

# Preventing Deaths in Alaska's Commercial Fishing Industry

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**Abstract: Background and Purpose:** The arctic and sub-arctic waters of Alaska provide a very hazardous work setting, with special hazards posed by great distances, seasonal darkness, cold waters, high winds, brief fishing seasons, and icing. Our intent is to reduce the remarkably high occupational fatality rate (200/100,000/year in 1991-1992) among Alaska's commercial fishing workers. Over 90% of these deaths have been due to drowning or drowning plus hypothermia, primarily associated with vessel capsizings and sinkings. **Methods:** Comprehensive surveillance for commercial fishing occupational fatalities was established during 1991 in Alaska. During 1990 through 1994, the U.S. Commercial Fishing Industry Vessel Safety Act of 1988 required the implementation of comprehensive prevention measures for all fishing vessels in offshore cold waters, including immersion suits and other personal flotation devices, survival craft (life rafts), emergency position-indicating radio beacons, and crew training in emergency response and first aid. Parallel to this, voluntary training efforts by nonprofit organizations have greatly increased. **Results:** During 1990-1994, drowning was the leading cause of occupational death in Alaska. During this period, 117 fishers died, 101 of them from drowning or drowning/hypothermia. During 1991-1994, there was a substantial decrease in Alaskan commercial fishing-related deaths, from 34 in 1991 to 35 in 1992, 22 in 1993, and 10 in 1994. While man-overboard drownings and some other categories of deaths (falls, fires) have continued to occur, the most marked progress has been in vessel-related events. **Conclusion:** Specific measures tailored to prevent drowning in vessel capsizings and sinkings in Alaska's commercial fishing industry have been very successful so far. Additional efforts must be made to reduce the frequency of vessel events and to prevent man-overboard events and drownings associated with them.

Keywords: Alaska; Occupational injury/mortality; Commercial fishing; Injury prevention; Drowning; Injury surveillance

## INTRODUCTION

One of the last decade's great regional public health success stories is the sharp decline of deaths in Alaska's commercial fishing industry.

During the 1970s and 1980s, Alaska experienced a boom in its commercial fishing industry. By the mid-1980s, it became clear that commercial fishing-related deaths were the principal contributor to Alaska's very high occupational fatality rate.<sup>1</sup> Based on data from the National Traumatic Occupational Fatality surveillance system, Alaska had the highest state-specific work-related fatality rate during 1980-1989. During this period, the annual average private industry fatality rate in Alaska was 34.8 per 100,000 workers, nearly five times the an-

nual average for the United States (7.0 per 100,000).<sup>2</sup> Fatalities in the commercial fishing industry—which accounts for the second largest percentage of revenue and number of jobs in the state—are among the highest industry-specific rates in the United States.<sup>2</sup> Nationally, the hazards of commercial fishing captured the attention of Congress, which enacted the Commercial Fishing Industry Vessel Safety Act (CFIVSA) of 1988. In 1991, because of the high occupational fatality rates for Alaska, the National Institute for Occupational Safety and Health (NIOSH) of the Centers for Disease Control and Prevention (CDC) initiated efforts in Alaska to improve surveillance and describe risk factors for serious occupational injuries as-

sociated with the fishing, logging, and air transport industries. Definitive surveillance for commercial fishing fatality events in Alaska began with the U.S. Coast Guard (USCG) Main Casualty Data Base (CASMAIN)<sup>3,9</sup> and death certificate review by collaborative efforts among federal agencies and the Alaska Department of Labor, and Department of Health and Social Services during the early 1990s.

**METHODS**

Our office, the Alaska Field Station of NIOSH's Division of Safety Research, obtained information on fishing-related fatalities, including the cause of death, the circumstances of the incident, and the location of the vessel's operation, for the years 1990-1994. These data resulted from interviews of survivors, review of death certificates, medical examiners' reports, and analysis of data received from USCG, the Alaska State Troopers (AST), and local news media reports.

Fatality rates were calculated for each type of fishery by estimating worker population of the fishery within which the vessel was operating at the time of the fatal event. These estimates were based on methodology developed by the Institute of Social and Economic Research, University of Alaska,<sup>4</sup> and revised by the Alaska Department of Labor and the Alaska

Commercial Fisheries Entry Commission:<sup>5</sup> the number of workers at risk was estimated by multiplying the number of vessels making landings each month by the mean crew size associated with the respective fishery.<sup>6</sup> Data on use of wearable personal flotation devices (PFDs) (i.e., survival suits, life jackets, and float coats) were obtained from either the USCG or AST reports.

Figure 1. Fatalities by occupation, Alaska, 1990-1994 (n = 365).

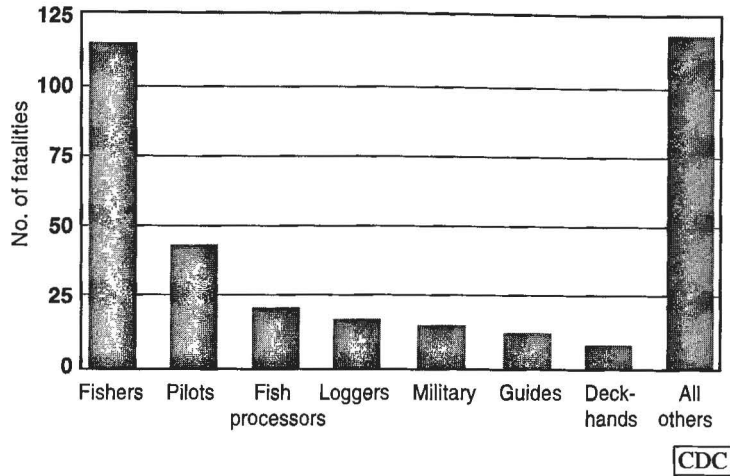


Figure 2. Occupational fatalities by circumstance of death, Alaska, 1990-1994 (n = 365).

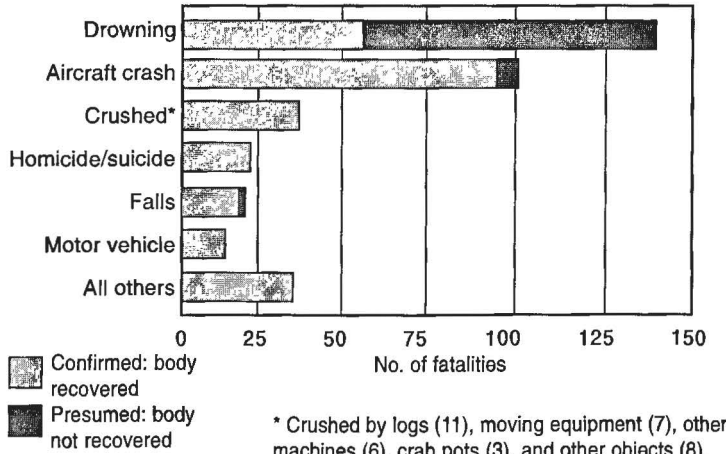


Figure 3. Commercial fishing fatalities by fishery, Alaska, 1990-1994.

Denominators based on 1991-1992 employment estimates, Alaska Dept. of Labor.

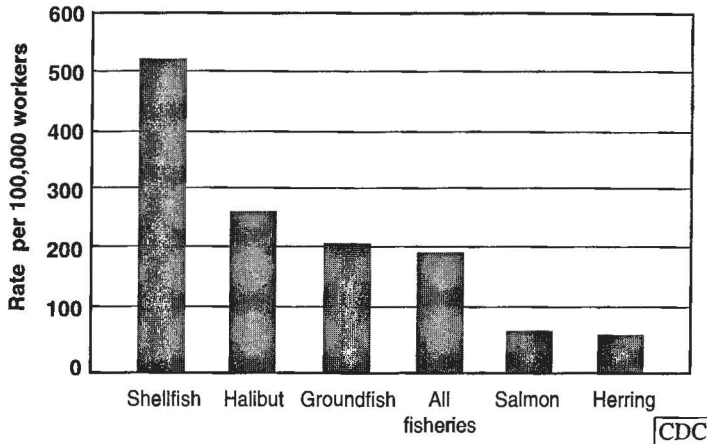


Table 1. Recent decrease in case fatality rate, Alaska commercial fishing industry, 1991-1994.

Year	No. of vessels lost*	No. of persons on board*	No. of persons killed*	Case fatality rate**
1991	38	86	21	24%
1992	43	101	18	18%
1993	24	91	13	14%
1994	36	130	3	2%

\* Source: U.S. Coast Guard, 17th District, Fishing Vessel Safety Coordinator.

\*\* Case fatality rate = (number killed/number at risk) x 100 percent.

## RESULTS

During 1990-1994, 117 commercial fishers died while working in Alaska, out of a workforce of 17,000 FTE (full-time equivalents) in that industry,<sup>6</sup> for a fatality rate of 140/100,000/year, which is 20 times higher than the overall U.S. occupational fatality rate. Some 101 of these fishers drowned, accounting for a

substantial portion of all Alaska occupational injury mortality.

Of the 118 deceased fishers, 73 died due to vessels sinking or capsizing. Twenty-two fishers, only one of whom was wearing a PFD at the time, died from falls overboard.

Commercial fishing fatality rates averaged 154/100,000/year for 1990-1994 with considerable variation by fishery.

The shellfish (primarily king crab) and halibut fisheries were most risky.

Our analysis of USCG vessel casualty statistics<sup>7</sup> from 1991-1994 revealed that over the four-year period the number of vessel casualties (vessels lost) remained relatively constant, as did the number of people on board (number at risk), while remarkable progress was made in the case-fatality rate in these vessel casualties, which dropped from 24% in 1991 to 2% in 1994.

## DISCUSSION

These mortality findings are consistent with previous reports of surveillance data, incident investigations, and survey information collected during 1980-1992 by NIOSH,<sup>8</sup> USCG,<sup>9</sup> the National Research Council,<sup>10</sup> and the University of Alaska.<sup>11</sup> These data indicate that workers at greatest risk for fishing-related fatal injuries are those who operate aboard unstable (i.e., easily capsized) vessels and those who have

insufficient training in shipboard safety, especially regarding cold-water survival techniques and the use of lifesaving equipment such as PFDs.

Fatality rates were greatest for shellfishing and varied substantially by fishery, each of which differs in geographic location of fishing grounds, type of harvesting equipment and techniques, and time of year and duration of fishing season. Alaska shellfishing, which is predominantly for crab, may be particularly hazardous because crab harvesting generally takes place during the winter months, often in conditions of cold, high winds, short daylight hours, and high seas. In addition, the basic equipment used in crabbing is large steel cages ("pots") that weigh up to 800 pounds (empty) each and require physical strength and use of winches and other equipment for placement, retrieval, and stowage. Stacking these pots on deck can also severely compromise vessel stability, especially if accompanied by icing of the vessel structure.

Etiologic factors for Alaska commercial fishing deaths are complex.

In addition to fishery, equipment design, and fatigue, environmental conditions may also contribute to the severity of work-related incidents. USCG has classified all waters in Alaska (including bays, inlets, harbors, and rivers) as

"cold" waters (<60°F, <15.6°C); in these waters, hypothermia can lead to death by drowning within minutes of immersion. Because immersion suits provide thermal protection from cold water temperatures and are critical for survival during immersions in cold waters, USCG has required their accessibility and recommended their routine use in these environments.<sup>12</sup>

Table 2. Features of commercial fishing injury events, Alaska.

	Host/human	Agent/vehicle	Environment
Pre-event/ pre-injury	Captain and crew fatigue, stress, Rx/illegal drugs/alcohol, inadequate training/exposure	Unstable vessel Unstable work platform Complex machinery and operations	High winds, large waves, icing Short daylight Limited fishing seasons Vessels far apart
Event/injury	Captain and crew reaction to emergency PFD not available/not working	Leaning or capsized vessel Delayed abandonment Emergency circumstances not understood Man overboard (MOB)	High winds Large waves Darkness Poor radio communications Cold water
Post-event	Poor use of available emergency equipment Hypothermia Drowning Lost at sea	Vessel sinking Poor crew response to MOB	High winds Large waves Cold water

Table 3. Personal flotation device (PFD) usage among individuals involved in a fatal event, Alaska commercial fishing industry, 1990-1994.

	Vessel-Related Incidents			
		Event Outcome		
		Survived	Drowned	Total
<b>Wearing PFD?</b>	<b>Yes</b>	12	7	19
	<b>No</b>	6	35	41
<b>Total</b>		18	42	60

Odds ratio = 10.0, 95% CI [2.8-60.0]



Table 4. Personal flotation device (PFD) usage among individuals involved in a fatal event, Alaska commercial fishing industry, 1990-1994.

		Man Overboard Events		
		Event Outcome		Total
		Survived	Drowned	
Wearing PFD?	Yes	NA	1	1
	No	NA	19	19
Total		NA	20	20

NA = not available

CDC

Table 5. Alaska commercial fishing injury countermeasures: Commercial Fishing Industry Vessel Safety Act of 1988 (implemented 1990-1993).

	Host/human	Agent/vehicle	Environment
Pre-event/pre-injury	Drills		Navigation publications Compasses Anchors
Event/injury	Immersion suits PFDs	Fire extinguishers/ systems Fireman's outfits/SCBAs High water alarms Bilge pumps/alarms	
Post-event	Immersion suits PFDs	Distress signals Life rafts EPIRBs	First aid kits, CPR and first aid

Prevention-oriented research activities aimed at reducing the risk for occupational injuries in the Alaska commercial fishing industry include our recently expanded surveillance and investigative activities to identify potential risk factors. Other activities include developing, testing, and increasing acceptance of PFDs that incorporate heat-conserving properties and

agency position-indicating radio beacons (EPIRBs). All of these measures were required to be implemented between 1990 and 1994 by CFIVSA.

The resulting USCG regulations (46 CFR 28.265 and 28.270) require that each master of each vessel must ensure that safety drills describing the use of this equipment are conducted

can be comfortably and safely worn by all fishers while working on deck. Wearing personal flotation devices has been shown to protect from drowning in vessel-related incidents.

Evidence on the rate of PFD use in man-overboard drowning decedents also supports their utility.

Ongoing activities include data collection by the Alaska Occupational Injury Prevention Program and USCG and safety education programs through USCG and nonprofit organizations (e.g., Alaska Marine Safety and Education Association, Alaska Vocational Technical Center, and the North Pacific Fishing Vessel Owners Association).

The impressive progress made during the early 1990s in reducing mortality has occurred in the post-event phase, primarily by keeping seamen who have evacuated capsized or sinking vessels afloat and warm (using immersion suits and life rafts required by CFIVSA) and being able to locate them readily, via emer-

Table 6. Alaska commercial fishing injury countermeasures: proposed by CDC/NIOSH Alaska.

	Host/human	Agent/vehicle	Environment
Pre-event/ pre-injury	Licensing of skipper Increased training on vessel stability Increased drills	Reassessment of stability after refitting Retrofitting of sponsons	IFOs for all fisheries No-sail guidelines due to weather Development of icing nomograms
Event/injury	Wearing PFDs MOB alarms Personal EPIRBs		
Post-event			

sel stability is measurable and predictable. By design enhancements (e.g., retrofitting of sponsons) and careful attention to loading, uses of the vessel, and environmental factors, vessels can be made much less susceptible to capsizing/sinking due to sudden changes in weather. In MOB events, PFDs are not being utilized. USCG regulations require commercial fishing vessels to be equipped with at least one USCG-approved PFD, or immersion suit, of the proper

at least once a month. The individual conducting the safety drills must be trained in the proper procedures. The Alaska Marine Safety Education Association (AMSEA) has played a major role in preparing Alaska's fishers to meet these needs. Convincing evidence has recently been presented for the effectiveness of the training components of this intervention.<sup>13</sup>

While it is tempting to declare victory once such substantial progress has been made, we should resist the inclination. The continuing circumstance of 25 to 45 vessels being lost per year and approximately 100 persons requiring rescue annually from cold Alaskan waters places a tremendous economic burden on taxpayers, and successful rescue is still dependent on the expertly trained and highly effective men and women of USCG search-and-rescue operations, and subject to the vagaries of the seas and the weather.<sup>14</sup> Mortality also persists largely unabated for man-overboard (MOB) events.

The critical etiologic factors that must be addressed for definitive, primary prevention efforts in this industry are compromised vessel stability and falls overboard. While the requirements of CFIVSA have greatly improved the chances of a successful rescue after a vessel capsizes or sinks, the capsizing events themselves should be generally preventable, as ves-

sel stability is measurable and predictable. By design enhancements (e.g., retrofitting of sponsons) and careful attention to loading, uses of the vessel, and environmental factors, vessels can be made much less susceptible to capsizing/sinking due to sudden changes in weather. In MOB events, PFDs are not being utilized. USCG regulations require commercial fishing vessels to be equipped with at least one USCG-approved PFD, or immersion suit, of the proper

size for each person on board. However, the PFD is not required to be worn. The usage of PFDs by fishers while on deck would be an appropriate preventive measure for MOB events. Effective surveillance and interventions for commercial fishing-related injury/mortality in Alaska, the historically worst-case setting in the U.S., should provide a useful paradigm and productive venue for prevention of similar deaths elsewhere in the U.S. The substantial progress made to date in Alaska's most hazardous industry through the thoughtful application of the public health model and incorporation of new technologies and comprehensive training should encourage others to try similar approaches elsewhere and for other problems.

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