AD-A272 907

Report No. CG-D-12-93

# A Study of Boat and Boat Propeller-Related Injuries in the United States 1991 - 1992

Christine M. Branche-Dorsey
Suzanne M. Smith
Denise Johnson

National Center for Injury Prevention and Control
Centers for Disease Control and Prevention
4770 Buford Highway, N.E.
Chamblee, Georgia 30341

FINAL REPORT
JUNE 1993

DTIC
ELECTE
NOV 16 1993
S D
E

This document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161

Prepared for:

U.S. Coast Guard
Research and Development Center
1082 Shennecossett Road
Groton, CT 06340-6096

and

U.S. Department of Transportation
United States Coast Guard
Office of Engineering, Logistics, and Development
Washington, DC 20593-0001

93-28018

93 11 15 047

# NOTICE

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

The United States Government does not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

The contents of this report reflect the views of the Coast Guard Research & Development Center. This report does not constitute a standard, specification, or regulation.

D. L. Motherway
Technical Director, Acting
United States Coast Guard
Research & Development Center
1082 Shennecossett Road
Groton, CT 06340-6096

Technical Report Documentation Page

| 1. Report No. | 2. Government Accession No. | 3. Recipient's Catalog No. |
|---|---|---|
| CG-D-12-93 | | |

| 4. Title and Subtitle | 5. Report Date |
|---|---|
| A Study of Boat and Boat Propeller-Related Injuries in the United States, 1991-1992 | June 1993 |
| | 6. Performing Organization Code |
| 7. Author(s) | 8. Performing Organization Report No. |
| Christine M. Branche-Dorsey, Suzanne M. Smith, Denise Johnson | R&DC 13/93 |
| 9. Performing Organization Name and Address | 10. Work Unit No. (TRAIS) |
| Epidemiology Branch, National Center for Injury Prevention and Control Centers for Disease Control and Prevention 4770 Buford Highway, N.E. (Mailstop K-60) Chamblee, Georgia 30341 | 11. Contract or Grant No. MIPR # Z51100-1-E33A18 |
| | 13. Type of Report and Period Covered Final Report, September 1991 - August 1992 |
| 12. Sponsoring Agency Name and Address | 14. Sponsoring Agency Code |
| U.S. Coast Guard Research and Development Center 1082 Shennecossett Road Groton, Connecticut 06340-6096 | Department of Transportation U.S. Coast Guard Office of Engineering, Logistics, and Development Washington, D.C. 20593-0001 |

15. Supplementary Notes

Coast Guard R&D Center COTR: Stephen J. Allen, 203-441-2731.

16. Abstract

This report emanates from the U.S. Department of Transportation Appropriations Bill, 1991 (Report 101-584), which requested that the United States Coast Guard contract with the National Center for Injury Prevention and Control, Centers for Disease Control and Prevention "to determine the number and severity of boat-propeller-related injuries." Data collection on boat and boat-propeller-related injuries was achieved through two mechanisms. The first mechanism was a nationwide data collection of boat and boat-propeller-related injuries using the existing National Electronic Injury Surveillance System, which is operated by the U.S. Consumer Product Safety Commission. The second mechanism made use of the Florida Department of Health and Rehabilitative Services' statewide hospital-based trauma registry. The latter data collection was enhanced by linkage with boating accident reports from the Florida Marine Patrol. The study shows that between 61,390 and 46,369 boating injuries were estimated to occur in the United States during September 1, 1991 through August 31, 1992, the study period. Boat propellers were responsible for an estimated 1,155 of these injuries. The study includes data on all boating-related injuries, including those occurring on and off the water, and with the engine on and off. Data from the State of Florida indicated that 860 boating injuries occurred during the study period, and that 43 of these were caused by a boat propeller. The Florida data also indicated that 71 individuals died while participating in boating-related activities, and that seven of these fatalities were as a result of propeller injuries.

| 17. Key Words | 18. Distribution Statement |
|---|---|
| propeller injuries<br>boating safety | Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161 |

| 19. Security Classif. (of this report) | 20. SECURITY CLASSIF. (of this page) | 21. No. of Pages | 22. Price |
|---|---|---|---|
| UNCLASSIFIED | UNCLASSIFIED | | |

Form DOT F 1700.7 (8/72) Reproduction of form and completed page is authorized

# METRIC CONVERSION FACTORS

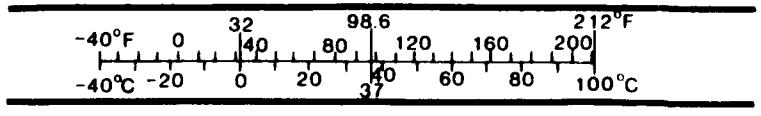
## Approximate Conversions to Metric Measures

| Symbol | When You Know | Multiply By | To Find | Symbol |
|---|---|---|---|---|
| | | **LENGTH** | | |
| in | inches | * 2.5 | centimeters | cm |
| ft | feet | 30 | centimeters | cm |
| yd | yards | 0.9 | meters | m |
| mi | miles | 1.6 | kilometers | km |
| | | **AREA** | | |
| $in^2$ | square inches | 6.5 | square centimeters | $cm^2$ |
| $ft^2$ | square feet | 0.09 | square meters | $m^2$ |
| $yd^2$ | square yards | 0.8 | square meters | $m^2$ |
| $mi^2$ | square miles | 2.6 | square kilometers | $km^2$ |
| | acres | 0.4 | hectares | ha |
| | | **MASS (WEIGHT)** | | |
| oz | ounces | 28 | grams | g |
| lb | pounds | 0.45 | kilograms | kg |
| | short tons (2000 lb) | 0.9 | tonnes | t |
| | | **VOLUME** | | |
| tsp | teaspoons | 5 | milliliters | ml |
| tbsp | tablespoons | 15 | milliliters | ml |
| fl oz | fluid ounces | 30 | milliliters | ml |
| c | cups | 0.24 | liters | l |
| pt | pints | 0.47 | liters | l |
| qt | quarts | 0.95 | liters | l |
| gal | gallons | 3.8 | liters | l |
| $ft^3$ | cubic feet | 0.03 | cubic meters | $m^3$ |
| $yd^3$ | cubic yards | 0.76 | cubic meters | $m^3$ |
| | | **TEMPERATURE (EXACT)** | | |
| °F | Fahrenheit temperature | 5/9 (after subtracting 32) | Celsius temperature | °C |

* 1 in = 2.54 (exactly).

## Approximate Conversions from Metric Measures

| Symbol | When You Know | Multiply By | To Find | Symbol |
|---|---|---|---|---|
| | | **LENGTH** | | |
| mm | millimeters | 0.04 | inches | in |
| cm | centimeters | 0.4 | inches | in |
| m | meters | 3.3 | feet | ft |
| m | meters | 1.1 | yards | yd |
| km | kilometers | 0.6 | miles | mi |
| | | **AREA** | | |
| $cm^2$ | square centimeters | 0.16 | square inches | $in^2$ |
| $m^2$ | square meters | 1.2 | square yards | $yd^2$ |
| $km^2$ | square kilometers | 0.4 | square miles | $mi^2$ |
| ha | hectares (10,000 $m^2$) | 2.5 | acres | |
| | | **MASS (WEIGHT)** | | |
| g | grams | 0.035 | ounces | oz |
| kg | kilograms | 2.2 | pounds | lb |
| t | tonnes (1000 kg) | 1.1 | short tons | |
| | | **VOLUME** | | |
| ml | milliliters | 0.03 | fluid ounces | fl oz |
| l | liters | 0.125 | cups | c |
| l | liters | 2.1 | pints | pt |
| l | liters | 1.06 | quarts | qt |
| l | liters | 0.26 | gallons | gal |
| $m^3$ | cubic meters | 35 | cubic feet | $ft^3$ |
| $m^3$ | cubic meters | 1.3 | cubic yards | $yd^3$ |
| | | **TEMPERATURE (EXACT)** | | |
| °C | Celsius temperature | 9/5 (then add 32) | Fahrenheit temperature | °F |



# Table of Contents


| Section | Page |
|---|---|
| Executive Summary | 1 |
| I. Introduction | 6 |
| II. Background | 7 |
| III. Scope ofWork | 10 |
| IV. Methods | 12 |
| A. Methods for Nationwide Data | 12 |
| 1. Data System | 12 |
| 2. Identification of Injuries | 13 |
| 3. Data Preparation | 13 |
| B. Methods for State Data | 14 |
| 1. Data System | 14 |
| 2. Identification of Injuries | 14 |
| 3. Data Preparation | 15 |
| C. Confidentiality | 15 |
| D. Coding | 15 |



DTIC QUALITY INSPECTED 5

Section For
S GRA&I
C TAB
Availability Codes
Dist | Avail and/or Special
A-1

# Table of Contents


| Section | Page |
|---|---|
| V. Results | 17 |
| A. Boating Injuries | 18 |
| 1. Nationwide Data | 18 |
| 2. State Data | 29 |
| B. Propeller Injuries | 29 |
| 1. Nationwide Data | 29 |
| 2. State Data | 38 |
| C. Fatal Injuries | 38 |
| VI. Conclusions | 44 |
| VII. Future Directions | 48 |
| VIII. References | 49 |

# List of Tables


| | Tables | Page |
|---|---|---|
| Table 1. | Boat-Related Injury E-Codes International Classification of Diseases Ninth Clinical Modification | 16 |
| Table 2. | Boat and Boat-Propeller-Related Injuries | 17 |
| Table 3. | Demographic Information--Boat Injury Data from all NEISS Product Codes | 19 |
| Table 4. | Demographic Information--Boat Injury Data from the Special Study Module - Nationwide Data | 21 |
| Table 4A. | Demographic Information--Boat Injury Data - State of Florida Data | 22 |
| Table 5. | Type of Vessel, Injured Person and Water Information--Boat Injury Data - Nationwide Data | 23 |
| Table 5A. | Type of Vessel, Injured Person and Water Information--Boat Injury Data - State of Florida Data | 24 |
| Table 6. | Activity or Operation at Time of Injury--Boat Injury Data - Nationwide Data | 25 |
| Table 6A. | Activity or Operation at Time of Injury--Boat Injury Data - State of Florida Data | 26 |

# List of Tables


| | Tables | Page |
|---|---|---|
| Table 7. | Injury Descriptions--Boat Injury Data - Nationwide Data | 27 |
| Table 7A. | Injury Descriptions--Boat Injury Data - State of Florida Data | 28 |
| Table 8. | Demographic Information--Propeller Injury Data - Nationwide Data | 31 |
| Table 8A. | Demographic Information--Propeller Injury Data - State of Florida Data | 32 |
| Table 9. | Type of Vessel, Injured Person and Water Information--Propeller Injury Data - Nationwide Data | 33 |
| Table 9A. | Type of Vessel, Injured Person and Water Information--Propeller Injury Data - State of Florida Data | 34 |
| Table 10. | Injury Descriptions--Propeller Injury Data - Nationwide Data | 35 |
| Table 10A. | Injury Descriptions--Propeller Injury Data - State of Florida Data | 35 |
| Table 11. | Activity or Operation at Time of Injury--Propeller Injury Data - Nationwide Data | 36 |
| Table 11A. | Activity or Operation at Time of Injury--Propeller Injury Data - State of Florida Data | 37 |

# List of Tables


| | Tables | Page |
|---|---|---|
| Table 12. | Demographic Information--Fatal Injury Data - Nationwide Data - State of Florida Data | 40 |
| Table 13. | Type of Vessel, Injured Person and Water Information--Fatal Injury Data - State of Florida Data | 41 |
| Table 14. | Injury Descriptions--Fatal Injury Data - State of Florida Data | 42 |
| Table 15. | Activity or Operation at Time of Injury--Fatal Injury Data - State of Florida Data | 43 |


# Appendix Table


| | | |
|---|---|---|
| Table A-1 | NEISS Sample Characteristics | Appendix 4-3 |

# List of Appendices

Appendix 1. 33 Code of Federal Regulations, Chapter 17

Appendix 2. All Propeller Injury Case Reports by Date - Nationwide Data

Appendix 3. All Propeller Injury Case Reports by Date - State of Florida Data

Appendix 4. Estimation of Nationwide Data - National Electronic Injury Surveillance System (NEISS) Hospitals

Appendix 5. Memorandum to NEISS Coordinators

Appendix 6. NEISS Special Boating Study Module

Appendix 7. NEISS Follow Back Questionnaire for Boating Injuries

Appendix 8. Florida HRS Letter and Survey

# EXECUTIVE SUMMARY

## Introduction

To address a Congressional request (U.S. Department of Transportation Appropriations Bill 1991 [Report 101-584]), the United States Coast Guard (USCG) contracted with the National Center for Injury Prevention and Control (NCIPC), Centers for Disease Control and Prevention (CDC), to design and implement a study to determine the number and severity of injuries caused by boat propellers.

Current knowledge regarding boat-propeller injuries has been learned from case reports or anecdotal information rather than from data gathered using standard epidemiologic methods. Propeller-related injuries are typically described as multiple, deep, parallel lacerations. The injuries can include severe musculoskeletal lacerations, heavy permanent scarring, and brain stem blows (Kelley, 1989); can lead to traumatic or surgical amputation; and may require long periods of hospitalization, recovery, and rehabilitation (Hargarten, 1992). The National Boating Safety Advisory Council's Propeller Guard Subcommittee (1989) called for population-based data to assess the magnitude of these injuries but none had been collected until this report.

The primary goal of the study was to determine the number and severity of motorboat-propeller-related injuries. NCIPC and the USCG agreed that data on all boating-related injuries, including those that occur on and off the water, would be useful and should also be collected. The resources available dictated a limited study using existing data systems. We used this opportunity to evaluate the feasibility of using existing national and state data to monitor boating-related injuries.

This report presents the background on boating and propeller injuries based on the scientific literature and other reports. Then we describe the scientific methodology used to conduct this study followed by our findings, conclusions, and recommendations for future directions.

## Methods

Data on recreational boating and boat-propeller-related injuries were collected from September 1, 1991, through August 31, 1992, using a nationwide system and one for a single state, Florida. Using a sample of data from United States hospital emergency departments, the United States Consumer Product Safety Commission (CPSC) provided nationwide data on the number of nonfatal boat and propeller-related injuries through their National Electronic Injury Surveillance System (NEISS). The Florida Department of Health and Rehabilitative Services (HRS) provided nonfatal and fatal data from the state's trauma registry. These data were supplemented by boating accident reports from the Florida Marine Patrol. Data from a single state were sought to obtain more detailed information from a smaller population-based region. Florida was selected

because it has a 12-month boating season, it has a large recreational boating population, and it is one of the few states with a statewide trauma registry.

Injury severity measures were not available for the study. Quantitative scoring of anatomic injury severity is not routinely performed in hospital emergency departments. Only gross measures of severity (i.e., death, hospitalization and emergency department treatment only) are available in the data collected.

## Results

Based on the NEISS system, between 61,390 (95% confidence limits: 41,745, 81,035) and 46,369 (95% confidence limits: 28,749, 63,989) boating injuries were estimated to occur in the United States during the study period. This range of estimates results from two methods of data capture. Data from the Florida HRS indicated that 41.6% (358) of the 860 injuries in the state occurred among 25- to 44-year-olds, followed by 25.6% among 15- to 24-year-olds. Data on fatal injuries were available only for Florida, where 71 individuals died while participating in boating-related activities. Seven of these fatal injuries were reported as due to boat propellers.

Boat propellers were responsible for an estimated 1,155 (95% confidence limits: 485, 1,825) injuries nationally, representing 2-2.5% of the boating injury burden. Most of the propeller injuries occurred among 25- to 44-year-olds (55.8%) and among 15- to 24-year-olds (20%). Injury descriptions from the emergency department records for the nationwide propeller injury data show that 75.8% (876; 95% confidence limits: 438, 1,314) occurred while the injured person was in the water.

We determined from the injury event narratives in the national sample that 670 (58%; 95% confidence limits: 335, 1,005) of the propeller injuries occurred while the engine was off. The engine was on in 146 of these injuries (13%: 95% confidence limits: 73, 219), and the engine status could not be determined in 340 (29%; 95% confidence limits: 170, 510) of the propeller injuries in the nationwide data.

During the study period in Florida, propellers injured 43 persons, representing 5% of the boating injury burden. (The difference in the estimates for the proportion of propeller-related injuries between the nationwide and Florida data may be attributed to sampling error. Therefore, we describe ranges of estimates.) Almost half (21) were between ages 25 and 44 years. Most (73%) of the propeller-related injuries described in the nationwide data were minor, and the majority of injured persons were treated in an emergency department and released. Injury descriptions from the linked trauma registry and Florida Marine Patrol data show that all 43 propeller injuries occurred in the water. The engine was off in 2 (5%) and on in 38 (88%) of these propeller injuries. The engine status could not be determined in 3 (7%) of the Florida propeller injury descriptions.

Assuming that hospitalization implies a more severe injury condition, 11.5% (nationally) and 20.9% (Florida) of persons

injured by boat propellers were hospitalized. Among the 1,155 persons injured by boat propellers in the nationwide data, 763 (95% confidence limits: 382, 1,145) had injuries to lower limbs and 392 (95% confidence limits: 196, 588) had injuries to upper limbs. Among the 43 persons injured by boat propellers discussed in the Florida data, the following injuries were described: 19 to lower limbs, 10 to upper limbs and 8 to the head or face (some persons sustained multiple injuries).

Propeller-related injuries are classically described as multiple, deep, parallel lacerations. In the U.S. and Florida data respectively, 1,044 of 1,155 (90.4%) and 26 of 43 (60.5%) propeller-related injuries were lacerations and amputations.

Based on the propeller injury narrative reports and patient follow-up conducted as part of this study, we have assumed that these injuries were due to direct contact with the propeller. In fact, 57% of the narratives in the nationwide data indicate that the individual believed that he or she was struck by or hit the propeller during recreational boating activities (for the remaining 43%, they either did not describe specifically how the propeller was involved in their injury or they were lost to follow-up). However, contact with other boat appurtenances close to the propeller (e.g., skeg, lower gearcase) could have, in fact, been the source of the injury. Only direct, objective observation of the injury event, clearly impossible to conduct, could have determined the true number of injuries due to direct contact with the propeller.

Of the reported propeller-related injuries, 21% or fewer were severe enough to require hospitalization. We assume from the existing scientific literature that the most severe injuries result from contact with the propeller while it is engaged and rotating. Although this study made no attempt to evaluate potential interventions, strategies should focus on preventing the most severe injuries. Available interventions include educational programs to alert boaters to the injury risks, measures to reduce the prevalence of drinking alcohol while engaged in water recreational activities, and direct modifications to the boat and propeller apparatus, e.g., propeller guards. While environmental modifications are appealing in that they are permanently in place to prevent nearby boating enthusiasts from damaging contact with the propeller, boating experts are not in agreement as to the efficacy and effectiveness of existing protective mechanisms. This study clarifies the magnitude and severity of propeller-related injuries in an effort to form a scientific foundation for further assessment of prevention strategies.

## Conclusions

Nationally, the majority (84.6%) of persons injured by boats and boat propellers required only emergency department treatment. Regardless of severity, lacerations comprised the largest proportion of boating injuries described in the nationwide data.

This study determined the feasibility and cost of obtaining a national sample and state-based supplemental data on boating injuries. Our adaptation of CPSC's NEISS data base collected information on a wide range of injuries by design

and provided national estimates. We wanted to capture boat and boat-propeller-related injuries in all settings where such injuries are possible. Injuries occurring, therefore, both in the water and in out-of-water activities such as storage and repair of vessels were depicted in the study. Florida provided state-based data using a different method, linking trauma registry to state marine patrol data. This linkage provided improved descriptions of the injury event. Not all records could be linked, however, so that descriptions were available for only a subset of injured persons.

This descriptive report is not a comprehensive analysis of the entire boat injury or propeller-related injury problem. Data from either CPSC's NEISS or Florida's trauma registry may not match USCG figures for the study period because of differences in data collection methodology. National data did not include fatalities because they are not collected by NEISS. Some injured persons were lost to follow-up, so supplemental data on the circumstances at the time of injury were not reported. This is not a report of injury risk during boating recreation. That is, we did not seek information from uninjured individuals who engaged in boat recreation during the study period. Consequently, this report is a description and enumeration of boating-related injuries only. We attempted to include data on alcohol use, but reliable information could not be collected through the selected data collection mechanisms. Additionally, our data collection missed individuals who sought medical treatment exclusively through a private provider and individuals whose injuries were so minor that no hospital care was needed.

This report uses medical reports as the initial data collection mechanism rather than reports originating from regulatory or legal sources. The injury events themselves were obviously not observed as part of this study. Although medically verified injury data were used, ascriptions of any injury to propellers were based on the statements of the injured person, medical personnel and/or the Florida Marine Patrol. One of the strengths of this study, however, was the follow-back component, which elicited a detailed narrative of the event from the injured individual. Many of the narratives indicate quite clearly that the individual believed that he or she was struck by or hit the propeller directly. Therefore, we have evidence to support our conclusions that this study captures a true representation of boating and propeller-related injuries.

## Future Directions

- **This study allowed the identification of data collection components that would be useful for a national data system.** Some of the benefits include improved mechanisms for case ascertainment; risk factor information; and linkage of systems which permitted injury specific data and circumstances of the injury.
- **The study underscored the advantages of active reporting.** More complete case identification, better risk factor data and injury specific data were available from active case finding. These benefits must be weighed against the relative costs and complexity of active data collection.

- **The Boat Accident Reporting Form (DOT, USCG-3865) can be amended to allow identification of propeller injuries distinct from other boating injuries, rather than combining them with other boating injuries.**

- **The Boat Accident Reporting Form (DOT, USCG-3865) can be amended to allow the collection of data on multiple injuries and all injuries that occur in the sequence of events.**

- **Refined injury severity assessment is currently not feasible.** Although current anatomic injury severity scoring schemes are available, there are no clearly superior systems that allow severity scoring retrospectively from existing data.

- **This study adds to a growing body of scientific research, including work conducted by the USCG, on boat and boat-propeller-related injury.** In view of this, the USCG now has a more extensive scientific foundation upon which to assess exising boat propeller injury prevention strategies.

# I. INTRODUCTION

The Committee on Appropriations, 101st Congress, United States House of Representatives, provided funds for research on boat propeller injuries. They were motivated by concern among constituents about risk the of these recreational injuries. Specifically, the United States Department of Transportation Appropriations Bill 1991 (Report 101-584), requested that the United States Coast Guard (USCG) "contract with the Centers for Disease Control, to develop data on the number and severity of propeller injuries" in response to the lack of such data. To address the Congressional request, the USCG contracted with the National Center for Injury Prevention and Control (NCIPC), Centers for Disease Control and Prevention (CDC), to design and implement a study to provide this information.

More than 60 million people engage in recreational boating annually according to 1987 estimates (CDC, 1987). Among boating enthusiasts, several boating-related injuries can ensue, including drowning, falls, burns and other events, like boat propeller injuries. The data on nonfatal boating-related injuries are inadequate, as many studies and surveys have focused mainly on fatalities. This study focused on both boat and boat propeller-related injuries and fatalities.

The primary goal of the study was to determine the number and severity of motorboat-propeller-related injuries. NCIPC and the USCG agreed that data on all boating-related injuries, including those that occur on and off the water, would be useful and should also be collected. The resources available dictated a limited study using existing data systems. We used this opportunity to evaluate the feasibility of using existing nationwide and state data to monitor boating-related injuries. To meet these goals, the NCIPC collected data on all types of recreational boating injuries, including propeller and personal watercraft injuries, during a one-year period.

This report presents the background on boating and propeller injuries based on the scientific literature and other reports. Then we describe the scientific methodology used to conduct this study followed by our findings, conclusions, and recommendations for future directions. Two important reports on boating and propeller injuries have been published subsequent to our initiation of this project. We describe the relevance of these reports to our study in the Background section. The report concludes with and suggestions for future directions.

# II. BACKGROUND

In 1991, 924 people died in boating-related incidents;[1] 80% of these deaths were due to drowning (USCG, 1992). Males are more frequently involved in boating fatalities. Research has shown that boat-related drowning deaths have decreased since the late 1970's (Baker, O'Neill, Ginsburg & Li, 1992).

Current knowledge regarding one particular type of boating-related injury, the motorboat-propeller-related injury, has been learned from case reports or anecdotal information rather than from epidemiologic data. Propeller injuries are typically described as multiple, deep, parallel lacerations. The injuries can include deep musculoskeletal lacerations, heavy permanent scarring, and brain stem blows (Kelley, 1989); can lead to traumatic or surgical amputation; and may require long periods of hospitalization, recovery, and rehabilitation may be required (Hargarten, 1992). Further complications may arise, as wounds occurring in water tend to bleed more, and water-borne organisms can infect wounds (Price, 1987). Because the magnitude of the problem is not known, total treatment and rehabilitation costs for propeller injuries have not been estimated nationwide. In one case series, however, the average cost for hospital and physician care for severe[2] propeller injuries exceeded $100,000 per injury (Hargarten, 1992).

Through its Coast Guard Boating Accident Form (DOT, USCG - 3865), the USCG annually collects data on recreational boat-related injuries and fatalities that have occurred on bodies of water over which the USCG has some jurisdiction (e.g., navigable waters of the United States and its territories [Appendix 1]). The form is to be completed when one of the following has occurred: loss of life, disappearance from a vessel, injury requiring medical attention beyond first aid, property damage in excess of $500, or complete loss of the vessel. By federal law, responsibility for reporting injuries rests with the individual operating and/or owning the boat.[3] The form is to be completed by the boat operator, submitted to state boating agencies, and then forwarded to the USCG. It is thought that boat injuries in general are underreported nationally. The USCG estimates that this system captures 4-10% of the actual number of boat-related incidents (Boat and Propeller Impact Injuries and Fatalities, 1987; Purcell & Lincoln, 1987).

[1] According to the USCG, a boating-related incident includes both loss of life and damage to a vessel.

[2] In the reference cited, "severe" injuries were defined as injuries with "major complications, permanent disfigurement and disability, and high treatment costs."

[3] A passive surveillance system relies, in this case, on boat owners to report injuries on their own initiative. An active system involves periodic solicitation of injury data from reporting sources such as police or medical personnel. Active surveillance is generally viewed as increasing reporting substantially (Orenstein and Bernier, 1990).

The USCG, injury control experts, and boating enthusiasts are concerned about boating-related injuries in general, and about the injuries caused by outboard motor propellers specifically. We know that propellers can cause severe, traumatic injuries, but the magnitude of the problem has not been previously defined. Propeller injuries cannot be readily identified in the current USCG system. Through its Boating Accident Form, the USCG collects data for personal injury involving motorboats and propellers. These injuries, however, are combined with data on *any* injury incurred if a person is hit by a part of the boat; the category reads "struck by boat or propeller." The USCG has made estimates of propeller injuries using these data. Furthermore, data on propeller injuries for the nation or for specific geographic areas (population-based data) are not available.

We conducted a search of the scientific literature on injuries from motorboats and propellers. Most of the current literature describes series of propeller injury case reports; only one population-based study exists. From the case reports, authors have shown that propeller-related case fatality rates vary from 15% in Kutarski's review of 77 cases (1989) to 23% in another analysis of 223 cases (Vernick et al., 1992). Data from analytic studies on propeller injuries are limited, save literature on their clinical presentation (Kutarski, 1989; Mann, 1976; Price et al., 1987) and alcohol involvement (Mengert et al., 1992; Howland & Hingson, 1988; CDC, 1990; Pentilla et al., 1979).

The one population-based study was conducted recently by the American Red Cross. The ***National Boating Survey*** was a telephone survey sample of boating and non-boating households in the continental United States covering the 1988-89 recreational boating period. The purpose of the survey was to ask respondents to describe critical incidents or "accidents" while recreational boating during the last year. Reportable incidents were enumerated using USCG criteria: loss of life, disappearance from a vessel, injury requiring medical attention beyond first aid, property damage in excess of $500, or complete loss of the vessel. A total of 236,599 reportable incidents and 413,074 non-reportable incidents were reported by respondents for the survey period. The number of incidents reported to the USCG during the same time period was 6,060. The Red Cross survey separated "struck by propeller" from "struck by boat;" respondents reported 5,032 (83.0%) estimated propeller injuries or property damage. Other than this survey, no other well-established sources of data on boat-related injuries, especially boat propeller injuries, are available.

Between 1987 and 1991, 586 injuries and 45 fatalities were reported in the "struck by boat or propeller" category according to official USCG reports (USCG, 1990). Based on these numbers and the number of recreational boats in the United States, during the 15-year period from 1976 to 1990 the estimated fatality rate per million boats has varied from a low of 0.3 in 1989 to a high of 1.3 in 1979 (Vernick et al., 1992). The nonfatal injury rate per million boats peaked at 9.2 in 1990 and was at its lowest level at 2.2 in 1988. Some injury control experts contend that boat propellers cause up to twice the number of injuries estimated in USCG reports for serious and fatal injuries nationally each year (Kelley, 1989; Vernick et al., 1992).

Guards for propeller blades have been suggested as preventive measure for injuries. Some injury control experts and marine engineers believe that guards are the most effective prevention strategy currently available (Vernick et al., 1992). The principle of the guards is to shield persons from the moving steel blades when the engine is engaged, or from the blade edges when the engine is off. The USCG has been assessing the need for propeller guards for motorboats since the mid-1970's (Purcell & Lincoln, 1987; Vernick et al., 1992). Several reports have been commissioned with experts in the marine, engineering, and medical fields to assess the efficacy of propeller guards. The latest of these reports, "Report of the Propeller Guard Subcommittee (November 7, 1989)" from the National Boating Safety Advisory Council, recommended that the USCG take no regulatory action at the time to require propeller guards on motorboats because, among other reasons, there was no feasible device and the data supporting such action were limited. No population-based data meeting the needs addressed by the Subcommittee had been collected until this report.

# III. SCOPE OF WORK

The work described in this report consists of primary data collection, our analysis and conclusions regarding data collection methodology, and recommendations stemming from the data collection.

Funding was insufficient to develop new data collection systems. We used two existing data collection systems. One of these was a system that provides nationwide estimates for injury data, and is maintained by the United States Consumer Product Safety Commission (CPSC). This system provided estimates of the number of nonfatal boat and propeller-related injuries for the United States. Data were collected from a probability sample of hospital emergency rooms throughout the United States from September 1, 1991, through August 31, 1992.

A second mechanism provided data through the trauma registry operated by the State of Florida. Data from a single state were collected to obtain more detailed information from a smaller population-based region. Florida was selected because it has a 12-month boating season, it has a large recreational boating population, and it is one of the few states with a statewide trauma registry. These data were also collected from September 1, 1991, through August 31, 1992. Because of limited resources, we did not conduct field observations, did not conduct hospital emergency department visits, and did not interview study subjects.

The United States Department of Transportation appropriations legislation stated explicitly that data on severity of injury be provided. Tabulations of the part of body injured, diagnosis (national data only), and length of hospital stay (state data only) are provided so that rough estimates of severity are available. Quantitative scoring of anatomic injury severity is not routinely performed in hospital emergency departments. Standard systems that measure and code injury severity (MacKenzie, 1984) are designed for patients who require inpatient care. The patients in our study were generally treated and released from emergency departments. Implementing a special severity scoring system for the study was not feasible, as it would have necessitated special training for emergency department staff of all participating hospitals. The length of the study period and the resources available precluded such training. Given the limitations of severity information in the data collected, only gross measures of severity (i.e., death, hospitalization and emergency department treatment only) are available in the data collected. We have, however, provided narrative descriptions of all propeller injuries identified in this study (Appendices 2 and 3).

National data on fatal boating and propeller injuries were not available from CPSC or any other centralized data system (e.g., death certificates). Arrangements with each of the 50 state health agencies would be necessary to obtain such reports. This was not feasible within the study deadlines

because of the 1 1/2 year lag time in providing routine death certificate data. We report fatal injury data from the State of Florida only. The United States Department of Transportation appropriations legislation stated that delivery of data be by January 1991.

At the time the legislation was passed in 1990, no data were available addressing the explicitly stated request. The USCG and NCIPC believed that one year of data collection would capture the appropriate variety of boating recreational situations. A Statement of Work had to be drafted by NCIPC and amended and accepted by the USCG, and contracts were drawn and signed. Consequently, data collection did not begin until September 1991. Hence, the delay in delivering the requested data.

The work described in this report differs substantially from two recently published reports on motorboat and propeller injuries. The American Red Cross ***National Boating Survey*** was a telephone survey of boating knowledge, boating uses, injuries, and property damage reported by participants covering the survey period, October 1, 1988, through September 30, 1989. Data were provided by 3,700 recreational boating households (representing 21,662,000 households) through telephone calls only (verification through medical records was not sought), and respondents were asked about incidents that occurred during the previous year.[4]

In the second report, ***Motorboat Propeller Injuries***, Vernick and colleagues present a compilation and assessment of the epidemiology of boat propeller injuries based largely on the USCG's own reported data and on data published in many of the case reports cited in this report. They reviewUSCG data and its data collection system, and provide background information and data on propeller-related fatalities. Also, they make recommendations to improve USCG data collection systems, including those for propeller injury.

This report does not duplicate the efforts of either the American Red Cross or Vernick et al. because we have collected primary data on boating-related injuries through systems with medically verified injury data.

[4] 1,331 non-boating households participated in the study, but were not asked about boating injury or property damage.

# IV. METHODS

Data on recreational boating and boat-propeller-related injuries were collected from September 1, 1991, through August 31, 1992 using a nationwide system and one for a single state, Florida.

## A. Methods for Nationwide Data

Using a sample of data from United States hospital emergency departments, the CPSC provided nationwide data on the number of nonfatal boat and propeller-related injuries through their National Electronic Injury Surveillance System (NEISS).

### *1. Data System*

The CPSC is charged with the responsibility of protecting the public from unreasonable risk of injury from consumer products. The Consumer Product Safety Act of 1972 authorized CPSC to develop safety standards to ban unsafe products and to disseminate safety and education materials to the public. The CPSC identifies and measures the magnitude of consumer product-related injuries that are treated in hospital emergency departments in the United States and its territories by sampling data from 92 selected hospital emergency rooms in the United States.[5] NEISS collects data at emergency rooms and from telephone follow-up interviews with injured individuals and/or with hospital staff. The system provides timely, statistically-valid national estimates of recreational and product-related injuries treated in hospital emergency departments. In 1972 CPSC began operating the NEISS because emergency department data had proved to be the most comprehensive and practical method for measuring the frequency and severity of the wide variety of product-related injuries which fall under CPSC's jurisdiction. Since 1978, other federal government agencies have found it useful to share NEISS data. Since that time, a variety of methods have been used successfully to expand the scope of the collected data on injuries and to tailor those data to specific federal agency needs. CPSC's cooperation with CDC in this boat injuries data collection is one such expansion.

[5]A full explanation of the method used for estimating injuries occurring at all hospitals in the United States using this sampling procedure can be found in Appendix 4. Briefly, each hospital in the United States is represented by the hospitals in the sample. Data from each sample hospital, therefore, represent data that would have been collected from all United States hospitals. For example, there were 237 large hospitals (i.e., large numbers of emergency department visits annually) in the United States in 1991, but only 14 large hospitals participated in NEISS. The probability that an injury was treated in one of these 14 hospitals is (14/237)=0.059. Each case in the large hospital stratum of the NEISS sample represents the reciprocal, (1/0.059 = 237/14) or 16.9 cases among large United States hospitals Further explanation of this weighting procedure is found in Appendix 4.

### 2. *Identification of Injuries*

In this study, CPSC was responsible for three major tasks. First, the agency provided a specialized data collection system for boat and boat propeller-related injuries accommodating up to 2,000 cases (Appendix 5). A special module, through which the CPSC had collected data on boat injuries during the 1970's was adapted and revised for this study (Appendix 6). Emergency department personnel at participating hospitals identified boating injuries, including those involving propellers. Data recorders at hospital emergency departments entered this information into the specialized data collection system which were sent to CPSC within 2 to 3 days of the injury.

Second, CPSC used a structured questionnaire to complete telephone follow-back calls with individuals injured by propellers (Appendix 7). CPSC personnel identified and called injured persons to administer the questionnaire (provisions for up to 100 calls). If individuals were not reached by telephone and a name and address were available, a letter was sent from CPSC asking the injured person to participate in the study by calling CPSC.

Third, CPSC was responsible for site visits to those hospitals expecting to treat large numbers of boat injuries. A NCIPC representative accompanied CPSC personnel on two visits as a data quality control measure. These visits were undertaken to orient the hospital staff to the project, help them identify all boating incidents, and stress the importance of the study and the need for detailed data. Such measures have proved useful in other investigations,such as the NCIPC/CPSC Firearm Injury Surveillance Feasibility Study (J. Lee Annest, personal communication).

### 3. *Data Preparation*

CPSC provided two estimates of national incidence data. First, they used all NEISS product codes under which boating injuries might have been ascertained to obtain an estimate of the maximum potential boat-related injuries. Second, they obtained an independent measure of injuries reported through the special study module implemented at NEISS hospitals for this study. The latter represents a minimum number of potential boat-related injuries. These include data on water skiing injuries which are collected nationally through NEISS, but which may have been missed if the special study module was not activated. Demographic data on water skiing are reported separately.The special study module accommodated all types of boating injury situations (e.g., cruising in motorboats or yachts, boats under repair or in storage, water skiing, canoeing, use of row boats, rafting, use of personal watercraft). Activation of the special module was dependent on emergency department personnel recording the word "boat" or "personal watercraft" (e.g., JetSki™) in the patient's record.

For boating injuries (including personal watercraft) ascertained through the special module, we collected data on demographics (age, sex); the type of vessel and body of water involved in the injury; diagnosis at the time of treatment; activity at the time of injury; and injury descriptions. The same data on boat-propeller-related injuries are reported separately. No data by race are available in NEISS. We sought information on blood alcohol level, but such data were

recorded for only 10 individuals in the study, and, therefore, are not included in this report. Rates were calculated for age and sex using 1990 United States census data as denominators, and using the total number of boats registered[6] in the United States during 1991.

It is CPSC's policy to disseminate only those national estimates that meet all three of the following criteria: coefficients of variation that are 33 percent or smaller, national estimates that are 1,200 or greater, and national estimates that are based on a sample count of 20 or more. For this report, however, we have had to derive confidence limits[7] that break this CPSC policy. Had we not calculated the confidence limits outside of this policy, we would have had no confidence limits for any of the propeller injuries from the nationwide data.

## B. Methods for State Data

The Emergency Medical Services (EMS), Florida Department of Health and Rehabilitative Services (HRS) provided nonfatal and fatal data from the state's trauma registry. These data were supplemented by boating accident reports from the Florida Marine Patrol. Data from a single state were sought to obtain more detailed information from a smaller population-based region.

### *1. Data System*

The Florida HRS trauma registry collects information from all 220 hospitals and emergency rooms throughout the state. Fatal and nonfatal boat-related injuries were identified by hospital and emergency department personnel and noted on the trauma registry form. Forms were sent and processed by EMS personnel. Boat-related injuries with propeller involvement were identified by HRS Injury Prevention Program personnel by requesting additional information from the Florida Marine Patrol, and by canvassing hospitals statewide using special small surveys (Appendix 8). Finally, boat injury data from the trauma registry were linked to the boating accident report system maintained by the Florida Marine Patrol by name and date of incident.

### *2. Identification of Injuries*

Letters were sent to each of the 220 acute care hospitals and trauma centers across the state requesting participation in this special effort to identify patients involved in boating incidents. Letters requesting the same cooperation were sent to all 240 EMS providers responsible for transporting trauma patients. Investigations of the boating crashes or subsequent injuries were conducted at the discretion of the Florida Marine Patrol.

[6] The official USCG term for "registered" is "numbered." Chapter 123 of Title 46, United States Code requires each undocumented vessel equipped with propulsion system to be numbered in the state in which it is principally operated. The law allows states and other jurisdicitions to create their own numbering systems as long as they meet or exceed federal requirements. Twenty-seven states in 1991 required the numbering on non-powered boats, such as sailboats. The statistics reported by the USCG are actual counts of valid boats numbers ("registered") which have been issued. The accuracy of the counts, therefore, is affected by several factors, including compliance of boat owners with the numbering laws and the efficiency with which the state numbering systems handle expired and new registrations.

[7] By definition, confidence limits are the interval or range within which the true magnitude of the measure lies with a certain degree of assurance. In this report, we use 95% confidence (degree of assurance ) limits. The narrower the confidence limits, the less variability was present in the estimate of the measure (Hennekens and Buring, 1987).

For persons identified as having been injured in a boating incident during the study period, letters and questionnaires were sent by the HRS Injury Prevention Program personnel to request specific information pertaining to the person's injury and the circumstances surrounding the event. Self-addressed and stamped envelopes were provided to individuals to mail their responses directly to the Injury Prevention Program. Letters were sent to each marina registered with the Florida Department of Natural Resources, requesting that they post the Florida Marine patrol poster indicating that reporting was required.

Coordination was sought through law enforcement agencies and insurance companies. The latter were asked to provide information on the number of claims filed for property damage greater than $500 or for an injury. Law enforcement agencies reported their data through the Florida Marine Patrol. Due to time limitations, full participation by insurance companies was not successful within the study period. HRS is seeking a cooperative relationship with the State's insurance industry for future HRS boating safety efforts.

### *3. Data Preparation*

We collected data on demographics (age, sex, race); the type of vessel (including personal watercraft and water skiing and body of water involved in the injury; cause of injury; activity at the time of injury; and injury descriptions. Data on boat-propeller-related injuries and on fatal injuries are reported separately. Information on blood alcohol level is not reported because it is not systematically collected in emergency departments. Rates were calculated for age, sex, and race using 1990 Florida census data as denominators, and using the total number of boats registered in Florida during 1991.

## C. Confidentiality

To maintain patient confidentiality, all data that could be used to identify a specific individual were housed by CPSC or the Florida EMS, but were never sent to NCIPC.

## D. Coding

The International Classification of Disease, Ninth Clinical Modification (ICD) external cause of injury codes (E-codes) are the standard system for classifying the cause of injuries in medical records. These codes were not adequate for this study because propeller involvement cannot be discerned from available boat-related injury E-codes (Table 1). To meet study goals, we had to adapt both the CPSC and Florida HRS systems to collect data on propeller injuries as distinct from boat injuries, independent of E-code designations.

**Table 1. Boat-Related Injury E-Codes International Classification of Diseases Ninth Clinical Modification**

| E-Code | Description |
|---|---|
| E830 | Accident to watercraft causing submersion |
| E831 | Accident to watercraft causing other injury |
| E832 | Other accidental submersion or drowning in water transport accident |
| E838 | Other and unspecified water transport accident |
| E910.0 | Accidental drowning and submersion while water skiing |
| E910.1 | Accidental drowning and submersion while engaged in other sport or recreational activity with diving equipment |
| E910.3 | Accidental drowning or submersion while swimming or diving for purposes other than recreation or sport |
| E910.9 | Unspecified accidental drowning or submersion |

# V. RESULTS

Data were collected from the CPSC for nationwide estimates, and Florida, which linked trauma registry and Florida Marine Patrol records, from September 1, 1991, through August 31, 1992. In order, we describe the findings for: (a) all of the boating injury data, (b) propeller injury data, and, (c) fatal boating injury data.

In describing age, sex, and race (Tables 3, 4, 4A, 8, 8A, 12), we calculated the rate of injury using as denominators data from the 1990 census and 1991 boat registrations for the United States and Florida. Generally, the pattern observed in injury frequency was similar to that observed in the calculated rates. In some cases where CPSC data are reported, wide confidence intervals are evident.

**Table 2. Boat and Boat-Propeller-Related Injuries United States, 1991- 1992**

| | Nationwide Data | | State Data | |
|---|---|---|---|---|
| Injury Causes | Estimate[+] | 95% Confidence Limits | All Injuries* | Fatalities |
| Boating | 61,390 | (41,745, 81,035) | 860 | 71 |
| Propeller | 1,155 | (485, 1,825) | 43 | 7 |

[+]These are estimates of injuries extrapolated from raw data; accordingly, 95% confidence limits are provided. Details of the sampling procedure are explained in Appendiix 4.

*Includes fatal injuries

## A. Boating Injuries

### *1. Nationwide Data*

Based on all potential boat-related NEISS product codes, an estimated 61,390 (95% confidence limits: 41,745, 81,035) boating-related injuries occurred in the United States during the study period. This figure includes all injuries to persons while they were boating, water skiing, using personal watercraft and while engaged in other boating-related activities (Tables 2,3), including injuries involving a boat propeller. Persons in all groups were injured during these activities, but most of the injuries occurred among persons ages 25 to 44 years (28,083; 45.7%) and 15 to 24 years of age (15,513; 25.3%). Males were injured more frequently than were females (73.2% vs 26.8%).

Using the United States 1990 census population as a denominator, the rate of boating and water skiing injuries was highest among persons 15 to 24 years of age (43.4 per 100,000 population). But in the United States, using the number of boats registered, the rate was highest among 25- to 44-year-olds (253.7 per 100,000 boats registered).[8]

[8]Data on boating are not adjusted by age.

## Table 3. Demographic Information--Boat Injury Data from all NEISS Product Codes
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**Nationwide Data:**

| Age: | Number | 95% Confidence Limits | Percent | Rate/100,000 Population[1] | Rate/100,000 Boats Registered[2] |
|---|---|---|---|---|---|
| 0-4 years | 671 | (336, 1,007) | 1.1 | 3.6 | 6.1 |
| 5-14 | 3,775 | (2,643, 4,908) | 6.1 | 10.6 | 34.1 |
| 15-24 | 15,513 | (11,789, 19,235) | 25.3 | 43.4 | 140.1 |
| 25-44 | 28,083 | (21,905, 34,261) | 45.7 | 34.5 | 253.7 |
| 45-64 | 8,477 | (6,443, 10,511) | 13.8 | 18.1 | 76.6 |
| 65+ | 4,871 | (3,410, 6,332) | 7.9 | 15.5 | 44.0 |
| Total | 61,390 | | | 24.6 | 554.6 |
| **Sex:** | | | | | |
| Males | 44,912 | (35,930, 53,894) | 73.2 | 36.9 | 405.8 |
| Females | 16,478 | (12,523, 20,433) | 26.8 | 12.9 | 148.9 |

**NOTE:** No Data By Race

[1]Rate/100,000 Population (U.S. 1990)

[2]Rate/100,000 Boats Registered (U.S. 1991)

The difference between the data from all potential boat-injury-related NEISS product codes (n=61,390) and data from the special study screen (n=46,369) is an estimated 14,021 (95% confidence limits: 10,656, 17,386). Almost all of the injuries in the latter figure were water skiing injuries for which the emergency department record did not mention the word "boat". The two CPSC boat injury estimates provide a maximum (n=61,390) and minimum (n=46,369) range of boating-related injuries that occurred nationally during the study period.

Based on the special study module data, the minimum estimate of boating-related injuries nationally was 46,369 (95% confidence limits: 28,749, 63,989) (Tables 4-7). Boating injuries occurred among all age categories (Table 4). The largest number of injuries occurred among people 25 to 44 years of age with an estimated 19,621 injuries (42.3%), followed by those 15 to 24 years old with 9,598 (20.7%). However, the highest rate of boating injury was seen in 15- to 24-year-olds for the United States 1990 census denominators (26.8 per 100,000 population), but was highest among 25- to 44-year-olds when the boat registration data were used as denominators (177.3 per 100,000 boats registered). Males experienced the largest injury burden (70.9%), and females sustained an estimated 13,476 (29.1%) of the boating injuries.

When vessel information was recorded (Table 5), most injuries involved motorboats (an estimated 14,062, 30.3%).[9] Unfortunately, most NEISS hospitals did not record the type of vessel when patients were treated at emergency departments (unknown = estimated 20,357). Personal watercraft were in use for 6.8% of the injuries. We observed injuries among a range of water recreation enthusiasts from boat operators (12.3%), passengers (23.2%) and bystanders (1.2%).

Injuries occurred most frequently at lakes among the emergency department records which described the body of water, with an estimated 13,518 injuries (29.2%) (Table 5). Activity at the time of injury was not always described adequately (33.3% other; 12.3% unknown) (Table 6). Where it was recorded and described, however, the most common activities at the time of injury were skiing (use of personal watercraft or water skis) (11.0%), falling (miscellaneous) (11.0%), and cruising (9.0%).

Lacerations (26.9%) and contusions/abrasions (22.3%) were the most common injuries described (Table 7). Sprains and strains were common also (17.3%), followed closely by fractures (17.1%). Almost all patients were treated and released (94.7%).

[9]In Tables 3-15, "unknown" means that the recorder at the NEISS or Florida hospital could not find sufficient information in the file to complete the variable placeholder..

## Table 4. Demographic Information--Boat Injury Data from the Special Study Module Study of Boat and Boat-Propeller-Related Injuries United States, 1991-1992

**Nationwide Data:**

| Age: | Number | 95% Confidence Limits | Percent | Rate/100,000 Population[1] | Rate/100,000 Boats Registered[2] |
|---|---|---|---|---|---|
| 0-4 years | 671 | (336, 1,007) | 1.4 | 3.6 | 6.1 |
| 5-14 | 3,366 | (2,356, 4,376) | 7.3 | 9.5 | 30.4 |
| 15-24 | 9,598 | (7,294, 11,902) | 20.7 | 26.8 | 86.7 |
| 25-44 | 19,621 | (17,463, 21,779) | 42.3 | 24.0 | 177.3 |
| 45-64 | 8,276 | (6,290, 10,262) | 17.8 | 17.7 | 74.8 |
| 65+ | 4,837 | (3,386, 6,288) | 10.4 | 15.3 | 43.7 |
| Total | 46,369 | | | 18.6 | 418.9 |
| **Sex:** | | | | | |
| Males | 32,893 | (25,657, 40,129) | 70.9 | 27.0 | 297.2 |
| Females | 13,476 | (10,242, 16,710) | 29.1 | 10.5 | 121.8 |

**NOTE:** No Data By Race

[1]Rate/100,000 Population (U.S. 1990)

[2]Rate/100,000 Boats Registered (U.S. 1991)

## Table 4A. Demographic Information--Boat Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**State Data, Florida:**

| Age: | Number | Percent | Rate/100,000 Population[1] | Rate/100,000 Boats Registered[2] |
|---|---|---|---|---|
| 0-4 years | 62 | 7.2 | 7.5 | 9.0 |
| 5-14 | 70 | 8.1 | 4.4 | 10.2 |
| 15-24 | 221 | 25.6 | 13.6 | 32.2 |
| 25-44 | 358 | 41.6 | 9.5 | 52.2 |
| 45-64 | 118 | 13.7 | 4.1 | 17.2 |
| 65+ | 31 | 3.6 | 1.4 | 4.5 |
| Total | 860 | | 6.6 | 125.5 |
| **Sex:** | | | | |
| Males | 614 | 71.4 | 9.8 | 89.6 |
| Females | 246 | 28.6 | 3.6 | 36.0 |
| **Race:** | | | | |
| White | 788 | 91.6 | 7.1 | 115.0 |
| Black | 24 | 2.8 | 1.3 | 3.5 |
| Asian/Pacific Islander | 10 | 1.2 | N/A | 1.5 |
| Other | 38 | 4.4 | 21.5 | 5.5 |

[1]Rate/100,000 Population (Florida 1990)

[2]Rate/100,000 Boats Registered (Florida 1991)

## Table 5. Type of Vessel, Injured Person and Water Information--Boat Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**Nationwide Data (N=46,369)**

| Vessel: | Number | 95% Confidence Limits | Percent |
|---|---|---|---|
| Motorboat | 14,062 | (10,687, 17,437) | 30.3 |
| Sailboat | 2,988 | (1,554 , 4,422) | 6.4 |
| Canoe | 1,046 | (523, 1,569) | 2.3 |
| Personal Watercraft | 3,166 | (1,646, 4,686) | 6.8 |
| Other | 4,751 | (3,326, 6,176) | 10.2 |
| Unknown | 20,357 | (15,878, 24,836) | 43.9 |
| **Injured Person:** | | | |
| Operator | 5,803 | (4,065, 7,544) | 12.3 |
| Passenger | 10,743 | (8,165, 13,321) | 23.2 |
| Swimmer | 331 | (166, 497) | 0.7 |
| Skier | 3,456 | (2,419, 4,493) | 7.5 |
| Scuba Diver | 34 | (17, 51) | 0.1 |
| Bystander | 542 | (271, 813) | 1.2 |
| Other | 5,647 | (3,953, 7,341) | 12.2 |
| Unknown | 19,812 | (15,453, 24,171) | 42.7 |
| **Body of Water:** | | | |
| Lake | 13,518 | (10,274, 16,762) | 29.2 |
| River | 4,815 | (3,371, 6,260) | 10.4 |
| Pond | 340 | (170, 510) | 0.7 |
| Ocean | 3,762 | (2,633, 4,891) | 8.1 |
| Other | 5,981 | (4,187, 7,775) | 12.9 |
| Unknown | 17,952 | (14,003, 21,901) | 38.7 |

## Table 5A. Type of Vessel, Injured Person and Water Information--Boat Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**State Data, Florida (N=860)**

| Vessel: | Number | Percent |
|---|---|---|
| Motorboat | 436 | 50.7 |
| Auxiliary Sail | 8 | 0.9 |
| Sail (only) | 12 | 1.4 |
| Row Boat | 11 | 1.3 |
| Canoe | 7 | 0.8 |
| Personal Watercraft | 165 | 19.2 |
| Other | 78 | 9.1 |
| Unknown | 143 | 16.6 |
| **Propulsion System:** | | |
| Outboard Motor | 338 | 39.3 |
| Inboard Motor | 115 | 13.4 |
| Inboard/Outboard | 72 | 8.4 |
| Air Propeller | 27 | 3.1 |
| Jet | 125 | 14.5 |
| Sail | 16 | 1.9 |
| Other | 21 | 2.4 |
| Unknown | 146 | 17.0 |
| **Body of Water:** | | |
| Lake/Pond | 99 | 11.5 |
| River | 135 | 15.7 |
| Ocean/Gulf | 129 | 15.0 |
| Canal/Cut | 64 | 7.4 |
| Bay/Sound | 170 | 19.8 |
| Inlet | 31 | 3.6 |
| Port/Harbor | 25 | 2.9 |
| Creek | 18 | 2.1 |
| Other | 45 | 5.2 |
| Unknown | 144 | 16.7 |

## Table 6. Activity or Operation at Time of Injury--Boat Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**Nationwide Data (N=46,369)**

| Activity or Operation: | Number | 95% Confidence Limits | Percent |
|---|---|---|---|
| Cruising | 4,156 | (2,909, 5,403) | 9.00 |
| Maneuvering | 1,109 | (555, 1,664) | 2.40 |
| Collision With Another Vessel | 186 | (93, 279) | 0.40 |
| Collision (Unspecified) | 166 | (83, 249) | 0.40 |
| Capsizing | 43 | (22, 65) | 0.10 |
| Fishing | 1,071 | (536, 1,607) | 2.30 |
| Racing | 220 | (110, 330) | 0.50 |
| Towing | 183 | (92, 275) | 0.40 |
| Swimming | 286 | (143, 429) | 0.60 |
| Skiing | 5,510 | (3,577, 6,643) | 11.00 |
| Scuba Diving | 34 | (17, 51) | 0.10 |
| Snorkeling | 17 | (9, 26) | 0.04 |
| Repairing/Cleaning Vessel | 2,249 | (1,169, 3,329) | 5.00 |
| Entering/Leaving Vessel | 2,224 | (1,156, 3,292) | 5.00 |
| Falls, Miscellaneous | 5,078 | (3,555, 6,601) | 11.00 |
| Jump/Thrown From Vessel | 1,158 | (579, 1,737) | 2.50 |
| Tubing | 1,319 | (656, 1,979) | 2.80 |
| Boogie or Knee Boarding/ Wave Running | 620 | (310, 930) | 1.30 |
| Other | 15,433 | (11,729, 19,137) | 33.30 |
| Unknown | 5,706 | (3,994, 7,418) | 12.30 |

## Table 6A. Activity or Operation at Time of Injury--Boat Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**State Data, Florida (N=860)**

| Activity or Operation: | Number | Percent |
|---|---|---|
| Cruising | 411 | 47.8 |
| Maneuvering | 95 | 11.0 |
| Fishing | 12 | 1.4 |
| Racing | 8 | 0.9 |
| Towing | 11 | 1.3 |
| Being Towed | 8 | 0.9 |
| Swimming | 2 | 0.2 |
| Skiing | 38 | 4.4 |
| Scuba Diving | 3 | 0.3 |
| Skin Diving | 1 | 0.1 |
| At Anchor | 21 | 2.4 |
| Tied to Dock | 8 | 0.9 |
| Docking | 7 | 0.8 |
| Drifting | 39 | 4.5 |
| Commercial Fishing | 3 | 0.3 |
| Other Commercial | 5 | 0.6 |
| Other | 27 | 3.1 |
| Unknown | 161 | 18.7 |

## Table 7. Injury Descriptions--Boat Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**Nationwide Data (N=46,369)**

| Injury Descriptions: | Number | 95% Confidence Limits | Percent |
|---|---|---|---|
| Strain, Sprain | 8,010 | (6,088, 9,932) | 17.3 |
| Fracture | 7,920 | (6,019, 9,821) | 17.1 |
| Dislocation | 550 | (275, 825) | 1.2 |
| Amputation | 34 | (17, 51) | 0.1 |
| Crushing | 115 | (58, 173) | 0.2 |
| Concussion | 216 | (108, 324) | 0.5 |
| Avulsion | 326 | (163, 489) | 0.7 |
| Contusions/Abrasions | 10,335 | (7,855, 12,815) | 22.3 |
| Laceration | 12,483 | (9,487, 15,479) | 26.9 |
| Puncture | 421 | (211, 632) | 0.9 |
| Internal Organ Injury | 805 | (403, 1,208) | 1.7 |
| Dermatitis, Conjunctivitis | 175 | (88, 263) | 0.4 |
| Foreign Body | 636 | (318, 954) | 1.4 |
| Hematoma | 330 | (165, 495) | 0.7 |
| Burns, Not Specified | 101 | (51, 152) | 0.2 |
| Burns, Scald | 177 | (89, 266) | 0.4 |
| Burns, Chemical | 36 | (18, 54) | 0.1 |
| Burns, Radiation | 79 | (40, 119) | 0.2 |
| Burns, Thermal | 720 | (360, 1,080) | 1.6 |
| Dental Injury | 158 | (79, 237) | 0.3 |
| Anoxia | 43 | (22, 65) | 0.1 |
| Electric Shock | 43 | (22, 65) | 0.1 |
| Poisoning | 231 | (116, 347) | 0.5 |
| Submersion | 292 | (146, 292) | 0.6 |
| Other | 2,133 | (1,109, 3,157) | 4.6 |

## Table 7A. Injury Descriptions--Boat Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**State Data, Florida (N=860)**

| Injury Descriptions: | Number | Percent |
|---|---|---|
| **Injury Status:** | | |
| Injured | 782 | 90.9 |
| Fatal | 71 | 8.3 |
| Uninjured | 5 | 0.6 |
| Missing | 2 | 0.2 |
| Fracture, Yes | 101 | 38.1 |
| Fracture, No | 164 | 61.9 |
| **Cause of Injury:** | | |
| Grounding | 33 | 3.8 |
| Capsizing | 31 | 3.6 |
| Flooding | 22 | 2.6 |
| Sinking | 4 | 0.5 |
| Fire or Explosion | 28 | 3.3 |
| Collision with Vessel | 163 | 19.0 |
| Collision with Fixed Object | 151 | 17.6 |
| Collision with Floating Object | 16 | 1.9 |
| Falls Overboard | 33 | 3.8 |
| Falls in Boat | 38 | 4.4 |
| Fallen Skier | 31 | 3.6 |
| Hit by Boat | 33 | 3.8 |
| Hit by Propeller | 43 | 5.0 |
| Other | 78 | 9.1 |
| Unknown | 156 | 18.1 |

### *2. State Data*

Data from Florida indicated that 41.6% of the 860 boating-related injuries in the state occurred among 25- to 44-year-olds, followed by 25.6% among 15- to 24-year-olds (Table 4A). Injuries were observed among all ages, but 15- to 24-year-olds had the highest rate of injury when both the Florida census and boat registration denominator data were used. Males sustained injuries most frequently (614; 71.4%) in this study. Like the nationwide data, the proportion of injuries among males was 71%. Boating injuries in Florida occurred mostly among whites, who sustained 91.6% of the injuries. Individuals classified as other race had a high rate of injury (21.5 per 100,000 population) by a large margin.

Data on the status of the injured person were not available from the HRS system (Table 5A), but information on vessel, propulsion system, and body of water were available. Most injuries in Florida involved motorboats (436; 50.7%) and personal watercraft (165; 19.2%). Most boating injuries involved outboard motors (338; 39.3%), inboard motors (115; 13.4%), or jet engines (125; 14.5%). Where the information was known, furthermore, most of the Florida injuries occurred primarily at a bay or sound (19.8%), a river (15.7%), or at the ocean or gulf (15.0%).

Activity at the time of injury was not always available (18.7%) (Table 6A), but where recorded, almost half of the individuals in the study were cruising (411; 47.8%). Activities covered a wide range: maneuvering (11.0%), drifting (4.5%), and skiing (4.4%) were frequent activities. Only one person was skin diving at the time of injury.

Injury descriptions were not available in the state data as they were for the nationwide data (Table 7A), but reports show that 101 (38.1%) persons sustained some kind of fracture. We know also that 71 (8.3%) were fatally injured. Fatalities are described in more detail in section C of the Results.

The linkage of trauma registry data with the Florida Marine Patrol provided cause of injury information (Table 7A). Where the information was available (unknown = 18.1%), almost 40% of injuries resulted from collisions with either a vessel or a fixed object. Forty-three persons (five percent) were struck by a boat propeller.

## B. Propeller Injuries

### *1. Nationwide Data*

Injury event narratives for each boat-propeller-related injury in the nationwide data are available (Appendix 2). Data from the special study module showed that motorboat propellers were reported to have injured 1,155 persons (95% confidence limits: 485, 1,825) persons nationally, representing 2-2.5% of the boating injury burden. Most of these injuries occurred among persons 25 to 44 years of age (55.8%) and among those 15 to 24 years of age (20%) (Table 8A). Because numerators were small, rates of injury are small. Rates of injury, however, were consistently highest among 25- to 44-year-olds for both data bases used. Three-fourths of the injuries were among males.

Most propeller injuries involved motorboats (57.9%) (Table 9A), but note also that 28.7% of the vessel data were unknown.

Detailed information on the category of injured persons was not available as in the boat injury data; 40% of the data in this category were unknown. Boat operators (17.1%), swimmers (16.7%), and passengers (10.4%) were the most common among those injured (Table 9). Nationally, propeller injuries occurred most frequently on lakes (27.0%), rivers (20.0%), and other bodies of water (19.8%).

Lacerations (90.4%) comprised the majority of propeller injuries, followed distantly by contusions and abrasions (6.7%) and fractures (1.5%) (Table 10). Information from the narratives indicate that 763 (95% confidence limits: 382, 1,145) of the injuries were to lower limbs and 392 (95% confidence limits: 196, 588) were to upper limbs. Injury descriptions were available on all propeller-related injuries in the nationwide data. The most common recorded activities at the time of propeller injury were other (49.3%), swimming (16.7%), and skiing (use of personal watercraft or water skis) (9.6%) (Table 11).

Injury descriptions from the emergency department records for the nationwide propeller injury data show that 75.8% (876; 95% confidence limits: 438, 1,314) occurred while the injured person was in the water, and 16.0% (185; 95% confidence limits: 93, 278) occurred when the injured person was out of the water. Location in or out of the water was unknown or could not be determined for 8.1% (94; 95% confidence limits: 47, 141) of the propeller injuries.

We determined from the injury event narratives that 670 (58%; 95% confidence limits: 335, 1,005) of the propeller injuries occurred while the engine was off. The engine was on in 146 of these injuries (12.6%; 95% confidence limits: 73, 219), and the engine status could not be determined in 340 (29.4%; 95% confidence limits: 170, 510) of the propeller injuries in the nationwide data.

## Table 8. Demographic Information--Propeller Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**Nationwide Data:**

| Age: | Number | 95% Confidence Limits | Percent | Rate/100,000 Population[1] | Rate/100,000 Boats Registered[2] |
|---|---|---|---|---|---|
| 0-4 years | 17 | (9, 26) | 1.5 | 0.1 | 0.2 |
| 5-14 | 91 | (46, 137) | 7.8 | 0.3 | 0.8 |
| 15-24 | 231 | (116, 347) | 20.0 | 0.7 | 2.1 |
| 25-44 | 645 | (323, 968) | 55.8 | 0.8 | 5.8 |
| 45-64 | 171 | ( 86, 257) | 14.8 | 0.4 | 1.5 |
| 65+ | 0 | | 0.0 | 0.0 | 0.0 |
| Total | 1,155 | | | 0.5 | 10.4 |
| **Sex:** | | | | | |
| Males | 876 | (438, 1,314) | 75.8 | 0.7 | 7.9 |
| Females | 279 | (140, 419) | 24.2 | 0.2 | 2.5 |

**NOTE:** No Data By Race

[1]Rate/100,000 Population (U.S. 1990)

[2]Rate/100,000 Boats Registered (U.S. 1991)

## Table 8A. Demographic Information--Propeller Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**State Data, Florida:**

| Age: | Number | Percent | Rate/100,000 Population[1] | Rate/100,000 Boats Registered[2] |
|---|---|---|---|---|
| 0-4 years | 3 | 7.0 | 0.4 | 0.4 |
| 5-14 | 1 | 2.3 | 0.1 | 0.1 |
| 15-24 | 16 | 37.2 | 1.0 | 2.3 |
| 25-44 | 21 | 48.8 | 0.2 | 3.1 |
| 45-64 | 2 | 4.7 | 0.6 | 0.3 |
| 65+ | 0 | 0.0 | 0.0 | 0.0 |
| Total | 43 | | 0.3 | 6.3 |
| **Sex:** | | | | |
| Males | 37 | 86.0 | 0.6 | 5.4 |
| Females | 6 | 14.0 | 0.1 | 0.9 |
| **Race:** | | | | |
| White | 40 | 93.0 | 0.4 | 5.8 |
| Other | 3 | 7.0 | 1.7 | 0.4 |

[1]Rate/100,000 Population (Florida 1990)

[2]Rate/100,000 Boats Registered (Florida 1991)

## Table 9. Type of Vessel, Injured Person and Water Information--Propeller Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

Nationwide Data (N=1,155)

| Vessel: | Number | 95% Confidence Limits | Percent |
|---|---|---|---|
| Motorboat | 669 | (335, 1,004) | 57.9 |
| Sailboat | 112 | (56, 168) | 9.7 |
| Other | 43 | (22, 65) | 3.7 |
| Unknown | 331 | (166, 497) | 28.7 |
| **Injured Person:** | | | |
| Operator | 198 | (99, 297) | 17.1 |
| Passenger | 120 | (60, 180) | 10.4 |
| Swimmer | 192 | (196, 288) | 16.7 |
| Skier | 111 | (56, 167) | 9.6 |
| Other | 73 | (37, 110) | 6.3 |
| Unknown | 460 | (230, 690) | 39.9 |
| **Body of Water:** | | | |
| Lake | 312 | (156, 468) | 27.0 |
| River | 231 | (116, 347) | 20.0 |
| Other | 228 | (114, 342) | 19.8 |
| Unknown | 383 | (192, 575) | 33.2 |

## Table 9A. Type of Vessel, Injured Person and Water Information--Propeller Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**State Data, Florida (N=43)**

| Vessel: | Number | Percent |
|---|---|---|
| Motorboat | 36 | 83.7 |
| Canoe | 1 | 2.3 |
| Personal Watercraft | 1 | 2.3 |
| Other | 3 | 7.0 |
| Unknown | 2 | 4.7 |
| **Propulsion System:** | | |
| Outboard Motor | 34 | 79.1 |
| Inboard Motor | 1 | 2.3 |
| Inboard/Outboard | 4 | 9.3 |
| Other | 1 | 2.3 |
| Unknown | 3 | 7.0 |
| **Body of Water:** | | |
| Lake/Pond | 14 | 32.6 |
| River | 5 | 11.6 |
| Ocean/Gulf | 10 | 23.3 |
| Canal/Cut | 3 | 7.0 |
| Bay/Sound | 6 | 14.0 |
| Port/Harbor | 1 | 2.3 |
| Creek | 1 | 2.3 |
| Other | 2 | 4.7 |
| Unknown | 1 | 2.3 |

## Table 10. Injury Descriptions--Propeller Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**Nationwide Data (N=1,155)**

| Injury Descriptions: | Number | 95% Confidence Limits | Percent |
|---|---|---|---|
| Fracture | 17 | (9, 26) | 1.5 |
| Contusions/Abrasions | 77 | (39, 116) | 6.7 |
| Lacerations | 1,044 | (522, 1,566) | 90.4 |
| Other | 17 | (9, 256) | 1.5 |

## Table 10A. Injury Descriptions--Propeller Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**State Data, Florida (N=43)**

| Injury Status: | Number | Percent |
|---|---|---|
| Injured | 36 | 83.7 |
| Fatal | 7 | 16.3 |
| Fracture, Yes | 6 | 42.9 |
| Fracture, No | 8 | 57.1 |

## Table 11. Activity or Operation at Time of Injury--Propeller Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**Nationwide Data (N=1,155)**

| Activity or Operation: | Number | 95% Confidence Limits | Percent |
|---|---|---|---|
| Maneuvering | 43 | (22, 65) | 3.7 |
| Racing | 43 | (22, 65) | 3.7 |
| Swimming | 192 | (96, 288) | 16.7 |
| Skiing | 111 | (56, 167) | 9.6 |
| Entering/Leaving Vessel | 34 | (17, 51) | 3.0 |
| Miscellaneous Falls | 34 | (17, 51) | 3.0 |
| Jump/Thrown From Vessel | 34 | (17, 51) | 3.0 |
| Other | 569 | (285, 854) | 49.3 |
| Unknown | 94 | (47, 141) | 8.1 |

## Table 11A. Activity or Operation at Time of Injury--Boat Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**State Data, Florida (N=43)**

| Activity or Operation: | Number | Percent |
|---|---|---|
| Cruising | 18 | 41.9 |
| Maneuvering | 7 | 16.3 |
| Fishing | 1 | 2.3 |
| Being Towed | 1 | 2.3 |
| Skiing | 6 | 14.0 |
| Scuba Diving | 2 | 4.7 |
| Skin Diving | 1 | 2.3 |
| At Anchor | 1 | 2.3 |
| Drifting | 3 | 7.0 |
| Unknown | 3 | 7.0 |

### *2. State Data*

Injury event narratives for each boat-propeller-related injury in the state data are provided in Appendix 3. Because of the linkage between the Florida trauma registry and the Florida Marine Patrol, more detail is available than in the CPSC data base. During the study period, HRS records indicate that motorboat propellers injured 43 persons representing 5% of the boating injury burden. Almost half (21) of these were injured persons between ages 25 and 44 years (Table 8A); the rate was highest for this age group as well using the Florida boat registration data. On the other hand, when using the 1990 census data, the rate is highest among persons 45 to 64 years of age. More than three-fourths were male (37), and over 90% were white.

Thirty-six of the propeller injuries involved motorboats (Table 9A). Where the information was recorded, outboard (13; 76.5%) and inboard/outboard motors (2; 11.8%) were the most common propulsion systems. The majority of propeller injuries, furthermore, occurred at lakes and ponds (32.6%) or at the ocean or gulf (23.3%).

Seven persons were reported to have died as a result of propeller injuries[10] (Table 10A), and six of the persons injured by propellers (42.9%) sustained fractures. Information from the narratives indicate that 19 of the persons injured by boat propellers had injuries to lower limbs, 10 had injuries to upper limbs and 8 had injuries to the head or face. Some persons sustained multiple injuries, and other injuries are not fully described. Cruising (41.9%) and maneuvering (16.3%) were the most common activities described at the time of injury.

Injury descriptions from the linked trauma registry and Florida Marine Patrol data show that all 43 propeller injuries occurred in the water. The engine was off in 2 (5%) and on in 38 (88.4%) of these propeller injuries. The engine status could not be determined in 3 (7%) of the Florida propeller injury descriptions.

## C. Fatal Injuries

Data on fatal injuries were available only for Florida, where 71 persons died while participating in boating-related activities (Tables 12-15). Children under age 5 years had the highest rate of injury death (1.4 per 100,000 population). Just over 30% of those who died were 25 to 44 years of age (23; 32.4%) (Table 12). This latter age group also had the highest death rate (3.4 per 100,000) using the boat registration denominator. Twelve children (16.9%) under age 5 died, as did 11 persons between ages 44 and 65 years of age. Over 80% of the deaths occurred among males (59; 83.1%), and almost 90% occurred among whites. Individuals classified as other race had the highest rate of injury (2.3 per 100,000 population), but this is based on only four deaths.

Motorboats were involved in more than half of the fatal injuries, usually with an outboard motor (63.4%) (Table 13).

[10]Based on information collected during the follow-up. Some individuals may have died once the follow-up efforts were completed.

Deaths were distributed among lakes and ponds (21.1%), rivers (16.9%), and the ocean and gulf (14.1%). Collision with a fixed object (11; 15.5%) or a fall overboard (10; 14.1%) were cited as the causes of most fatal injuries (Table 14). About 10% of the fatal injuries were due to the boat propeller. Most individuals, furthermore, were said to have been cruising (30; 42.3%) just prior to or at the time of death (Table 15).

## Table 12. Demographic Information--Fatal Injury Data Study of Boat and Boat-Propeller-Related Injuries United States, 1991-1992

**State Data, Florida:**

| Age: | Number | Percent | Rate/100,000 Population[1] | Rate/100,000 Boats Registered[2] |
|---|---|---|---|---|
| 0-4 years | 12 | 16.9 | 1.4 | 1.8 |
| 5-14 | 6 | 8.5 | 0.4 | 0.9 |
| 15-24 | 11 | 15.5 | 0.7 | 1.6 |
| 25-44 | 23 | 32.4 | 0.6 | 3.4 |
| 45-64 | 11 | 15.5 | 0.4 | 1.6 |
| 65+ | 8 | 11.3 | 0.4 | 1.2 |
| Total | 71 | | 0.5 | 10.4 |
| **Sex:** | | | | |
| Males | 59 | 83.1 | 0.9 | 8.6 |
| Females | 12 | 16.9 | 0.2 | 1.8 |
| **Race:** | | | | |
| White | 62 | 87.3 | 0.6 | 9.0 |
| Black | 5 | 7.0 | 0.3 | 0.7 |
| Other | 4 | 5.6 | 2.3 | 0.6 |

[1]Rate/100,000 Population (Florida 1990)

[2]Rate/100,000 Boats Registered (Florida 1991)

## Table 13. Type of Vessel, Injured Person and Water Information--Fatal Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**State Data, Florida (N=71)**

| Vessel: | Number | Percent |
|---|---|---|
| Motorboat | 41 | 57.8 |
| Auxiliary Sail | 2 | 2.8 |
| Sail (Only) | 1 | 1.4 |
| Row Boat | 3 | 4.2 |
| Canoe | 1 | 1.4 |
| Personal Watercraft | 3 | 4.2 |
| Other | 18 | 25.4 |
| Unknown | 2 | 2.8 |
| **Propulsion System:** | | |
| Outboard Motor | 45 | 63.4 |
| Inboard Motor | 7 | 9.9 |
| Inboard/Outboard | 1 | 1.4 |
| Air Propeller | 1 | 1.4 |
| Jet | 2 | 2.8 |
| Sail | 3 | 4.2 |
| Other | 9 | 12.7 |
| Unknown | 3 | 4.2 |
| **Body of Water:** | | |
| Lake/Pond | 15 | 21.1 |
| River | 12 | 16.9 |
| Ocean/Gulf | 10 | 14.1 |
| Canal/Cut | 8 | 11.3 |
| Bay/Sound | 8 | 11.3 |
| Inlet | 2 | 2.8 |
| Port/Harbor | 1 | 1.4 |
| Other | 10 | 14.1 |
| Unknown | 5 | 7.0 |

## Table 14. Injury Descriptions--Fatal Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**State Data, Florida (N=71)**

| *Injury Descriptions:* | Number | Percent |
|---|---|---|
| **Injury Status:** | | |
| Fracture, Yes | 4 | 80.0 |
| Fracture, No | 1 | 20.0 |
| Missing | 67 | |
| **Cause of injury:** | | |
| Grounding | 1 | 1.4 |
| Capsizing | 5 | 7.0 |
| Flooding | 6 | 8.5 |
| Collision with Vessel | 8 | 11.3 |
| Collision with Fixed Object | 11 | 15.5 |
| Falls Overboard | 10 | 14.1 |
| Falls in Boat | 2 | 2.8 |
| Fallen Skier | 1 | 1.4 |
| Hit by Propeller | 7 | 9.9 |
| Other | 6 | 8.5 |
| Unknown | 14 | 19.7 |

## Table 15. Activity or Operation at Time of Injury--Fatal Injury Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

**State Data, Florida (N=71)**

| Activity or Operation: | Number | Percent |
|---|---|---|
| Cruising | 30 | 42.3 |
| Maneuvering | 5 | 7.0 |
| Fishing | 5 | 7.0 |
| Racing | 1 | 1.4 |
| Swimming | 1 | 1.4 |
| Skiing | 1 | 1.4 |
| At Anchor | 2 | 2.8 |
| Drifting | 6 | 8.5 |
| Other Commercial | 1 | 1.4 |
| Other | 5 | 7.0 |
| Unknown | 14 | 19.7 |

# VI. CONCLUSIONS

This report enumerates boat and boat-propeller-related injuries during a one-year period. Two different perspectives of this injury problem are described. Data collection by CPSC provided a range of nationwide boat-related injury estimates. A maximum of 61,390 to a minimum of 46,369 boat-related injuries were treated in hospital emergency departments in the United States. An estimated 1,155 of these were boat-propeller-related injuries. In Florida, 860 boating-related injuries were recorded based on data from the Florida trauma registry and the Florida Marine Patrol. Of these, 43 were caused by boat propellers and 71 resulted in death.

Consistently, persons aged 25 to 44 years had the highest frequencies for boating, propeller and fatal injuries. Persons aged 15 to 24 years often had the highest rate of injury, but children under 5 years had the highest rate of injury death. Males had both the highest frequency and rate of injury. Skiing, swimming, cruising and maneuvering were common activites at the time of injury or death in the nationwide and Florida data bases. In the nationwide data, lacerations comprised the largest proportion of boat and boat-propeller-related injuries

We used two denominators to calculate rates of injury in the nationwide and Florida data. The 1990 census data are categorized by age, sex and race which allows assessment of relative differences in rates of injuries within the sample populations. The disadvantage of census data is that only total population figures by age, sex and race are available; there is no opportunity to separate recreational boating. Of the estimates available, the boat registration data probably comes closest to the true boating population estimate. Boat registration data, however, are not categorized by age, sex and race, and misleading rates have resulted. For example, the high rate of fatal injury among children under age 5 years is likely due to no boat registrations in that age group.

In the nationwide data, the majority (84.6%) of persons injured by boats required only emergency department treatment. Seventy-three percent of the boat propeller injuries were minor. Regardless of severity, lacerations comprised the largest proportion of boating injuries described in the nationwide data. In Florida, however, more individuals were hospitalized for extensive injuries.

Assuming that hospitalization implies a more severe injury condition, 11.5% (nationally) and 20.9% (Florida) of persons injured by boat propellers were hospitalized. Among the 1,155 persons injured by boat propellers in the nationwide data, 763 (95% confidence limits: 382, 1,145) had injuries to lower limbs and 392 (95% confidence limits: 196, 588) had injuries to upper limbs. Among the 43 persons injured by boat propellers discussed in the Florida data, the following injuries were described: 19 to lower limbs, 10 to upper limbs and 8 to the head or face (some persons sustained multiple injuries).

Propeller-related injuries are classically described as multiple, deep, parallel lacerations. In the U.S. and Florida data respectively, 1,044 of 1,155 (90.4%) and 26 of 43 (60.5%) propeller-related injuries were lacerations and amputations.

Based on the propeller injury narrative reports and patient follow-up conducted as part of this study, we have assumed that these injuries were due to direct contact with the propeller. In fact, 57% of the narratives in the nationwide data indicate that the individual believed that he or she was struck by or hit the propeller during recreational boating activities (for the remaining 43%, they either did not describe specifically how the propeller was involved in their injury or they were lost to follow-up). However, contact with other boat appurtenances close to the propeller (e.g., skeg, lower gearcase) could have, in fact, been the source of the injury. Only direct, objective observation of the injury event, clearly impossible to conduct, could have determined the true number of injuries due to direct contact with the propeller.

Of the reported propeller-related injuries, 21% or fewer were severe enough to require hospitalization. We assume from the exisitng scientific literature that the most severe injuries result from contact with the propeller while it is engaged and rotating. Although this study made no attempt to evaluate potential interventions, strategies should focus on preventing the most severe injuries. Available interventions include educational programs to alert boaters to the injury risks, measures to reduce the prevalence of drinking alcohol while engaged in water recreational activities, and direct modifications to the boat and propeller apparatus, e.g., propeller guards. While environmental modifications are appealing in that they are permanently in place to prevent nearby boating enthusiasts from damaging contact with the propeller, boating experts are not in agreement as to the efficacy and effectiveness of existing protective mechanisms. This study clarifies that magnitude and severity of propeller-related injuries in an effort to form a scientific foundation for further assessment of prevention strategies.

This study determined the feasibility and cost of obtaining a national sample and state-based supplemental data on boating injuries. Our adaptation of CPSC's NEISS data base collected information on a wide range of injuries by design and provided national estimates. We wanted to capture boat and boat-propeller-related injuries in all settings where such injuries are possible. Injuries occurring, therefore, both in the water and in out-of-water activities such as storage and repair of vessels were depicted in the study. Florida provided state-based data using a different method, linking trauma registry to state marine patrol data. This linkage provided improved descriptions of the injury event. Not all records could be linked, however, so that descriptions were available for only a subset of injured persons.

This descriptive report is not a comprehensive analysis of the entire boat injury or propeller-related injury problem. National data did not include fatalities because they are not collected by NEISS. Some injured persons were lost to follow-up, so supplemental data on the circumstances at the time of injury were not reported. This is not a report of injury risk during boating recreation. That is, we did not seek information from uninjured individuals who engaged in boat recreation during the study period. Consequently, this report is a description and enumeration of boating-related injuries

only. We attempted to include data on alcohol use, but reliable information could not be collected through the selected data collection mechanisms. Additionally, our data collection missed individuals who sought medical treatment exclusively through a private provider and individuals whose injuries were so minor that no hospital care was needed.

In keeping with USCG requests, we believed that broadening the scope of data collection would give the USCG an opportunity assess the margin by which its current data collection system missed boat-related injuries. Data from either CPSC's NEISS or Florida's trauma registry, however, may not match USCG figures for the study period. CPSC collects data from hospital emergency rooms, and no attempt is made to corroborate their data with police, marine patrol or USCG data. Data from Florida's trauma registry, despite the linkage with Florida Marine Patrol data, may under-report USCG boat injury estimates for the study period. While all hospitals in Florida participate in the trauma registry, reporting is not complete. That is, we know that all hospitals in Florida submitted at least one report to the trauma registry during the study period, but hospitals may not have reported every traumatic injury to the trauma registry. No mechanism exists to assure that all traumatic injuries are reported to the state. Some injuries that were treated by emergency medical or hospital personnel were likely not recorded in the trauma registry.

Our adaptation of CPSC's NEISS data base collected information on a wide range of injuries by design. We wanted the special module to capture boat and boat propeller-related injuries in all settings where such injuries are possible. Injuries occurring, therefore, in the storage and repair of water vessels were depicted in this study. Florida used a different method, linking trauma registry to the state marine patrol data. The advantage was improved injury descriptions. Not all records could be linked so that descriptions were available for only a subset of injured persons.

This report describes the boat and propeller injury problems from a medical perspective--medical reports initiated the data collection mechanisms. In a one-year period, this study records fewer injuries nationally when compared to the American Red Cross's ***National Boating Survey***, and fewer injuries when compared with USCG data. We also report fewer Florida injuries than those recorded by the USCG.

This report uses medical reports as the initial data collection mechanism rather than reports originating from regulatory or legal sources. The injury events themselves were obviously not observed as part of this study. Although medically verified injury data were used, ascriptions of any injury to propellers were based on the statements of the injured person, medical personnel and/or the Florida Marine Patrol. One of the strengths of this study, however, was the follow-back component, which elicited a detailed narrative of the event from the injured individual. Many of the narratives indicate quite clearly that the individual believed that he or she was struck by or hit the propeller directly. Therefore, we have evidence to support our conclusions that this study captures a true representation of boating and propeller-related injuries.

The main goal of the study was to describe the boating and boat propeller-related injury problem in the United States. Data are provided for one year, consequently, fluctuations in these injuries from year to year have not been accommodated. We encourage caution, therefore, in drawing long-term conclusions from our report.

# VII. FUTURE DIRECTIONS

The USCG may consider the following issues when it evaluates data collection and regulatory decisions on boat and boat-propeller-related injuries in the future.

- **This study allowed the identification of data collection components that would be useful for a national data system.** Some of the benefits include improved mechanisms for case ascertainment; risk factor information; and linkage of systems which permitted injury specific data and circumstances of the injury.
- **The study underscored the advantages of active reporting.** More complete case identification, better risk factor data and injury specific data were available from active case finding. These benefits must be weighed against the relative costs and complexity of active data collection.
- **The Boat Accident Reporting Form (DOT, USCG-3865) can be amended to allow identification of propeller injuries distinct from other boating injuries, rather than combining them with other boating injuries.**
- **The Boat Accident Reporting Form (DOT, USCG-3865) can be amended to allow the collection of data on multiple injuries and all injuries that occur in the sequence of events.**
- **Refined injury severity assessment is currently not feasible.** Although current anatomic injury severity scoring schemes are available, there are no clearly superior systems that allow severity scoring retrospectively from existing data.
- **This study adds to a growing body of scientific research, including work conducted by the USCG, on boat and boat-propeller-related injury.** In view of this, the USCG now has a more extensive scientific foundation upon which to assess existing boat propeller injury prevention strategies.

# VIII. REFERENCES


American Red Cross. ***National Boating Survey*** Washington, DC: American Red Cross, 1991.

Centers for Disease Control. Recreational boating fatalities--Ohio, 1983-1986. ***Morbidity and Mortality Weekly Report*** 1987;36(21):321-324.

Centers for Disease Control. Alcohol use and aquatic activities--Massachusetts, 1988. ***Morbidity and Mortality Weekly Report*** 1990;39(20):332-334.

United States Coast Guard. Boating statistics 1991. Washington, DC: U.S. Department of Transportation (COMDTPUB P16754.3), July 1992.

Baker S.P., O'Neill B., Ginsburg M.J., Li, G. ***The Injury Fact Book (2nd ed.)*** New York: Oxford University Press, 1992:176.

Hargarten S.W., Karlson T., Vernick J.S., Aprahamian C. Outboard motor propellers and injuries: Enumeration, prevention, and policy. Unpublished manuscript, 1992.

Hennekens C.H., Buring J.E. ***Epidemiology in Medicine*** Boston: Little, Brown & Company, 1987:33.

Howland J., Hingson R. Alcohol as a risk factor for drownings: a review of the literature (1955-1985). ***Accident Analysis & Prevention*** 1988:20(1):19-25.

Report of the Propeller Guard Subcommittee, National Boating Safety Advisory Council. November 7, 1989.

Kelley B. Institute for Injury Reduction. SPIG Newsletter 1991.

Kutarski P.W. Outboard motor propeller injuries. ***Injury: the British Journal of Accident Surgery*** 1989;20(2):88-91.

MacKenzie E.J. Injury severity scales: Overview and directions for future research. ***American Journal of Emergency Medicine*** 1984;2(6):537-549.

Mann R.J. Propeller injuries. ***Southern Medical Journal*** May 1976;69(5):567-9.

Mann R.J. Propeller injuries incurred in boating accidents. ***American Journal of Sports Medicine*** 1980;8(4):280-4.

Mengert P., Sussman E.D., DiSario R. A study of the relationship between the risk of fatality and blood alcohol concentration of recreational boat operators. Final Report. Washington, DC: United States Coast Guard (CG-D-09-92, DOT-VNTSC-CG-92-1), March 1992.

Orenstein W.A., Bernier R.H. Surveillance: Information for action. ***Pediatric Clinics of North America*** June 1990;37(3):709-33.

Penttila A., Piipponen S., Pikkarainen J. Drunken driving with motorboat in Finland. ***Accident Analysis & Prevention*** 1979;11:237-239.

Price C.T., Moorefield C.W. Motorboat propeller injuries. ***The Journal of the Florida Medical Association, Inc.*** June 1987;74(6):399-401.

Purcell E.S., Lincoln W.B. Boat and propeller impact injuries and fatalities (Project 763584.20, Final Report). Groton, CT: U.S. Coast Guard Research and Development Center, March 1, 1987.

Vernick J.S., Baker S.P., Edmunds L., Kelley B., Smith L., Teret S.P., Zierler A. ***Motorboat Propeller Injuries.*** Baltimore, Maryland: The Johns Hopkins University Injury Prevention Center and the Institute for Injury Reduction, September 1992.

# Appendices

Sec.

2.05-25 Navigable waters of the United States; Navigable Waters; Territorial Waters.
2.05-27 Waters subject to tidal influence; waters subject to the ebb and flow of the tide; mean high water.
2.05-30 Waters subject to the jurisdiction of the United States; waters over which the United States has jurisdiction.

**Subpart 2.10—Availability of Jurisdictional Decisions**

2.10-1 Maintenance of decisions.
2.10-5 Availability of lists and charts.
2.10-10 Decisions subject to change or modification.

AUTHORITY: 14 U.S.C. 633, 80 Stat. 931 (49 U.S.C. 1655(b)); 49 CFR 1.4(b), 1.46(b).

SOURCE: CGD 75-098, 40 FR 49326, Oct. 22, 1975, unless otherwise noted.

## Subpart 2.01—Purpose

### § 2.01-1 Purpose.

The purpose of this part is to inform the public of the definitions which the Coast Guard uses to examine waters to determine whether the Coast Guard has jurisdiction on those waters under particular U.S. laws.

## Subpart 2.05—Definitions of Jurisdictional Terms

### § 2.05-1 High seas.

(a) Except as provided in paragraphs (b) and (c) of this section, *high seas* means all waters which are neither territorial seas nor internal waters of the United States or of any foreign country.[1]

(b) *High seas*, as used in 18 U.S.C. 7(1), means the Great Lakes and waters seaward of the low water line along the coast, except waters within harbors or narrow coastal indentations enclosed by promontories.[1]

(c) *High seas*, as used in section 2 of the Act of February 19, 1895, as amended, 33 U.S.C. 151, and all laws referring thereto, means the waters seaward of the lines described in part 82 of this chapter.

### § 2.05-5 Territorial seas.

(a) With respect to the United States, *territorial seas* means the waters within the belt, 3 nautical miles wide, that is adjacent to its coast and seaward of the territorial sea baseline.

(b) With respect to any foreign country, *territorial seas* means the waters within the belt that is adjacent to its coast and whose breadth and baseline are recognized by the United States.

### § 2.05-10 Territorial sea baseline.

*Territorial Sea Baseline* means the delimitation of the shoreward extent of the territorial seas of the United States drawn in accordance with principles, as recognized by the United States, of the Convention on the Territorial Sea and the Contiguous Zone, 15 U.S.T. 1606. Charts depicting the territorial sea baseline are available for examination in accordance with § 1.10-5(b) of this chapter.

### § 2.05-15 Contiguous zone.

*Contiguous zone* means the belt of high seas, 9 nautical miles wide, that is adjacent to and seaward of the territorial seas of the United States and that was declared to exist in Department of State Public Notice 358 of June 1, 1972, 37 FR 11906.

[1] It should be noted that under 14 U.S.C. 89 the Coast Guard is authorized to enforce the laws of the United States upon the "high seas" and waters over which the United States has jurisdiction. Certain of the criminal laws of the United States are based on its special maritime and territorial jurisdiction, one of whose components is the "high seas", as defined in paragraph (b). However, this definition of "high seas" does not apply to the use of "high seas" found in 14 U.S.C. 89, to which the definition in paragraph (a) applies. A clear distinction should be maintained between the Coast Guard's authority under 14 U.S.C. 89 and the jurisdictional base of the criminal laws which apply to the special maritime and territorial jurisdiction. For example, while assault (18 U.S.C. 113) committed seaward of the territorial sea could be committed on the "high seas" for both purposes, an assault committed within the territorial sea could be committed on the "high seas" to bring it within the special maritime and territorial jurisdiction and at the same time be committed on waters over which the United States has jurisdiction (not the "high seas") for purposes of the Coast Guard's authority to undertake enforcement action.





### § 2.05-20 Internal waters and inland waters.

(a) *Internal waters* and, except as provided in paragraph (b) of this section, *inland waters* mean:

(1) With respect to the United States, the waters shoreward of the territorial sea baseline.

(2) With respect to any foreign country, the waters shoreward of the baseline of its territorial sea, as recognized by the United States.

(b) *Inland waters*, as used in 33 U.S.C. Chapter 3, means the waters shoreward of the lines described in part 82 of this chapter, except the Great Lakes and their connecting and tributary waters as far east as Montreal, the waters of the Mississippi River between its source and the Huey P. Long Bridge and all of its tributaries emptying thereinto and their tributaries, that part of the Atchafalaya River above its junction with the Plaquemine-Morgan City alternate waterway, and the Red River of the North.

### § 2.05-25 Navigable waters of the United States; Navigable Waters; Territorial Waters.[2]

(a) Except as provided in paragraph (b) of this section, *navigable waters of the United States*, *navigable waters*, and *territorial waters* mean, except where Congress has designated them not to be navigable waters of the United States:

(1) Territorial seas of the United States;

(2) Internal waters of the United States that are subject to tidal influence; and

(3) Internal waters of the United States not subject to tidal influence that:

(i) Are or have been used, or are or have been susceptible for use, by themselves or in connection with other waters, as highways for substantial interstate or foreign commerce, notwithstanding natural or man-made obstructions that require portage, or

(ii) A governmental or non-governmental body, having expertise in waterway improvement, determines to be capable of improvement at a reasonable cost (a favorable balance between cost and need) to provide, by themselves or in connection with other waters, highways for substantial interstate or foreign commerce.

(b) *Navigable waters of the United States* and *navigable waters*, as used in sections 311 and 312 of the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1321 and 1322, mean:

(1) Navigable waters of the United States as defined in paragraph (a) of this section and all waters within the United States tributary thereto; and

(2) Other waters over which the Federal Government may exercise Constitutional authority.

### § 2.05-27 Waters subject to tidal influence; waters subject to the ebb and flow of the tide; mean high water.

*Waters subject to tidal influence* and *waters subject to the ebb and flow of the tide* are interpreted as waters below mean high water. "Mean high water" is the average of the height of the diurnal high water at a particular location measured over a lunar cycle period of 19 years. These terms do not include waters above mean high water caused by flood flows, storms, high winds, seismic waves, or other non-lunar phenomena.

(Secs. 107, 108, Pub. L. 97-322, 96 Stat. 1582 (33 U.S.C. 495, 499, 502, 525, 533); 49 CFR 1.46(c))

[CGD 82-102, 47 FR 54299, Dec. 2, 1982]

### § 2.05-30 Waters subject to the jurisdiction of the United States; waters over which the United States has jurisdiction.[2]

*Waters subject to the jurisdiction of the United States* and *waters over which the United States has jurisdiction* mean:

(a) Navigable waters of the United States;

[2] In various laws administered and enforced by the Coast Guard, the terms "State" and "United States" are defined to include some or all of the territories and possessions of the United States. The definitions in §§ 2.05-25 and 2.05-30 should be considered as supplementary to these statutory definitions and not as interpretive of them.

[2] See footnote 2 to § 2.05-25.

(b) Other waters that are located on lands, owned by the United States, with respect to which jurisdiction has been accepted in accordance with 33 U.S.C. 733 by the authorized federal officer having custody, control, or other authority over them;

(c) Other waters that are located on lands, owned by the United States, with respect to which the United States retains concurrent or exclusive jurisdiction from the date that the State in which the lands are located entered the union; and

(d) Waters within the territories and possessions of the United States and the Trust Territories of the Pacific Islands.[1]

## Subpart 2.10—Availability of Jurisdictional Decisions

### § 2.10-1 Maintenance of decisions.

Each Coast Guard district maintains:

(a) A list of waters within the district which the Coast Guard has decided to be navigable waters of the United States for the purposes of its jurisdiction, and

(b) Charts reflecting Coast Guard decisions as to the location of the territorial sea baseline for the purposes of Coast Guard jurisdiction, if the district includes portions of the territorial seas.

### § 2.10-5 Availability of lists and charts.

The lists and charts referred to in § 2.10-1 of this chapter are available to the public and may be inspected or obtained in accordance with § 1.10-5(b) of this chapter.

### § 2.10-10 Decisions subject to change or modification.

The decisions referred to in § 2.10-1 of this subpart are subject to change or modification. Inquiries concerning the status of specific waters, for the purposes of Coast Guard jurisdiction, should be directed to the District Commander of the district in which the waters are located.



# PART 3—COAST GUARD AREAS, DISTRICTS, MARINE INSPECTION ZONES, AND CAPTAIN OF THE PORT ZONES


Subpart 3.01—General Provisions

Sec.
3.01-1 General description.
3.01-5 Assignment of functions.

Subpart 3.04—Coast Guard Areas

3.04-1 Atlantic Area.
3.04-3 Pacific Area.

Subpart 3.05—First Coast Guard District

3.05-1 First district.
3.05-10 Boston Marine Inspection Zone and Captain of the Port Zone.
3.05-15 Portland, Maine Marine Inspection Zone and Captain of the Port Zone.
3.05-20 Providence Marine Inspection Zone and Captain of the Port Zone.
3.05-25 New York Marine Inspection Zone.
3.05-30 New York Captain of the Port Zone.
3.05-35 Long Island Sound Captain of the Port Zone.

Subpart 3.10—Second Coast Guard District

3.10-1 Second district.
3.10-10 St. Louis Marine Inspection Zone and Captain of the Port Zone.
3.10-15 Paducah Marine Inspection Zone and Captain of the Port Zone.
3.10-30 Huntington Marine Inspection Zone and Captain of the Port Zone.
3.10-35 Louisville Marine Inspection Zone and Captain of the Port Zone.
3.10-40 Memphis Marine Inspection Zone and Captain of the Port Zone.
3.10-50 Pittsburgh Marine Inspection Zone and Captain of the Port Zone.

Subpart 3.25—Fifth Coast Guard District

3.25-1 Fifth district.
3.25-05 Philadelphia Marine Inspection Zone and Captain of the Port Zone.
3.25-10 Hampton Roads Marine Inspection Zone and Captain of the Port Zone.
3.25-15 Baltimore Marine Inspection Zone and Captain of the Port Zone.
3.25-20 Wilmington Marine Inspection Zone and Captain of the Port Zone.

Subpart 3.35—Seventh Coast Guard District

3.35-1 Seventh district.
3.35-10 Miami Marine Inspection Zone and Captain of the Port Zone.





Sec.
3.35-15 Charleston Marine Inspection Zone and Captain of the Port Zone.
3.35-20 Jacksonville Marine Inspection Zone and Captain of the Port Zone.
3.35-25 San Juan Marine Inspection Zone and Captain of the Port Zone.
3.35-30 Savannah Marine Inspection Zone and Captain of the Port Zone.
3.35-35 Tampa Marine Inspection Zone and Captain of the Port Zone.

Subpart 3.40—Eighth Coast Guard District

3.40-1 Eighth district.
3.40-10 Mobile Marine Inspection Zone and Captain of the Port Zone.
3.40-15 New Orleans Marine Inspection Zone and Captain of the Port Zone.
3.40-17 Morgan City Marine Inspection Zone and Captain of the Port Zone.
3.40-20 Port Arthur Marine Inspection Zone and Captain of the Port Zone.
3.40-25 Houston Marine Inspection Zone and Captain of the Port Zone.
3.40-30 Galveston Marine Inspection Zone and Captain of the Port Zone.
3.40-35 Corpus Christi Marine Inspection Zone and Captain of the Port Zone.

Subpart 3.45—Ninth Coast Guard District

3.45-1 Ninth district.
3.45-5 Cleveland Marine Inspection Zone and Captain of the Port Zone.
3.45-10 Buffalo Marine Inspection Zone and Captain of the Port Zone.
3.45-15 Chicago Marine Inspection Zone.
3.45-20 Detroit Marine Inspection Zone and Captain of the Port Zone.
3.45-25 Duluth Marine Inspection Zone and Captain of the Port Zone.
3.45-30 Milwaukee Marine Inspection Zone and Captain of the Port Zone.
3.45-35 Sturgeon Bay Marine Inspection Zone.
3.45-45 St. Ignace Marine Inspection Zone and Sault Ste. Marie Captain of the Port Zone.
3.45-50 Toledo Marine Inspection Zone and Captain of the Port Zone.
3.45-60 Chicago Captain of the Port Zone.
3.45-80 Grand Haven Captain of the Port Zone.

Subpart 3.55—Eleventh Coast Guard District

3.55-1 Eleventh district.
3.55-10 Los Angeles-Long Beach Marine Inspection Zone and Captain of the Port Zone.
3.55-15 San Diego Marine Inspection Zone and Captain of the Port Zone.
3.55-20 San Francisco Marine Inspection Zone and Captain of the Port Zone.

Sec.
Subpart 3.65—Thirteenth Coast Guard District

3.65-1 Thirteenth district.
3.65-10 Puget Sound Marine Inspection Zone and Captain of the Port Zone.
3.65-15 Portland, Oregon, Marine Inspection Zone and Captain of the Port Zone.

Subpart 3.70—Fourteenth Coast Guard District

3.70-1 Fourteenth district.
3.70-10 Honolulu Marine Inspection Zone and Captain of the Port Zone.
3.70-15 Guam Marine Inspection Zone and Captain of the Port Zone.

Subpart 3.85—Seventeenth Coast Guard District

3.85-1 Seventeenth district.
3.85-10 Southeast Alaska Marine Inspection Zone and Captain of the Port Zone.
3.85-15 Western Alaska Marine Inspection Zone and Captain of the Port Zone.
3.85-20 Prince William Sound Marine Inspection Zone and Captain of the Port Zone.


AUTHORITY: 14 U.S.C. 633; 49 CFR 1.45, 1.46.

## Subpart 3.01—General Provisions

### § 3.01-1 General description.

(a) The structure of the Coast Guard's general organization for the performance of its assigned functions and duties consists of the Commandant, assisted by the Headquarters staff, two Area Offices to act as intermediate echelons of operational command, and District Offices to provide regional direction and coordination. The District Offices operate within defined geographical areas of the United States, its territories, and possessions, including portions of the high seas adjacent thereto. The description of the districts is established by the Commandant under the authority delegated by 49 CFR 1.45 and 1.46.

(b) The two Coast Guard Areas are the Atlantic Area (see § 3.04-1 of this part) and the Pacific Area (see § 3.04-3). The Coast Guard Area Commander is in command of a Coast Guard Area; the offices are referred to as a Coast Guard Area Office. Area Commanders have the responsibility of determining when operational matters require the coordination of forces and facilities of more than one district.

### CODE OF FEDERAL REGULATIONS

Boating safety system, see 33 CFR Chap. I, Subchap. S.

### NOTES OF DECISIONS

Admissions 2
Tampering with report 1

1. Tampering with report

The unexplained abstraction from the files of the office of the local inspectors of the report of a vessel in collision, and the filing of an amended report four days after, both of which were in the handwriting of a clerk of the claimant, is irregular and unlawful, and presumably chargeable upon the claimant, and would throw discredit upon its case, if the merits were otherwise doubtful. Dinniny v. The Sam Sloan, D.C.N.Y. 1894, 65 F. 125.

2. Admissions

Report by master of towboat to Coast Guard, including statement that collision was caused principally by tow sheering from shoal was required by law and was an admission against interest, and where received in evidence while action in admiralty was still undetermined and under consideration by court, its receipt was within discretion of court, though master who made report had died before report was accepted by court. Carolinersville Towing Co. v. John I. Hay Co., C.A.La. 1964, 334 F.2d 376.

## § 6102. State marine casualty reporting system

(a) The Secretary shall prescribe regulations for a uniform State marine casualty reporting system for vessels. Regulations shall prescribe the casualties to be reported and the manner of reporting. A State shall compile and submit to the Secretary reports, information, and statistics on casualties reported to the State, including information and statistics concerning the number of casualties in which the use of alcohol contributed to the casualty.

(b) The Secretary shall collect, analyze, and publish reports, information, and statistics on marine casualties together with findings and recommendations the Secretary considers appropriate. If a State marine casualty reporting system provides that information derived from casualty reports (except statistical information) may not be publicly disclosed, or otherwise prohibits use by the State or any person in any action or proceeding against a person, the Secretary may use the information provided by the State only in the same way that the State may use the information.

(Pub.L. 98-89, Aug. 26, 1983, 97 Stat. 536; Pub.L. 98-557, § 7(b)(2), Oct. 30, 1984, 98 Stat. 2862.)

### HISTORICAL AND STATUTORY NOTES

1984 Amendment
Subsec. (a). Pub.L. 98-557 added provisions relating to alcohol as a contributing factor to the casualty.

Legislative History
For legislative history and purpose of Pub.L. 98-557, see 1984 U.S. Code Cong. and Adm. News, p. 4831.

### NOTES OF DECISIONS

1. Disclosure restrictions

In view of fact that evidence before trial judge was solely as the effect that report which was made by defendant after motorboat accident and from which plaintiff's counsel sought to question defendant was one which had been filed with the Coast Guard, there being no evidence before the trial judge that the report required by the Coast Guard had in fact been filed with Maryland, it was not improper to allow the report to be used in questioning defendant and any error, if committed, was not reversible where it appeared from record that questioning from document did not contradict defendant's testimony. Engle v. Stull, 1967, 377 F.2d 930, 126 U.S.App. D.C. 291.



## § 6103. Penalty

(a) An owner, charterer, managing operator, agent, master, or individual in charge of a vessel failing to report a casualty as required under section 6101 of this title or a regulation prescribed under section 6101 is liable to the United States Government for a civil penalty of $1,000.

(b) A person failing to comply with section 6104 of this title or a regulation prescribed under that section is liable to the Government for a civil penalty of not more than $5,000.

(Pub.L. 98-89, Aug. 26, 1983, 97 Stat. 536; Pub.L. 98-498, Title II, § 212(b)(2), Oct. 19, 1984, 98 Stat. 2306; Pub.L. 100-424, § 4(b), Sept. 9, 1988, 102 Stat. 1590.)

### HISTORICAL AND STATUTORY NOTES

1988 Amendment
Pub.L. 100-424, § 4(b), designated provisions which imposed civil penalty of $1000 for failure to report casualty as subsec. (a), and added subsec. (b).

1984 Amendment
Pub.L. 98-498 struck out "or incident" after "a casualty".

Effective Date of 1984 Amendment
Amendment by Pub.L. 98-498, effective one hundred and eighty days after Oct. 19, 1984, see section 214 of Pub.L. 98-498 set out as an Effective Date note under section 2306 of this title.

Legislative History
For legislative history and purpose of Pub.L. 98-498, see 1984 U.S. Code Cong. and Adm. News, p. 3909. See, also, Pub.L. 100-424, 1988 U.S. Code Cong. and Adm. News, p. 2149.

### LIBRARY REFERENCES

Shipping ⇐16.
C.J.S. Shipping § 11.

## § 6104. Commercial fishing industry vessel casualty statistics

(a) The Secretary shall compile statistics concerning marine casualties from data compiled from insurers of fishing vessels, fish processing vessels, and fish tender vessels.

(b) A person underwriting primary insurance for a fishing vessel, fish processing vessel, or fish tender vessel shall submit periodically to the Secretary data concerning marine casualties that is required by regulations prescribed by the Secretary.

(c) After consulting with the insurance industry, the Secretary shall prescribe regulations under this section to gather a statistical

12/18/92 13:13 202 267 4385 G-NAB-5 004/006

### § 173.35 Coast Guard validation sticker.

No person may use a vessel except a vessel exempted in § 173.13 that has a number issued by the Coast Guard unless it has the validation sticker issued with the certificate of number displayed within 6 inches of the number.

## Subpart C—Casualty and Accident Reporting

### § 173.51 Applicability.

(a) This subpart applies to each vessel used on waters subject to the jurisdiction of the United States and on the high seas beyond the territorial seas for vessels owned in the United States that:

(1) Is used by its operator for recreational purposes; or

(2) Is required to be numbered under this part.

(b) This subpart does not apply to a vessel subject to inspection under Title 46 U.S.C. Chapter 33.

[CGD 72-54R, 37 FR 21399, Oct. 7, 1972, as amended by CGD 84-099, 52 FR 47533, Dec. 14, 1987]

### § 173.53 Immediate notification of death or disappearance.

(a) When, as a result of an occurrence that involves a vessel or its equipment, a person dies or disappears from a vessel, the operator shall, without delay, by the quickest means available, notify the nearest reporting authority listed in Appendix A of this part of:

(1) The date, time, and exact location of the occurrence;

(2) The name of each person who died or disappeared,

(3) The number and name of the vessel; and

(4) The names and addresses of the owner and operator.

(b) When the operator of a vessel cannot give the notice required by paragraph (a) of this section, each person on board the vessel shall notify the casualty reporting authority or determine that the notice has been given.

### § 173.55 Report of casualty or accident.

(a) The operator of a vessel shall submit the casualty or accident report prescribed in § 173.57 to the reporting authority prescribed in § 173.59 when, as a result of an occurrence that involves the vessel or its equipment:

(1) A person dies;

(2) A person is injured and requires medical treatment beyond first aid;

(3) Damage to the vessel and other property totals more than $500 or there is a complete loss of the vessel; or

(4) A person disappears from the vessel under circumstances that indicate death or injury.

(b) A report required by this section must be made:

(1) Within 48 hours of the occurrence if a person dies within 24 hours of the occurrence;

(2) Within 48 hours of the occurrence if a person is injured and requires medical treatment beyond first aid, or disappears from a vessel; and

(3) Within 10 days of the occurrence or death if an earlier report is not required by this paragraph.

(c) When the operator of a vessel cannot submit the casualty or accident report required by paragraph (a) of this section, the owner shall submit the casualty or accident report.

[CGD 72-54R, 37 FR 21399, Oct. 7, 1972, as amended by CGD 76-155, 44 FR 5308, Jan. 25, 1979; CGD 82-015, 54 FR 5610, Feb. 6, 1989]

### § 173.57 Casualty or accident report.

Each report required by § 173.55 must be in writing, dated upon completion, and signed by the person who prepared it and must contain, if available, at least the following information about the casualty or accident:

(a) The numbers and names of each vessel involved.

(b) The name and address of each owner of each vessel involved.

(c) The name of the nearest city or town, the county, the State, and the body of water.

(d) The time and date the casualty or accident occurred.

(e) The location on the water.

(f) The visibility, weather, and water conditions.





(g) The estimated air and water temperatures.

(h) The name, address, age, or date of birth, telephone number, vessel operating experience, and boating safety training of the operator making the report.

(i) The name and address of each operator of each vessel involved.

(j) The number of persons on board or towed on skis by each vessel.

(k) The name, address, and date of birth of each person injured or killed.

(l) The cause of each death.

(m) Weather forecasts available to, and weather reports used by, the operator before and during the use of the vessel.

(n) The name and address of each owner of property involved.

(o) The availability and use of personal flotation devices.

(p) The type and amount of each fire extinguisher used.

(q) The nature and extent of each injury.

(r) A description of all property damage and vessel damage with an estimate of the cost of all repairs.

(s) A description of each equipment failure that caused or contributed to the cause of the casualty.

(t) A description of the vessel casualty or accident.

(u) The type of vessel operation (cruising, drifting, fishing, hunting, skiing, racing, or other), and the type of accident (capsizing, sinking, fire, or explosion or other).

(v) The opinion of the person making the report as to the cause of the casualty, including whether or not alcohol or drugs, or both, was a cause or contributed to causing the casualty.

(w) The make, model, type (open, cabin, house, or other), beam width at widest point, length, depth from transom to keel, horsepower, propulsion (outboard, inboard, inboard outdrive, sail, or other), fuel (gas, diesel, or other), construction (wood, steel, aluminum, plastic, fiberglass, or other), and year built (model year), of the reporting operator's vessel.

(x) The name, address, and telephone number of each witness.

(y) The manufacturer's hull identification number, if any, of the reporting operator's vessel.

(z) The name, address, and telephone number of the person submitting the report.

[CGD 72-54R, 37 FR 21399, Oct. 7, 1972, as amended by CGD 84-099, 52 FR 47533, Dec. 14, 1987]

### § 173.59 Where to report.

A report required by § 173.55 must be submitted to:

(a) The reporting authority listed in Appendix A of this part where the vessel number was issued, or, if the vessel has no number, where the vessel is principally used; or

(b) The reporting authority where the casualty or accident occurred, if it occurred outside the State where the vessel is numbered or principally used.

## Subpart D—Issue of Certificate of Number

### § 173.71 Application for certificate of number.

Any person who is the owner of a vessel to which § 173.11 applies may apply for a certificate of number for that vessel by submitting to the issuing authority, listed in Appendix A of this part, where the vessel will principally be used:

(a) An application on a form and in a manner prescribed by the issuing authority; and

(b) The fee required by the issuing authority.

### § 173.73 Duplicate certificate of number.

If a certificate of number is lost or destroyed, the person whose name appears on the certificate as the owner may apply for a duplicate certificate by submitting to the issuing authority that issued the certificate:

(a) An application on a form or in a manner prescribed by the issuing authority; and

(b) The fee required by the issuing authority, if any.

### § 173.75 Temporary certificate.

A temporary certificate valid for not more than 60 days after it is issued may be issued by an issuing authority pending the issue of a certificate of number. A temporary certificate is not valid after the date that the owner re-



12/18/92 13:13 202 267 4285 G-NAB-5 005/008

(46 U.S.C. 1451, 1467, 1488; 49 CFR 1.46(nX1))

[COD 72-54R, 37 FR 21402, Oct. 7, 1972, as amended by COD 77-117, 44 FR 42195, July 19, 1979]

§ 174.21 Contents of temporary certificate.

A temporary certificate issued pending the issuance of a certificate of number must contain the following information:

(a) Make of vessel.
(b) Length of vessel.
(c) Type of propulsion.
(d) State in which vessel is principally used.
(e) Name of owner.
(f) Address of owner, including ZIP code.
(g) Signature of owner.
(h) Date of issuance.
(i) Notice to the owner that the temporary certificate is invalid after 60 days from the date of issuance.

§ 174.23 Form of number.

(a) Each number must consist of two capital letters denoting the State of the issuing authority, as specified in Appendix A of Part 173 of this chapter, followed by—

(1) Not more than four numerals followed by not more than two capital letters (example: NH 1234 BD); or

(2) Not more than three numerals followed by not more than three capital letters (example: WN 567 EFG).

(b) A number suffix must not include the letters "I", "O", or "Q," which may be mistaken for numerals.

§ 174.25 Size of certificate of number.

Each certificate of number must be approximately 2½ by 3½ inches.

§ 174.27 Duration of certificate of number.

A certificate of number must not be valid for more than 3 years.

§ 174.29 Temporary certificate of number.

A State may issue a temporary certificate of number that is effective for not more than 60 days.

§ 174.31 Terms and conditions for vessel numbering.

A State numbering system may condition the issuance of a certificate of number on—

(a) Title to, or other proof of ownership of a vessel except a recreational-type public vessel of the United States; or

(b) The payment of State or local taxes, except for a recreational-type public vessel of the United States.

## Subpart C—Casualty Reporting System Requirements

§ 174.101 Applicability of State casualty reporting system.

(a) A State casualty reporting system must require the reporting of vessel casualties and accidents involving vessels to which § 173.51 of this chapter applies.

(b) The State casualty reporting system may also require vessel casualty or accident reports for property damage in amounts less than that required under § 173.55 of this chapter.

(46 U.S.C. 1486; 49 CFR 1.46(nX1))

[COD 72-54R, 37 FR 21402, Oct. 7, 1972, as amended by COD 78-155, 44 FR 5309, Mar. 25, 1979; COD 82-015, 54 FR 5610, Feb. 6, 1989]

§ 174.103 Administration.

The State casualty reporting system must be administered by a State agency that—

(a) Will provide for the reporting of all casualties and accidents prescribed in § 173.55 of this chapter;

(b) Receives reports of vessel casualties or accidents required in § 174.101;

(c) Reviews each accident and casualty report to assure the accuracy and completeness of each report;

(d) Determines the cause of casualties and accidents reported based on information available and indicates the apparent cause on the casualty report or on an attached page;

(e) Notifies the Coast Guard, in writing, when a problem area in boating safety peculiar to the State is determined, together, with corrective measures instituted or recommended; and

(f) Reports on vessel numbering and vessel casualties and accidents as required in Subpart D of this part.

(46 U.S.C. 1486; 49 CFR 1.46(nX1))





[COD 72-54R, 37 FR 21402, Oct. 7, 1972, as amended by COD 78-155, 44 FR 5309, Mar. 25, 1979]

§ 174.105 Owner or operator casualty reporting requirements.

A State casualty reporting system must contain the following requirements of Part 173 applicable to an owner or a person operating a vessel:

(a) Section 173.55 *Report of casualty or accident.*

(b) Section 173.57 *Casualty or accident report.*

(c) Section 173.59 *Where to report.*

(46 U.S.C. 1451, 1467, 1488; 49 CFR 1.46 (nX1))

[COD 77-117, 44 FR 42195, July 19, 1979]

§ 174.106 State casualty reporting system optional sections.

In addition to the requirements in § 174.105, a State casualty reporting system may contain any of the other requirements applicable to a boat owner or operator prescribed in Part 173.

(46 U.S.C. 1451, 1467, 1488; 49 CFR 1.46 (nX1))

[COD 77-117, 44 FR 42195, July 19, 1979]

§ 174.107 Contents of casualty or accident report form.

Each form for reporting a vessel casualty or accident must contain the information required in § 173.57 of this chapter.

## Subpart D—State Reports

§ 174.121 Forwarding of casualty or accident reports.

Within 30 days of the receipt of a casualty or accident report, each state that has an approved numbering system must forward a copy of that report to the Commander of the Coast Guard District in which the state capitol is located, except that Ohio and Minnesota must forward reports to Commander, Ninth Coast Guard District, Cleveland, Ohio.

[COD 87 003b, 52 FR 25219, July 6, 1987]

§ 174.123 Annual report of numbered vessels.

Before March 1 of each year, each State that has an approved numbering system must prepare and submit Coast Guard Form CGHQ-3923, Report of Certificates of Number Issued to Boats, to the Coast Guard.

§ 174.125 Coast Guard address.

The report required by § 174.123 must be sent to the U.S. Coast Guard Auxiliary, Boating, and Consumer Affairs Division, 2100 Second Street SW., Washington, DC 20593 0001.

[COD 88-052, 53 FR 25122, July 1, 1988]

# PART 175—EQUIPMENT REQUIREMENTS

### Subpart A—General

Sec.
175.1 Applicability.
175.3 Definitions.

Subpart B—Personal Flotation Devices

175.11 Applicability.
175.13 Definitions.
175.15 Personal flotation devices required.
175.17 Exceptions.
175.19 Stowage.
175.21 Condition; size and fit; approval marking.

Subpart C—Visual Distress Signals

175.101 Applicability
175.105 Definitions.
175.110 Visual distress signals required.
175.113 Launchers.
175.115 Exceptions.
175.120 Stowage.
175.125 Serviceability.
175.128 Marking.
175.130 Visual distress signals accepted.
175.135 Existing equipment.
175.140 Prohibited use.

Subpart D—Ventilation

175.201 Ventilation.

Authority: 46 U.S.C. 4302; 49 CFR 1.46.

Source: COD 72-120R, 38 FR 8115, Mar. 28, 1973, unless otherwise noted.

## Subpart A—General

§ 175.1 Applicability.

This part prescribes rules governing the use of boats on waters subject to the jurisdiction of the United States and on the high seas beyond the terri-



12/18/92 13:15 202 267 4285 G-NAB-3 006/006

## Appendix 2.
## All Propeller Injury Case Reports by Date
## Nationwide Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992[11]

1. 09/01/91, Michigan: *Lacerated left foot*
   30-year-old female victim had been riding in a motorboat operated by a 30-year-old driver on a lake, and decided to enter the water. Victim misjudged the distance when slid off the rear of boat into water. Left foot struck the non-moving propeller. Treated and released.

2. 09/08/91, Maryland: *Lacerated left foot*
   19-year-old female had been swimming in bay. While climbing onto back of motorboat struck the propeller blade. Treated and released.

3. 11/27/91, Florida: *Lacerated lower leg*
   29-year-old male entering rear of boat when a wave bumped the boat causing him to lose his balance and while attempting to regain balance, left foot struck the propeller. Motor was not running. Treated and released.

4. 12/16/91, Alabama: *Injured left leg*
   46-year-old male injured leg on propeller of boat motor. Treated and released. Not assigned for follow-back telephone call.

5. 04/27/92, Florida: *Lacerated middle toe*
   46-year-old male stepped on anchored boat motor. Foot slipped off the step while trying to get into boat and struck propeller. Motor was not running. Treated (tetanus shot) and released.

6. 05/18/92, Missouri: *Lacerated 5th finger on right hand*
   39-year-old male was changing propeller outboard engine on boat. While trying to loosen belt with screwdriver, hand slipped and hit finger on the propeller. Treated (2 stitches) and released.

[11] These 26 cases represent 1,155 cases nationally.

7. 05/28/92, South Dakota: *Lacerated finger*
   6-year-old female was learning to ride a bike; around the house. Lost balance between house and boat, grabbed propeller to keep balance and lacerated finger. Treated (2 stitches) and released. Not assigned for follow-back telephone call.

8. 06/03/92, Wisconsin: *Lacerated left foot*
   25-year-old male struck propeller on power boat propeller while getting into boat at lake. Treated and released. Lost to follow-up.

9. 06/06/92, Missouri: *Lacerated palm of right hand*
   46-year-old male was preparing to moor boat after 11-hour fishing trip. Front of boat caught onto something on dock causing a small jolt which caused the swivel seat on which the victim was sitting to jerk. Victim fell out of the boat, but the boat floated back towards him so that when swam to the surface, he bumped his hand against the propeller. Victim not wearing life jacket because he had taken it off in preparing to moor the boat. The engine disengaged due to the automatic switchoff mechanism, but this occurred only within seconds of his contact with the propeller. Record shows that victim smelled of alcohol at the hospital. Treated and released.

10. 06/06/92, Washington: *15-cm jagged laceration to lower leg and involving tendon*
    35-year-old male was racing a hydroplane and was ejected when took a wave from another boat. Victim was run over by propeller of following boat. Hospitalized.

11. 06/14/92, Florida: *Lacerated left ankle/foot*
    35-year-old male was swimming around a power boat with an outboard motor. Motor was not running. Victim lifted himself up out of the water over the stern of boat when left foot struck propeller. Treated (2 stitches) and released.

12. 06/14/92, Illinois: *Lacerated thigh*
    16-year-old female was attempting to board boat from the wrong side after water skiing. Victim swam around rear of boat to get to the side with the ladder. Boat operator (who had owned boat only for 1-2 mos) accidentally set or bumped controls from neutral to reverse position causing the propeller to turn and the tow rope to wrap around propeller and victim, and, then, restrict the propeller's turning. The victim kicked the propeller while she was treading water, and was pulled under surface. Operator rescued her using the life jacket she was wearing. After detangling rope, victim was pulled into boat. Treated (100 stitches) and released.

13. 06/28/92, Rhode Island: *Lacerated left knee*
    44-year-old male had been swimming in a cove after which he pushed himself onto diving platform on rear of his motorboat. Motor not running. Knee struck stainless steel propeller. Treated (4 stitches) and released.

14. 07/01/92, Illinois: *Cut hand*
    26-year-old male swimming in lake. As he approached rear of boat, his left had hit the propeller. Motor not running. Treated (5 stitches) and released.

15. 07/06/92, New York:
    31-year-old male whose fingers were struck by propeller blade of boat. Treated and released.

16. 07/07/92, Washington: *2-cm lacerated foot*
    52-year-old male had finished water skiing, handed his skis to the boat operator in front of boat, swam around to back of boat to exit water via swim steps. Inexperienced boat operator either failed to turn off the engine or put controls in the neutral position. Victim's foot struck the propeller as he entered the boat. Treated and released.

17. 07/18/92, Illinois: *Lacerated right thigh*
    23-year-old male caught by boat propeller while water skiing. Treated and released.

18. 07/31/92, Washington: *Near amputation of left thigh at buttocks*
    27-year-old male fell off boat, was run over by boat, and was hit several times by the propeller. Hospitalized. Lost to follow-up.

19. 08/01/92, Maryland: *Lacerated right leg*
    53-year-old male was returning his outboard motor power boat to marina. Low tide and steady winds caused unusually low water; marina staff advised that he dock elsewhere or wait for high tide. Disregarding advice, victim stopped motor, raised it, but did not turn propeller to the side. Pushed boat through shallow water (about one and a half feet) from rear, and leg struck the propeller. Treated (18 stitches) and released.

20. 08/06/92, Rhode Island: *Open fracture/crushed bone, toe of right foot*
    4-year-old male playing with neighbor on boat in neighbor's back yard. Victim's friend was playing with push button that lifts and lowers driveshaft that powers the boat propeller (button operates without power from the engine, including rotation of propeller blades). Wearing canvas sneakers, the victim stuck foot in rotating propeller blades causing laceration to toe. Treated and released (toe deformity may result).

21. 08/08/92, Michigan: *Lacerated right leg between knee and ankle*

31 year-old male (wearing "life preserver") had been swimming in 3-foot waves in Detroit River. Victim pushed himself up on the back of the boat and onto swimming platform; a wave came up causing the boat to rise; brushed against propeller cutting leg. Motor was not running. Treated (3 stitches) and released.

Note well: Work-related injury--victim on rescue boat for some races.

22. 08/22/92, Michigan: *Lacerated left 4th and 5th toes, involving tendons*

21-year-old female was being pulled through water on a tube. Jumped off tube, swam to boat. While treading water, she kicked left leg and hit propeller. Treated (8 stitches) and released initially; surgery for tendons next day--15 missed work days.

23. 08/23/92, Maryland: *Lacerated left lower leg*

22-year-old female struck propeller while getting into boat. Treated and released.

24. 08/26/92: *Multiple abrasions, some deep, on left thigh*

14-year-old female sustained injuries from a boat propeller. Transferred and hospitalized.

25. 08/29/92, Tennessee: *Lacerated left foot*

19-year-old male slipped off back of boat, and foot struck propeller. Motor not running. Treated and released.

26. 08/30/92, New Jersey: *Lacerated right hand*

41-year-old male fell off back of boat; caught hand on propeller. Record shows he had been drinking beer. Treated and released.

## Appendix 3.
## All Propeller Injury Case Reports by Date
## State of Florida Data
## Study of Boat and Boat-Propeller-Related Injuries
## United States, 1991-1992

1. 09/01/91, Putnam County: *Fracture of the scapula, open wound of unspecified site without mention of complication.*

   23-year-old male skier was one of two riders that fell off a hydroslide. The second person fell off a short time later. The ski boat returned to retrieve the second skier. A second ski boat pulling another skier observed the first ski boat retrieving one person and maneuvered to avoid them not realizing there was a second person in the water. The second ski boat then ran over the first person to fall off the hydroslide from the first ski boat. Treated and released.

   The operator of the second ski boat was cited for failing to have a proper lookout for a ski boat.

2. 09/01/91, Duval County: *Lacerations to the head and ankles.*

   34-year-old female was riding in the bow of a small boat that was pulling a hydroslide. The boat was underpowered for pulling the hydroslide so the passenger leaned forward into the bow to stabilize the vessel. The passenger lost her grip and fell overboard in front of the boat, which passed over. The passenger was then hit on the head and ankles by the propeller. Hospitalized (1 day) and released.

   The operator was cited for violation of navigation rules resulting in a boating accident.

3. 09/02/91, Bradford County: *Fracture of face bone and lacerated face from left ear to a point under the right eye.*

19-year-old male dove off the front of a power boat as it approached a dock for mooring. The boat passed over the victim who was struck in the face by the non-moving propeller or skeg. Hospitalized (16 days) and released.

Operator of the boat was cited for operating under the influence (OUI) of alcohol.

4. 09/15/91, Lee County: *Open wound of elbow with complications, superficial injury of the trunk, abrasion.*

23-year-old male dove into the water from a boat to retrieve the hat of one of the four passengers. He was hit by the moving propeller when he attempted to re-enter the boat from the stern. Treated and released.

Operator of the boat was cited for operating under the influence (OUI) of alcohol.

5. 09/15/91, Santa Rosa County: *Injury to face without mention of complication, injury to internal structures of mouth, without mention of complication.*

44-year-old male fell overboard after boat collided with a floating object in the water. Treated and released.

6. 09/28/91, Monroe County: *Open fracture to right arm and clavicle, a large wound to the head and numerous contusions and lacerations.*

36-year-old male boat operator was ejected when his boat went into a hard right turn that resulted from hitting a wake. As he had one hand on the wheel, he was reaching back to upright the bilge pump with the other hand. The sharp turn caused the operator to be ejected. The boat then ran over the operator as it came back around in a circle.

7. 10/04/91, Polk County: *Fatality. Deep cut on front and back of head.*

14-year-old male passenger who was standing in the bow was ejected from a boat traveling at about 35 MPH after it made a sudden sharp turn to the left. The boat passed over the passenger resulting in the propeller hits.

8. 11/01/91, Monroe County: *Severe cut on right foot.*

49-year-old female was scuba diving with two companions about 200 feet from shore without a dive flag. The operator of a boat saw the diver too late for his swerving maneuver to completely miss her. Hospitalized (6 days) and released.

Victim was cited for failure to display a dive flag.

9. 11/03/91, Dade County: *Fatality. Intracranial injury of other and unspecified nature, drowning.*
   Male passenger was ejected from a boat that hit a concrete marker going at a high rate of speed. The other 5 passengers were also ejected, one drowned and the other four were injured.

10. 12/08/91, Dade County: *Lacerations on back.*
    22-year-old male skier released tow rope. The sudden thrust forward of the inflatable tow boat caused the operator to lose balance and be ejected at which time the boat went into a hard right turn and continued a circling pattern. On one pass the boat ran over the skier causing the propeller injuries. Treated and released.

11. 01/02/92, Broward County: *Severed leg and severe wound to other leg requiring amputation of foot.*
    40-year-old male skin diver hit by fast moving boat while diver was snorkeling 60-70 feet from his dive flag. Hospitalized (23 days) and released.

12. 03/14/92, Leon County: *Two lacerations in the scalp and fracture of occipital bone in the skull, lacerations and fracture of right hand.*
    51-year-old male was fishing with a companion from his anchored boat. A second boat crashed into the back of the other boat and rode up over the injured persons boat resulting in the latter being hit by the propeller of the second boat.

13. 03/19/92, Santa Rosa County: *Two 1" to 3" cuts on upper left thigh, severe cuts to left kneecap, and 3 cuts 1" to 3/4" long on lower left leg. Abrasions on left thigh from propeller hitting but not cutting.*
    8-year-old female ejected from 14-foot boat caught in a whirlpool. Boat continued to circle operators position in the water. Operator attempted to reach motor and turn it off. In the process, she was struck by the moving propeller. Treated and released.

14. 04/14/92, Duval County: *Injuries not identified.*
    21-year-old male passenger ejected from the bow of a tow boat pulling a skier when boat made a sharp turn. Boat then passed over the passenger resulting in the propeller hits.

15. 04/17/92, Orange County: *Fatality.*
    41-year-old male was killed when a second boat crashed into his boat striking him with the boat and the propeller when the second boat rode up and over his boat.

16. 04/18/92, Levy County: *Fatality.*
    18-year-old male stood up in a fast moving 18-foot boat when his hat blew off. The operator made a sharp right turn ejecting the passenger over the front left side of the boat after which the boat passed over the individual. The body was recovered the next day by law enforcement divers.

    The operator was cited for reckless operation of a motor vessel and OUI-manslaughter.

17. 04/18/92, Dade County: *Serious injury to left leg and chest area.*

35-year-old male passenger fell off the bow while boat was underway at 30 miles per hour. Boat passed over passenger resulting in propeller hits.

18. 04/25/92, Orange County: *Cut on right leg.*

32-year-old female swimmer run over by boat driven by husband after he approached her going too fast. She was attempting to swim to the shore from the middle of the lake and the concerned husband was going after her to prevent her from the attempt.

19. 05/03/92, Pinellas County: *Five lacerations across the top of right forearm.*

53-year-old male passenger hit by propeller after being ejected from a 17 foot boat that took a sudden sharp right turn while moving at high speed in shallow water. The operator was also ejected but uninjured. Treated and released.

20. 05/03/92, Orange County: *Traumatic amputation of legs (partial), open wound of knee, leg with complications.*

37 year-old father-in-law of operator had been learning to kneeboard. As boat slowed and approached the dock, the operator's 5 year old son jumped from the bow in front of the boat. The operator put the boat in neutral and jumped into the water to prevent boat from running over his son. The boat was in neutral but was continuing to move forward; the wife fearing the boat would run over her son and husband, put the engine in reverse. The boat then backed into the father-in-law who was kneeboarding. Hospitalized (16 days).

21. 05/05/92, Polk County, Florida: *Fatality.*

21-year-old male was ejected and run over by the boat he was driving after making a sharp turn. He was struck by the propeller and drowned. He had been doing figure eights at high rates of speed to show his one passenger how well the boat would perform. His body was recovered 7 hours later.

22. 05/23/92, Manatee County: *Hit in the head by propeller.*

25-year-old male swimmer hit by propeller of idling speed boat while swimmer was snorkeling just outside a designated swimming area.

Swimmer was charged with diving without dive flag.

23. 05/24/92, Monroe County: *Six propeller cuts over back and left arm. Only one cut was serious and caused muscle damage.*

3-year-old male ejected from bow seat when inexperienced operator (3 days boating experience) cut across the wake of a sail boat at high speed throttling back at impact. The combination of impact with the wake and immediate reduction of speed ejected the passenger that held onto a "bow rope" momentarily. Upon release of the bow rope the boat passed over the passenger at which time he was hit with the moving propeller. Hospitalized (1 day) and released.

24. 05/25/92, Orange County: *Two large cuts on the under medial portion of the foot.*

14-year-old male ejected from his boat when he made a sharp turn at high speed. The boat ran over the operator resulting in the propeller hits.

Operator cited for careless operation resulting in injury.

25. 05/26/92, Broward County: *Injuries not identified.*

58-year-old male operator was ejected when he started engine while it was in gear. The "right handed" moving propeller caused the boat to make a left hand turn. The boat returned to the operator who was in the water and ran over the operator resulting in the propeller hits.

26. 05/29/92, Brevard County: *Severe lacerations on left forearm near shoulder area.*

26-year-old male passenger, under the influence of alcohol, stood up in stern of the boat to urinate just after the boat came off of a plane. Rough water and the passengers inebriation caused him to fall from the back of the boat into the water. As the operator, who was also under the influence of alcohol, maneuvered the boat to pick up passenger, the latter was struck by the transom and the propeller.

The operator was charged with careless operation.

27. 06/07/92, Volusia County: *Injury not identified.*

26-year-old lost his grip while sitting on top of the left passenger seat, was thrown overboard by a sharp right turn, and run over by the boat and hit by the propeller. The sharp turn was one of several the operator was using to shake weeds off the outdrive.

The operator was cited for operating under the influence of alcohol and careless operation. The injured person had also been drinking alcohol.

28. 06/07/92, Brevard County: *Lacerations on knee.*

26-year-old female skier had completed skiing complaining about stings from jelly fish. Operator requested that skier stay clear of the boat while he maneuvered to avoid bridge pylons. Receiving additional jelly fish stings, skier ignored operators request and while attempting to use the outdrive as a ladder to board the boat was struck by the moving propeller.

29. 06/08/92, Orange County: *Fracture of radius and ulna and fracture of metacarpal bones.*

15-year-old male sustained injury when a second boat driven by his 19-year-old cousin crashed into and rode over the first boat. The cousins were using rented boats at high speeds to jump each other's wakes. The first boat stopped, the second boat's operator did not react quickly enough resulting in the crash. The injury occurred when the lower unit of the second boat passed over the injured person. Hospitalized (22 days).

30. 06/20/92, Dade County: *Fatality.*

32-year-old male drove his 14-foot boat into a bridge pylon at night at a high speed. Both he and his passenger were killed. The Florida Marine Patrol coded this individual as having propeller injuries as subsequent events of the crash.

Blood test showed that the operator was under the influence of alcohol at the time of the crash.

31. 06/21/92, Leon County: *Lacerations of back of both thighs.*

22-year-old male was learning how to ski, and the boat returned to skier when he fell. Operator thought the engine was in idle when skier approached the rear of the boat. Skier turned away from the boat to avert injury, but was struck. Treated and released.

Operator was cited for carelessness for not having engine off or in neutral.

32. 07/11/92, Brevard County: *Severe lacerations on left forearm required stitches, wound to thigh (no stitches).*

17-year-old male passenger was ejected from the bow of a tow boat when it hit a sandbar immediately after entering a left turn. The boat passed over the passenger resulting in the propeller hits.

33. 07/11/92, Brevard County: *Fatality. Open multiple wounds, approximately 18 lacerations extending from the left shoulder along the back to the buttock, and cardiac arrest.*

41-year-old male passenger was ejected when boat broached a wave in 3-4 foot waves causing an abrupt left turn. The propeller hit the passenger as the boat passed over him. A second passenger (case #34) was also ejected and injured by the propeller. Treated and released.

34. 07/11/92, Brevard County: *Severe lacerations to right leg and foot.*

29-year-old male passenger was ejected when boat broached a wave in 3-4 foot waves causing an abrupt left turn. The propeller hit the passenger as the boat passed over him. A second passenger(case #33) was also ejected and killed by the propeller.

35. 07/19/92, Pinellas County: *Deep lacerations on right knee.*

24-year-old female, after knee-boarding, lost grip when climbing up the ladder at the back of the boat resulting in being hit by the moving propeller. Operator was not aware injured person was trying to re-enter the boat. Treated and released.

36. 07/26/92, Bay County: *Lacerations to the left calf and right hand.*

23-year-old male slipped off the front of a slow moving pontoon boat carrying 9 other passengers. The boat passed over the individual resulting in the propeller related injuries. Treated and released.

37. 07/26/92, Dade County: *Minor injuries.*

19-year-old male scuba diver hit by boat propeller while diving with several other divers with dive flag up. Treated and released.

38. 07/29/92, Martin County: *Contusion of right upper limb, open wound of elbow, and open wound to the head.*

40-year-old male scuba diver was injured while diving in 10' of water about 100' in front of his anchored boat when the second boat hit him. Hospitalized (1 day) and released.

39. 07/30/92, Monroe County: *Five inch laceration to lower left leg.*

24-year-old male swimmer hit by moving propeller after operator set anchor of boat with reverse propulsion. The swimmer was one of three who had entered the water from the boat while the operator was setting the anchor. The operator thought the engine was out of gear after anchoring as the swimmers approached the back of the boat. Treated and released.

40. 08/09/92, Dade County: *Lacerations on buttock and leg.*

21-year-old male skier, having completed demonstration of the hydroslide, began swimming back to the boat. Operator maneuvered boat to retrieve skier. Boat went too close to skier resulting in hit by propeller.

41. 08/11/92, Monroe County: *Severe laceration to the right foot.*

15-year-old male ejected from a 15-foot boat he was operating at a high rate of speed after a sharp right turn that impacted into a wave. The boat then passed over the operator with the moving propeller hitting his foot.

42. 08/15/92, Brevard County: *Severe lacerations requiring partial amputation of an arm and a leg.*

27-year-old male operator was ejected from boat when reaching for debris in the boat and inadvertently turning the wheel sharply. The resulting sharp turn of the boat ejected the operator. The boat continued to circle and in one pass ran over the operator causing the propeller injuries.

43. 08/20/92, Highlands County: *Lacerations and broken bones in both ankles and feet: 2 bones broken in one ankle, one bone broken in the other.*

Male skier was hit by propeller of the tow boat when the operator returned to pick him up after a fall. The skier grabbed for the side of the boat but boat was still in gear and moving forward. Skier slipped along the side of the boat and legs went under the boat resulting in the propeller hits. Hospitalized (2 days) and released.

## Appendix 4.
## Estimation of Nationwide Data
## National Electronic Injury Surveillance System (NEISS) Hospitals

Implementation of the present NEISS sample was begun in October, 1978. The sampling frame consisted primarily of the National Center for Health Statistics' 1975 Master Facilities Inventory hospital computer tape prepared by the American Hospital Association. Hospitals in the sampling frame were stratified by size (based on annual number of emergency department visits into four strata). The hospitals were organized geographically within strata in order to assure wide geographic representation. Primary and alternate hospitals were selected within strata. Rules were developed for replacement of hospitals and for computing special weight factors to cover hospital mergers, etc. This sampling frame was updated in 1982.

In order to accommodate major changes which had occurred over time in the sampling frame and the sample of NEISS hospitals, the sampling frame was updated with a 1985 listing of hospitals from the SMG Marketing Group of Chicago in 1988. The sample update which ensued led in 1989 to the dropping of some hospitals, the addition of other hospitals and a realignment of stratum boundaries and sample hospitals by stratum.

The types of reportable cases have been modified over the years, reflecting both a more focused approach dictated somewhat by budgetary consideration within CPSC and the data needs of other federal agencies enlisted to share the system. In an effort to share the fixed costs of the NEISS while providing valuable data at a fraction of the cost of a full data collection activity, in 1978 CPSC began soliciting the interest of other federal agencies to share the NEISS. Expansions to the NEISS have allowed other federal agencies to meet some of their data needs at minimal cost by sharing data from the system. For example, NEISS has been a mechanism for collecting motor vehicle injuries for the National Highway Traffic Safety Administration, occupational injuries for the National Institute for Occupational Safety and Health, pesticide injuries for the Environmental Protection Agency and all trauma and firearm injuries for the Centers for Disease Control and Prevention.

Studies using data from NEISS have been used in presentations to the United States Congress. Such presentations have included data on all-terrain vehicles, riding power mowers and chain saws.

In the nationwide data for this study, 76 of the 92 NEISS hospital emergency departments recorded 1,138 boating and water skiing injuries; these represent 61,390 injuries nationally. For the boating injuries and boat-propeller-related

injuries, we collected data on 864 boating injury cases without separate water skiing data from NEISS. On a national basis, this represents 46,369 boating injuries. Frequencies of injuries are estimated because NEISS is a probability sample of all hospitals with emergency departments in the United States and its territories. The frequencies reported are based on 864 actual boating injury cases reported throughout the study period. The probability sample is stratified by size of emergency department based on the number of annual emergency department visits), and includes a measure of geographic distribution. The strata are designated by small, medium, large and very large hospital emergency departments (Table A-1). The weights are reciprocals of the probability of selection of a particular hospital in the sample. ***It is important to note that although the actual sample comprises 864 reported cases, the number reflects 46,369 boating injuries, which is what is reported in all tables.***

The small numbers on which the sample estimates are based have probably resulted in loss of precision in the sample estimates. This is reflected in the wide 95% confidence limits in the tables. There is no loss in validity of the estimates (i.e., no bias has been introduced), however, because all NEISS hospitals had equal opportunities to participate in the study, and data collection procedures were not altered.

There may be problems in the geographical representativeness of the sample estimates because most of the data are from NEISS hospitals at coastal, Great Lakes and southeast regions. There were very few reports from western and mountain regions of the United States.

## Table A-1. NEISS Sample Characteristics
## January 1991 to Present

| Stratum Size | Range of Total Emergency Department Visits | Number of Hospitals in Universe | Total Sample | Weight |
|---|---|---|---|---|
| Small | 1 - 15,730 | 4,262 | 38 | 112.1579 |
| Medium | 15,731 - 25,895 | 943 | 22 | 42.8636 |
| Large | 25,896 - 42,298 | 685 | 20 | 34.2500 |
| Very Large | 42,299 + | 237 | 14 | 16.9286 |

UNITED STATES GOVERNMENT

MEMORANDUM

U.S. CONSUMER PRODUCT SAFETY COMMISSION

WASHINGTON, D.C. 20207

TO : NEISS Coordinators

DATE : August 1991

FROM : NEISS Operations
Division of Hazard and Injury Data Systems

SUBJECT: Special Study to Collect Boating Injuries for Emergency Room (ER) Patients Treated from September 1, 1991 through August 31, 1992

**INJURIES TO BE REPORTED:**

All NEISS hospitals are being asked to identify and report all **injuries that were associated with boats or boating activities** (excluding work-related injuries). This includes all types of boats (sail boats, motor boats, row boats, canoes, kayaks, jet skis, etc.). Other activities which might be included if a boat is mentioned in the ER record are: water skiing, scuba diving, swimming, and diving.

These data are being collected for and shared with the Centers for Disease Control (CDC) and the U.S. Coast Guard in their efforts to reduce injuries associated with boating. Since boating injuries may not be among the most often reported injuries, we want to be sure to capture every case of interest and provide as complete a surveillance record as possible. For these reasons, we include a one-page study reminder sheet which could be placed in the admitting area. We plan to forward to you a boating study poster as soon as it is prepared.

All normal rules for NEISS data collection will be followed, such as excluding cases which are identified as work-related and reporting assaults or suicide attempts only for victims 15 years and younger. Some examples of reportable and not reportable cases are given below:

| | |
|---|---|
| Report: | Swimming in bay when run over by motor boat; leg lacerated by boat motor. |
| Report: | Near drowning - canoe overturned in river; victim pulled from water by bystander. |
| Report: | Water skier injured when he got tangled in boat tow rope. |
| Do not report: | Captain of cruise ship fell on deck of ship; broken leg (occupational injury). |

Do not report: Operator of pontoon boat lacerated finger on nail when securing boat at dock (ER indicates workman's compensation case; occupational injury)

Do not report: Self-employed fishing boat captain strained his back when loading his boat with supplies (occupational injury)

**STUDY PERIOD:** Injuries treated in your emergency room from

**September 1, 1991 through August 31, 1992.**

**IN-SCOPE PRODUCT CODES:** Whenever a boat or boating activity is mentioned in the ER record, use one of the following codes as either the first or the second product:

**3292 - Personal watercraft, powered** (e.g., jet ski)
**3298 - Boat and/or boating activity** (excl. flotation devices, ice and snow boating)

Product code 3292 already exists. Product code 3298 is being added for this study.

Of course, in conjunction with the use of one of the above product codes, you should also report any other product involved (water skiing, scuba diving, footwear, etc.)

**SURVEILLANCE DATA:** In addition to the usual NEISS variables, such as age, sex, diagnosis, body part, fire or motor vehicle involvement, etc., we will be requesting special data variables on a special screen whenever a boat (product code **3292** or **3298**) is mentioned as part of the incident. Several copies of the screen are attached. Use a hard copy of this special screen as a coding sheet for each boating case. Make sure you **write in the patient's treatment date and case number** in the upper right-hand corner, enter the necessary responses based on the ER record and keep the special coding sheet with the appropriate NEISS coding sheet for that treatment date.

**DATA ENTRY:** A new PC-NEISS program has been written to accommodate the boating study together with some other new features. Before September 1, you will receive new PC-NEISS computer diskettes and instructions for loading them into your computer. For boating injury cases treated on or after September 1, 1991, you will enter the boating cases through PC-NEISS as you normally do, including all the usual NEISS variables. In addition, whenever you enter one of the two boating product codes (3292 or 3298) as either 1stProd or 2ndProd, a second data entry screen will appear. Use your special boating code sheet to enter the data on the second screen. Treatment date and case number will appear automatically on the second screen.

The data entry program will include edit procedures to check for valid codes and other entries as required. Listed below are the special study variables:

**SPECIAL STUDY VARIABLES:**

Type of Boat: _

1 = motorboat
2 = sail boat
3 = canoe
4 = personal watercraft (product 3292)
5 = other_____
0 = type of boat not recorded

Note: Whenever you use code 5 = other, please describe the type of boat on the line provided. Some examples of other types of boats are: kayak, cruise ship, rubber raft.

Body of Water: _

1 = lake
2 = river
3 = pond
4 = ocean
5 = other_____
0 = body of water not recorded

Note: Whenever you use code 5 = other, please describe the body of water on the line provided. Some examples of other bodies of water are: creek, inlet, bay, canal.

Victim status: _

1 = operator of boat
2 = passenger on boat
3 = swimmer
4 = water skier
5 = scuba diver
6 = bystander
7 = other_____
0 = ER record does not state what the victim was doing

Note: Whenever you use code 7 = other, please describe the victim status on the line provided. Some examples of other types of victim status not included in codes 1-6 are: repairing boat, loading boat onto boat trailer.

Victim's activity: _____

Enter on this line a description of exactly what the victim was doing when the accident happened. Report major activity followed by exactly what the victim was doing. Examples of entries you might have are:

water skiing - skiing behind motor boat; hit rock
scuba diving - lacerated hand on boat when entering water

How transported to ER: _

1 = emergency vehicle
2 = personal vehicle
3 = walked in
4 = other_____
0 = how victim arrived at ER was not recorded

Note: Whenever you use code 4 = other, please describe how the victim was transported to the ER. Some examples of other types of transport to the ER not in codes 1-3 are: bus, cab.

Nearest City, State: City_____ State__

List in spaces provided. Please use 2-digit postal code for the State, e.g.;

Alabama = **AL**
California = **CA**
Maryland = **MD**

5

Blood alcohol done: _

1 = yes
2 = no
3 = unknown

Note: Whenever a lab test for blood alcohol level was done, enter **1** for "yes" and enter the result just as it appears in the ER record.
For example,
if the ER record says 01 mg/dl enter: **01 mg/dl**
If the test was done, but the result is **not** available, enter **NA.**

ICD ECode recorded: _

1 = yes
2 = no
3 = unknown

Note: If your ER **does not** use ECodes (External Cause of Injury Codes), enter code **2** above.
If your ER **does** use ECodes, and the code is available, enter the code (without any decimals) as it appears. For example:

| | |
|---|---|
| for Ecode 8301 or 830.1 | enter **8301** |
| for Ecode 91028 or 910.28 or 910.2.8 | enter **91028** |
| for Ecode 830 | enter **830** |

If your ER **does** use ECodes, but the code is **not** available, enter **NA.**

BOATING SPECIAL STUDY TRDT: _____ CNO: _____

Type of boat: _ 1=motor 2=sail 3=canoe 4=personal watercraft
5=other_____ 0=unknown

Body of water: _ 1=lake 2=river 3=pond 4=ocean
5=other_____ 0=unknown

Victim status: _ 1=driver 2=passenger 3=swimmer 4=water skier
5=scuba diver 6=bystander
7=other_____ 0=unknown

Victim's activity: _____

How transported to ER: _ 1=emergency veh. 2=personal veh. 3=walked in
4=other_____ 0=unknown

Nearest city, State: city _____ State __

Blood alcohol done? _ 1=yes _____ 2=no 0=unknown
ICDA ECode recorded? _ 1=yes _____ 2=no 0=unknown

PRESS <F1> TO CONTINUE, <F3> TO SKIP

FOLLOW BACK QUESTIONNAIRE FOR BOATING INJURIES (CATID CGSN01) 10-3-91

Task Number _____ _____ Date of Interview _____

Before conducting interview, review NEISS and special study information attached.

Hello, May I speak with _____ _____?

Hello. I'm _____ from _____. We are working with the U.S. Consumer Product Safety Commission, the U.S. Coast Guard, and various hospitals to find out how boating accidents occur.

1. I understand that you were treated at _____ hospital on _____(date) for an injury involving a boat. Is that correct?

   1 yes--> (Continue)

   2 no---> If you **did not reach the appropriate person**, ask to speak with the person most familiar with the accident; if necessary, set up call back time in Box A below.

   If the incident **did not involve a boat**, obtain brief scenario of the incident, including product information, correct information as needed, and **end interview**.)

   _____

   3 other--> (Specify:)_____

2. Would you answer some questions about your accident so that we can learn how to prevent similar accidents? Your answers will be kept completely confidential. Only statistical totals will be used from this study. Your name will not be used in any way -- it will not be linked to the answers; it will not be disclosed or released to others.

   1 yes-->(Continue)
   2 no--->(Ask if another time would be better and set up call back time below in Box A.)
   3 refused

**BOX A**

Interviewer: Complete below as necessary:

Best call back time: _____ _____ a.m. p.m.
day of week time of day

Respondent is:
1 person injured in incident
2 parent of person injured in incident
3 someone else-->(Specify:)_____
_____

Note: Substitute "the victim" for "you" in questions.

If respondent is not the person injured, indicate whether respondent:
1 witnessed the incident
2 did not witness the incident

3. **Please tell me how the accident happened. (Include summary of events just prior to, during and just after the accident. Probe as needed.)**

**(Interviewer: If this narrative does not match the information obtained from the NEISS case, please correct the NEISS information on the cover sheet.)**

**BOX B**

**HAZARD PATTERN**

**Interviewer:** When appropriate, confirm details volunteered earlier by respondent. Say, "Let me see, earlier you told me ... Is that correct?"

4. When the accident happened, was the boat being operated, being put in or taken out of water, being transported, being repaired, or something else?

1 being operated (on a body of water)

2 being put into/taken out of body of water
3 being transported
4 being repaired
5 something else-->(Specify:)_____
_____

9 don't know

--> Skip to Box C

5. About how many persons, including the operator, were on the boat at the time of the accident?

____ persons
9 don't know

6. Was anyone else injured in this accident?

1 yes-->(Specify:) _____
2 no
9 don't know

7a. Was (your/victim's) injury the result of a boat collision?

1 yes-->(Specify what the boat collided with):_____
2 no--->(Skip to 8.)
9 don't know-->(Skip to 8.)

7b. What part of the boat hit (you/victim)?

_____ (Specify part of boat.)
00 none; boat did not hit (me/victim)
99 don't know

8. About how fast was the boat traveling when the accident happened?
_____mph/knots (circle whether mph or knots)
99 don't know

**BOX C**

**Interviewer:** Thank the respondent and terminate interview if the injury did not occur while the boat was being operated on a body of water.
If you are unsure whether boat was being operated, return to question 5. and continue the interview.

9. What would you say was (your/victim's) major activity at the time the accident happened?

1 operating boat/jet
2 passenger in boat/jet ski
3 water skiing
4 scuba diving
5 swimming
6 fishing
7 other-->(Specify:)_____
9 don't know

10. What were the weather conditions at the time of the accident? (Interviewer: Probe for whether clear, cloudy, foggy, raining, or windy.)

_____
99 don't know/don't remember

11. How calm or rough would you say the water was at the time of the incident?

1 calm
2 choppy (waves 6" to 2 feet)
3 rough (waves 2 - 6 feet)
4 very rough (waves over 6 feet)
9 don't know

12. When the accident happened, were (you/victim) wearing a life jacket or other flotation device?

1 yes
2 no
9 don't know

13. Have (you/victim) ever had a course in water/boating safety?

1 yes
2 no
9 don't know

**BOX D**

**INJURED PERSON DATA**

14. Let's see, the emergency room record indicates that the injury was (description of the injury). Was that what the ER staff told (you/victim)?

1 yes
2 no --> (Describe:)_____
9 don't know

15. Thinking back on the day of the accident, but before the accident happened, were (you/victim) feeling ill in any way?

1 yes-->Please describe: _____
_____
2 no
9 don't know

16. When the accident happened, did anyone call for emergency help?

1 yes --> How was this done--by shouting, signaling, flares, a radio, telephone, or some other way?-->(Specify:)

_____
2 no
9 don't know

17. Did (you/victim) receive any type of emergency help?

1 yes-->(Specify:)_____
2 no
9 don't know/don't remember

18. As a result of the injury, did (you/victim) have to spend any nights in the hospital?

1 yes-->How many nights?
__ nights
99 don't know
2 no
9 don't know

19. As a result of this injury, did (you/victim) miss any days of work or school?

1 yes-->How many days?
__ days (work or school)
99 don't know
2 no
9 don't know

**BOX E**

**BOAT OPERATOR DATA**

**Ask the following questions about the OPERATOR of the boat whether or not the victim was the operator. If victim was the operator, substitute the word "operator" for "you."**

**If more than one boat (more than one operator) was involved, ask the respondent to think about and respond for the operator of the boat most directly involved in causing the victim's injuries.**

20. **The next few questions concern the person who was operating the boat which was most directly involved in the accident; that is, most directly caused the victim's injury. (Interviewer: If victim was operating the boat, change the wording in the questions to say "you" instead of "operator.")**

How old was the operator?

____ years
99 don't know-->(Probe for whether adult, teenager or younger.)

1 adult
2 teenager (ages 13-19)
3 younger than teenager
9 don't know

21. Was the operator male or female?

1 male
2 female
9 don't know/don't recall

22. On the day of the accident, about how long had the operator been operating the boat before the incident occurred?

____ minutes and/or ____ hours
9999 don't know

23. Had the operator ever operated this boat before the day of the incident?

1 yes--> About how often had the operator operated this boat prior to this accident? _____

2 no
9 don't know

24. Prior to this accident, how much experience did the operator have operating other power boats?

0 none, first-time operator of this boat on day of accident
1 prior experience-->(Describe:) _____

_____

9 don't know

25. Has the operator had any other boating accidents in the past year?

1 yes---> (Probe for types of accidents:) _____

_____

2 no
3 don't know

26. Whose boat is it?

1 operator's/operator's household
2 operator's relative
3 operator's friends/acquaintances
4 commercial/rental company
5 someone else-->(Specify:_____)
9 don't know

27. Were you aware of any problem with the boat that may have contributed to the accident?

1 yes, specify: _____
2 no
9 don't know

**BOX G**

**BOAT DESCRIPTION DATA**

If more than 1 boat was involved, ask for the details concerning the boat/jet ski most directly involved with the victim's injury and write in below under "BOAT 1." Then ask about a second boat/jet ski and include details below under "BOAT 2."

If the respondent does not know the answers to the boat description questions but can obtain the information later, continue the interview but say that you will call back for this information. Set up and write in Box A the best call back time.

28. Now I have a few questions about the boat or boats involved in the accident. Earlier you told me that (one boat was involved/two boats... were involved.) (First, let's talk about the boat **most directly** involved in your accident.)

| | BOAT 1 | BOAT 2 |
|---|---|---|
| a.Type of boat: | 1 motor | 1 motor |
| | 2 sail | 2 sail |
| | 3 canoe | 3 canoe |
| | 4 jet ski | 4 jet ski |
| | 5 other _____ | 5 other_____ |
| | 9 don't know | 9 don't know |
| b.Brand name: | _____ | _____ |
| c.Type engine: | 0 none (Skip to 29) | 0 none (Skip to 29) |
| | 1 inboard | 1 inboard |
| | 2 outboard | 2 outboard |
| | 3 stern drive | 3 stern drive |
| | 4 jet drive | 4 jet drive |
| | 5 fan | 5 fan |
| | 6 other:_____ | 6 other: _____ |
| | 9 don't know | 9 don't know |
| d.Power source: | 0 none | 0 none |
| | 1 gas propeller | 1 gas propeller |
| | 2 water (jet) | 2 water (jet) |
| | 9 don't know | 9 don't know |
| e.Number of propellers | 0 none | 0 none |
| | 1 one propeller | 1 one propeller |
| | 2 two+ propellers | 2 two+ propellers |
| | 9 don't know | 9 don't know |

29. Were there other problems, such as the weather or passenger behavior that you think may have contributed to the accident?

1 yes-->(Describe:)_____
2 no
9 don't know/don't remember

30. Did anyone involved in the accident (e.g., victim or operator of the boat) take any medicine or other drugs on that day before the accident occurred?

1 yes-->(Describe:)_____
2 no
8 refused
9 don't know/don't remember

31. Did anyone involved in the accident (e.g., victim or operator of the boat) have anything to drink with alcohol in it, on that day before the accident occurred?

1 yes-->(Describe:)_____
2 no
8 refused
9 don't know/don't remember

32. In order for us to learn how to help prevent boating accidents, we need to be sure we understand how they occur. Were there any witnesses to your accident who might provide additional information either on the accident or the emergency treatment you received?

1 yes (Record on Cover Record Sheet)
2 no
9 don't know

33. If I have missed anything, would you mind if I call you back?

1 ok to call back
2 don't call back

Thank respondent and end interview.

«data x:barslist.doc»

July 17, 1992

«ADD»

Dear «N1»:

Florida's Injury Control Program within the Office of Emergency Medical Services is collecting information on injuries due to boating accidents in Florida. This study was authorized by the United States Congress who further requested that the Centers for Disease Control and the United States Coast Guard collaborate in its completion.

I have received information from the Florida Marine Patrol which indicates that you were injured in a boating accident on or about «DATE». We need some additional information about any medical treatment you may have received for the injury. Would you please complete the questions on the attached sheet and return it to me in the enclosed self-addressed envelope? The information you provide will be regarded as confidential and never reported in such a way as to identify you.

«N2», I appreciate your cooperation. Please feel free to call me at (904) 487-1911 if you have any questions about our project.

Sincerely,

James M. Croushorn, D.P.A.
Medical/Health Care
Program Analyst
Emergency Medical Services

Attachment
1. Survey

STATE OF FLORIDA
DEPARTMENT OF HEALTH AND REHABILITATIVE SERVICES

September 3, 1992

TO: See Distribution List

SUBJECT: Injuries Caused by Boating Accidents

Thank you for your help with our Boating Accident Project for the Centers for Disease Control (CDC) and the U.S. Coast Guard (USCG). As you recall, we wrote the staff responsible for the trauma registry forms in each of the acute care hospitals and emergency medical services providers. The letter requested that all trauma registry forms forwarded to the trauma registry be marked as involving boating if the injury was due to a boating accident. Your help in this project has been very helpful.

The project included all boating related injuries that occurred during the period of September 1, 1991 through August 31, 1992. Please forward any additional trauma registry forms you may have for injuries that occurred on or before August 31. This will help us finalize the data file for CDC/USCG before our October 16 deadline.

Call me if you have any questions or comments about this project (904-487-1911 or SC 277-1911). Again, thank you for helping in this project.

JAMES M. CROUSHORN, D.P.A.
Medical/Health Care
Program Analyst
Emergency Medical Services

DISTRIBUTION LIST:
(AIG 56A): Hospital Trauma Registry Coordinators
(AIG 56B): EMS Provider Trauma Registry Coordinators

JIM/vrp

BOATING ACCIDENT SURVEY FOR THE CENTERS FOR DISEASE CONTROL AND THE UNITED STATES COAST GUARD

Return to: Dr. Jim Croushorn
Office of Emergency Medical Services
Florida Department of Health and
Rehabilitative Services
1317 Winewood Blvd
Tallahassee, Florida 32301

*Please correct the following personal information:*

NAME : ROSALIE ABTEY
AGE AT TIME OF BOATING INJURY: 53
RACE: 1 SEX: 2
01 Caucasian 01 Male
02 Black 02 Female
03 Hispanic
04 Other

*Please answer the following questions:*

NAME OF THE BODY OF WATER IN WHICH THE ACCIDENT OCCURRED?

_____
(Name of river, creek, bay, etc)

WHAT WAS SITE LOCATION OF THE ACCIDENT? (circle the one that best describes the location)

| | | | |
|---|---|---|---|
| 01 | Bay/Sound | 06 | Creek |
| 02 | Inlet | 07 | Canal/Cut |
| 03 | Ocean/Gulf | 08 | Port/Harbor |
| 04 | Lake/Pond | 99 | Other |
| 05 | River | | |

WHAT WAS THE CITY IN WHICH THE ACCIDENT OCCURRED OR THE CLOSEST CITY TO THE ACCIDENT LOCATION?

_____
(name of city)

IDENTIFY THE TYPE OF ACCIDENT (circle the one that best describes your accident)

01 Grounding
02 Capsizing
03 Flooding
04 Sinking
05 Fire or Explosion (fuel)
06 Fire or Explosion (other than fuel)
07 Collision with Vessel
08 Collision with fixed object
09 Collision with floating object
10 Falls Overboard
11 Falls in Boat
12 Fallen Skier
13 Hit by Boat
14 Hit by Prop
99 Other

TYPE OF OPERATION (circle the activity that best describes what your boat was doing at the time)

01 Commercial Fishing
02 Other Commercial
03 At Anchor
04 Tied to Dock
05 Docking
06 Drifting
07 Maneuvering
08 Cruising
09 Racing
10 Fishing
11 Hunting
12 Towing
13 Being Towed
14 Skin Diving
15 SCUBA Diving
16 Swimming
17 Skiing
99 Other

TYPE BOAT (circle the type of vessel that best describes the boat you were in)

01 Open motorboat
02 Cabin motorboat
03 Auxiliary Sail
04 Sail (only)
05 Rowboat
06 Canoe
07 Personal Watercraft (includes jet ski)
99 Other

TYPE PROPULSION (circle the type of propulsion of the vessel that best describes the boat you were in)

01 Outboard
02 Inboard
03 Sail
04 Inboard/Outboard
05 Air prop
06 Jet
99 Other