

# Marina Drownings, Life Rings, and Safety Ladders

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Provided by:

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# Contents

<b>Introduction</b>	5
<b>Research Findings</b>	7
Highlights of Drowning Data	8
Prevention	11
<b>Existing Guidelines, Regulations, and Standards</b>	13
Life Rings	13
Safety Ladders	16
Further Notes	18
Fire Extinguishers	20
<b>Recommendations</b>	21
<b>Appendix A</b>	25
<b>Appendix B</b>	41
<b>Carl Wolf, CMM, CMI</b>	57

# Introduction

This research project will explore the magnitude and frequency of persons unintentionally falling and subsequently drowning in marina waters, and specifically whether this danger has been properly addressed.

In recent years, I have consulted with numerous marinas, both domestic and abroad. The majority of these marinas were located within the United States. Outside of the continental U.S., I have consulted with marinas in regions that include Canada, U.S. Virgin Islands, Bahamas, Panama, Cyprus, and Puerto Rico.

I am the author of the *Marina Policy Guidelines* manual, published in December 2016, by the University of Wisconsin, and was a co-editor of the first edition of the *Marina Operations Manual*, published by the International Marina Institute in 1989. I have taught at various International Marina Institute marina management courses, have been a presenter at the University of Wisconsin's *Docks and Marinas* course, and the Association of Marina Industries *International Marina and Boatyard Conference*. In 2016, I created and continue to present the *Marina 101* course for the International Marina Institute.

Through past experience, I have noticed what I believe to be an under-addressed danger within the marina industry: persons unintentionally falling into the waters of a marina and the inability to rescue those persons in a timely manner. Initially, this research began with a survey of what guidelines, regulations, and standards already exist for marinas addressing life rings, safety ladders, and fire extinguishers.

My findings indicated that most of the guidelines, regulations, and standards that exist on the use and placement of life rings and safety ladders are limited and ambiguous.

I then shifted my research to see to what extent persons may be unintentionally falling into the waters of a marina. The findings showed that there is an issue of persons not only unintentionally falling into the waters of a marina, but drowning in marinas as well.

This report discusses the findings on unintentional incidents of persons falling into and drowning in the waters of a marina, as well as existing guidelines, regulations, and standards on life-saving equipment to safely rescue those who have fallen into the waters of a marina.

## Research Findings

This research centers on persons unintentionally falling into the waters of a marina and subsequently drowning. The report does not include people intentionally swimming or jumping into the waters of a marina deliberately. During the time that research was being conducted, numerous news reports or marina and boating sources were identified that included information on drownings that took place in or near waterfront facilities or activities. While most of these reports and sources had information on drownings, the majority of the information had specific language indicating that the drownings were related to boating accidents or swimming, neither of which fit the parameters of this project. These reports or sources included, but were not limited to:

- United States Coast Guard; Recreational Boating Statistics, 2016;
- Great Lakes Surf Rescue Project; Statistics;
- Centers for Disease Control and Prevention; Unintentional Drowning, Get the Facts;
- Electric Shock Drowning Incidents; Marinas;
- Global Drowning Tracker online;
- United States Lifesaving Association online; and
- Individual news media sources.

The vast majority of the research conducted was through online databases. Information collected for this project was for the period of 2008 through 2017. Most of the drowning articles found were published online by local newspapers and local news media. A spreadsheet categorizing the findings is included in “Appendix A.”

This research has identified 107 drowning cases that fell within the established parameters of the project. Some information, such as the cause of the incident, was either not available or released at the time that an article

on that drowning event was published. For information that was not available, those categories are simply identified as “unidentified.”

Refer to Appendix “A” for the detailed information collected on the 107 drowning cases that form the central focus of this paper.

#### **HIGHLIGHTS OF THE DROWNING DATA COLLECTED:**

##### **Of the 107 marina drownings that were identified:**

- 24 of the drownings or 22% of the drownings identified happened in the first 6 ½ months of 2017;
- Drownings occurred in 34 different states;
- Of the 34 different states identified in this report, 7 of the states:
  - had 46 of the drownings or 43% of the drownings identified;
  - those states with relatively high numbers of drowning incidents are:
    - California, which had 6 drownings;
    - Florida, which had 7 drownings;
    - Georgia, which had 10 drownings;
    - Massachusetts, which had 7 drownings;
    - South Carolina, which had 5 drownings;
    - Texas, which had 6 drownings; and
    - Washington, which had 5 drownings.

##### **The gender breakdown of the drowning victims were as follows:**

- 91 were male;
- 15 were female; and
- 1 was unidentified.

##### **Age groups of the victims are:**

- Age group 1 to 7 had 8 drownings;
- Age group 8 to 17 had 2 drowning;
- Age group 18 to 29 had 8 drownings;
- Age group 30 to 44 had 17 drownings;
- Age group 45 to 59 had 36 drownings;
- Age group 60 to 84 had 29 drownings; and
- Unidentified age had 7 drownings.

##### **Drownings occurred in all twelve months of the year. The number of victims drowning in each month:**

- January had 5 drownings;
- February had 5 drownings;
- March had 5 drownings;
- April had 12 drownings;
- May had 20 drownings;
- June had 9 drownings;
- July had 13 drownings;
- August had 15 drownings;
- September had 9 drownings;
- October had 7 drownings;
- November had 5 drownings; and
- December had 2 drownings.

##### **Number of victims drowning on a seasonal basis:**

- Winter (December – February) had 12 drownings;
- Spring (March – May) had 37 drownings;
- Summer (June – August) had 37 drownings; and
- Fall (September – November) had 21 drownings.

##### **Number of victims drowning during the week versus the weekend:**

- 48 of the drownings occurred on a weekday (Monday through Thursday); and
- 59 of the drownings occurred during a weekend (Friday through Sunday).

##### **Number of victims drowning during the time of day:**

- 13 of the drownings occurred in the morning (6:00 a.m. – 11:59 a.m.);
- 18 of the drownings occurred in the afternoon (noon – 5:59 p.m.);
- 14 of the drownings occurred in the evening (6:00 p.m. – 9:59 p.m.);
- 22 of the drownings occurred in the night (10:00 p.m. – 5:59 a.m.);
- 40 of the drownings happened at an unidentified time.

##### **7 of the 8 children had drowned on a weekend.**

### **Various descriptions of how the person fell into the water:**

- Walking on or fell from the docks, 23 persons;
- Embarking / disembarking from boat, 11 persons;
- Working on boat, 6 persons;
- Fell into the water while the boat was being docked, 6 persons;
- Fell out of the boat while in the marina, 3 persons;
- Slipped, 4 persons;
- Loading / unloading boat, 2 persons;
- Playing on docks, 3 persons;
- Being chased by the police, 2 persons;
- Fell out of chair on dock, 1 person;
- Rescuer, drowned, 3 persons; and
- Unidentified reasons, 43 persons.

### **12 of the drowning victims were persons that lived aboard their boats in the marina.**

In summary, persons do fall unintentionally into the waters of a marina for a number of reasons; at different times of the day, week, and year; at any age; and in various states across the country, both coastal and inland. The majority (85%) of the drowning victims were male. Of the victims in which their age was identified, 65% of the victims were aged 45 years or older.

The time of the day was unidentified 37% of the time for drowning victims who entered the water. Causes of drowning incidents were unidentified 40% of the time. Both of these statistics imply that these drowning victims were alone when they entered the water.

### **PREVENTION**

A number of precautionary measures, had they been implemented, may have prevented some of these drownings.

Children should always wear a personal floatation device (PFD) whenever they are near any body of water. Furthermore, when children are in areas where they may be prone to accidentally falling into the water, a responsible individual should always be with them.

When a person is walking the docks, embarking or disembarking from a boat, a “buddy” system should be used. According to the research data, 40% of the drowning victims fell into the water while alone and for unidentified reasons. If the drowning victim would have had a companion, some of these drownings may have been prevented.

Embarking and disembarking from a boat can be a dangerous event, each and every time. If a “buddy” or companion is unavailable, the person on board the boat should consider wearing some type of floatation device, in the unlikely event they would fall into the water. 12 of the victims were identified as persons living aboard their boat, while 11 victims drowned while embarking / disembarking from a boat.

Videos were recovered with respect to 5 of the drowning incidents. Video cameras are valuable instruments to monitor and record incidents. From the available information gathered, it appears that these video recordings did not have anyone monitoring the video feeds in real time. Unless monitored, the videos would be rendered largely useless as a preventative measure in detecting persons falling into the water although the videos still may provide valuable information as to what happened and how it can be avoided in the future.

Life rings should always be readily available at any waterfront facility. A life ring presents the opportunity for someone standing on the dock or pier to assist the person in the water. The potential rescuer may be a non-swimmer or the conditions in the water may be too hazardous for someone to climb into the water to help. Life rings need to be strategically placed so that they are readily accessible. The life rings need to be in good working order, and have enough line to reach persons in the water.

The line should also be made of a material which allows it to float on the water. Having this line would allow the thrower the ability to retrieve and throw the life ring again. The floating line allows the swimmer to grab the line in case the life ring is not accurately thrown.

If a person is alone and the fall into the water goes unnoticed, a life ring will not help her or him in getting out of the water. Safety ladders placed throughout the marina could give the person a chance to exit from the water. Exiting from the water in a timely basis could be critical as cold water or other conditions could impair the ability of a person to physically use the ladder.

A combination of life rings and safety ladders at a marina could mean the difference of a person safely getting out of the water or not.

# Existing Marina Guidelines, Regulations, and Standards

## LIFE RINGS

### ***Planning and Design Guidelines for Small Craft Harbors, ASCE Manuals and Reports on Engineering Practices No. 50, Third Edition, Life Rings:***

“While there are no established federal guidelines for life rings at recreational small craft harbors, state and local codes may require them. For example, Washington State code requires a life ring at intervals not to exceed 60 m (200 ft). However, many facilities provide standard 760-mm (30-in.) life rings at each fire extinguisher cabinet. Where harbor workers are exposed to potential drowning hazards, 29 CFR 1917 Marine Terminals (OSHA 2009) requires that a USCG-approved life ring with at least 27 m (90 ft) of attached line is provided at readily accessible points. According to U.S. Navy guidance (UFC 4-152-01) (NAVFAC 2005), this criterion should be interpreted as one life ring per wharf / pier. Additional life rings are at the discretion of the small craft harbor owner / operator, in accordance with their safety plan, facility usage and users, and insurance requirements.”

### **29 CFR 1917.26 (f) *First aid and lifesaving facilities:***

“A U.S. Coast Guard approved 30-inch (76.2 cm) life ring, with at least 90 feet (27.43 m) of line attached, shall be available at readily accessible points at each waterside work area where the employees’ work exposes them to the hazard of drowning.”

**Guidelines for the Safe Operation and Maintenance of Marinas by the National Water Safety Congress:**

Throwable Lifesaving Devices and First Aid – (13.1) “At least one throw-type lifesaving device with 60 feet of 3/8-inch diameter rope attached and/or a reach pole should be available on each dock. On docks more than 200 feet long, one device should be located every 200 feet along the dock. Rope should be made of polypropylene or some other floating material.”

**National Park Service Marina Standards 2016:**

“At least one USCG approved throw-type flotation device (with at least 60 feet of 3/4-inch diameter rope attached or a reach pole) is accessible on the fuel dock and every 200 feet on other docks.”

**Safety and Health in Ports, International Labour Office, Life-saving Equipment, section 3.3.6:**

“Adequate and suitable life-saving equipment should be provided and maintained for the rescue of anyone in danger of drowning.” And “Life-saving equipment should be located at suitable places at intervals of not more than 50 m (164 ft).”

**Unified Facilities Criteria (UCF), Design: Piers and Wharves: 7-9.2 Life Rings.**

“29 CFR 1917.26, First Aid and Lifesaving Facilities requires that a U.S. Coast Guard approved 30-inch (0.76 m) life ring, with at least 90 feet (27 m) of line attached, shall be available at readily accessible points at each waterside work area where the employees' work exposes them to the hazard of drowning. Provide a readily available portable or permanent emergency egress ladder giving access to the water within 200 feet (61 m) of work areas.”

**State of Washington WAC 296-800-16070: Make sure your employees are protected from drowning:**

“Provide approved life rings with an attached line on all docks, walkways, and fixed installations on or adjacent to water more than five feet deep. Life rings must:

- Be United States Coast Guard approved 30-inch size.
- Have attached lines that are at least 90 feet in length.
- Have attached lines at least 1/4 inch in diameter.
- Have attached lines with a minimum breaking strength of 500 pounds.
- Be spaced no more than 200 feet apart.
- Be kept in easily visible and readily accessible locations.”

**PIANC RecCom WG Report n° 149/part IV – 2017: Guidelines for Marina Design:**

“A ratio of one lifebuoy every 30 berths or 50m of length of quay/pon-toon is advisable. These have to be putted [sic] on well-marked, visible (at any condition, especially during low or no daylight, bad weather and fog) and well suited pedestal or support, easy to be reached and kept in good order.”

## **SAFETY LADDERS**

### ***Planning and Design Guidelines for Small Craft Harbors, ASCE Manuals and Reports on Engineering Practices No. 50:***

“Ladders are generally provided on fixed and floating docks to allow emergency access from the water. In addition, where the tide range and fixed piers may not provide convenient berthing access at all tidal stages, ladders are also provided adjacent to the berths (from the finger piers). According to the requirements of UFC 4-152-01 (NAVFAC 2005), ladders to provide access to fixed piers (or floating docks) from the water should be provided at a maximum spacing of 120 m (400 ft) on centers [sic] or within 60 m (200 ft) of any work area.

Ladders should be a minimum of 406 mm (16 in.) wide and reach the lowest water elevation anticipated. Retractable or flip ladders may be used as an alternative to fixed ladders to avoid marina fouling of the lower steps, but they can be difficult for a swimmer to reach and pull down in case of an emergency. There are numerous commercially available ladders made typically of marine-grade aluminum or stainless steel.”

Various forms of “lifting ladders” are convenient for floating docks, where they can be kept in the retracted position until needed. For recreational small craft harbors, ladders are generally spaced according to the management’s anticipated needs, clientele usage, and safety plan. They are often placed at the ends of T-heads of finger piers (so as to not affect berthing in the slips), in fairways, or adjacent to bulkheads so that anyone who may fall into the water can easily swim to a ladder without crossing under or through piers and vessels or across main navigable waterways.”

### ***California Code of Regulations: #4405. Working Over Water:***

(a) – “Permanently installed or portable ladders available for emergency use shall be provided on all waterfront docks.

- Such ladders shall extend from the face of the dock to the water line at its lowest elevation;
- Spacing between ladder installations shall not exceed 400 feet; and

- The ladder shall be secured to the dock or pier before use.”

### ***29 CFR 1917.26 (f) First Aid and lifesaving facilities:***

“A readily available portable or permanent ladder giving access to the water shall also be provided within 200 feet (61 m) of such work areas.”

### ***National Park Service Marina Standards 2016:***

“Access ladders are well-maintained and secured, and appropriately located throughout the marina.”

### ***Safety and Health in Ports, International Labour Office, Quayside Ladders, section 3.3.5:***

- “Permanent ladders should be provided at the edge of any structure in a port from which persons may fall into deep water to enable them to climb out of the water.”
- “Ladders should be spaced at intervals of not more than 50 m (164 ft) from each other or from steps.”

### ***Unified Facilities Criteria (UCF), Design: Piers and Wharves: 7-9.1 Safety Ladders.***

“Provide safety ladders from pier or wharf deck to water at a maximum spacing of 400 feet (122 m) or as noted below with regard to life rings. Such ladders should be at least 1 foot 4 inches (0.41 m) wide and should reach to the lowest water elevation anticipated.”

### ***PIANC RecCom WG Report n° 149/part IV – 2017: Guidelines for Marina Design:***

“Ladders should be located along quay walls, fixed piers, pontoons, and in whatever place where they could be useful for safety, at a distance of not more of 50 m from each other.”

## FURTHER NOTES ON LIFE RINGS AND SAFETY LADDERS

Other interesting notes concerning life rings and safety ladders:

### **California Code of Regulations: #4405. Working Over Water:**

“The dock area immediately adjacent to ladder locations shall be painted a contrasting bright color.”

### **Safety and Health in Ports, International Labour Office, Quayside Ladders, section 3.3.5:**

“Ladders from the water should be conspicuous so as to be easily seen by anyone falling into the water. The tops of the ladder should be clearly visible to persons on the quayside.”

### **Unified Facilities Criteria (UCF), Design: Piers and Wharves: 7-9.2 Life Rings.**

“Co-locate life rings with permanent ladders.”

Governing Authority		Life Ring(s)	Safety Ladder(s)
National Water Safety Congress: <i>Guidelines for the Safe Operations and Maintenance of Marinas</i>	<b>Guideline</b> for marinas	1 device located every 200 feet (61 meters)	
Federal 29 CFR 1917.26	<b>Regulation</b> for first aid and lifesaving facilities	1 device at each waterside work area	Readily available or within 200 feet of work area
National Park Service – Marina (via FOIA request response)	<b>Standard</b> for NPS marinas	1 every 200 feet	Appropriately located throughout marina
California Code of Regulation #4405: <i>Working Over Water</i>	<b>Regulation</b> in workplace		Spacing not to exceed every 400 feet between ladders. Contrasting bright color at ladder locations.
Washington WAC 296-800-16070	<b>Regulation</b> in workplace	Spaced no further than 200 feet apart	
American Society of Civil Engineers: <i>Planning and Design Guidelines for Small Craft Harbors</i>	<b>References regulations:</b> Federal 29 CFR 1917.26 and Washington WAC 296-800-16070	Spaced no further than 200 feet apart / 1 device at each waterside work area	Readily available or within 200 feet of work area
World Organization for Waterborne Transport: <i>Guidelines for Marina Design</i>	<b>Guidelines</b> for marinas	Advisable lifebuoy every 50 meters (164 feet)	Not at a distance more than 50 meters (164 feet) apart
International Labour Office: <i>Safety and Health in Ports.</i>	<b>Code of Practice</b> for safety in ports	Life-saving equipment should be located at suitable places at intervals of not more than 50 meters (164 feet)	Ladders should not be spaced at intervals of not more than 50 meters (164 feet) from each other or other steps
Unified Facilities Criteria: <i>UFC 4-152-01, Design: Piers and Wharves</i>	<b>Design criteria</b> for Department of Defense projects	References Federal 29 CFR 1917.26. Co-locate with permanent ladders	Maximum spacing of 400 feet, co-locate with life rings
U.S. Army Corps of Engineers Marinas (via FOIA request response)	<b>None</b>		

## FIRE EXTINGUISHERS

Fire extinguishers have little obvious value as a life-saving preventative device for persons who have fallen into the water. However, applicable guidelines as to the location and placement of fire extinguishers may assist the marina industry in identifying where to place life rings and safety ladders. The National Fire Protection Association (NFPA) has specific codes on where fire extinguishers need to be located in a marina. The NFPA codes for marinas are recognized by the American Society of Civil Engineers, an organization responsible for the publishing of *Planning and Design Guidelines for Small Craft Harbors*. Where the NFPA codes describe the placement locations for fire extinguishers within a marina, those locations could be used in defining placement locations for life rings and safety ladders.

### **National Fire Protection Association (NFPA) 303- 6.1.1.1:**

“shall be installed at the pier/land intersection on a pier that exceeds 25 ft (7.62 m) in length.”

“Additional fire extinguishers shall be placed such that the maximum travel distance to an extinguisher does not exceed 75 ft (22.86 m).”

### **Planning and Design Guidelines for Small Craft Harbors, ASCE Manuals and Reports on Engineering Practices No. 50, Third Edition, Fire Extinguishers:**

“Chemical fire extinguishers for small craft harbors and marine facilities shall be provided as per applicable National Fire Protection Agency (NFPA), state, and local codes and regulations. For small craft facilities, NFPA 303 (2006a) specifies portable fire extinguisher requirements (types and locations), which primarily includes provision of an extinguisher at the head of each dock access point (gangway or pier) and thereafter so that the maximum travel distance to the extinguisher from any point on the docks does not exceed 23 m (75 ft).”

## Recommendations

It is my recommendation that a dialogue or discussion commence with a national panel of marina industry experts and companies, such as: marina owners, marina operators, insurance companies, dock manufacturers, aquatics safety expert, and a human factors expert. This panel could be charged with the task of whether or not the placement and use of life rings and safety ladders should be uniformly addressed in the marina industry.

Utilizing research data presented in this report, the following thoughts should be considered:

### **Create “Safety Centers” within the Marina**

Each “Safety Center” is to include:

- A fire extinguisher as described in the appropriate National Fire Protection Association codes;
- A safety ladder; and
- A life ring with a floating line attached.

“Safety Center” location considerations:

- Within 75 feet (22.9 meters) of any point on the main docks / piers or at maximum intervals of 150 feet (45.7 meters) and shall be installed at the pier/land intersection of each pier that exceeds more than 25 feet (7.6 meters) in length. The description of these locations are similar to the placement descriptions of:
  - Fire extinguishers in National Fire Protection Association’s (NFPA) *Fire Protection Standard for Marina and Boatyards 2016 Edition* 303- 6.1.1.1;
  - Ladders and life buoys in the *World Association for Waterborne Transport Infrastructure* (PIANC) RecCom WG Report n 149/part

IV – 2017, Guidelines for Marina Design; and

- Quayside ladders and life-saving equipment in the *International Labour Office's* Safety and health in ports.
- While in maximum intervals of 150 feet may be easy to calculate on the deck of a dock or pier, careful considerations need to be discussed, as safety ladders may be considerably further by water. For example:
  - A person falling into the water on one side of a floating pier is physically only 8 feet away from a safety ladder placed on the other side of the floating pier. Due to the design and placement of the pontoons of the floating pier, the person cannot swim under the floating pier; and the person either needs to swim around the floating pier or to another safety ladder placed elsewhere in the marina.

#### **Marina Safety Center Identification**

Placards or signs next to each safety ladder:

- Placards or signs to include the following language “For emergency use only;”
- One sign is to be placed on the pier, facing upward for persons on the pier; and
- A second sign is to be placed positioned towards the water above the upper rails of the safety ladder.

Each “Safety Center” is to have the surfaced deck area in a bright contrasting color from the rest of the pier and surrounding area above and by water. This bright contrasting color will make the “Safety Center” easier to identify, both from the pier and from the water. The description of the bright contrasting color is similar to the description listed in the California Code of Regulations: #4405 - Working Over Water: “The dock area immediately adjacent to ladder locations shall be painted a contrasting bright color;” and

Include a raised pennant marker which is readily identifiable. This will allow a person to locate a “Safety Center” above the congested view of boat bow pulpits, power pedestals, and dock boxes.

#### **Education**

Harbor rules on children wearing personal floatation devices (PFDs) while on the piers and docks, or near bodies of water within the marina;

- Written communications with slip lessees; and employee training programs on the use of life rings and safety ladders.
- Posted; and
- Distributed at the same time the dockage agreement is executed.

#### **References - see appendix B.**

# Appendix A

Date of Incident	Day of Week	Time of Day	City/County	State	Male/Female	Age	Video / Liveboard	Cause of Incident	Description
16-Jul-17	Sunday	Evening	Charlotte	Vermont	Male	64		Fell into water while docking	Victim apparently fell into the water while docking his boat.
1-Jul-17	Saturday	Afternoon	Conway	South Carolina	Male	40		Walking on or fell from the docks	Victim was working on his boat and fell into the water.
1-Jul-17	Saturday	Night	Kootenai County	Idaho	Male	41		Walking on or fell from the docks	Victim fell off dock.
16-Jun-17	Friday	Evening	Put-in-Bay	Ohio	Male	19		Rescuer, drowned	Jumped in water to rescue father, drowned due to ESD.
14-Jun-17	Wednesday	Evening	Burlington	Iowa	Male	63		Embarking or disembarking from boat	Fell from his houseboat anchored at slip in marina.
14-Jun-17	Wednesday	Afternoon	Burlington	Iowa	Male	63		Fell out of boat at marina	Victim fell from boat in the marina.
1-Jun-17	Thursday	Afternoon	Saugatuck	Michigan	Male	71		Embarking or disembarking from boat	Victim fell from boat docked in the marina into the water.
28-May-17	Sunday	Unidentified	Bartow County	Georgia	Female	55		Unidentified	Victim last seen on dock in the marina on 5/26/17. Body found on 5/28/17. Incident under investigation.

Date of Incident	Day of Week	Time of Day	City/County	State	Male/Female	Age	Video / Liveboard	Cause of Incident	Description
19-May-17	Friday	Afternoon	Slideil	Louisiana	Male	25		Unidentified	Victim disappeared while swimming in marina and drowned.
15-May-17	Monday	Morning	Tampa	Florida	Male	53		Walking on or fell from the docks	Victim was pressure washing docks and fell in the water.
14-May-17	Sunday	Night	Cleveland	Ohio	Male	57		Unidentified	Victim never made it back to his boat. Left yacht club bar at 1:00 a.m.
5-May-17	Friday	Afternoon	Lake Mead	Nevada	Male	22		Unidentified	Victim fell into water trying to retrieve raft.
16-Apr-17	Sunday	Evening	Beaumont	Texas	Male	7		Playing on docks	Victim was playing on dock with squirt guns, he was hit in the eye and fell off the docked and drowned.
10-Apr-17	Monday	Unidentified	Manteo	North Carolina	Male	51		Unidentified	Found dead in marina where victim kept his boat.
9-Apr-17	Sunday	Unidentified	Silver Point	Tennessee	Female	35		Unidentified	Victim staying on houseboat w
30-Mar-17	Thursday	Morning	Garrard County	Kentucky	Female	82	Live-aboard	Unidentified	Victim lived on houseboat at the marina. Presumed to have fallen into water near her houseboat. Drowned.

Date of Incident	Day of Week	Time of Day	City/County	State	Male/Female	Age	Video / Liveaboard	Cause of Incident	Description
24-Mar-17	Friday	Unidentified	Monmouth Beach	New Jersey	Male	59		Embarking or disembarking from boat	Victim fell into water trying to get on board a boat. Friend jumped in to save victim, both drowned.
24-Mar-17	Friday	Unidentified	Monmouth Beach	New Jersey	Female	51		Rescuer, drowned	Victim jumped in water to rescue friend who fell into water. Both drowned.
2-Mar-17	Thursday	Unidentified	Des Moines	Washington	Male	Unidentified	Live-aboard	Unidentified	Body found in water off marina. Victim believed to have lived on one of the boats at the marina.
23-Feb-17	Thursday	Unidentified	Islamorada	Florida	Male	68		Unidentified	Victim did not return to houseboat in marina previous evening. Body found in water.
7-Feb-17	Tuesday	Evening	Louisville	Kentucky	Male	Unidentified	Video	Slipped	Victim slipped while checking on his boat at the marina. Near drowning. Video captured event.
2-Feb-17	Thursday	Unidentified	Hall County	Georgia	Male	37		Unidentified	Victim's body was recovered adjacent to pier he may have been fishing at.

Date of Incident	Day of Week	Time of Day	City/County	State	Male/Female	Age	Video / Liveaboard	Cause of Incident	Description
30-Jan-17	Monday	Morning	Willis	Texas	Male	69		Unidentified	Victim located in the water near a boat
17-Dec-15	Thursday	Unidentified	South Rockwood	Michigan	Female	41	Live-aboard	Unidentified	Victim was found in the waters of the marina where she lived on board her boat
8-Nov-15	Sunday	Morning	Bass River Township	New Jersey	Male	57		Working on boat	Victim was working on his boat at the marina when he slipped and fell into the water
1-Nov-15	Sunday	Night	Milwaukee	Wisconsin	Male	24		Unidentified	Victim drowned after he fell into Lake Michigan at the marina. Drowned.
15-Oct-15	Thursday	Unidentified	Chickasaw	Alabama	Female	3		Unidentified	3 year old boy fell into the waters of the marina and drowned.
23-Sep-15	Wednesday	Night	Charleston	South Carolina	Male	64		Unidentified	Victim was found in the waters of the marina, pulled out. Unknown circumstances of death.
6-Sep-15	Sunday	Evening	Polk City	Iowa	Male	34		Walking on or fell from the docks	Walking down the docks, fell off dock in the waters of the marina and drowned.
6-Sep-15	Sunday	Unidentified	Whiskeytown	California	Male	59		Walking on or fell from the docks	Victim fell off of the dock at the marina.

Date of Incident	Day of Week	Time of Day	City/County	State	Male/Female	Age	Video / Liveboard	Cause of Incident	Description
16-Aug-15	Sunday	Morning	Eufaula	Oklahoma	Male	56		Unidentified	Victim possibly fell off dock at the marina and drowned.
13-Aug-15	Thursday	Unidentified	Gainesville	Georgia	Male	58		Working on boat	Victim appeared to be working on his boat in the marina, fell in the water and drowned.
5-Aug-15	Wednesday	Afternoon	North Fort Myers	Florida	Female	57		Unidentified	Victim was found in the water of the marina. Last seen at bar.
29-Jul-15	Wednesday	Night	Manson	Washington	Female	50	Video	Walking on or fell from the docks	Video determined that the victim lost her balance while walking down the dock and fell into the water. Drowned.
25-Jul-15	Saturday	Night	Maynardville	Tennessee	Male	59		Walking on or fell from the docks	Victim fell off the end of the marina dock and didn't resurface. Drowned.
16-Jun-15	Tuesday	Night	Yankton	South Dakota	Male	54		Unidentified	Victim had been on a sailboat that was docked at the marina when he fell into the water. Drowned.

Date of Incident	Day of Week	Time of Day	City/County	State	Male/Female	Age	Video / Liveboard	Cause of Incident	Description
31-May-15	Sunday	Afternoon	Columbus	Georgia	Male	15		Fell out of boat at marina	Victim fell out of boat around 5:35 p.m. Body recovered on June 3, 2017.
31-May-15	Sunday	Afternoon	Columbus	Georgia	Male	35		Fell out of boat at marina	Victim fell out of boat around 5:35 p.m. Body recovered on June 2, 2017.
24-May-15	Sunday	Evening	Greensboro	North Carolina	Male	4	Video	Unidentified	Family was fishing from pier at the marina when they noticed the 4-year-old boy had not been seen for 30 to 45 minutes. Boy was found submerged in water near the dock. Possible video of incident. Drowned.
23-Apr-15	Thursday	Unidentified	Bayfield	Wisconsin	Male	48		Working on boat	Victim was working on his boat. Apparently stumbled on dock and fell into the water, was unable to get out of the water and drowned.
16-Oct-14	Thursday	Afternoon	Sitka	Alaska	Male	41	Video	Walking on or fell from the docks	Victim fell off main float. Video recorded incident.

Date of Incident	Day of Week	Time of Day	City/County	State	Male/Female	Age	Video / Liveaboard	Cause of Incident	Description
29-Sep-14	Monday	Unidentified	Seattle	Washington	Male	59	Live-aboard	Unidentified	Victim lived on his boat at the marina. Found dead in water. Drowned.
21-Sep-14	Sunday	Afternoon	Red Wing	Minnesota	Male	44		Embarking or disembarking from boat	Fell into the water while exiting a boat, drowned.
1-Sep-14	Monday	Unidentified	Montauk	New York	Male	64		Unidentified	Victim was found floating in the waters of the marina he owned
8-Aug-14	Friday	Morning	Bucksport	Maine	Male	54		Rescuer, drowned	Tried rescuing grandson who fell into water. Drowned during rescue.
8-Aug-14	Friday	Morning	Bucksport	Maine	Male	5		Walking on or fell from the docks	Fell into water and drowned. Grandfather tried to rescue him and also drowned
10-Jun-14	Tuesday	Evening	Lake Powell	Utah	Male	22		Fell into water while docking	Victim fell into water while tying up boat
27-May-14	Tuesday	Unidentified	Columbus	Georgia	Male	43		Unidentified	Victim had drowned at the marina.

Date of Incident	Day of Week	Time of Day	City/County	State	Male/Female	Age	Video / Liveaboard	Cause of Incident	Description
25-May-14	Sunday	Night	Acworth	Georgia	Male	18		Playing on docks	Playing a game in which person would sit in shopping cart and pushed into water. The cart was not tied to a pole, but victim was instead tied to cart. Drowned.
28-Apr-14	Monday	Night	Hendersonville	Tennessee	Male	34		Walking on or fell from the docks	Walking along dock at the marina when he fell into the water around 3:00 a.m. Drowned.
20-Oct-13	Sunday	Unidentified	Racine	Wisconsin	Male	58		Loading/Unloading Boat	Victim was packing up the boat for the winter when the incident occurred. Sheriff's Office received report of missing person, located victim in the water within an hour.
17-Sep-13	Tuesday	Night	Boston	Massachusetts	Female	53		Walking on or fell from the docks	Victim fell into the water returning to her boat
14-Sep-13	Saturday	Night	Salem	Massachusetts	Male	69		Embarking or disembarking from boat	Victim slipped and fell off pier in the marina

Date of Incident	Day of Week	Time of Day	City/County	State	Male/Female	Age	Video / Liveaboard	Cause of Incident	Description
25-Aug-13	Sunday	Evening	Salisbury	Massachusetts	Female	64		Unidentified	Victim entered the water near the marina and was found in the water two hours later around floating docks at another marina.
23-Aug-13	Saturday	Unidentified	Crosby	Texas	Male	1		Unidentified	Child was pulled from the water adjacent to a boat ramp. A near-drowning.
20-Aug-13	Tuesday	Unidentified	Hampton	New Hampshire	Male	53		Unidentified	Victim #1 and friend staying aboard a floating dock owned by the marina, with the dock isolated out in the river. Found missing and later drowned.
20-Aug-13	Tuesday	Unidentified	Hampton	New Hampshire	Male	57		Unidentified	Victim #2 and friend staying aboard a floating dock owned by the marina, with the dock isolated out in the river. Found missing and later drowned.
6-Aug-13	Tuesday	Unidentified	Hadley	Massachusetts	Male	54		Slipped	Victim apparently fell off a dock and drowned.

Date of Incident	Day of Week	Time of Day	City/County	State	Male/Female	Age	Video / Liveaboard	Cause of Incident	Description
28-Jul-13	Sunday	Afternoon	Westbrook	Connecticut	Male	61		Walking on or fell from the docks	Fell into water and drowned.
26-May-13	Sunday	Afternoon	Crosby	Texas	Male	6		Unidentified	Discovered underwater, family couldn't find him.
22-May-13	Wednesday	Evening	Mayo	Maryland	Male	70		Walking on or fell from the docks	Victim was found in the water near his boat
29-Jan-13	Tuesday	Unidentified	Erie	Pennsylvania	Male	17		Unidentified	Body was found near marina almost 2 months after victim went missing. Unknown circumstances of drowning.
20-Jan-13	Sunday	Unidentified	Olympia	Washington	Male	Unidentified		Unidentified	May have fallen off a boat or the dock.
4-Mar-12	Sunday	Night	Clearwater	Florida	Male	36		Walking on or fell from the docks	Victim missed a turn on the dock, walked off dock and drowned.
10-Dec-11	Monday	Night	St. Helens	Oregon	Male	43		Slipped	Victim slipped on ice on Christmas boat, fell into marina waters and drowned. Body found 5 months later.

Date of Incident	Day of Week	Time of Day	City/County	State	Male/Female	Age	Video / Liveboard	Cause of Incident	Description
24-Jul-11	Sunday	Afternoon	Burley	Idaho	Male	5		Playing on docks	Young boy was playing on docks and slipped unnoticed into the water and drowned.
7-Jul-11	Thursday	Unidentified	Lake Powell	Utah	Male	Unidentified		Fell into water while docking	Victim fell out of boat while trying to side tie
27-May-11	Friday	Evening	Salisbury	Massachusetts	Male	29	Live-aboard	Embarking or disembarking from boat	Lived aboard 20-foot cabin cruiser. Likely that victim misjudged the edge of the boat's back ramp and fell into the river. Drowned.
16-Apr-11	Saturday	Unidentified	Hilton Head Island	South Carolina	Male	84	Live-aboard	Walking on or fell from the docks	Victim lived on his boat in the marina.
6-Aug-10	Friday	Night	Hilton Head Island	South Carolina	Male	72		Walking on or fell from the docks	Victim fell off the dock after a charter boat he was on docked during a thunderstorm
6-Jun-10	Sunday	Night	Ventura	California	Male	64		Unidentified	Victim didn't return after excusing himself. Found shortly thereafter floating face-down only feet from his 30' sailboat. Drowned.

Date of Incident	Day of Week	Time of Day	City/County	State	Male/Female	Age	Video / Liveboard	Cause of Incident	Description
27-May-10	Thursday	Afternoon	Salisbury	Massachusetts	Male	66		Fell into water while docking	Victim fell into water tying his boat up at the marina
16-May-10	Sunday	Evening	Savannah	Georgia	Male	23		Fell into water while docking	Williams fell into water while docking the boat
3-Apr-10	Saturday	Unidentified	Oxnard	California	Male	57	Live-aboard	Unidentified	Victim lived on a boat in the harbor. Body was found floating near a boat slip. Drowned and death was accidental.
11-Feb-10	Thursday	Morning	South San Francisco	California	Male	56	Live-aboard	Working on boat	Victim became tangled in some ropes on sailboat he lived on in the marina
13-Nov-09	Friday	Unidentified	Sandusky	Ohio	Male	58		Working on boat	Body found clinging to floating dock in about 5 to 7 feet of water. Appeared victim was trying to get out of the water. Water temperature between 40 and 50 degrees. Boat was to be removed from water and placed in winter storage.

Date of Incident	Day of Week	Time of Day	City/County	State	Male/Female	Age	Video / Liveaboard	Cause of Incident	Description
26-Oct-09	Monday	Unidentified	Hope	Idaho	Female	59	Live-aboard	Unidentified	Victim was living on sailboat docked at the marina during the week. Her body was found floating in water near the marina. Drowned.
13-Jul-09	Monday	Unidentified	Deale	Maryland	Male	62	Live-aboard	Unidentified	Victim lived on boat in marina, circumstances of drowning are not known
23-May-09	Saturday	Unidentified	Warwick	Rhode Island	Male	58		Walking on or fell from the docks	Fallen into water. Owned boat in marina.
8-Aug-08	Friday	Night	Fall River	Massachusetts	Male	54		Embarking or disembarking from boat	Victim slipped and fell while exiting a friend's docked boat. Several people jumped into water in a vain effort to find him. Drowned.
28-May-08	Friday	Unidentified	Hall County	Georgia	Male	46		Embarking or disembarking from boat	Fell off personal watercraft at fuel dock.
16-Apr-08	Wednesday	Night	East Greenwich	Rhode Island	Male	45		Embarking or disembarking from boat	Tried to board boat at marina when he slipped and fell into water. Drowned.

Date of Incident	Day of Week	Time of Day	City/County	State	Male/Female	Age	Video / Liveaboard	Cause of Incident	Description
22-Feb-08	Friday	Afternoon	Bayou Liberty	Louisiana	Male	73		Embarking or disembarking from boat	Witnesses heard victim hit the water and saw his boat rocking. Drowned.

## Appendix B

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Carl is an expert in the operations and management of marinas, boat-yards, and dry-stack boat storage facilities. Throughout his career, since 1976, Carl owned his own marina related businesses, operated water-front facilities, and developed marina operations manuals. Carl operated boats and boatyard equipment, and served in the U.S. Coast Guard. As an expert at Robson Forensic, Carl applies his expertise to a variety of injury and economic loss investigations involving incidents that occur in marinas, boatyards, waterfront facilities, and on boats.

For nearly thirty years, Carl served as Vice President and General Man-ager of a 683 slip marina and a 23-acre boatyard on Lake Erie. In these roles, he managed the day to day operations, planned and oversaw capital improvement projects, worked with insurance companies on risk management, and also collaborated with local and federal agencies for security and environmental protection initiatives. Carl personally trained and supervised staff, participated in designing and constructing marinas, and managed the maintenance activities. Carl was one of Ohio's first recipients of the Clean Marina Award.

Carl remains active in the industry as the owner of a marina operations consulting company in Delray Beach, Florida. Carl is the author of the Ma-rina Policy Guidelines Manual, published by the University of Wisconsin's Department of Engineering Professional Development and the co-editor of the International Marina Institute's (IMI) 1st edition of the Marina Oper-ations Manual, a standard in the marina industry. Carl is an instructor and speaker for IMI Marina Management certification classes, and the Asso-ciation of Marina Industries Marina 101 and the Annual S.E. Florida Marina and Boatyard Study Tour. He is a Certified Marina Manager and a Certified Marine Investigator. Internationally, Carl has been a speaker in Great Brit-ain, and worked with marinas in Canada, U.S. Virgin Islands, Puerto Rico, Bahamas, Cyprus and Panama.

# Notes