# IMPROVING SAFETY IN THE ALASKAN COMMERCIAL FISHING INDUSTRY

**Jennifer M. Lincoln, M.S.**
**Brad J. Husberg, M.S.P.H.**
**George A. Conway, M.D., M.P.H.**
**Alaska Field Station**
**Division of Safety Research**
**National Institute for Occupational Safety & Health**
**Centers for Disease Control & Prevention**
**Anchorage, Alaska, U.S.A.**
**E-mail: jlincoln@cdc.gov**

*LCDR Lincoln is an officer in the U.S. Public Health Service, working as an Injury Epidemiologist and Occupational Safety and Health Specialist for NIOSH in Anchorage, Alaska. For the past nine years, Jennifer has concentrated her research on commercial fishing safety and drowning prevention in Alaska. Since her start at NIOSH, Ms. Lincoln has collaborated in the design and pilot testing of the Alaska Occupational Injury Surveillance System, writing a special supplement for that database for the collection and analysis of commercial fishing and drowning injury risk factor data.*

---

*This paper was previously printed in the International Journal of Circumpolar Health vol. 60; no. 4, 2001*

Objectives: Over 90 percent of deaths in Alaska's commercial fishing industry were due to drowning, following vessel sinkings. In the early 1990s, the U.S. Commercial Fishing Industry Vessel Safety Act required the implementation of safety measures for all fishing vessels. The purpose of our study was to examine the effectiveness of these measures in reducing the high fatality rate of Alaska's commercial fishermen.

Study Design: Alaska Occupational Injury Surveillance System and Alaska Trauma Registry data were used to examine fishing fatalities and injuries. Demographic, risk factor, and incident data were analyzed for trends.

Results: During 1991-1998, there was a significant ($p<0.001$) decrease in Alaskan commercial fishing deaths. Significant progress has been made in

saving lives of fishermen involved in vessel sinkings. During 1991-1997, 536 fishermen suffered severe injuries (437/100,000/year). These injuries resulted from being entangled, struck or crushed by equipment (60 percent) and from falls (25 percent).

Conclusions: Vessel sinkings still continue to occur, placing fishermen at substantial risk. Efforts toward improving vessel stability and hull integrity and avoidance of harsh weather conditions must be made to further reduce the fatality rate. The nature of nonfatal injuries reflect that modern fishing vessels are complex industrial environments posing multiple hazards. Measures are needed to prevent falls and improve equipment handling and machinery guarding.

## INTRODUCTION

For many years, commercial fishing has been well-known as a dangerous occupation. Numerous publications have been written about the hazards of commercial fishing in the U.S. and Alaska [Schnitzer 1993; NRC 1991; NTSB1987; Knapp 1991; Storch 1978]. More recent studies show a reduction in fatalities in Alaska since the implementation of the Commercial Fishing Industry Vessel Safety Act (CFIVSA), and has also shed light on continued problems that current regulations have not addressed, such as machine hazards on deck [NIOSH 1997; Husberg 1998; Lincoln 1999]. This more recent literature also recommended that the approach to improving safety in the fleet be augmented by concentrating on preventing vessel capsizings and sinkings from occurring in the first place, as well as continuing to prepare crew to react to them if they do occur [NIOSH 1997; Lincoln 1999].

The purpose of this paper is to update the information from previous studies to illustrate the continued progress in reducing fatalities in the commercial fishing industry in Alaska, as well as to address a more complete spectrum of injury by evaluating the nonfatal injuries on board fishing boats. Injury prevention programs are described that have been implemented as a result of our surveillance efforts to address the safety problems in the commercial fishing industry in Alaska.

## MATERIALS AND METHODS

The Alaska Occupational Injury Surveillance System (AOISS) is a comprehensive surveillance system for fatal occupational traumatic injuries. It contains information on demographics, location, cause of injury, weather conditions, emergency gear, personal protective equipment, and work experience. Usually, press releases from the Alaska State Troopers, reports from news media, calls from the Alaska Occupational Injury Prevention Program (OIPP) Coordinator, or from jurisdictional agencies alert us to new cases. Data from other agency sources are entered to supplement the AOISS database. The National Institute for Occupational Safety and Health (NIOSH) Alaska Field Station (AFS) shares AOISS data and reconciles tabulations with the OIPP and the Bureau of Labor Statistics Census of Fatal Occupational Injuries (CFOI) program within the Alaska Department of Labor and Workforce Development.

The Alaska Trauma Registry (ATR) is a population-based trauma registry that collects information from all 24 acute-care hospitals in Alaska. Information is abstracted from hospital medical records and added to the ATR database. The ATR consists of information on persons who are injured. Also, those injured have to either be admitted to a hospital, transferred from an emergency department to another hospital for admission, or declared dead after they arrive at the hospital. Trauma registries are a unique source of injury surveillance and prevention data. Demographics, geographic information, disability, medical cost, payment source, cause of injury, discharge diagnosis, and severity scoring are a few examples of data that are collected. The ATR is managed by the State of Alaska Department of Health and Social Services, Division of Public Health, Section of Community Health and Emergency Medical Services in Juneau, Alaska.

The AFS emphasizes non-regulatory collaborative responses in our intervention efforts. Strong working relationships have been established with many other federal, state, municipal, and nongovernmental agencies. These relationships have been formalized into the Alaska Interagency Working Group for the Prevention of Occupational Injuries (AIWG). Industry and workers are also asked to be full partners in planning and executing interventions and in providing ongoing surveillance data to track success or failure of these interventions. The NIOSH Alaska Field Station provides assistance to the AIWG in organizing, analyzing, and interpreting surveillance data. Based on this data and

collaboration, several injury prevention strategies have been established and implemented.

## RESULTS

## FATALITIES

Commercial fishermen represented 217 (33 percent) of the 648 occupational fatalities that occurred in Alaska during 1990-1999. Given the mean full-time equivalent Alaska commercial fishing workforce of 17,500, this is equivalent to a fatality rate of 124/100,000 workers/year. This rate has decreased from the rate reported in 1991 through 1992 (200/100,000/year); however, it is still over five times as high as the overall occupational fatality rate for the state (22/100,000/year) (Alaska, 2000) and 28 times the overall U.S. occupational fatality rate of 4.4/100,000/year [CDC 1993].

The fatality rate among fishermen varied considerably by type of fishery: shellfish (primarily crab) had the highest (407/100,000/year), followed by herring (204/100,000/year), and halibut (119/100,000/year) (See Figure 1— Fishery-Specific Fatality Rates). Fisheries differ in geographic location of fishing grounds,

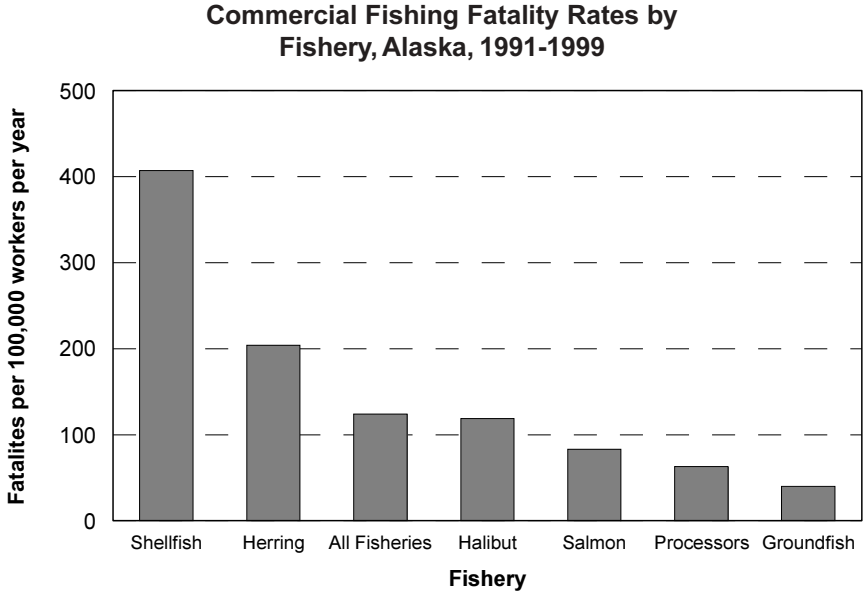


**Figure 1:** Fishery-Specific Fatality Rates

type of harvesting equipment and techniques, time of year, and duration of seasons. Crabbing, a shellfish fishery, is particularly hazardous because harvesting of crab species in Alaska generally takes place during the winter, which is often characterized by rough weather.

Most fishermen drowned and/or died from hypothermia (186, 86 percent), as the result of vessel-related events (vessel sinkings or capsizings) (133, 72 percent), falls overboard (43, 23 percent), diving incidents (5, 3 percent), or other drowning event (3 percent). Other fatalities were due to deck injuries (16, 7 percent), or some other event (15, 7 percent). Of 133 fatalities in vessel-related events, the largest number (61, 46 percent) of fishermen were participating in the shellfish fishery. Of those falling overboard (man overboard [MOB]) and drowning, 22 (51 percent) were also participating in the shellfish fishery. Fatalities from falling overboard were categorized by cause of immersion: entanglement in net or line (12, 27 percent), observed fall (12, 27 percent), unobserved fall (victim missing from vessel) (10, 23 percent), or being washed or blown into the water (10, 23 percent). None of these workers wore personal flotation devices (PFDs). Of the 71 fishermen who drowned in vessel-related events and for whom PFD/immersion suit usage was available, 54 (76 percent) were documented not to have been wearing any type of PFD or immersion suit, whereas 17 (24 percent) were wearing such devices. (For 62 fishermen in vessel-related events, it is unknown whether they were wearing any type of PFD or immersion suit.) On the other hand, among survivors of such casualties, 34 of 47 were wearing PFDs or immersion suits. Thus, odds ratio calculation shows that survivors of these vessel-related events in which at least one person drowned were 8.3 times (95 percent CI=3.59-19.24) more likely to have been wearing a PFD or immersion suits than were decedents.

The CFIVSA was implemented from 1990-1995. This act requires specific safety equipment (i.e. life rafts and immersion suits) and training (i.e. drill instructor training and first aid) for fishermen. From 1990-1999, Alaska experienced a 49 percent decline in all work-related deaths including a 67 percent decline in commercial fishing deaths (1990-1992 average compared to 1997-1999 average). By 1999, there had been a significant ($p<0.001$) decrease in the number of deaths in the Alaskan commercial fishing industry (See Figure 2).

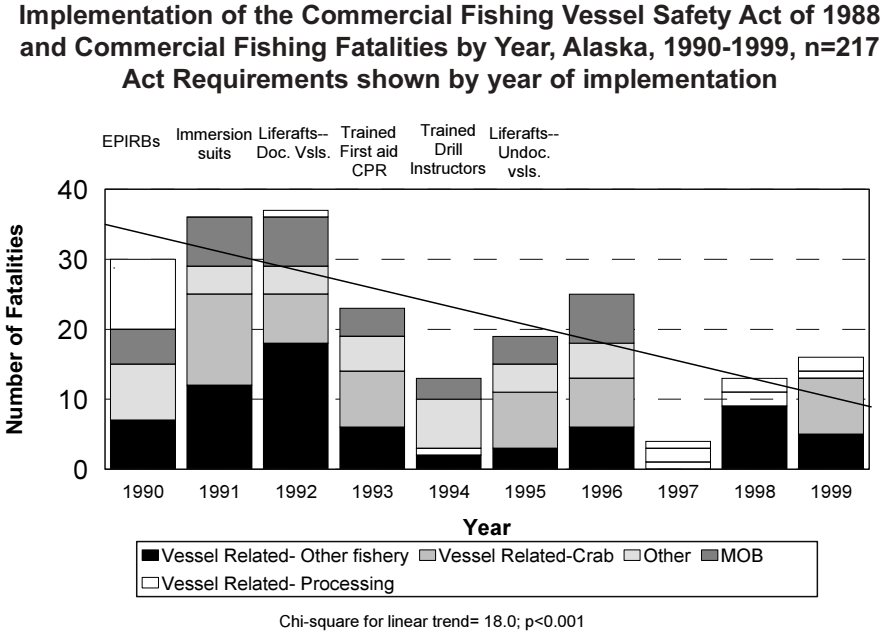


*Figure 2: Fatality Trend Line During and After CFVISA*

AFS analysis of USCG vessel casualty statistics for 1991 through 1999 revealed that the number of vessels lost per year have remained relatively constant (mean 34, median 36), as have the number of workers on board (i.e., number of persons at risk) (mean and median 106), whereas remarkable progress has been made in the case-survivor rate (number survivors ÷ number on board) in this type of incident. The case-survivor rate has increased from an average of 78 percent in 1991-1993, to 92 percent in 1994-1996, and then to an average of 94 percent from 1997-1999 (See Table 1— Case Fatality Rate). (Information is not available for 1990.) These data only represent fatalities due to the loss of a vessel, therefore, MOBs, crushings, and fires are not represented.

## NONFATAL INJURIES

From 1991 through 1997, commercial fishing had the highest number of injuries as recorded in the ATR. However, by 1998, the construction industry (621) had overtaken commercial fishing (587) as the industry with the highest number of hospitalized injuries from 1991-1998. Commercial fishing had an average

**Table 1:** Recent Decrease in Case Fatality Ragte, Alaska Commercial Fishing Industry, 1991-1999

| Year | Number of Vessels Lost* | Workers on Board* | Worker Fatalities** | Case Fatality Rate*** | Case Survivor Rate |
|---|---|---|---|---|---|
| **1991** | 39 | 93 | 25 | 27% | 73% |
| **1992** | 44 | 113 | 26 | 23% | 77% |
| **1993** | 24 | 83 | 14 | 17% | 83% |
| **1994** | 36 | 131 | 4 | 3% | 97% |
| **1995** | 26 | 106 | 11 | 10% | 90% |
| **1996** | 39 | 114 | 13 | 11% | 89% |
| **1997** | 31 | 84 | 1 | 1% | 99% |
| **1998** | 37 | 124 | 9 | 7% | 93% |
| **1999** | 28 | 104 | 11 | 11% | 89% |

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

**Fatalities from capsized or lost commercial fishing vessels only.

***Case Fatality Rate: (number killed/number at risk) x 100 percent.

annual hospitalized injury rate of 4/1,000 workers, ranking third behind the logging (18/1,000) and construction industries (6/1,000). There has been a slight decline in the number of nonfatal injuries in the industry.

The three most common types of injuries were fractured bones (279), open wounds (73), and burns (29). Extremities were the body regions most often injured with 184 to the upper extremities and 171 to the lower extremity. The third most common body region mentioned was the spine (35).

Machinery (187) was the leading cause of nonfatal hospitalized injuries in the commercial fishing industry. Falls (149) ranked a close second, followed by being struck by an object (98). Narrative descriptions of injury events revealed that falls most often occurred into holds, through open hatchways, and as a result of slipping on ladders and gangways. Injuries from machinery often involved equipment unique to this industry. "Crab pots" (baited cages weighing up to 800 lbs. empty which are maneuvered by cranes on deck) and "crab pot launchers" were listed in the records as factors in a number of injuries. A crab pot launcher is a hydraulic lift which raises and tilts the pot over the top of the gunwale where the pot slides into the water. Bait choppers, powerblocks, cranes, and winches were also repeatedly mentioned as being factors in these injuries. It is not possible to do an analysis based on fishery using ATR data.

## DISCUSSION

Contributing factors in commercial fishing deaths vary from those for nonfatal injuries to workers in this industry. As mentioned previously, most commercial fishing deaths result from the loss of a vessel due to capsizing or sinking. If commercial fishing is going to continually become safer, capsizings and sinkings must be prevented by concentrating on vessel stability and hull integrity. MOB prevention and successful retrieval from the water are also important to further improve safety in the fleet. ATR data show that most nonfatal injuries occur while working on the vessel (either on deck or below). Nonfatal injuries are more commonly caused by machinery on deck, falls, and/or being struck by objects with most of these injuries occurring in the crab fishery.

## ALASKA INTERAGENCY WORKING GROUP- FISHING SUBCOMMITTEE

The focus areas that were identified from the AIWG to prevent fatalities include addressing the stability problems and MOB prevention and rescue on crabbing vessels. The focus areas identified for nonfatal injuries include examining the problems with deck layout and machinery and how this relates to deck injuries.

## DOCKSIDE ENFORCEMENT PROJECT

The Fishing Subcommittee of the AIWG developed a project to address the issues of vessel stability in the Bering Sea crab fleet. Members of the committee

(primarily in the USCG) developed and organized groups starting in October 1999, to board crab vessels in Dutch Harbor, King Cove, and Akutan, Alaska, in conjunction with Alaska Department of Fish and Game personnel during their tank inspections to check compliance with on board stability instructions. The USCG enforced stability instructions on overloaded vessels with Captain of the Port authority detaining overloaded vessels. There has been strong industry for this project. The subcommittee is also using this project as a way to collect information on MOB experiences and risk factor information among crab fishermen.

## DECK SAFETY PROJECT

The subcommittee also determined that attention should be given to worker safety around deck machinery, an area that appears not to have been adequately addressed by current safety regulations. Efforts are needed to better define the relationship between the vessel, fishing equipment and the worker. The NIOSH Alaska Field Station started an engineering design project in October 2000 to address some of these issues. This project is first addressing safety concerns on board crab boats and plans to also look at other vessel types.

Many of the injuries in the ATR occurred while working in the proximity of a crab pot launcher while fishing for either crab or cod. Recommendations to fishermen for the prevention of these injuries could come from safety and machine guarding lessons learned in general industry. For example, installing a machine guard on the bait chopper to prevent hands from entering the blades, or painting a yellow line for a "safety zone" around the perimeter of the crab pot launcher to serve as a reminder for the fishermen to stand behind the line while the launcher is in motion. Painting the launcher itself a bright color and/or with reflective paint could help fishermen to see the launcher under low light conditions, to be aware of its location and movement. Such measures require further evaluation.

The NIOSH Alaska Field Station has initiated a project to examine the deck environment surrounding the deployment and retrieval systems (e.g. cranes, "power blocks", pulleys, winches, lines, nets, crab pots, and crab pot launchers) of fishing equipment from a mechanical and safety engineering perspective.

Additional areas to focus on include machine guarding, separating workers and lines, and fall prevention.

The NIOSH Alaska Field Station is continuing to study the causes of these deck injuries, develop strategies to prevent them, and evaluate safety practices that some crews already have in place. This information is communicated to other fishermen, captains, and vessel owners to increase awareness of the problem to discuss potential solutions. These ideas could then be personalized and individually implemented with the intent of increasing safety awareness and preventing these types of injuries.

The NIOSH Alaska Field Station organizes, analyzes, and interprets data for action. Both successful safety regulations (CFIVSA) and non-regulatory collaborations resulting in intervention efforts have proven to be effective in reducing deaths in Alaskan commercial fishing industry. Fishery-specific approaches like the Dockside Enforcement Project and the Deck Safety Project can also be tailored to suit needs in other fisheries. The NIOSH Alaska Field Station is very interested in further collaboration, and invite individuals/groups interested in preventing injuries and fatalities in this industry to contact us.

## REFERENCES

Centers for Disease Control and Prevention [1993]. Commercial fishing fatalities–Alaska, 1991-1992. MMWR, *42*(18):350-359.

Husberg BJ, Conway GA, Moore MA, et al. [1998]. Surveillance for nonfatal work-related injuries in Alaska, 1991-1995. Am J Industrial Med *34*:493-498

Knapp G and Ronan N [1991]. Fatality rates in the Alaska commercial fishing industry. Alaska Sea Grant College Program, Pub No. AK-SG-90-03. Anchorage, Alaska:University of Alaska, Institute of Social and Economic Research.

Lincoln JM, Conway, GA [1999]. Preventing commercial fishing deaths in Alaska. Occup Environ Med *56:* 691-695.

NIOSH[1997]. Current Intelligence Bulletin #58: Commercial fishing fatalities in Alaska, risk factors and prevention strategies. Cincinnati, Ohio: U.S. Department of Health and Human Services, Public Health Service, U.S. Public Health Service, Centers for Disease Control and Prevention, Natonal Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 97-163.

National Research Council, [1991]. Fishing vessel safety: blue print for a national program. Washington, D.C.: National Academy Press.

National Transportation Safety Board [1987]. Safety study, uninspected commercial fishing vessel safety. Washington, D.C.:PB87-917003.

Schnitzer PG, Landen DD, Russell JC [1993]. Occupational injury deaths in Alaska's fishing industry, 1980 through 1988. Am J Public Health *83*: 685-688

State of Alaska [2000]. Occupational-related fatalities in Alaska, 1990-1999. Alaska: Department of Health and Social Services Bulletin No. 16 .

Storch RL [1978]. Alaskan king boat casualties. Marine Technology *15*: 75-83.

# PROCEEDINGS OF THE INTERNATIONAL FISHING INDUSTRY SAFETY AND HEALTH CONFERENCE

---

Edited by

Jennifer M. Lincoln, M.S., C.S.P.
Diana S. Hudson, M.P.H.
George A. Conway, M.D., M.P.H.
Rachel Pescatore

---

October 23-25, 2000
Woods Hole, Massachusetts, U.S.A.

Convened by

U.S. Department of Health and Human Services
Public Health Service
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
and
Occupational Health Program
Department of Environmental Health
Harvard School of Public Health

October, 2002

## DISCLAIMER

Sponsorship of the FISH Conference and these *Proceedings* by the National Institute for Occupational Safety and Health (NIOSH) does not constitute endorsement of the views expressed or recommendations for use of any commercial product, commodity, or service mentioned. The opinions and conclusions expressed in the papers are those of the authors and not necessarily those of NIOSH.

Recommendations are not to be considered as final statements of NIOSH policy or of any agency or individual who was involved. They are intended to be used in advancing the knowledge needed for improving worker safety and health.



Copies of this and other NIOSH documents are available from

Publications Dissemination, EID
National Institute for Occupational Safety and Health
4676 Columbia Parkway
Cincinnati, OH 45226-1998

Fax number: (513) 533-8573
Telephone number: 1-800-35-NIOSH (1-800-356-4674)
E-mail: pubstaft@cdc.gov

For further information about occupational safety and health topics, call 1-800-35-NIOSH (1-800-356-4674), or visit the NIOSH Web site at www.cdc.gov/niosh.

Cover photograph by Earl Dotter

**DHHS (NIOSH) PUBLICATION No. 2003-102**


IFISH
2000