 YOA	MB>10 HP & SB>14'

KEY:	
HP	Horsepower
MB	Motorboat
PWC	Personal Watercraft
SB	Sailboat
YOA	Years of Age

State	Effective Date	No Requirements	Boat
AK		**No Requirements**	
AS		**No Requirements**	
AZ		**No Requirements**	
CA		**No Requirements**	
GU		**No Requirements**	
HI		**No Requirements**	
MP		**No Requirements**	
SD		**No Requirements**	
WY		**No Requirements**	

Table 12. Date of Birth, PWC Only, and Combination States

State	Effective Date	Date of Birth	Boat
AR	01/01/2001	B 1/1/1986	MB
DE	01/01/1994	B 1/1/1978	MB
LA	07/01/2003	B 1/2/1988	MB>10 HP
MD	07/01/1988	B 7/1/1972	MB
MO	01/01/2005	B 8/29/1984	MB & SB >12'
MS	07/01/1997	B 6/30/1980	MB
NM	01/01/2007	B 1/1/1989	MB
NV	01/01/2003	B 1/1/1983	MB>15 HP
OH	01/01/2000	B 1/1/1982	MB>10 HP
PA	01/01/2005	B 1/1/1982	MB>25 HP
PR	01/01/2001	B 7/1/1972	MB
RI	07/02/1999	B 1/1/1986	MB>10 HP
TN	01/01/2005	B 1/2/1989	MB>8.5 HP
VT	07/01/1991	B 1/2/1974	MB
WV	01/01/2001	B 12/31/1986	MB

State	Effective Date	PWC Only	Boat
ME	06/30/2006	16-17 YOA	PWC
NC	06/30/2000	12-15 YOA	PWC
UT	07/01/2002	12-17 YOA	PWC
VA	01/01/1999	14-15 YOA	PWC
VI	UNKNOWN	< 18 YOA	PWC

State	Effective Date	Combo	Boat
ID	07/01/1996	ALL AGES	RENTAL PWCS ONLY
KS	01/01/2001	B 1/1/1989 but only <21 YOA	MB & SB
WI	Late Summer 2006	12-15 YOA; B 1/1/1989	MB

Table 13. Quick Phase-In and Combination States

State	Effective Date	Quick Phase-In	Boat
AL	Start-04/28/1994; End-04/28/1999	12 YOA through B April 28, 1954	MB
CT	Start-11/24/1992; End-10/1/1997	ALL AGES	MB, SB>19.5'
DC	UNKNOWN	ALL AGES	ALL VESSELS
NH	Start-01/01/2002; End-01/01/2008	ALL AGES--phase in by 1/1/2008	MB>25 HP
OR	Start-01/01/2003; End-10/23/2009	ALL AGES--phase in by 10/23/2009	MB>10 HP
WA	Start-01/01/2008; End-01/01/2016	Individuals born before 01/01/1955 are exempt	MB

State	Effective Date	Combo	Boat
NJ	06/01/2008	13-15 YOA	MB<1 HP or 12 volts
		13-15 YOA	MB 12' + in length & <10 HP
		B 1/1/1979;	MB>10 HP
		ALL AGES;	PWC
		ALL AGES	SB>12'

Appendix E – Policy Summaries for Quick Phase-In States

Alabama

The Roberson/Archer Act of 1994 requires that residents who operate motorized vessels (does not apply to sailboats, rowboats, or canoes) in Alabama must first obtain an Alabama Boater Safety Certification. Residents that were 40-years old or older by April 28, 1994 are exempt. Additionally, no person under the age of 12 may operate a motorized vessel of any type. Residents had a 5-year "phase-in" period, from the time that the Act was passed in1994, to obtain an Alabama Boater Safety Certification. The 5-year period ended on April 28, 1999. Residents may obtain an Alabama Boater Safety Certification by passing a written exam or presenting proof of completing an approved course in boating safety. The exams are offered at the Alabama Driver's License Examining Offices and they contain twenty-five (twenty correct is passing) questions on rules of the road, laws, safety equipment, and waterways marking. Alabama Boater Safety Certification appears as a "V" endorsement placed on the automobile driver's license or a "Vessel Only" license is issued for non-automobile license holders. Alabama Boater Safety Certification can be cancelled, suspended, or revoked ($50 reinstatement fee along with meeting other requirements).

Connecticut

Effective November 24, 1992, operators of motorboats and sailboats 19.5-feet or longer must obtain a Safe Boating Certificate from the Department of Environmental Protection. There was a 5-year "phase-in" period that began with those individuals who were twenty and younger and ended with the requirement that those forty and older obtain certificates by October 1, 1997. Likewise, operators of personal watercraft, regardless of state residency, must obtain a Certificate of Personal Watercraft Operation (Connecticut recognizes certificates from New York, Massachusetts, and Rhode Island). Individuals must pass an approved basic boating course with an exam or pass an equivalency exam (50 question multiple choice test) to apply for their Safe Boating Certificate. Personal watercraft operators are also required to pass an approved personal watercraft course (or combination course) to apply for a Certificate of Personal Watercraft Operation. These certificates are wallet-sized cards that need to be aboard the vessel at all times. No person under the age of twelve shall operate a vessel with greater than 10 horsepower unless they are accompanied by an individual that is 18 or older and both are carrying certificates of operation. After March 9, 2004, no person under the age of 16 may operate a personal watercraft without onboard supervision of an individual aged 18 or older (both carrying certificates of operation). Violation of these requirements can result in fines ranging between $60 and $250.

New Hampshire

7 year "phase-in" period was initiated January 1, 2002 for those born on or after January 1, 1983. Operators of motorboats greater than 25 horsepower or personal watercraft operators must obtain a Safe Boater Education Certificate (all ages by January 1, 2008). The certificate can be obtained by completing a boating safety course or equivalency exam approved by the New Hampshire Marine Patrol or a National Association of State Boating Law Administrators (NASBLA) approved course of another state. The equivalency exam is 75 questions (80% correct passes) and it is offered on-line for $15. The certificate must be carried on board. No person under the age of 16 may operate a personal watercraft. No person under the age of 16 may operate a motorboat greater than 25 horsepower without onboard supervision of an individual aged 18 or older (carrying a certificate of operation).

Oregon

In 2003, operators thirty-years old and younger were required to carry a boater education card when operating motorized vessels greater than 10 horsepower. The age cut-off increases by ten each subsequent year resulting in a requirement that all boaters seventy-years old and younger must carry a boater education card by 2008 and in 2009 all boaters must meet the card carrying requirement. A person (12 years old and older) may obtain a boater education card by passing an approved boating safety course with an examination or the equivalency exam (seventy-five questions). Citations for non-compliance with the Mandatory Education Law are $94.

New Jersey

Legislation was passed on January 9, 2006 and signed by Governor Codey that requires all boaters to pass a boating safety course. Individuals 16 years of age or older shall not operate a power vessel, including a personal watercraft, on the waters of this State without having completed a boat safety course approved by the Superintendent of State Police in the Department of Law and Public Safety. Initially, mandatory boating safety education is required for persons born after December 31, 1978. The age cut-off increases yearly by ten-year age increments until all operators will be required to have completed a boating safety course by June 1, 2009. Operators will be required to complete a boating safety course with an examination or an equivalency exam (for experienced boaters). Violation of these requirements can result in fines ranging between $100 and $500.

Washington

Boater safety education course legislation in Washington State was signed into law by Washington Governor Christine Gregoire May 11, 2005. It will require completion of a basic boating class, or passage of an equivalency exam, to obtain a Boater Education Card. The Boater Education Card will be required for operation of a boat with 15 horsepower or more. The "phase-in" period will begin on January 1, 2008, when boaters

20 years of age and younger will be required to obtain their Boater Education Card. The phased-in period for compliance will continue until 2016 for various age groups. Boaters born before January 1, 1955 will be exempt.