

NIOSH Center for Maritime Safety and Health Studies

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Western States Division

EPIDEMIOLOGY & SURVEILLANCE

- Epidemiologists
- Statisticians
- Health Scientists

HEALTH COMMUNICATIONS

- Health Communications Specialists
- Visual Information Specialists



INDUSTRIAL HYGIENE & OCCUPATIONAL HEALTH

- Industrial Hygienists
- Medical Officers
- Prevention Specialists

ENGINEERING

- Mechanical Engineers
- Electrical Engineers



Overview

- Commercial Fishing
- Commercial Fishing Safety Research and Design Program
 - Description of Program
 - Impact
- Center for Maritime Safety and Health Studies
- Future Directions



2012 U.S. Commercial Fishing

- 9.6 billion pounds of seafood
- Earning over \$5.1 billion
- Approximately 115,000 harvesters
- Dutch Harbor, Alaska
 - 706 million pounds (highest volume for U.S.)
 - \$207 million
- New Bedford, Massachusetts
 - 117 million pounds
 - \$369 million (highest-valued catch for U.S.)



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NIOSH

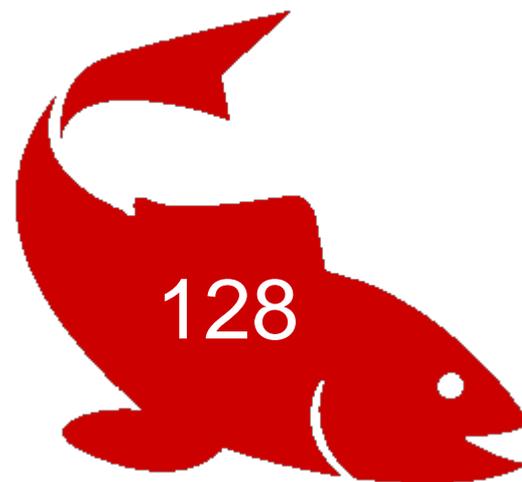
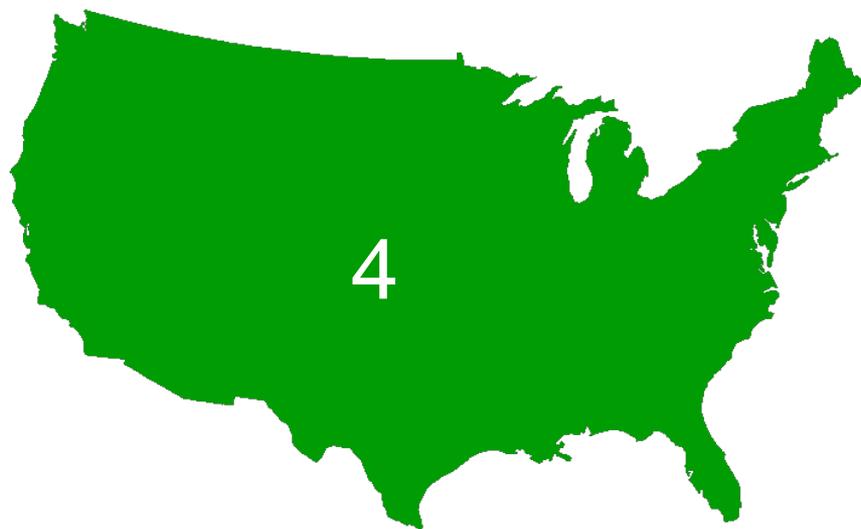
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US Occupational Fatality Rates per 100,000 Workers, 1992-2014

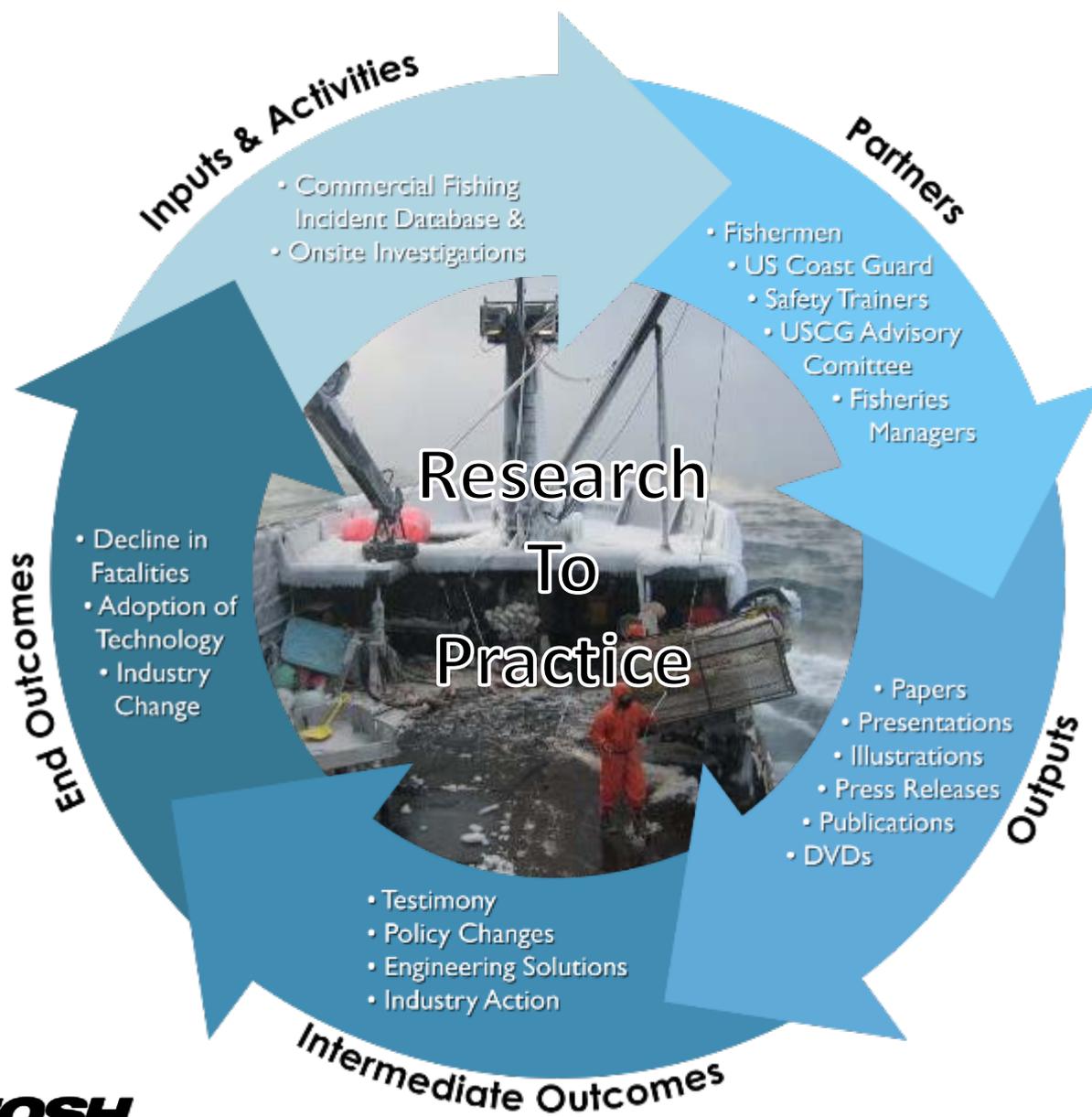


Commercial Fishing Safety Research and Design Program

- National program
- Provide high quality, relevant, impactful information
- Research findings used by
 - industry
 - government agencies
 - fishing safety advocates
- To inform decisions and educate workers



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Partners



Commercial Fishing Vessel Safety Act

- Passed in 1988
- Implemented 1990-1995
- Primarily safety equipment
 - No PFD required to be worn
- No licensing or vessel requirements
- Focus is placed on secondary prevention
 - Surviving a vessel sinking



US Coast Guard

Agreement to share information:

- To identify patterns of hazards leading to deaths and injuries.
- Collaborate regionally on interventions.

March 2014 Signing to expand Memorandum of Agreement



Coast Guard Rear Adm. Joseph Servidio and NIOSH Director, Dr. John Howard



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Marine Casualty
Occurs



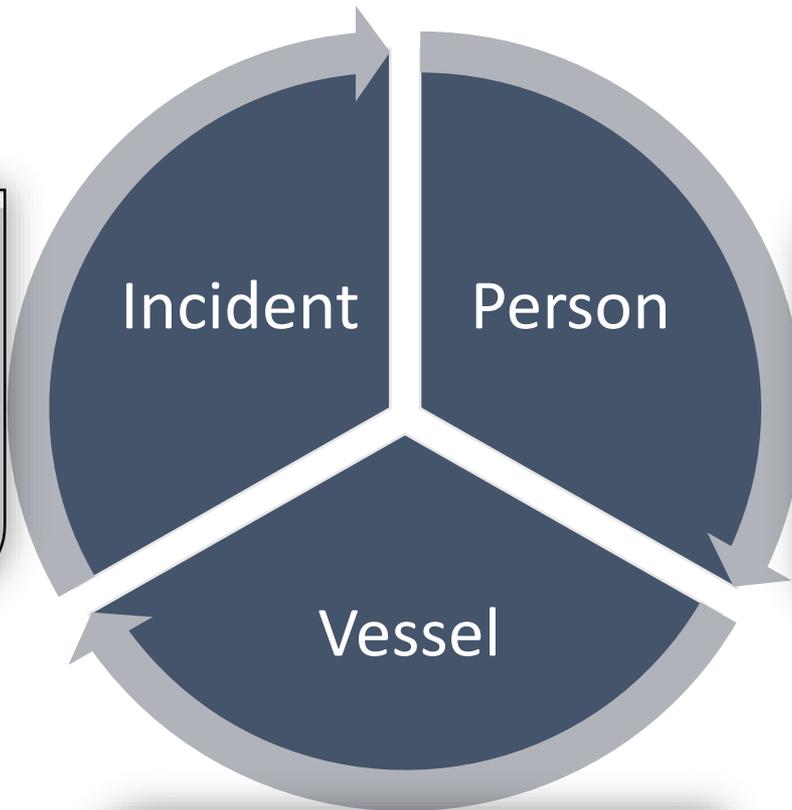
USCG
Investigates



NIOSH collects
information and
enters into CFID



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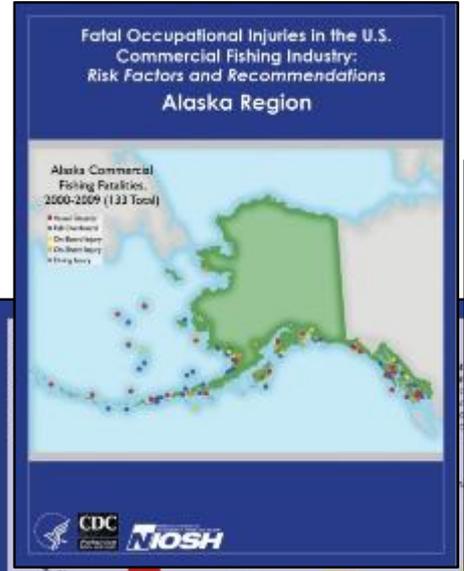
A screenshot of a software interface for incident reporting. It features a header with 'Key Incident Data' and 'Case Number: 1000001'. The interface is divided into several sections: 'Person' (with fields for Name, SSN, Date of Birth, etc.), 'Vessel Details' (with fields for Vessel Name, Home Port, etc.), and 'Incident Details' (with fields for Date, Time, Location, etc.). There are also buttons for 'Save' and 'Cancel'.

A screenshot of a software interface for vessel details. It features a header with 'Key Incident Data' and 'Case Number: 1000001'. The interface is divided into several sections: 'Person' (with fields for Name, SSN, Date of Birth, etc.), 'Vessel Details' (with fields for Vessel Name, Home Port, etc.), and 'Incident Details' (with fields for Date, Time, Location, etc.). There are also buttons for 'Save' and 'Cancel'.

A screenshot of a software interface for vessel data. It features a header with 'Vessel Data' and 'Incident ID: 2014001'. The interface is divided into several sections: 'Vessel Details' (with fields for Length, Year Built, Hull Material, Vessel Type, Gear Type, etc.), 'Vessel Distress Incidents' (with fields for Stability Instructions, EPIRB Present, Notification, etc.), and 'Safety Details' (with fields for Operation Safe Crabs, Decal, PFD Policy, etc.). There are also buttons for 'Add A Vessel' and 'Save and Close'.

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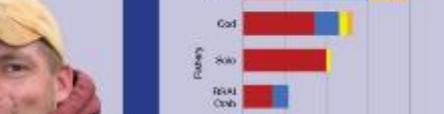
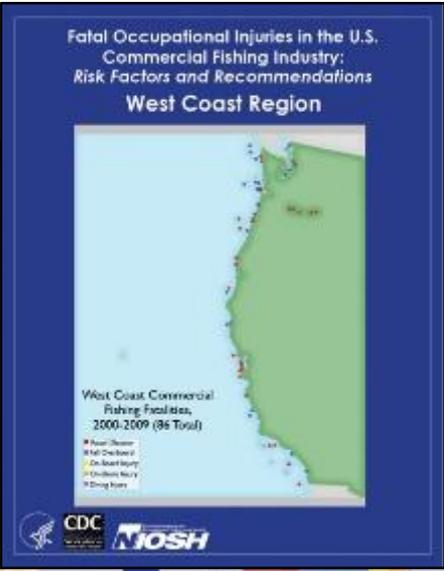
Regional Summaries of Fatality Data



During the decade of 2000-2009, 133 commercial fishermen died while working in Alaska as fatalities occurred in 2000 and 2009, with eight occupational deaths in each of those years, died on the job, including 15 on single vessel (boat) (Fig. 1). On average for the decade, 12 fatalities were killed per year. Half of the deaths were caused by drowning following an overboard incident, while working, exposing the crew when the crew was forced to abandon ship (Fig. 2). Another 37% of fatalities were the result of falls overboard. The 12 fall injuries sustained on board were the result of being struck by gear (14, 20%), falling from height (13, 20%), getting caught in or struck with it (2, 17%), and propulsion or confined space (2, 17%), and a drug overdose (1, 8%).

After 10 vessel deaths contributed to the total fatalities during the decade or more, the most risk factors varied from year to year. For example, in 2001 29% of fatalities resulted from vessel collisions, but in 2007 there were none related to a vessel collision. In 2006, there were no falls from height, but in 2009 85% of deaths were caused by falls overboard.

Like before contributed to 80% of fatalities in Alaska during 2000-2009 (Fig. 3). Crews with fewer than five deaths sustained almost no fatalities in any category, to help fishing, analysis, and others. The salmon fishery experienced the most occupational deaths with 29 fatalities. Fall overboard caused the most deaths among salmon fisheries (17, 58%). About 6% (13, 20%) occurred on other fisheries and were usually the result of a slip or trip. Most (13, 79%) were not witnessed. Vessel deaths contributed to 27% of deaths in the salmon fishery. Most of these vessel deaths (3, 45%) occurred on open-air decks and were almost always (4, 25%) non-witnessed and captured in poor sea conditions. The cost and risk fisheries experienced the most highest number of fatalities during the three period (24 and 21, respectively). These fatalities occurred most often either a vessel collision with multiple fatalities in each event.

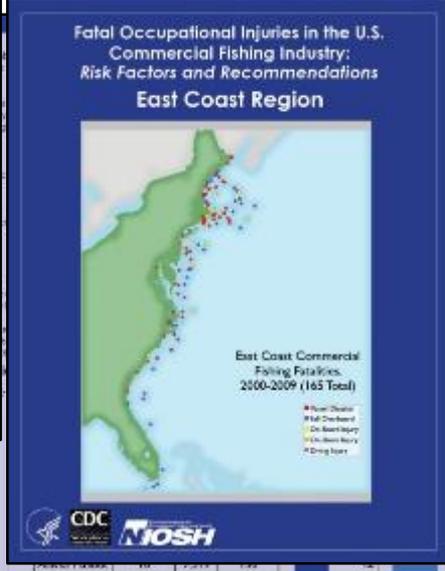


Data Key

- Vessel Collision
- Fall Overboard
- On-Board Injury
- On-Shore Injury
- Diving Injury

Conclusions

The Coast Guard has developed advanced prevention programs for specific fisheries in Alaska that mitigate hazards found in high risk fisheries such as the Bering Sea crab fleet, as well as the Bering Sea Aleutian Kodiac head boat fleet that fishes for sole and cod. As a result of these efforts, the total fatalities in the Bering Sea crab fleet declined by 60% during 1999-2000. This improvement was due to the implementation of a prevention doctrine and equipment effort developed by the Coast Guard in concert with vessel operators. Additionally, in 2000 the largest crab fisheries underwent changes in the way they were regulated. The previous "market-to-market" (retail) approach that each vessel was awarded the right to catch a certain amount of crabs. This change resulted in a lower price fishery and a consolidation of the fleet. A different Coast Guard program known

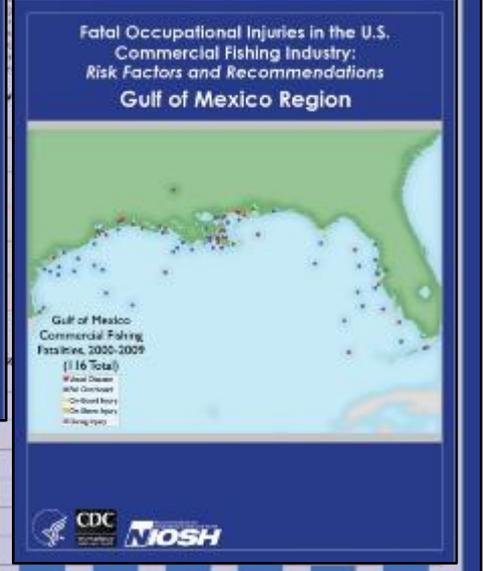


Region	2000-2009	2000-2009	2000-2009
Alaska Fisheries	133	24,207	115

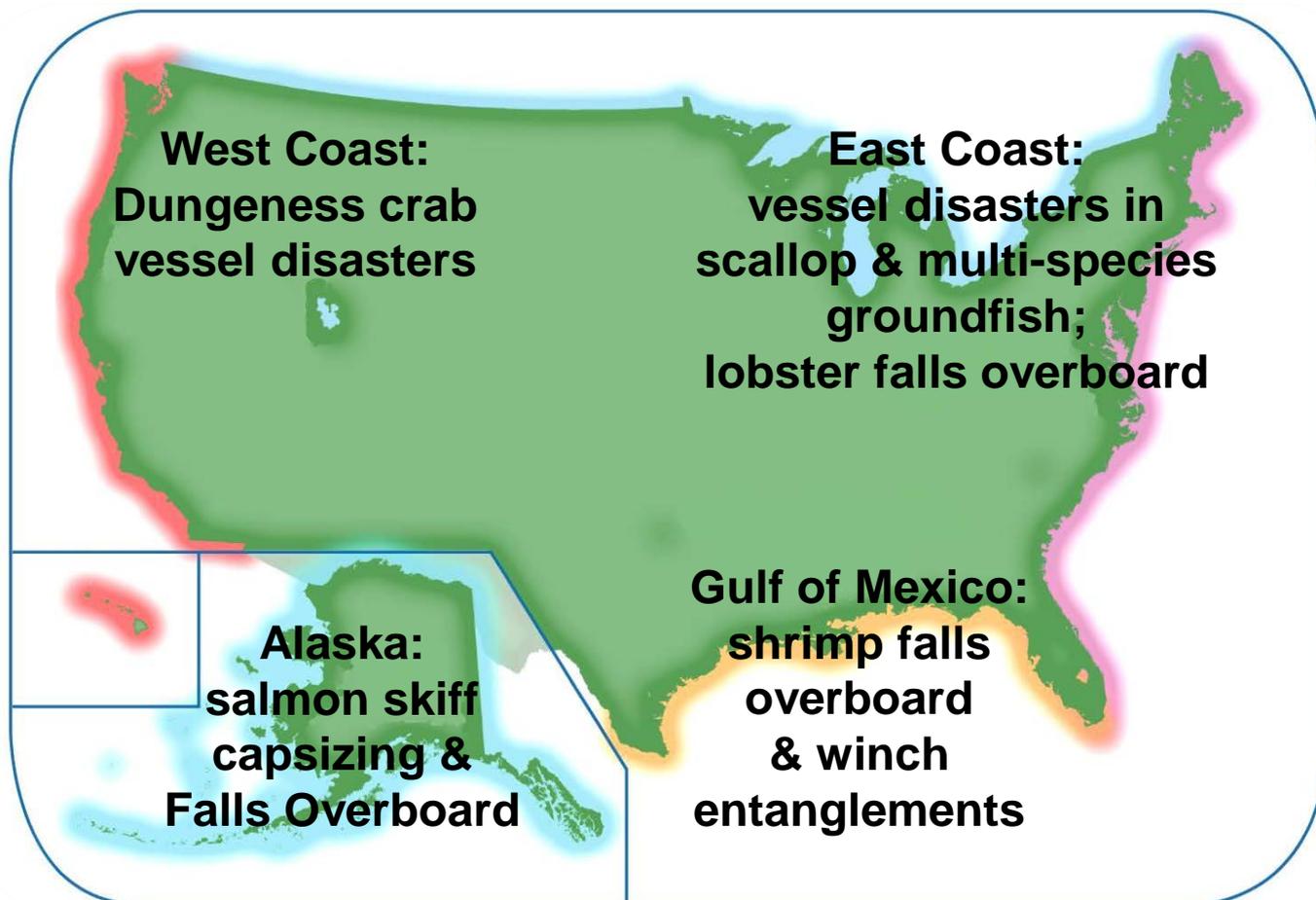
* Rates were calculated by dividing the total number of fatalities for the 10 year period by the total number of PLE.

Alaska Safety Agreement (ASCA) (based on the Bering Sea Aleutian Kodiac head boat fleet). ASCA requires vessel operators to improve hull and mechanical condition of the vessel, to improve additional lowering and hoisting capabilities, and demarcation of the vessel.

Alaska claims the highest number of falls. While not the highest rate within the State, in total, these occupational safety positions which need to be addressed. Weekly should be



Most Hazardous Fisheries & Events



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Fishing Program - Engineering Design



505 McElroy-Catchot

F/V Captain Magic

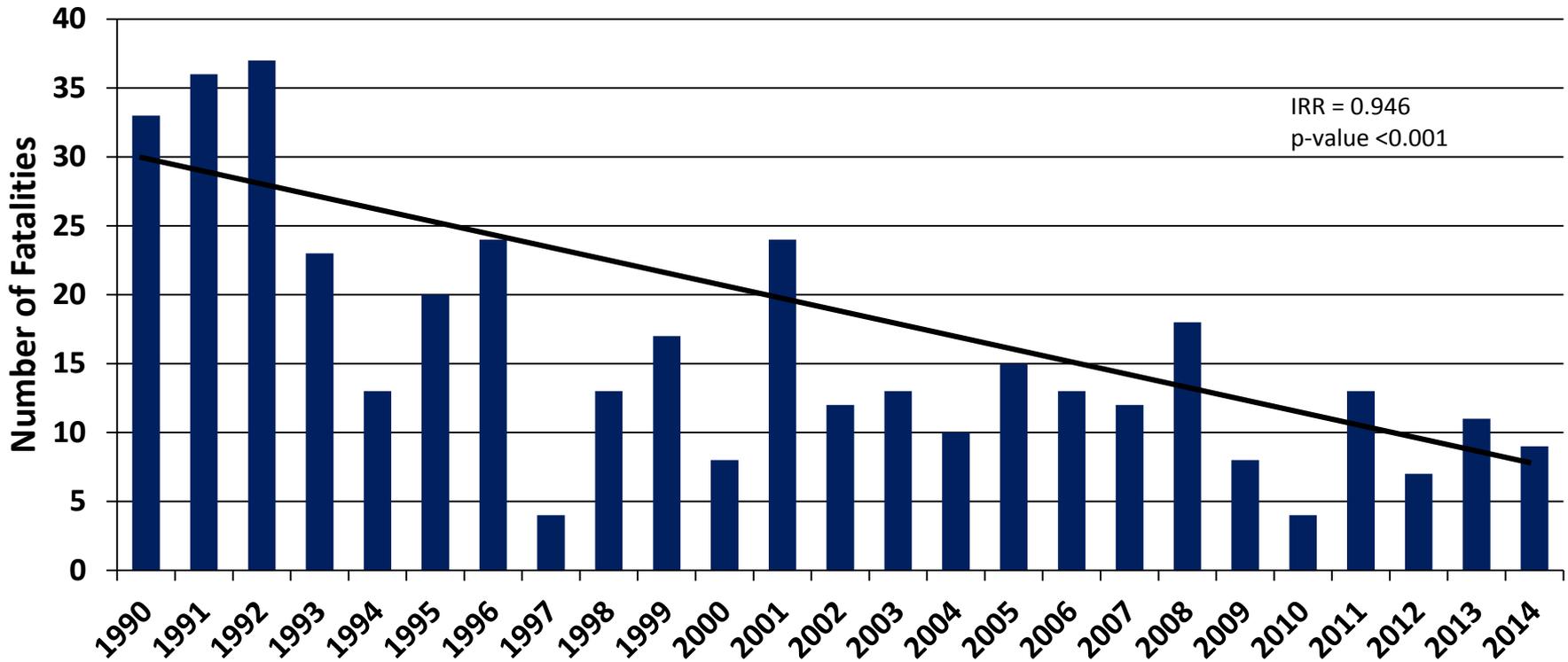
Fishing Program - Epidemiology

Measure incidence of vessel casualties, vessel disasters, fatal & non-fatal injuries during 2010-2016 in certain high risk fleets

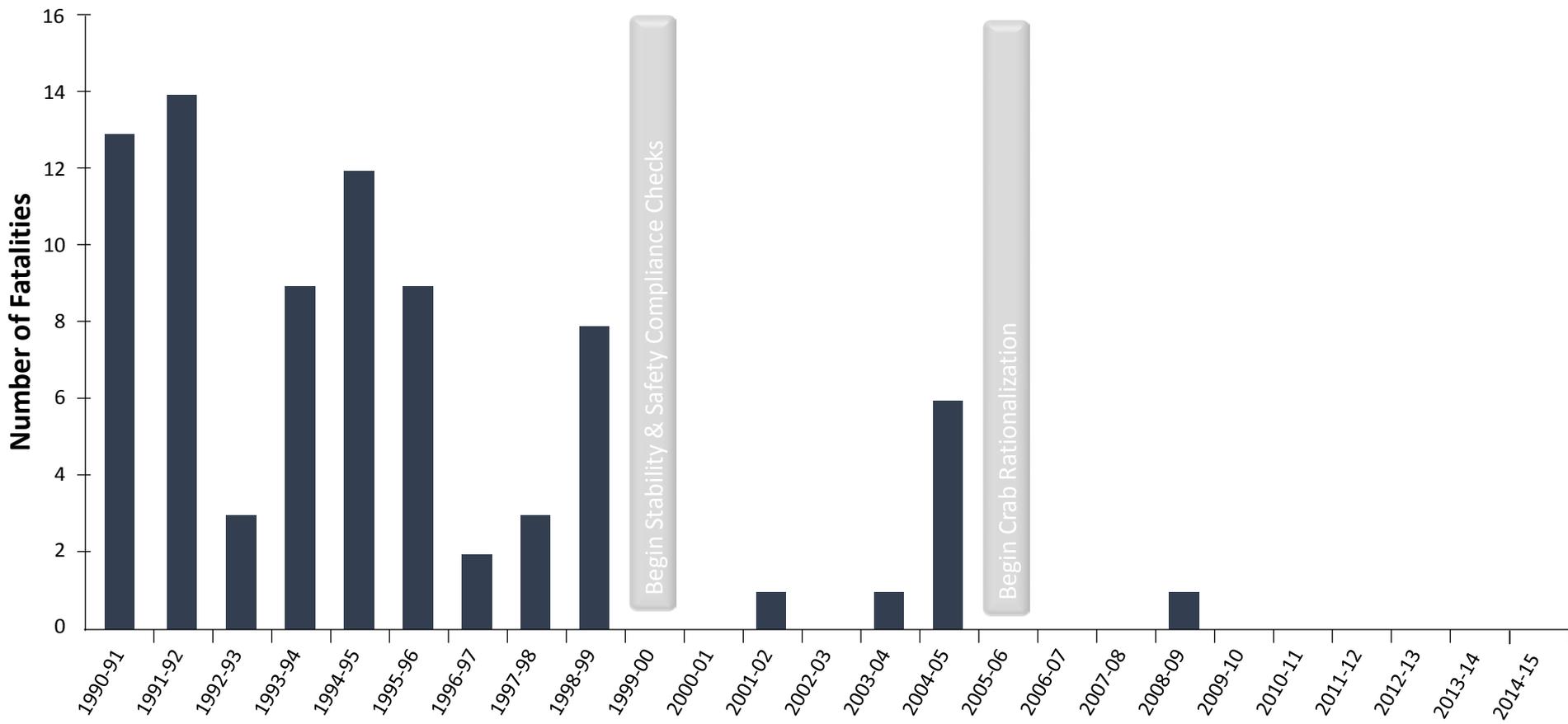
- Develop evidence-based recommendations for the USCG to consider when designing forthcoming safety programs



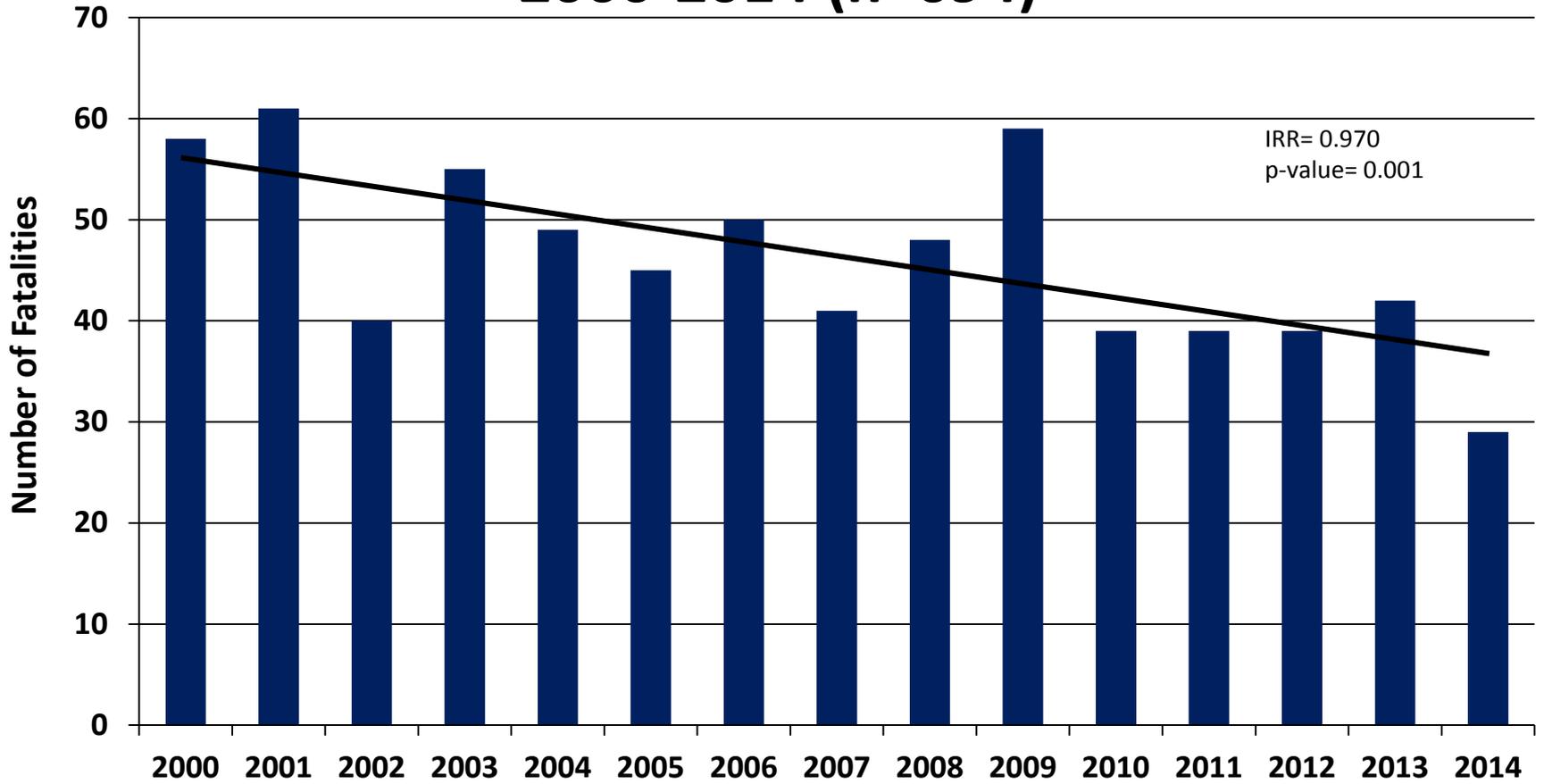
Commercial Fishing Fatalities, Alaska, 1990-2014 (n=397)



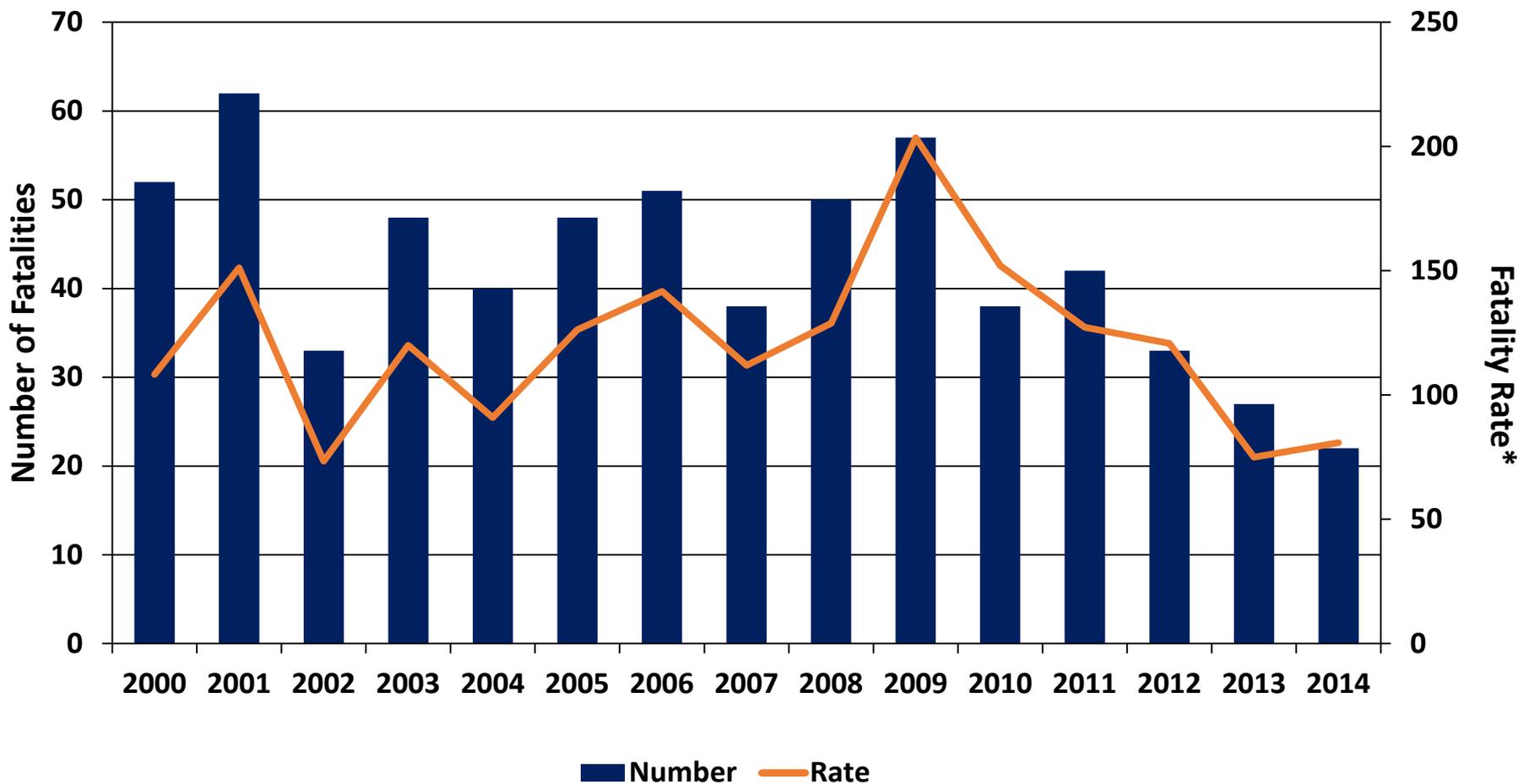
BSAI Crab Fleet Fatalities, 1990/91 – 2014/15



U.S. Commercial Fishing Fatalities, 2000-2014 (n=694)



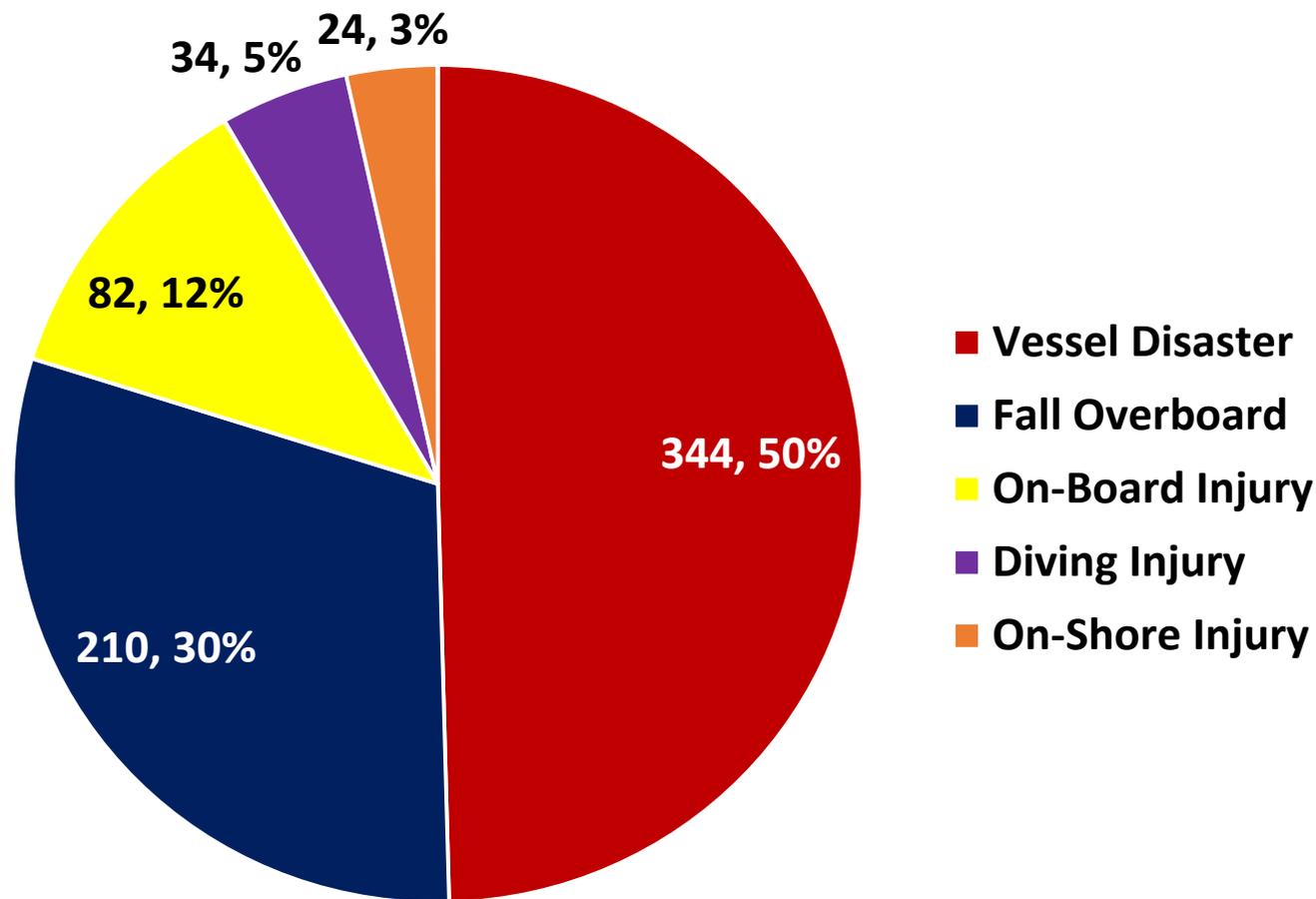
U.S. Commercial Fishing Fatalities, 2000-2014



Data source: BLS

*2000-2005: per 100,000 workers; 2006-2014: per 100,000 full-time equivalent workers

U.S. Commercial Fishing Fatalities by Incident Type, 2000-2014 (n=694)



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Commercial fishermen typically do not wear PFDs

Anecdotal evidence suggests that fishermen feel PFDs are:

- Too heavy
- Hot
- Bulky
- Uncomfortable
- Cumbersome

No regulations require PFD use on deck.



“Why doesn’t someone buy a bunch of PFDs and see what fishermen like to wear?”



PFD Selection

- Potential for out-of-water comfort and functionality

Variety of styles and features:

Inflatable or inherent flotation

Built in/for raingear

Neoprene or nylon material

Foam padded or non-padded

High visibility

Price point



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Predictors of personal flotation device (PFD) use among commercial fishing industry

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 Drowning prevention
 Occupational safety

ABSTRACT

Introduction
 The purpose of this study was to identify predictors of PFD use among commercial fishing industry workers in the Alaska commercial fishing industry. **Methods**
 This study analyzed data from a questionnaire of commercial fishing vessels in Alaska. Working PFDs and other factors were compared to use to fit multivariate logistic regression models. **Results**
 PFD usage ranged from 0% reporting alone. Among the statistically significant predictors of PFD use an employment hazard was lower (OR: 0.38; 95% CI: 0.20, 0.71) and gillnetters (OR: 0.18) was inversely associated with high use with always using PFDs among trawlers (OR: specific to each vessel type). **Conclusions**
 Interventions to increase PFD use in the fishing industry should focus on addressing the significant barriers to PFD use with newer PFDs that have been tested.

1. Introduction

Commercial fishing is the most hazardous occupation in the US, with a fatality rate of 116 deaths per 100,000 workers during 2010 (Bureau of Labor Statistics, 2011). During 2006–2009, 155 workers in the US fishing industry (crewmembers on commercial fishing vessels) drowned after falling overboard (Lincoln and Lucas, 2010). None of the victims were wearing a personal flotation device (PFD). These fatal falls overboard were the second largest cause of work-related fatalities, accounting for 31% of all fatalities in the US fishing industry for those years (Lincoln and Lucas, 2010) with only vessel disasters accounting for more.

Fatal fall overboard in that time period 2000–2009, 7 fishing vessels (4, 11%), total Safety 6700 workers nets, primary anchoring strategy of bottom to catch crab following large (NIOSH, 2011). The Nation (NIOSH) has

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Personal flotation devices (PFDs) in the fishing industry:

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ABSTRACT

The purpose of this study was to determine which type of commercially available PFD resulted in the highest satisfaction among workers in the fishing industry. Fishing industry workers on four types of vessels and evaluated six different PFDs during their fishing season. Linear regression was used to determine differences in mean satisfaction scores, adjusting for clustered observations on vessels. The data indicated by vessel type to determine the differences in PFD satisfaction within each vessel type. had the highest mean satisfaction score, but satisfaction with particular PFDs varied depending on vessel type. Although the common objections by workers to wearing PFDs are that they are bulky and uncomfortable, some of the PFDs that were evaluated in this study received high scores for comfort and fit. Given the availability of PFDs that are comfortable to wear while working, fishing vessel owners and operators should consider implementing policies mandating the use of PFDs on deck.

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After submersion in cold water, experts have identified four stages at which a person may perish. These are commonly referred to as cold shock, swimming failure, hypothermia and post-rescue collapse (Brooks et al., 2005). Cold shock occurs within 2–3 min of submersion. The victim appears to struggle and then gives up before sinking and drowning. Swimming failure occurs within 3–15 min of submersion. The victim is observed having increased difficulty to stay afloat but has not been in the water long enough to bring the core body temperature to the level defined by hypothermia. In both of these stages, a PFD is vital for survival.

There is a lack of published articles or reports examining the barriers to PFD use among fishing industry workers. However, a recent study of recreational boaters in Alaska found that 38 percent cited discomfort as the primary reason for not wearing a PFD (McDowell Group, 2009). It is possible that fishing industry workers share the same opinion.

Several studies have examined barriers to wearing other forms of personal protective equipment (PPE) among different types of workers. Common reasons cited for non-use were discomfort, misperceptions of risk, and negative attitudes about the efficacy of PPE (Alkhasan-Zadeh, 1998; Stone et al., 2006; Salazar et al., 2001). An additional study stated that, “improper fit, added weight, out-of-fashion style or color make much PPE undesirable” (Alkhasan-Zadeh et al., 1995). Among fishing industry workers, there may be similar perceptions and attitudes; they may feel that a PFD will be uncomfortable and encumber them in their work. There may also be concern that a PFD not designed for their working

Results

- Fishermen working with different gear types have different perceptions of risk, attitudes, beliefs, and preferences for PFDs
- A “one size fits all” approach to increasing PFD use in fishing will likely not be effective
- PFDs and communications must be tailored to individual gear types

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TRAWLERS

PFDs That Work

Researchers from the NIOSH Alaska Pacific Office conducted an evaluation with commercial fishermen from 4 gear groups to rate the comfort and acceptability of six modern personal flotation devices (PFDs).¹ About 200 fishermen were asked to evaluate a PFD for one month while working on deck so that wearable PFDs could be identified. This document shows which PFDs were preferred by trawlers.

PFD Use Among Trawlers:

PFD Evaluation:
After the 30 day on deck evaluation PFDs, trawlers said that the Regatta raingear with built in flotation would be acceptable for use on their vessels. Comments on the devices include:

- Lightweight, did not interfere with their work
- Did not snag on fishing gear
- Easy to keep clean and easy to dry
- The Stearns inflatable suspenders were also acceptable for work on gillnet vessels; they too did not snag on gear and were easy to clean

GILLNETTERS

PFDs That Work

Researchers from the NIOSH Alaska Pacific Office conducted an evaluation with commercial fishermen from 4 gear groups to rate the comfort and acceptability of six modern personal flotation devices (PFDs).¹ About 200 fishermen were asked to evaluate a PFD for one month while working on deck so that wearable PFDs could be identified. This document shows which PFDs were preferred by gillnetters.

PFD Use Among Gillnetters:

PFD Evaluation:
After the 30 day on deck evaluation PFDs, gillnetters said that the Regatta raingear with built in flotation would be acceptable for use on their vessels. Comments on the devices include:

- Lightweight, did not interfere with their work
- Did not snag on fishing gear
- Easy to keep clean and easy to dry
- The Stearns inflatable suspenders were also acceptable for work on gillnet vessels; they too did not snag on gear and were easy to clean

LONGLINERS

PFDs That Work

Researchers from the NIOSH Alaska Pacific Office conducted an evaluation with commercial fishermen from 4 gear groups to rate the comfort and acceptability of six modern personal flotation devices (PFDs).¹ About 200 fishermen were asked to evaluate a PFD for one month while working on deck so that wearable PFDs could be identified. This document shows which PFDs were preferred by longliners.

PFD Use Among Longliners:

PFD Evaluation:
After the 30 day on deck evaluation PFDs, longliners said that the Mustang Inflatable Suspenders (MD3188) was the only PFD acceptable for use on their vessels. Comments on the device include:

- Not bulky, did not interfere with work
- Easy to put on, and did not snag on gear
- Was rated as comfortable to wear because they were not tight or bulky

CRABBERS

PFDs That Work

Researchers from the NIOSH Alaska Pacific Office conducted an evaluation with commercial fishermen from 4 gear groups to rate the comfort and acceptability of six modern personal flotation devices (PFDs).¹ About 200 fishermen were asked to evaluate a PFD for one month while working on deck so that wearable PFDs could be identified. This document shows which PFDs were preferred by crabbers.

PFD Use Among Crabbers:

Crabbers' Responses to Survey:

- Over half of the crabbers said they knew someone who had died from a fall overboard
- 60% of crabbers believed PFDs are effective at saving lives
- Most crabbers didn't think that PFDs are uncomfortable or interfere with work, although half of them thought PFDs could be an entanglement hazard

PFD Evaluation:
After the 30 day on deck evaluation of PFDs, crabbers preferred Mustang and Stearns Inflatable Suspenders. Comments on the devices include:

- Did not constrict motion or snag on gear
- Did not interfere with their work
- Were rated as comfortable to wear because they were not tight or bulky

Mustang Inflatable Suspenders (MD3188): Not too tight, Not bulky, Does not interfere with work.

Stearns Inflatable Suspenders (I100): Doesn't snag on gear, Does not limit motion.

"I feel that the [Mustang suspenders PFD] is something that would be received well by the deckhands of the fleet."

— Crabber and study participant



Any Progress?

PFD Use	2008 Survey	2014 Survey
Never Wear	16%	16%
Sometimes Wear	51%	24%
Frequently Wear	12%	8%
Always Wear	22%	52%

$\chi^2 = 22.5; p < 0.001$



“Rogue” Tactical Deck Vest

Streamlined to be worn under
bibs and raingear

12 lbs. flotation

Field-tested for continuous wear
and further adjusted based on
fishermen’s feedback

Released November 2014

Winner 2014 Fisheries Supply
Innovation Award (safety
category)

2000 units sold in first year.



Affecting National Policy

National Marine Fisheries Service
Safety Tech Memo, 2016

US Coast Guard
Alternate Safety Compliance Programs, 2017
US Coast Guard Reauthorization Bill, 2010
NIOSH Testimony, April 2007

National Transportation Safety Board, 2010
Describing the Problem
LifeSaving Equipment
Fisheries Management and Safety



International Collaborations





Center for Maritime Safety and Health Studies



The New York Times

One Dead and Two Missing After Tugboat Hits Barge Near Tappan Zee Bridge

By ASHLEY SOUTHWALL MARCH 12, 2020



Rescuers searching the Hudson River near the Tappan Zee Bridge for two people who were missing after a tugboat hit a barge on Saturday. Greg Vozzella for The New York Times.

Email

Share

A tugboat with three crew members aboard struck a construction barge moored beneath the Tappan Zee Bridge and sank into the Hudson River before dawn on Saturday, killing one crew member and leaving the other two missing, officials said.



Why NIOSH?

- Strong Expertise
 - Fishing Program Success
 - MOU with USCG
- Established Industry and Regulatory Connections
 - USCG Advisory Role
 - MACOSH Advisory Committee
 - Industry partners in fishing, vessel safety, fish processing



Maritime Worker Definition

Individuals employed:

- On vessels (ship's officer/crew)
- At waterfront facilities, working in and around vessels (shipyard and dock workers, marine terminal employees, longshoremen)
- On shore directly supporting marine operations (seafood preparation and packaging, navigational services)



Core Areas of Focus

- Commercial fishing
- Fish processing
- Shipyard operations
- Marine transportation
- Marine terminal operations
- Longshoring
- Commercial diving
- Aquaculture?



Maritime Industry Hazards

- Exposures to toxic chemicals, metals, dust
- Exposures to extreme heat, cold
- Musculoskeletal/ergonomic injuries
- Confined spaces
- Shiftwork and fatigue
- Falls overboard/drowning
- Vessel disasters
- Deck safety
- Falls and traumatic injuries
- Diving injuries

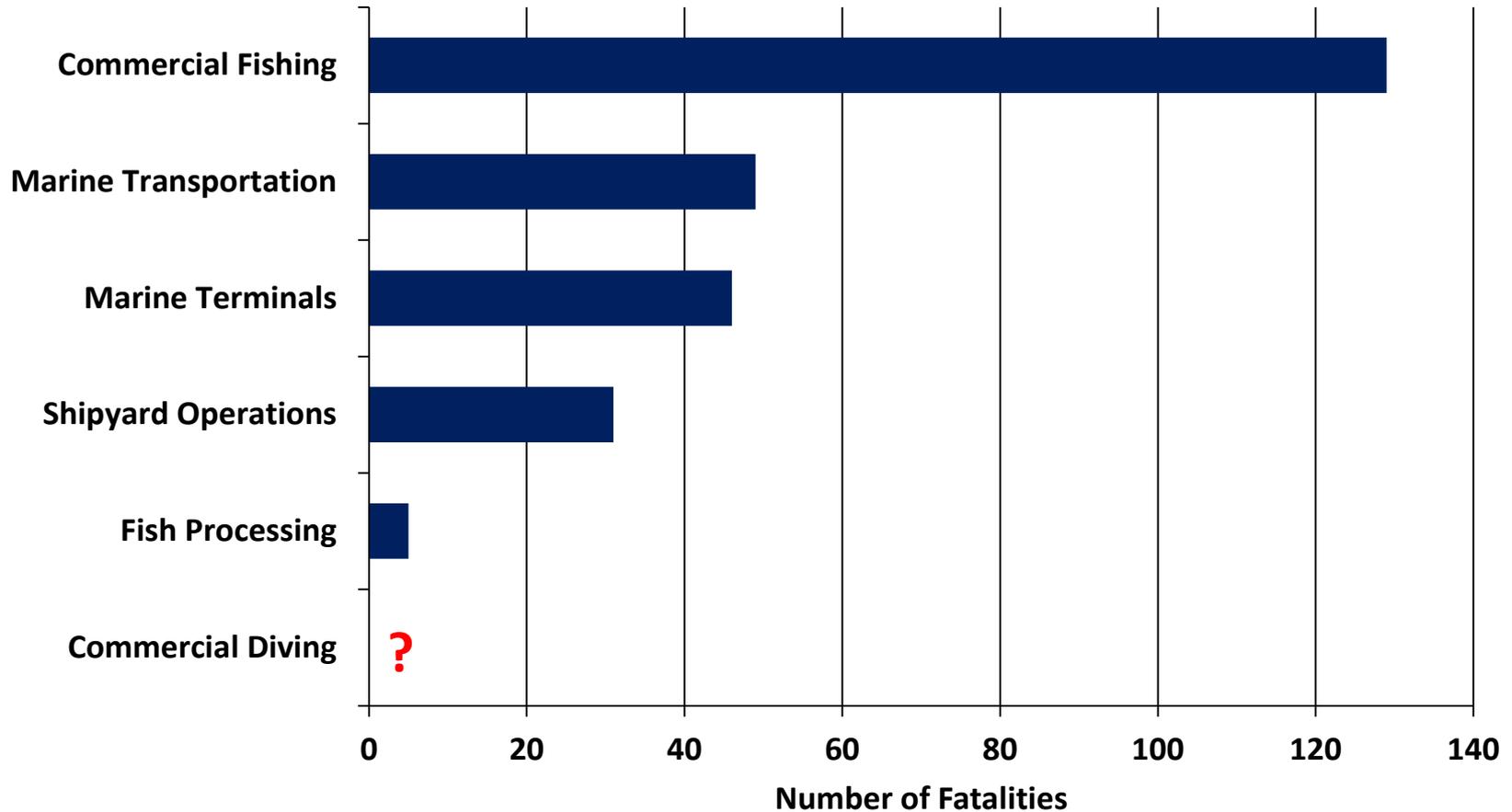


Complex Maritime Jurisdictional Issues

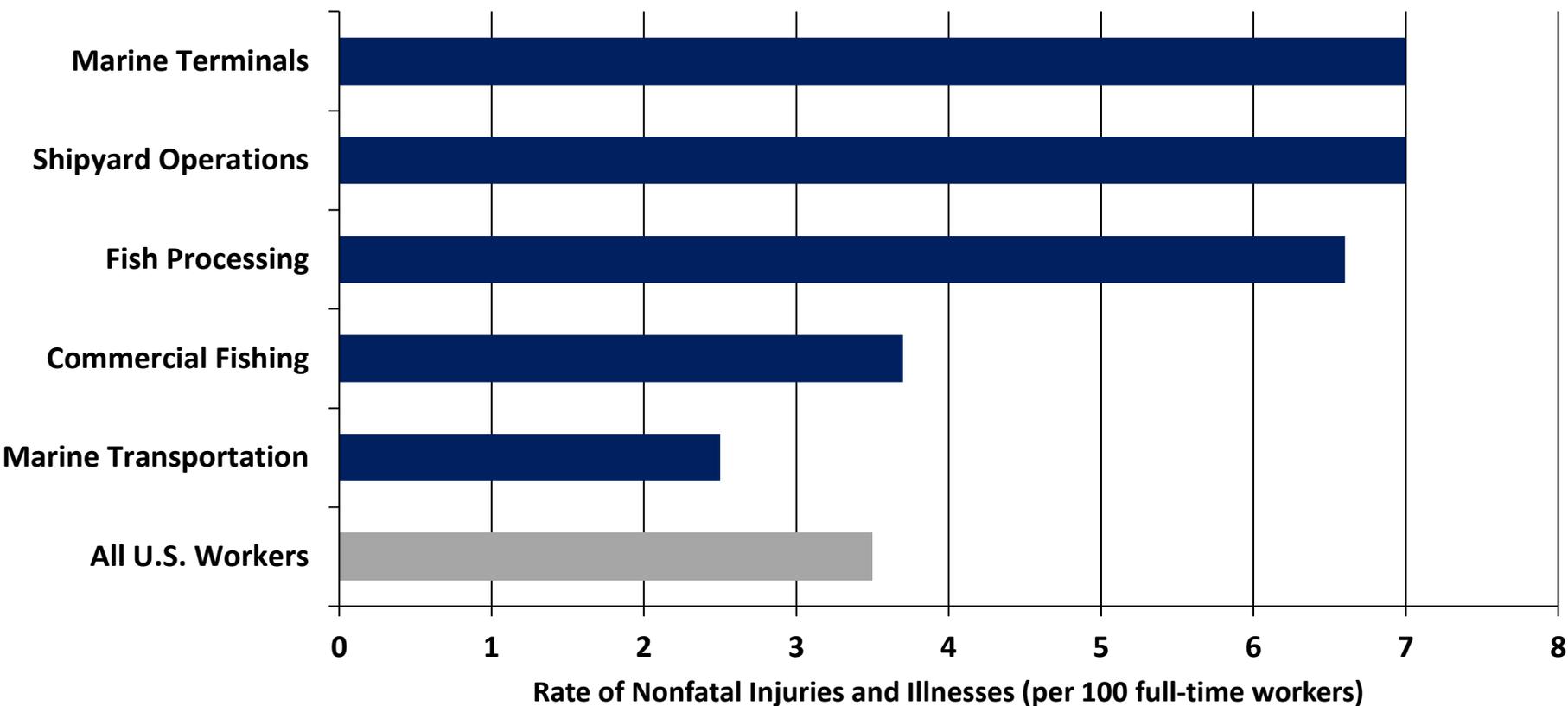
- OSHA
 - State vs. Federal
 - Part 1915 Shipyard Workers
 - Part 1917 Marine Terminals
 - Part 1918 Longshoring
- USCG
 - Uninspected Vessels
 - Commercial fishing
 - Tug/tow boats
 - Inspected Vessels
 - Other Marine transportation vessels
- Jones Act vs. Workers compensation



Fatalities in Core Areas, 2011-2014



Nonfatal Injuries and Illnesses in Core Areas, 2013



Literature Findings: Excess Cancer Morbidity in Shipyard Workers

- Lung cancer, especially among welders (Sanden et al., 1985; Sanden, 1987; Melkild et al., 1989; Danielsen et al., 1993)
- Bronchial carcinoma (Edge, 1979)
- Mesothelioma (Sanden et al., 1992; Matanoski et al., 2008)
- Leukemia among welders and electricians (Stern et al., 1986)
- Comprehensive studies lacking



Next Steps

- Collect additional burden data
 - Fatality rates
 - Commercial diving fatalities
 - Causes of injury and illness
 - Exposures
 - Health outcomes
- Explore data sources
 - BLS
 - OSHA inspections, citations, and investigations
 - Peer-reviewed literature
 - Trauma registries
 - Workers' compensation



Current Activities

- Develop understanding of maritime industries, hazards
 - Identify Labor Organizations to talk to (listen to)
 - Attended OSHA training
 - Site visits at ports, shipyards, and marine terminals



Current Activities

- Coordinate with internal stakeholders on expertise, approach
 - Relevant NIOSH Projects and Committees
 - Transportation, Warehousing, Utilities (Jennifer E. Lincoln)
 - Intramural and Extramural funded projects
 - Division of Global Migration and Quarantine
 - Maritime Activity Team
 - Q Stations



Current Activities

- Meet with external stakeholders about collaboration, priorities
 - USCG Prevention Policy Command: maritime safety, regulations, compliance
 - OSHA Offices of Maritime and Agriculture, Maritime Standards
 - Industry safety experts
 - National Transportation Safety Board



Center for Maritime Safety and Health Studies

- Input on approach as we move forward?
- Ideas on labor organizations?
- Input on academic institutions?
- What didn't I talk about that you thought I was going to?
- How do we prioritize our activities and research areas?



Thank You

For more information about the Center for Maritime Safety and Health Studies,
please contact:

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cmshs@cdc.gov

