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Research Article

Distribution and Risk Factors of Water-Related Accidents for General Aviation Aircraft

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In the past two decades, dozens to more than a hundred people have died each year in water-related accidents, most of which general aviation has accounted for. To identify the distribution and risk factors of fatal water-related accidents for general aviation aircraft, a total of 594 water-related accidents according to 14 CFR Part 91 from 2009 to 2019 were chosen from the National Transportation Safety Board's online database. A two-step approach, consisting of a univariable logistic regression and a multivariable logistic regression, was performed to estimate the effects of 28 parameters. Results show that aircraft with a rated power of more than 100 horsepower (odds ratio > 5), instrument conditions (odds ratio = 25.585), flying night operations (odds ratio = 3.717), and cruise phase (odds ratio = 11.699) possessed an elevated risk for a fatal outcome. This research is the first to identify the distribution and risk factors of fatal water-related accidents under 14 CFR Part 91. The necessity and importance of survival equipment for water-related accidents are also highlighted in this paper.

1. Introduction

An aircraft accident is defined by Title 49 Code of Federal Regulations Part 830 as "an occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight and all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage." According to the well-established human factors analysis and classification system, the cause of aircraft accident can often be attributed to organizational influences, unsafe supervision, preconditions for unsafe acts, and unsafe acts [1].

Water-related accidents are aircraft accidents that involve an emergency landing on water, in which planned water-related accidents are called ditching accidents [2]. Dozens to more than a hundred people have died in water-related accidents every year in the past two decades. Figure 1 shows the fatalities and involved occupants in water-related accidents from 1999 to 2019. Each year, fatalities due to water-related accidents ranged from 30 to 195 with the number of involved occupants in these accidents ranging from 101 to 506. Although the overall trends of fatalities and involved occupants have downward in the past two decades (see Figure 1), water-related accidents still deserve special attention because they are particular, i.e., occupants in water-related accidents require additional survival equipment to help them survive. It is estimated that approximately 70% of the fatalities in water-related accidents were attributed to drowning [3]; therefore, aircraft should be equipped with survival equipment to save more lives during overwater operations.

General aviation (GA) implies all flights except those of scheduled airlines and uniformed armed flights [4]. In recent years, the fatal accident rate of GA operations under 14 CFR Part 91 fell below 1 fatal event per 100,000 hours [5]. Fatal injury is defined by 49 CFR 830.2 as "any injury which results in death within 30 days of the accident." Impact is often the main cause of traffic deaths [6, 7], Similarly, the most important cause of death in aircraft accidents is also impact, followed by fire and drowning [8]. The death in water-related accidents can also be attributed to these three categories, but the possibility of drowning increased significantly. The literature on GA safety has focused on the causes and

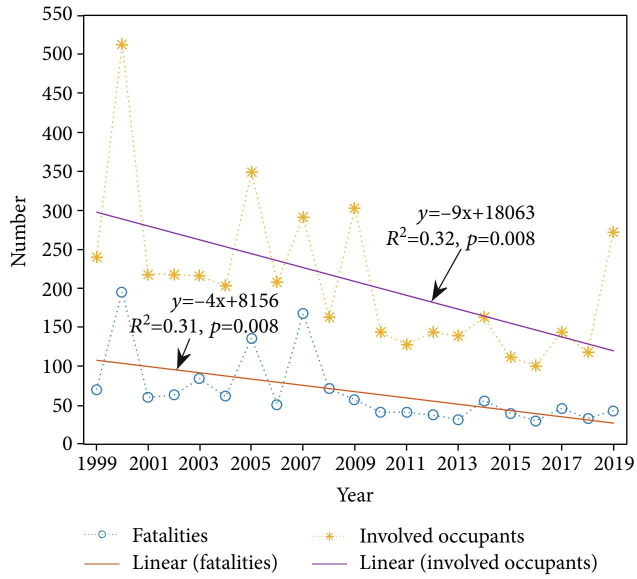

Figure 1: Fatalities and involved occupants in water-related accidents from 1999 to 2019. The equations in the figure are linear regression equations, r^2 is the coefficient of determination, and p is the significant value. Data source: https://www.ntsb.gov/_layouts/ntsb.aviation/index.aspx.

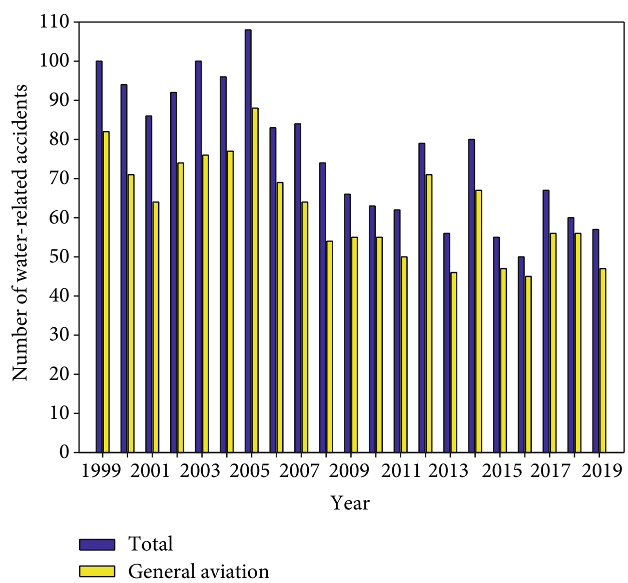

Figure 2: The number of water-related accidents from 1999 to 2019. Data source: https://www.ntsb.gov/_layouts/ntsb.aviation/index.aspx.

trends of GA [9] and human error [10] and models [1]. GA accounted for the overwhelming majority of civil aviation accidents and fatalities in the United States. Similarly, most of the water-related accidents from 1999 to 2019 occurred in GA (see Figure 2). The ratio of GA water-related accidents to total water-related accidents ranges from 75.7% to 86.2%. However, no literature researching GA water-related accidents has been published.

R.G.W. Cherry & Associates Limited also [11] presented a review of accident data and existing research applicable to aircraft water-related accidents from 1967 to 2009. But their research only includes water-related accidents involving western-built airplanes certified for 20 or more passengers under CAR 523/FAR 23/CS-23, only some of which were general aviation aircraft. The report discussed 81 water-related accidents occurring in 43 years, of which only 31 accidents had official accident reports. The US Federal Regulations 49 CFR 830 specifies which aircraft accident occurrences must be reported to the National Transportation Safety Board (NTSB), which means that only 31 accidents from 1967 to 2009 in the report are considered formal aircraft accidents. In reality, the number of water-related accidents ranged from 49 to 107 every year from 1999 to 2018 (see Figure 2), which is more than the total number of formal accidents reported by R.G.W. Cherry & Associates Limited [11]. Furthermore, the report did not consider the distribution and risk factors of water-related accidents. Therefore, the objective of the present study is to show the distribution of water-related accidents of GA operating under 14 CFR Part 91 and to identify the risk factors that lead to the fatal crashes for the period spanning 2009–2019.

2. Methods

All accident reports under 14 CFR Part 91 were downloaded from the NTSB online database (https://www.ntsb.gov/_layouts/ntsb.aviation/index.aspx). Water-related accidents under 14 CFR Part 91 were chosen by carefully reading these reports. Because there were many missing items in the reports from 1999 to 2008, this study analyzes only the reports from 2009 to 2019.

All statistical analyses were performed using SPSS (v22) software. Logistic regression was used to identify the risk factors for fatal accidents. To solve the problem of missing data for several parameters, a two-step approach that consisted of a univariable logistic regression and a multivariable logistic regression [12] was performed. A univariable logistic regression was used to choose the significant parameters, and a multivariable logistic regression was used to statistically adjust the estimated effects of each significant parameter.

3. Results

3.1. Water-Related Accident and Injury Distributions. There were 594 water-related accidents, of which 220 were fatal accidents and 374 were nonfatal accidents in GA operating under 14 CFR Part 91 from 2009 to 2019. Of the 594 water-related accidents, 580 accidents occurred in the United States. In addition, 8, 3, 1, 1, and 1 accidents occurred in Bahamas, Kiribati, Gulf of Mexico, and Atlantic Ocean, respectively. The number of annual water-related accidents ranged from 45 to 71 (see Figure 3), and the number of involved occupants ranged from 87 to 125 (see Figure 4). There were 12 to 25 fatal accidents each year that resulted in 22 to 47 fatalities. Annual nonfatal accidents are significantly higher than fatal accidents, and the annual fatalities accounted for approximately 40% of the involved occupants.

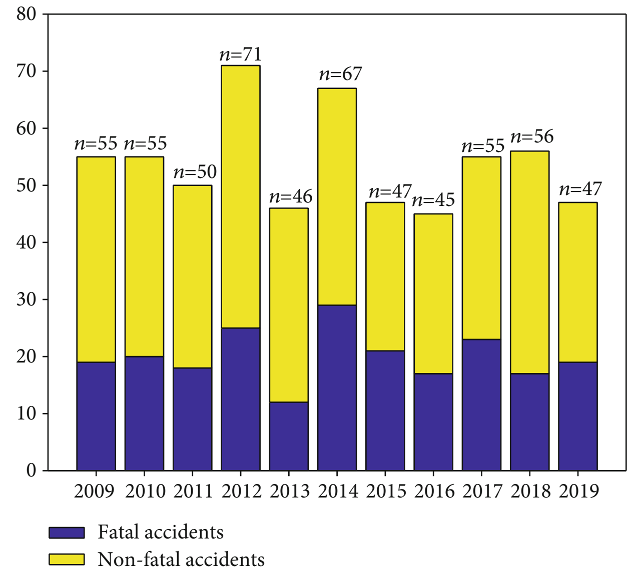

Figure 3: Water-related accident distribution in GA operating under 14 CFR Part 91 in 2009-2019. *n* denotes the number of total accidents.

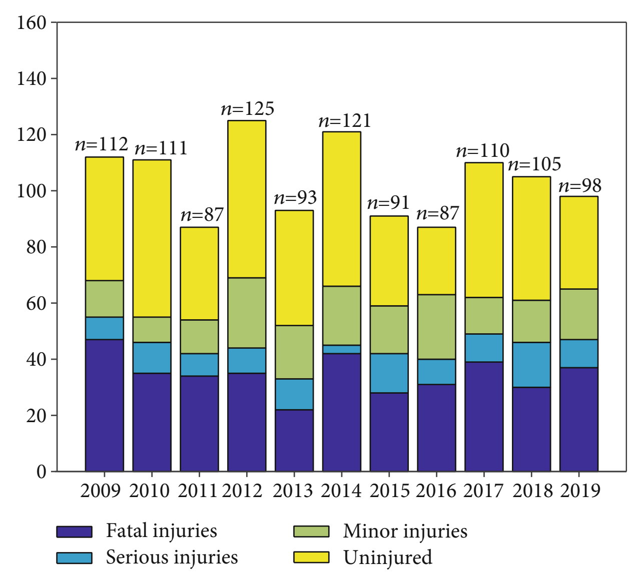

Figure 4: Injury distribution of water-related accidents in GA operating under 14 CFR Part 91. *n* denotes the number of total injuries for each year.

3.2. Ditching Location of Water-Related Accidents. Accident reports were used to identify ditching locations. If an aviation accident report did not mention the ditching location, the latitude and longitude were used to determine the ditching location through Google Maps. Figure 5 shows the ditching locations of water-related accidents in GA operating under 14 CFR Part 91. There were 8 types of ditching locations: lake/lagoon, gulf/bay/estuary, ocean/sea, river/creek, marsh/swamp, pond/pool/reservoir, canal/water lane/ditch/-channel, and choppy water/standing water. The four most common ditching locations were lake/lagoon (189/594),

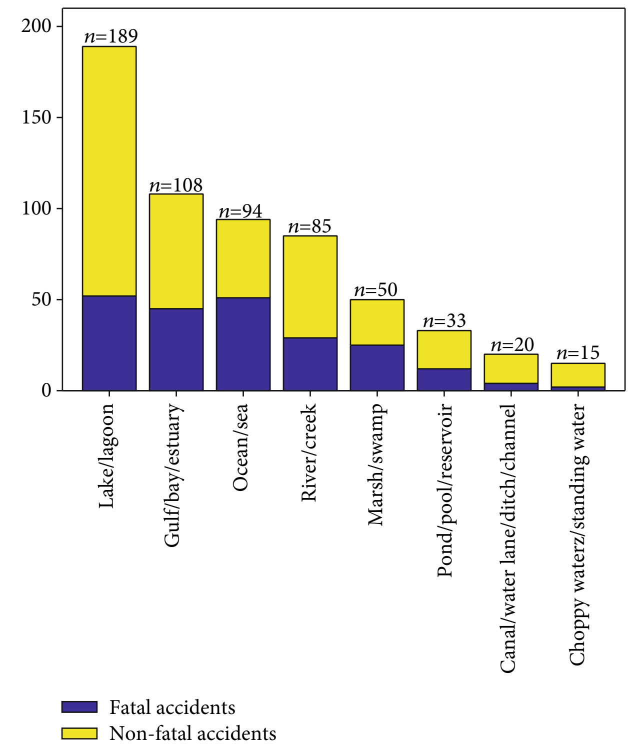

Figure 5: Ditching locations of water-related accidents in GA operating under 14 CFR Part 91. *n* denotes the number of water-related accidents in each type of ditching location.

gulf/bay/estuary (108/594), ocean/sea (94/594), river/creek (85/594), and marsh/swamp (50/594). Other smaller locations such as ponds acted as the ditching locations for 68 airplanes. When ditching occurred in the ocean or sea, the number of nonfatal accidents was lower than that of fatal accidents (43 nonfatal accidents versus 51 fatal accidents). When ditching in a marsh or swamp, the number of nonfatal accidents was equivalent to that of fatal accidents. In all the other cases, the number of nonfatal accidents was less than that of fatal accidents.

3.3. Risk Factors for Fatal Flights. There were 28 parameters used as risk factors for a fatal flight. These parameters were classified into four issues: pilot issue, aircraft issue, weather issue, and flight issue. Pilot issue included eight parameters: pilot certificate, occupational pilot, pilot age, pilot sex, second pilot present, pilot total flight time, pilot flight time of make/-model, and instructor rating. Aircraft issue included eleven parameters: airplane rating, certified max gross weight, rated power, number of engines, engine type, airworthiness certificate, time since last inspection, airframe total time, seats, aircraft category, and amateur built. Weather issue included six parameters: weather conditions, conditions at accident site, conditions of light, visibility, wind speed/gusts, and precipitation and obscuration. Flight issue included three parameters: broad phase of flight, distance from the nearest shore, and purpose of flight. Except for the distance from the nearest shore, which was determined by the latitude, longitude, and Google Maps, the other parameters were all obtained from the accident reports.

Table 1: Univariable logistic regression for a fatal flight.

Issue	Parameter	N	Comparison	p value	Odds ratio	95% confidence intervals Lower	Upper
Pilot issue	Pilot certificate (types)	547	3+				
			2	0.869	0.897	0.246	3.265
			1	0.676	0.771	0.228	2.605
			None	0.352	0.575	0.18	1.841
	Occupational pilot	510	Yes				
			No	0.476	1.153	0.779	1.708
	Pilot age	527	70+				
			60-69	0.819	0.929	0.494	1.746
			50-59	0.336	1.31	0.755	2.272
			40-49	0.395	1.269	0.733	2.199
			17-39	0.418	1.296	0.692	2.429
	Pilot sex	568	Male				
			Female	0.224	0.385	0.082	1.797
	Second pilot present	574	Yes				
			No	0.056	0.626	0.387	1.012
	Pilot total flight time (hours)	527	0-500				
			500-999	0.339	0.755	0.424	1.343
			1000-1999	0.283	1.441	0.74	2.805
			2000-4999	0.919	0.968	0.515	1.817
			5000-9999	0.952	1.019	0.554	1.874
			10000+	0.493	1.274	0.638	2.543
	Pilot flight time make/model (hours)	425	0-99				
			100-299	0.115	0.56	0.272	1.152
			300-499	0.290	0.661	0.307	1.424
			500-999	0.637	1.25	0.494	3.162
			1000+	0.469	1.437	0.539	3.837
	Instructor rating (types)	529	3+				
			2	0.598	1.167	0.657	2.075
			1	0.281	1.518	0.711	3.238
			0	0.864	1.058	0.555	2.015
	Airplane rating (types)	530	4+				
			3	0.194	0.506	0.181	1.416
			2	0.501	1.318	0.59	2.946
			1	0.288	0.684	0.34	1.378
			0	0.021[a]	0.436	0.216	0.88
Aircraft issue	Certified max gross weight (lbs)	443	0-1999				
			2000-2999	0.051	1.947	0.998	3.8
			3000-4999	0.022[a]	2.2	1.12	4.323
			5000+	0.300	1.451	0.718	2.932
	Rated power (hp)	513	0-99				
			100-199	0.014[a]	3.238	1.273	8.239
			200-299	0.001[a]	3.696	1.649	8.283
			300-499	<0.001[a]	5.097	2.145	12.109
			500+	0.001[a]	4.2	1.751	10.073
	Number of engines	568	1				
			2	0.002[a]	2.737	1.462	5.126

Table 1: Continued.

Issue	Parameter	N	Comparison	p value	Odds ratio	95% confidence intervals Lower	Upper
	Engine type	582	Turbo				
			Reciprocating	0.025[a]	0.513	0.286	0.918
	Airworthiness certificate	515	Normal				
			Experimental	0.842	0.934	0.476	1.833
			Other	0.435	0.745	0.356	1.558
	Time since last inspection (hours)	175	0-19				
			20-49	0.927	1.05	0.371	2.972
			50-99	0.782	1.167	0.392	3.471
			100+	0.277	0.544	0.182	1.629
	Airframe total time (hours)	444	0-499				
			500-999	0.333	1.343	0.739	2.442
			1000-4999	0.403	0.745	0.373	1.486
			5000+	0.916	1.027	0.626	1.684
	Seats	508	1 or 2				
			3 or 4	0.894	0.967	0.594	1.575
			5+	0.481	0.835	0.506	1.379
	Aircraft category	588	Airplane				
			Other	0.902	0.968	0.574	1.631
	Amateur built	591	Yes				
			No	0.631	0.897	0.577	1.396
Weather issue	Weather condition	586	VMC				
			IMC	<0.001[a]	14.6	5.633	37.838
	Conditions at accident site	584	Visual conditions				
			Instrument conditions	<0.001[a]	13.049	5	34.054
	Condition of light	588	Day				
			Night/dark/dusk/dawn	<0.001[a]	3.783	2.231	6.414
	Visibility	573	0-9				
			10+	<0.001[a]	0.277	0.163	0.473
	Wind speed/gusts (knots)	580	Calm				
			2-4	0.284	1.362	0.774	2.396
			5-9	0.872	0.958	0.566	1.62
			10+	0.129	0.724	0.476	1.099
	Precipitation and obscuration	488	No precipitation; no obscuration;				
			Rain or snow or thunderstorm	0.134	2.513	0.754	8.377
			Rain and fog	0.331	0.5	0.124	2.022
			Fog	0.816	1.2	0.257	5.593
Flight issue	Broad phase of flight	468	Takeoff				
			Maneuvering	0.097	1.857	0.893	3.86
			Landing	0.679	0.859	0.418	1.765
			Cruise	<0.001[a]	8.369	3.541	19.78
			Approach	0.731	0.848	0.332	2.169
			Other	0.928	1.04	0.439	2.465
	Distance (nautical miles)	588	0-0.9				
			1-9.9	0.100	2.921	0.813	10.49
			10-49.9	0.742	1.258	0.32	4.943
			50+	0.606	1.5	0.322	6.991

Table 1: Continued.

Issue	Parameter	N	Comparison	p value	Odds ratio	95% confidence intervals Lower	Upper
			Personal				
	Purpose of flight	590	Instructional	0.102	0.667	0.41	1.084
			Other	0.062	0.488	0.229	1.037

[a]Statistically significant factors $p < 0.05$.

Of the 594 water-related accidents, only 84 accidents were complete with all 28 parameters of interest (listed in Table 1). Of the complete cases, there were 22 fatalities and 62 nonfatalities equating to a value of approximately 1 event per variable (22/28), far less than the recommended minimum value of 10 [13]. For this reason, a two-step approach was used to analyze the risk factors for fatal accidents. In the two-step approach, a fatal accident was chosen as the response variable, and each latent risk factor was chosen as the predictor variable.

Table 1 shows the results of the univariable logistic regression for evaluating the relationship between accidents and latent risk factors.

In the univariable logistic regression, all parameters regarding pilot issue were not associated with a diminished risk for a fatal accident. Similar to our findings, O'Hare et al. [14] showed that pilot characteristics were not the key determinants of an injury outcome. However, Bazargan et al. [15] showed that a fatal accident was more likely to be associated with male pilots, pilots that are 60 plus years old, and pilots with more experience. They suggested that female pilots made fewer fatal mistakes, and more experienced pilots were likely to pilot challenging flights. In fact, only 11 female pilots out of 594 pilots were involved in water-related accidents. The results of a statistical analysis show that no significant difference exists between male and female pilots, and because there were too few female pilot data, the gender comparison may be rendered meaningless [13]. Water-related accidents involve an emergency landing on water and are generally not related to the pilot's flight experience; thus, fewer years of pilot experience did not result in more fatal accidents.

Some parameters regarding aircraft issue such as airplane rating, certified max gross weight, rated power, number of engines, and engine type were identified as risk factors based on the univariable logistic regression. O'Hare et al. [14] and Boyd [12] also proved that twin-engine aircraft carried a higher risk of fatality due to different flight profiles. The parameters regarding weather issue such as weather conditions, conditions at accident site, conditions of light, and visibility were also identified as risk factors based on the univariable logistic regression. These findings partially coincide with Boyd [12], which showed that conditions at accident site and conditions of light both carried an excess risk for a fatal flight. The parameter, broad phase of flight, in the flight issue category was identified as a risk factor, and the difference between takeoff phase and cruise phase was statistically significant, but the difference between takeoff and other phases of flight was not statistically significant.

Therefore, some of the parameters regarding aircraft issue, weather issue, and flight issue do carry a higher risk for a fatal accident, whereas other parameters are associated with a lower risk. More specifically, 10 parameters have been identified as risk factors based on the univariable logistic regression: airplane rating, certified max gross weight, rated power, conditions at accident site, conditions of light, visibility, number of engines, engine type, weather conditions, and broad phase of flight.

Multiple-variable analysis using a frontward selection procedure was used to assess the risks for a fatal accident. At each step of the frontward selection procedure, the variable with the largest nonsignificant p value was eliminated from the model. The final multiple-variable logistic regression model included four parameters: rated power, conditions at accident site, conditions of light, and broad phase of flight (see Table 2). There were 319 complete records available for multiple-variable logistic regression analysis (225 nonfatal and 94 and fatal accidents). The number of events per variable was therefore 23.5 (94/4), which far exceeds the necessary 10 number of events suggested by Peduzzi et al. [13].

Of the 28 parameters discussed in this paper, only four parameters (rated power, conditions at accident site, conditions of light, and broad phase of flight) were included in the final multivariable logistic regression, indicating that there was a significant association between the four risk factors and fatal accidents. The four parameters all contributed to a robust multivariable model ($\text{Chi}-\text{square} = 95.924$, $p < 0.001$) with a predictive value of 79.3%. Whether from the univariable logistic regression or the multivariable logistic regression, aircraft with a rated power of more than 100 horsepower, operating under instrument conditions, flying night operations, and flying in cruise phase all showed an elevated risk for a fatal outcome. Furthermore, the odds ratio values also showed that the change direction of significant independent variables to the corresponding outcome variable is consistent when conducting univariable logistic regression and multivariable logistic regression.

Compared with an aircraft with less than 100 horsepower, an aircraft with larger horsepower was five times more likely to have a fatal water-related accident ($\text{odds ratio} > 5$). The reason may be because aircraft with higher horsepower generally tend to fly longer distances over water, resulting in a higher risk for mortality. It can be seen from Figure 5 that

Table 2: Multivariable logistic regression of risk factors for a fatal flight.

	Comparison	p value	Odds ratio	95% confidence intervals Lower	Upper
Rated power (hp)	0-99				
	100-199	0.017[a]	5.709	1.374	23.716
	200-299	0.006[a]	5.573	1.645	18.883
	300-499	0.002[a]	8.537	2.264	32.194
	500+	0.004[a]	7.595	1.943	29.683
Conditions at accident site	Visual conditions				
	Instrument conditions	0.003[a]	25.585	3.047	214.822
Condition of light	Day				
	Night/dark/dusk/dawn	0.002[a]	3.717	1.645	8.400
Broad phase of flight	Takeoff				
	Maneuvering	0.145	2.128	0.771	5.87
	Landing	0.447	0.689	0.264	1.798
	Cruise	0.001[a]	7.899	2.417	25.815
	Approach	0.910	1.088	0.254	4.658
	Other	0.940	1.047	0.322	3.402

[a]Statistically significant factors $p < 0.05$.

the number of fatal accidents was greater than that of nonfatal accidents when ditching on the ocean or sea.

Operations under instrument conditions showed a greater risk of a fatal water-related accident than those under visual conditions (odds ratio = 25.585), a conclusion of which is similar to that of Boyd [12]. Of the 319 complete records in the multiple-variable logistic regression model, 14 water-related accidents that occurred while operating under instrument conditions consisted of 13 fatal water-related accidents, whereas 305 water-related accidents that occurred while operating under visual conditions consisted of 81 fatal water-related accidents.

Night operations showed an excess risk for a fatal outcome (odds ratio = 3.717). Of the 319 complete records, 280 water accidents that occurred during the day consisted of 69 fatal water-related accidents, whereas 39 water accidents that occurred during the night consisted of 25 fatal water-related accidents.

The difference between the takeoff phase and cruise phase was statistically significant. Compared to the takeoff phase, the cruise phase indicated an elevated risk for a fatal outcome (odds ratio = 11.699). However, the difference in risk between the takeoff phase and other phases of flight was not statistically significant.

4. Discussion

To the author's knowledge, this is the first study to exclusively report the distribution and risk factors of water-related accidents in GA operating under 14 CFR part 91. A water-related accident is a unique accident that involves an emergency landing on water, in which specialized water emergency equipment may be used to save lives. According to 14 CFR 91.509, an aircraft should be equipped with a life preserver or an approved flotation device for each occupant of the aircraft when the flight is over water more than 50 nautical miles from the nearest shore. If the flight distance from the nearest shore is more than 100 nautical miles or the flight time is over 30 minutes, life preservers must be installed on the aircraft. As for other overwater operations under 14 CFR part 91, survival equipment is not mandatory.

Of the 588 water-related accidents for which the distance from the nearest shore could be determined in this study, the distance was more than 50 nautical miles from the nearest shore for only 10 accidents. These accidents, which consisted of 6 fatal accidents and 4 nonfatal accidents, resulted in 10 fatalities with 21 involved occupants. Considering the 594 water-related accidents with 380 fatalities and 1140 involved occupants, it is unreasonable to have required only the aircraft in the 10 accidents to install survival equipment.

Because survival equipment was not required for the aircraft involved in most of the water-related accidents, many airlines and pilots often ignored the importance of having survival equipment on the aircraft. In the 594 water-related accident reports discussed in this paper, only 38 reports mentioned survival equipment, in which only 5 aircraft were installed with personal flotation devices and 23 aircraft installed with life preservers. In fact, survival equipment played a huge role in saving at least 24 lives, according to the NTSB online database. Thus, airlines and pilots should pay more attention to survival equipment. It is necessary to equip more planes, even those not intending to fly over water, with the appropriate survival equipment.

However, the aircraft in 7 water-related accidents was equipped with individual survival equipment, but the equipment was not in use at the time of the accidents. The main reason for this was because the passengers either did not know or were not familiar with how to use the survival equipment. Thus, more safety education regarding water-related accidents and survival equipment should be performed to pilots and passengers.

Table 3: Comparison of life preservers and inflatable individual flotation devices.

Feature	Life preserver	Inflatable individual flotation device
Active TSO standard	TSO-C13g [18]	TSO-C72c [17]
Float chambers	One or two, often two	One
Minimum buoyancy	16.3 kg	6.4 kg
Reflective material	At least 25.8 cm^2 of reflective material on each side	No required
Color	Approved international orange-yellow or similar high visibility color	No required
Survivor locator light	Yes	No required
Donning test	Yes	No required
Self-righting	Yes	No required

Figure 6: A typical life preserver.

Figure 7: A typical inflatable individual flotation device.

Common individual survival equipment includes life preservers and inflatable individual flotation devices. A life preserver is a flotation device used by an aircraft occupant if the aircraft ditches on water and can sometimes be termed as "life jacket" or "life vest" in some aviation documents [16]. Individual survival equipment other than life preservers is defined as individual flotation devices, which should meet TSO-C72c [17]. There are two categories of individual flotation devices: noninflatable types and inflatable types. Noninflatable types typically include flotation seat cushions, headrests, armrests, and pillows, which serve other primary functions on a flight. Inflatable types can replace life preservers in some less demanding flights. Typical inflatable types have a similar form and function as life preservers but demonstrate a lower performance. Table 3 compares the different life preservers and inflatable individual flotation devices.

In general, life preservers typically have double float chambers and a survivor locator light (see Figure 6), which can meet more stringent performance requirements and be used in a flight with high safety requirements. Inflatable individual flotation devices have one float chamber with low performance (see Figure 7) and can only be used to replace life preservers in a flight with low safety requirements.

Aircraft with a rated power of more than 100 horsepower (odds ratio > 5), operating under instrument conditions (odds ratio = 25.585), and flying night operations (odds ratio = 3.717) carried an elevated risk for a fatal outcome; therefore, aircraft flying under these conditions should be equipped with survival equipment that meets high safety requirements such as life preservers to save more lives.

5. Conclusions

The distribution and risk factors of water-related accidents in general aviation aircraft were presented using a two-step approach. First, approximately 95.3% of the general aviation aircraft (566/594) involved in water-related accidents were not equipped with survival equipment, resulting in casualties. Therefore, aircraft operating under 14 CFR Part 91 should be equipped with survival equipment for each occupant of the aircraft to avoid the risk of injuries and death. Second, aircraft with a rated power of more than 100 horsepower (odds ratio > 5), operating under instrument conditions (odds ratio = 25.585), and flying night operations (odds ratio = 3.717) carried an elevated risk for a fatal outcome; therefore, aircraft flying under these conditions should be equipped with survival equipment that meets high safety requirements such as life preservers to save more lives. Finally, because many airlines and pilots often ignore relevant knowledge about survival equipment, more safety education regarding water-related accidents and survival equipment should be conducted to airlines and pilots.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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