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Occupational Fatalities in the United States Commercial Fishing Industry, 2000–2009

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ABSTRACT. The occupational fatality rate among commercial fishermen decreased in the United States during 1992–2008; however, commercial fishing continues to be one of the most dangerous occupations in the United States, with an average annual fatality rate of 129 deaths per 100,000 fishermen in 2008. By contrast, the average annual occupational fatality rate among all US workers during the same period was four deaths per 100,000 workers. During the 1990s, numerous safety interventions were developed for Alaska fisheries that resulted in a significant decline in the state's commercial fishing fatality rate. In 2007, the National Institute for Occupational Safety and Health (NIOSH) expanded surveillance of commercial fishing fatalities to the rest of the United States. The purpose of this report is to identify the hazards and risk factors for all causes of occupational mortality in the US commercial fishing industry, and to explore how those hazards and risk factors differ among fisheries and locations. During 2000–2009, 504 commercial fishing fatalities occurred in the United States. Most (261, 52%) occurred following a vessel disaster (defined as a sinking, capsizing, or other event in which the crew was forced to abandon ship) or a fall overboard (155, 31%). Fatalities occurred in Alaska (133, 26%), Northeast (124, 25%), Gulf of Mexico (116, 23%), West Coast (83, 16%), and the Mid- and South Atlantic (41, 8%) regions. Fatalities occurred most commonly while fishing for shellfish (226, 47%), groundfish (144, 30%) and pelagic fish (97, 20%). Average annual fatality rates were calculated for selected fisheries. The Northeast multispecies groundfish fleet had the highest average annual fatality rate (600 deaths per 100,000 full-time equivalent [FTE] fishermen) followed by the Atlantic scallop fleet (425 deaths per 100,000 FTE fishermen) and the West Coast Dungeness crab fleet (310 deaths per 100,000 FTE fishermen). To reduce fatalities among fishermen at greatest risk, additional prevention measures tailored to specific high-risk fisheries should be considered.

KEYWORDS. Drowning, falls overboard, fatal injuries, fishing, vessel sinkings

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INTRODUCTION

In the United States, as in other countries, commercial fishing has the highest fatality rate of any occupation.[1–4] During 1992–2008, the fatality rate declined among fishermen in the United States; however, since 2000, there has been no significant change in the fatality rate. In 2008, commercial fishing had a fatality rate of 129/100,000, nearly 36 times higher than the rate for all US workers.[1] Nationally, about 9.0 billion pounds of seafood products are landed each year. These landings were valued at $4.1 billion in 2007.[5] A host of species are caught in the United States, including pollock, menhaden, salmon, cod, flatfish, crab, scallops, lobster, shrimp, and many others, using a variety of vessel designs and types of fishing gear, each with its own unique operating area and associated hazards.

The Commercial Fishing Industry Vessel Safety Act (CFIVSA) of 1988 gave authority to the United States Coast Guard (USCG) to develop basic lifesaving regulations for commercial fishing vessels (46CFR Part 28). These regulations require that vessels carry various pieces of emergency equipment such as immersion suits, life rafts, and emergency beacons (EPIRBS) depending on vessel size and the operating area. These regulations have been shown to have saved lives by keeping fishermen warm and afloat until the USCG arrived to rescue them.[6,7] These safety regulations focus largely on the rescue from events and do not address the primary prevention of vessel disasters, fatalities from falls overboard, or deck injuries.

The National Institute for Occupational Safety and Health (NIOSH) has conducted many studies on occupational safety in the Alaska fishing fleet. In the 1990s, NIOSH found evidence that the CFIVSA improved survivability of vessel disasters. The number of vessels lost per year during 1991–1998 stayed relatively constant, but the survival rate for those onboard increased from 73% in 1991 to 93% in 1998.[8] When comparing victims to survivors of vessel losses, NIOSH found that survivors were 7 times more likely to have used an immersion suit and 15 times more likely to have entered a life raft.[9]

In addition to evaluating safety regulations, NIOSH evaluated the impact that fisheries management policies have on fishing safety.[10] After implementation of Individual Fishing Quotas in 1995, removing the "race to fish" in the Alaska Halibut fishery, this fishery experienced an 81% decline in the fatality rate and a 47% decline in the rate of search and rescue missions. NIOSH has worked with the USCG, marine safety organizations, and fishermen to develop interventions to improve safety in the Alaskan fishing industry. These interventions include stability checks on crab vessels,[11] engineering controls for deck machinery on purse seiners,[12] and preventing fatalities from falls overboard on crab vessels, longliners, and gillnetters.[13] Through the use of survival equipment, safety training, and by tailoring prevention efforts to address the leading hazards for each fishery, the fishing fatality rate has declined in Alaska.[14] The success in improving safety in Alaskan fisheries demonstrates that prevention efforts may be most successful when a practical regional, fishery-specific, and hazard-specific approach is taken.

The purpose of this paper is to identify the hazards and risk factors for all causes of occupational mortality in the US commercial fishing industry, and to explore how those hazards and risk factors differ among fisheries, gear types, and locations. Understanding these risk factors will allow for tailored prevention solutions to be developed.

METHODS

NIOSH developed the Commercial Fishing Incident Database (CFID) to collect data on fatalities in the US commercial fishing industry and to identify high-risk fisheries (defined by species targeted and location of fishing grounds). For CFID, a case is defined as a fatal occupational traumatic injury in the commercial fishing industry reported anywhere in the United States. Only cases that met the criteria for an occupational fatality using established guidelines for injury at work are included.[15] The occupation of commercial fisherman was defined by the Standard

Occupational Classification (SOC) code 45-3011 "Fishers and Related Fishing Workers."

Data are collected from multiple sources in each state, including reports from the US Coast Guard (USCG), local law enforcement agencies, and local media; death certificates; and state-based occupational fatality surveillance programs. Causes of death were coded using the International Classification of Disease version 10 (ICD-10) from either death certificates or determined from investigative reports. This report presents results for 2000–2009.

Five types of fatal incidents were identified: vessel disasters, falls overboard, on-board injuries, on-shore injuries, and diving injuries. Vessel disasters involved the fishing vessel being capsized, sunk, or damaged to a degree that the crew abandoned the vessel. A fall overboard was defined as a fisherman entering the water outside of the vessel, which included all methods for entering the water: struck by gear, washed over, slipped, jumped, entangled, etc. On-board fatal injuries occurred on or within the fishing vessel. On-shore injuries occurred while on land, including on a dock or float. Falls into water from a dock were coded as on-shore injuries, not falls overboard. If a fall into water occurred while boarding or disembarking a fishing vessel, the fatality was coded as a fall overboard if the decedent was in contact with the vessel, or as an on-shore injury if the decedent was in contact with the dock. Diving injuries occurred when the fisherman was intentionally in the water for the purpose of harvesting or other work related tasks (e.g., diving to untangle a line or net from the propeller).

Analysis

Data were entered into a Microsoft Access database and exported to SPSS ver. 15 for analysis.[16] Descriptive statistics such as frequency and percent distributions, measures of central tendency and dispersion, and cross-tabulations were calculated to explore the data. For many variables there were a number of cases missing data. Missing data were excluded from percent distributions. Consequently, the total number of cases for each variable reported in the results may be different depending on the amount of missing data in each variable.

When possible, fatality rates were calculated for specific fisheries using estimates of the number of full-time equivalent (FTE) commercial fishermen for each year during 2000–2009; these estimates considered the number of vessels participating in a fishery, number of days at sea, and average number of crew members on board each vessel. A detailed explanation of the FTE calculation can be found in a previously published paper utilizing the same method.[13] Estimates of the number of FTE fishermen in many fisheries could not be determined; therefore, fatal events from those fisheries were included in the descriptive statistics but not in rate calculations. National rates reported in this report are from the Bureau of Labor Statistics.[1]

RESULTS

During 2000–2009, 504 commercial fishing fatalities occurred in the United States, a mean of 50 per year. Most of the decedents were male (491, 97%), with a mean age of 41 years and a range from 10 to 86. About half were deckhands (51%) and another 40% were the vessel master (captain). The cause of death was most often drowning (86%). Most deaths (261, 52%) occurred following a vessel disaster and falls overboard accounted for 155 (31%) of fatalities. The remaining deaths were due to on-board injuries (51, 10%), diving injuries (19, 4%), and on-shore injuries (18, 3%). The Alaska region had the highest number of fatalities (133, 26%), followed by Northeast (124, 25%), the Gulf of Mexico (116, 23%), West Coast (83, 16%), and the Mid- and South Atlantic (41, 8%). There were also six fatalities in Hawaii and one other that occurred on a US commercial fishing vessel transiting Canadian waters. Fatalities occurred most commonly while fishing for shellfish (226, 47%), groundfish (144, 30%), and pelagic fish (97, 20%).

The 261 fatalities that resulted from vessel disasters occurred in 148 separate vessel disaster incidents (Table 1). The most frequent initiating events were flooding (37, 28%), vessel instability (24, 18%), or being struck by a large

TABLE 1. Initiating Events and Causes Involved With Fatal Vessel Disasters, United States, 2000–2009

Events and causes	N	%
Initiating event (*n* = 148)		
Flooding	37	28 2
Instability	24	18.3
Struck by large wave	23	17 6
Collision/allision	13	9 9
Prop entanglement	6	4.6
Fire/explosion	6	4.6
Struck by wind gust	5	3 8
Gear caught on bottom	4	3 1
Engine failure	4	3 1
Crossing hazardous bar	4	3 1
Struck rocks/bottom	3	2 3
Steering failure	1	0 8
Listing	1	0 8
Unknown events	17	—
Cause of flooding (*n* = 37)		
Down-flooding (foundering)	14	43 8
Below waterline flooding	10	31.3
Swamping (open skiff)	8	25 0
Unknown cause	5	—
Cause of instability (*n* = 24)		
Overloading	10	43 5
Hauling up heavy net	6	26 1
Shifting load	3	13.0
Icing	2	8.7
Structural modifications	1	4 3
Slack tank (free surface effect)	1	4 3
Unknown	1	—

wave (23, 18%). The type of flooding as an initiating event was attributed to down-flooding (14, 44%), below-waterline flooding (10, 31%), and skiffs swamping (8, 25%). Severe weather conditions contributed to 61% of fatal vessel disasters. The fisheries where fatal vessel disasters most commonly occurred were the Northeast multispecies groundfish, Alaska salmon, West Coast Dungeness crab, and Northeast scallop fisheries (Table 2).

Falls overboard accounted for 31% of fatalities nationally during 2000–2009. Among the 155 victims who died from falling overboard, none were wearing a personal flotation device (PFD) and 53% of these fatal falls overboard were not witnessed (Table 3). The main causes of falls overboard were trips/slips (43, 33%), losing balance (34, 26%), and gear entanglement (21, 16%). Contributing factors included working alone on deck (82, 53%), alcohol and drug use (35, 23%), and vessel motion (17, 11%). The fisheries where falls overboard most commonly occurred were the Gulf of Mexico Shrimp, Alaska salmon, and Northeast lobster fisheries (Table 2).

Ten percent of the total US fatalities were due to on-board injuries. These injuries were usually due to gear entanglements (17, 33%), being struck by gear or other objects on deck (13, 25%), and poisoning (12, 24%). Of the 17 deaths due to gear entanglement, 12 involved being caught in a deck winch. On-board injuries occurred most commonly in the Gulf of Mexico shrimp fishery (Table 2).

Average annual fatality rates were calculated for selected fisheries (Table 4). The Northeast multispecies groundfish fleet had the highest average annual fatality rate (600 deaths per 100,000 FTE fishermen), followed by the Atlantic scallop fleet (Note: "Atlantic scallop fleet" includes scallop fishermen in both the Northeast and Mid-Atlantic regions) (425 deaths per 100,000 FTE fishermen) and the West Coast Dungeness crab fleet (310 deaths per 100,000 FTE fishermen). Other fishery-specific fatality rates were calculated for the Bering Sea Aleutian Island (BSAI) crab fleet (260 deaths per 100,000 FTE fishermen), Alaska halibut (130 deaths per 100,000 FTE fishermen), and Alaska salmon (115 deaths per 100,000 FTE fishermen).

DISCUSSION

Commercial fishing remains one of the most dangerous occupations in the United States, as defined by high fatality rates. In order to reduce these fatality rates, efforts should focus on the fisheries with the highest fatality rates (Northeast multispecies groundfish and Atlantic scallop) and on those fleets accounting for the highest number of fatalities due to vessel disasters (Northeast multispecies groundfish, Alaska salmon, West Coast Dungeness crab, and Northeast scallop) and falls overboard (Gulf of Mexico shrimp, Alaska salmon, and Northeast lobster fisheries).

TABLE 2. Fatal Incident Types for US Fisheries With ≥5 Fatalities due to Vessel Disaster, Fall Overboard, or On-board Injury, 2000–2009

US fishing region	Fishery	No of fatalities*	No. of incidents	Avg fatalities per incident
Fatal vessel disasters				
Northeast	Multispecies groundfish	19	12	1 6
Alaska	Salmon	13	12	1.1
West Coast	Dungeness crab	21	10	2.1
Northeast	Scallop	27	9	3 0
Gulf of Mexico	Shrimp	10	8	1.3
Alaska	Cod	17	7	2.4
West Coast	Salmon	11	6	1.8
Northeast	Clam	7	5	1 4
Gulf of Mexico	Oyster	6	5	1 2
Northeast	Lobster	5	5	1 0
Gulf of Mexico	Crab	6	4	1 5
Alaska	Sole	20	2	10 0
Alaska	Bering Sea crab	7	2	3.5
Northeast	Urchin	5	2	2 5
Fatal falls overboard				
Gulf of Mexico	Shrimp	29	29	1 0
Alaska	Salmon	17	17	1.0
Northeast	Lobster	11	11	1 0
Alaska	Cod	6	6	1 0
West Coast	Dungeness crab	6	6	1 0
Gulf of Mexico	Oyster	5	5	1.0
Gulf of Mexico	Snapper/grouper	5	5	1.0
Fatal on-board injuries				
Gulf of Mexico	Shrimp	12	11	1 1
Northeast	Multispecies groundfish	6	6	1.0
Alaska	Salmon	5	5	1 0

*n = 276; 55% of total US fatalities (504)

TABLE 3. Causes and Contributing Factors of Fatal Falls Overboard, United States, 2000–2009 (n = 155)

Causes and contributing factors	*N*	%
Causes		
Trip/slip	43	32 6
Lost balance	34	25 8
Gear entanglement	21	15 9
Jumped	16	12.1
Knocked by gear/object	11	8 3
Washed over	7	5.3
Unknown	23	—
Contributing factors		
Alone on deck	82	52 9
Alcohol and drug use	35	22 6
Vessel motion	17	11 0
Weather conditions	15	9 7
Leaning over side	9	5 8
Wet/slippery deck	6	3 9
Fatigue	5	3 2

TABLE 4. Commercial Fishing Fatality Rates by Fishery, 2000–2009

Fishery	Fatalities	FTE	Rate
Northeast multispecies groundfish	26	4340	600
Atlantic scallop*	44	10384	425
West Coast Dungeness crab†	25	8092	310
Bering Sea Aleutian Island crab	12	4658	260
Atlantic snapper/grouper	6	3622	170
Alaska halibut	10	7519	130
Alaska cod	26	21327	120
Alaska salmon	39	34287	115

*Includes scallop fishermen in both the Northeast and Mid-Atlantic regions

†Excludes 2 WA tribal crab fatalities which are not included in the FTE

Focusing on the primary prevention of vessel disasters by tailoring solutions for particular fleets has been found to be effective. Concern over high fatality rates in the Alaska Bering Sea

Aleutian Island crab fishery during the 1990s led to the institution of a USCG Preseason Dockside Enforcement Program in 1999 focusing on the immediate hazard of vessel overloading which can make the vessel unstable.[11] This program does not allow vessels to be overloaded with crab pots (large 700–800-lb cages) when they leave port. NIOSH evaluated the effectiveness of this program and found that since implementation, the average annual fatality rate for the BSAI crab fleet has decreased by 60% from a high of 768 deaths per 100,000 FTE fishermen during 1990–1999 to 305 deaths per 100,000 FTE fishermen during 2000–2006.[14] Tailored solutions like the Preseason Dockside Enforcement Program for the BSAI crab fleet should be developed for other fisheries across the country. Fleet-specific interventions should focus on the fleet-specific hazard.

Another innovative USCG program known as the Alternate Compliance and Safety Agreement (ACSA) was developed for a specific fleet of trawl vessels operating in Alaska after they were identified as high-risk due to the location in which they operated and the number of crew (>6) they carry.[17] Safety components of the ACSA program focus on maintaining hull condition and watertight integrity, prevention of down flooding, ensuring adequate vessel stability, enhanced emergency training, and improved lifesaving equipment. In both 2008 and 2009, the House of Representatives sponsored and passed bipartisan legislation that would require certain fishing vessels over 50 feet in length to become enrolled in a regionally developed, USCG-approved ACSA program no later than 2017.

Priority should be given to the development of prevention strategies that address particular hazards in high-risk fleets. In 2008, NIOSH reviewed commercial fishing fatalities that occurred along the West Coast and Alaska.[14] The report identified the West Coast Dungeness crab fleet as having a higher fatality rate than the BSAI crab fleet. NIOSH made recommendations, including activities that would result in better weather reporting, safer procedures for crossing river bars, continued marine safety training, and increasing PFD usage. These recommendations were made to address the specific hazards faced by Dungeness crab fishermen. Incremental progress in implementing these recommendations has been made, but it is too early to determine the impact of them. For instance, in 2009, the USCG implemented stricter guidelines for all vessels crossing river bars (33 CFR Part 165), and the Oregon Dungeness Crab Commission has increased fleet participation in safety training programs and has sponsored rebates for fishermen to purchase PFDs.

Falls overboard are a persistent problem in the US commercial fishing fleet. These events accounted for one third of all fatalities, and the fleets where these most commonly occurred were the Gulf of Mexico shrimp fleet, the Alaska salmon fleet, and the Northeast lobster fleet. The risk factors in all three fisheries included the lack of PFDs being worn on deck, and being alone at the time of the event. Increasing the wearing of PFDs, preventing falls overboard, and identifying effective recovery methods after a fall overboard should be a priority for these fisheries in particular. Entanglement prevention ideas were identified through interviewing lobstermen and include the use of line bins and rope lockers.[18,19]

Identifying and understanding the barriers to PFD usage among fishermen is necessary. Anecdotal evidence reveals that the most common objections among fishermen to wearing PFDs are that they are bulky, heavy, hot, and generally uncomfortable. Many new types and styles of PFDs have become available that appear to have overcome these complaints; but it is unknown how many commercial fishermen are aware of them, or if they are in fact more comfortable and wearable than the older styles. After reviewing fatal falls overboard in Alaska that occurred during 1990–2005, NIOSH noted that the rate of fatal falls overboard did not show a decreasing trend despite major decreases in other types of fishing fatalities.[13] In 2009, NIOSH conducted a study to identify fishermen's perceptions of the risk of falling overboard, safety attitudes, beliefs about PFDs, and experiences with falls overboard; as well as to evaluate a variety of modern PFDs with commercial fishermen to discover the features and qualities that they like and dislike. Findings

from the PFD evaluations will provide valuable information about commercial fishermen's PFD preferences and expectations. The PFD evaluation will supply information to fishermen about which types of PFDs were the most comfortable to wear while working. Results from this study will be published soon.

Although only 10% of the US commercial fishing fatalities during 2000–2009 were due to onboard injuries, many of these fatalities could have been prevented through the installation of an emergency stop switch for winches.[12] This is an example of a practical engineering control that can protect workers from hydraulic equipment such as a deck winch.

The findings in this paper are subject to at least three limitations. First, unlike the methodology used in this study, national fatality rates for commercial fishermen are not calculated based on FTE fishermen but are calculated using annual average estimates of employed civilians aged ≥16 years and deaths from the Census of Fatal Occupational Injuries. Therefore, the national rates might not be directly comparable to the fishery specific rates calculated in this study. Second, the FTE estimates used in this study were not available for all fisheries, especially those in the Gulf of Mexico and most small-scale fisheries across the United States. Finally, certain information (e.g., type of fishery) was not available for all fatal events. The USCG continues to work with NIOSH to improve data-collection instruments so that investigating USCG officers can produce more complete reports.

CONCLUSION

This paper identified the hazards and risk factors for all causes of occupational mortality in the US commercial fishing industry, and showed how those hazards and risk factors differ among fisheries and locations. By understanding these risk factors, safety professionals and industry should be able to design prevention solutions to prevent fatalities. The USCG and Congress have proposed many new safety measures including the expansion of the requirement for stability reports to smaller vessels, making dockside safety exams mandatory, and enrolling certain vessels in ACSA-like programs. Safety improvements have been attained through focusing on fishery specific hazards like vessel overloading in the Alaska crab fleet. By successfully tailoring interventions to prevent specific hazards found in fisheries leading to fatalities, more lives can be saved.

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