

NTSB Commercial Fishing Safety Forum NIOSH Research

Jennifer M. Lincoln, PhD

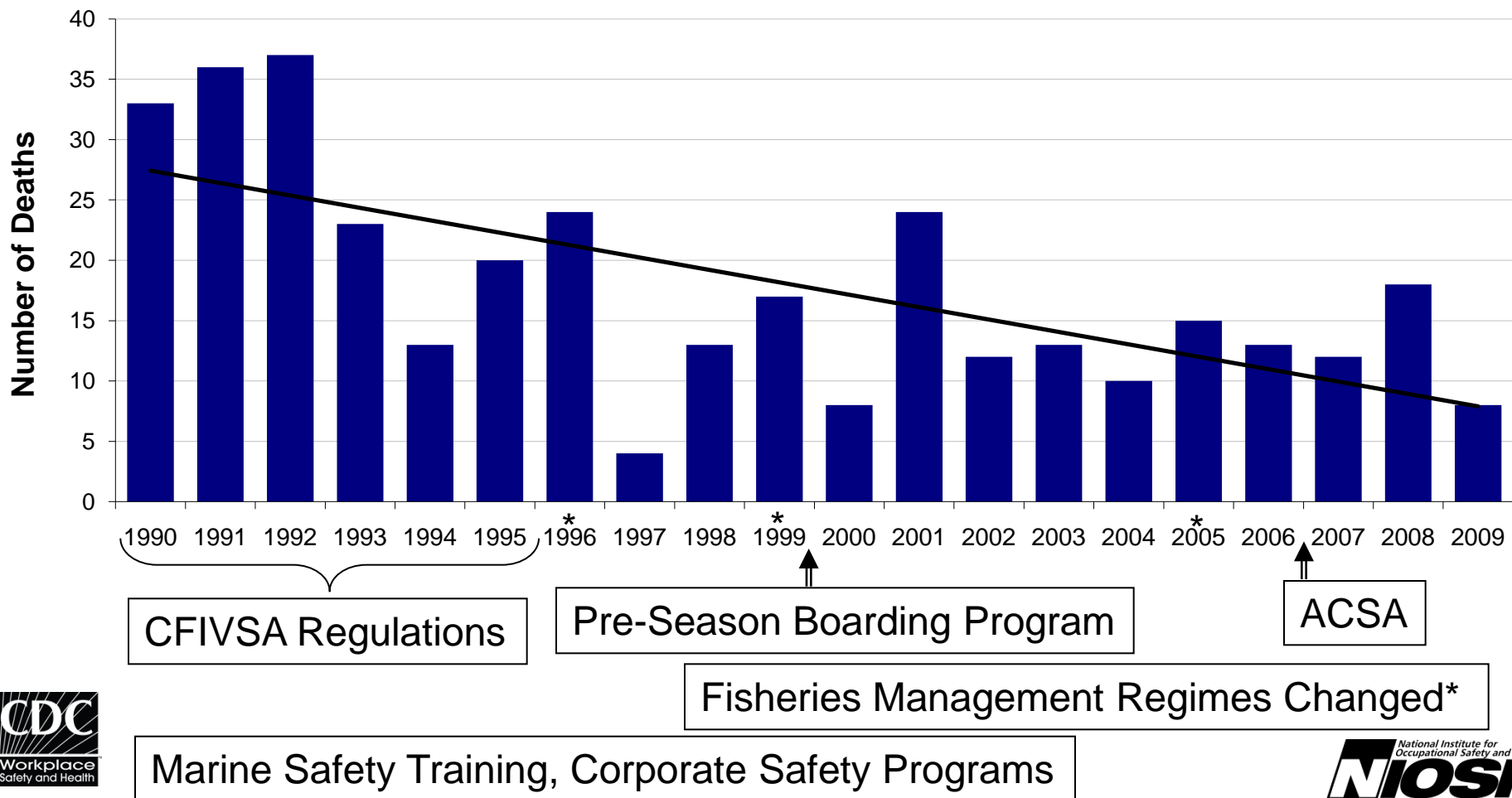
Devin L. Lucas, MS

Partnership

- NIOSH has served as a catalyst for change by:
 - Providing scientific assessment of the worst problems
 - Identifying high-risk groups
 - Supporting the development of interventions
 - Evaluating interventions



Commercial Fishing Fatalities by Year, Alaska, 1990-2009 (N=353)





Survivors are...

- 7 times more likely to have worn an Immersion Suit
- 15 times more likely to have used a Life Raft
- 1.5 times more likely to have had formal marine safety training



Implications

- Training in the use of emergency equipment for all fishermen
 - Immersion suits
 - Life raft use
 - Mayday calls
- Dockside Exams
 - Pre-season activities



But other things are related to safety...



Focusing on the Specific Problem...

- NIOSH identified extremely high fatality rate
- BSAI Crab fleet losing an avg. 8 per year
- Vessels sinking while fully loaded going out to sea
- Stability Information



At the Dock Stability Checks



- October 1999
- Developed jointly with agencies, crab industry, & NPFVOA
- Review vessel stability letters & examine safety equip.
- No stability reports, overloaded, or discrepancies with safety equip were not allowed to get underway.

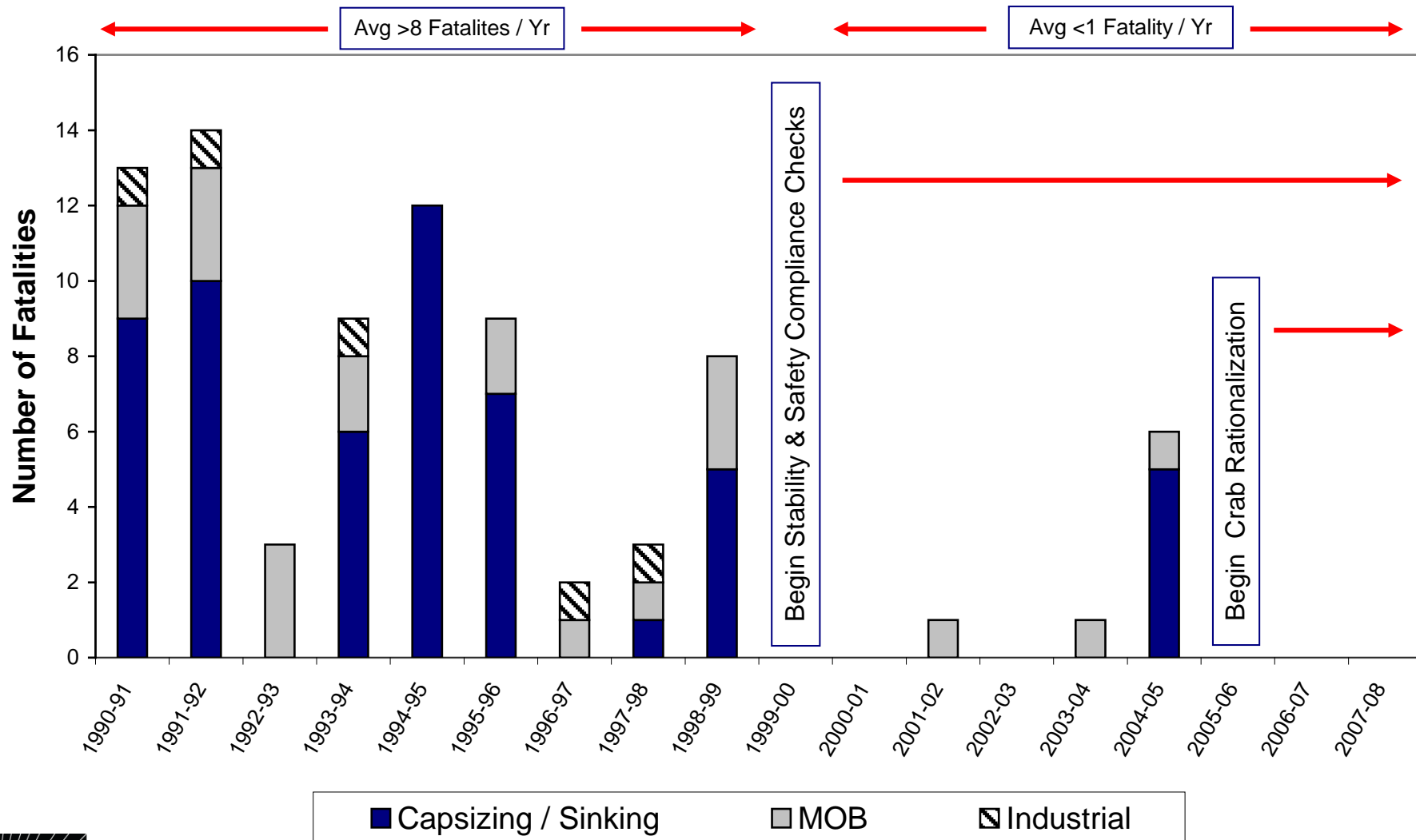


At the Dock Stability Check Results

- 74% reduction in overall fatalities
- 60% reduction in fatality rates
 - Accounts for reduction in fleet size



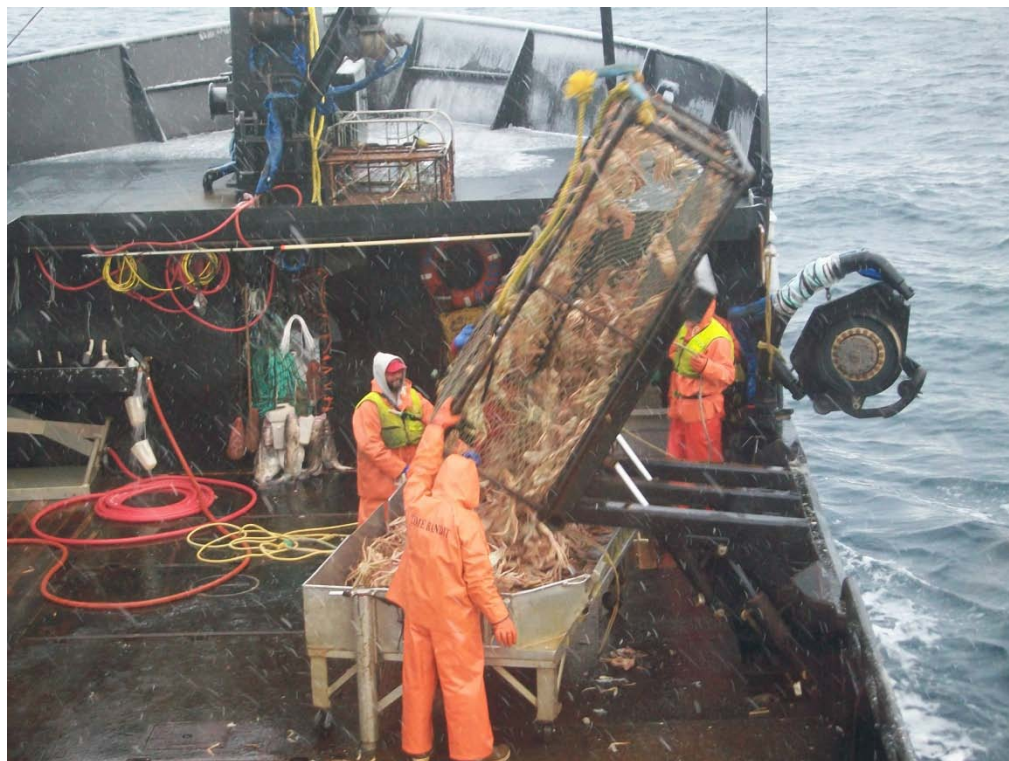
Bering Sea / Aleutian Island Crab Fishery Fatalities (1990-2008)





Crab Rationalization and Safety

- Continue to be no vessel losses
 - 1 fatal fall overboard in January 2009
- Increase in fishing season length
- Reduction in fleet size- sidelining less efficient vessels and using vessel cooperatives
- Pots carried decreased
- Pot lifts per vessel per day decreased

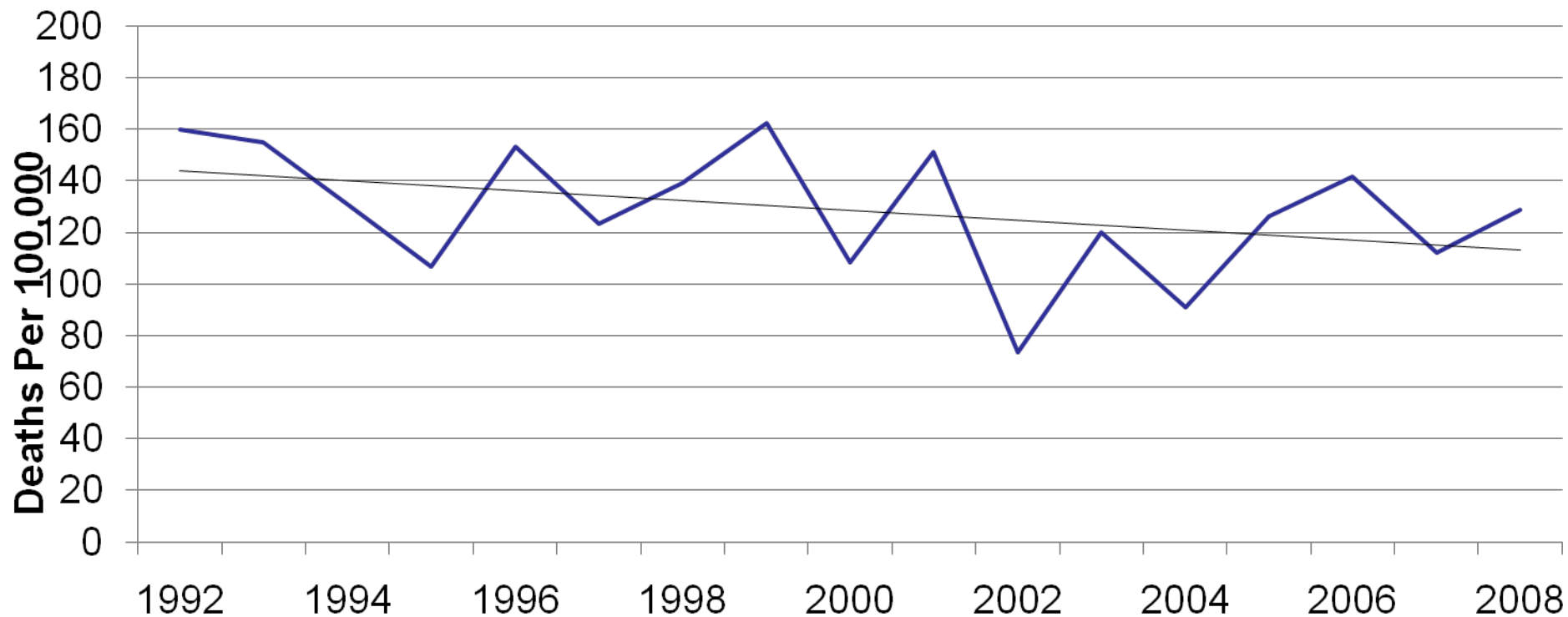




National Statistics



US Commercial Fishing Fatality Rate by Year, 1992-2008



Source: Bureau of Labor Statistics, Census of Fatal Occupational Injuries

Chi Square Test for Trend
 $X^2=6.719$
 $p=0.009$



Fatality Surveillance

- What is the problem?
 - who, how many, in what ways
- What is the cause?
 - risks, contributing factors
- Identifies areas for targeted interventions
- Monitors progress
 - Reduction in deaths



NIOSH: Commercial Fishing Incident Database (CFID)

- Relational database
 - Three data tables linked by incident ID
 - Incident Table, Victim Table, Vessel Table
- ~100 variables gather data on the Incident, Victim, and Vessel
- Ability to query data in many different ways
- Export to statistical software

Data Sources

- United States Coast Guard
- State health departments
- Local law enforcement agencies
- News media
- Death certificates



Types of Events

- Vessel Disasters
 - Initiating Event
 - Cause of flooding
 - Cause of instability
- Falls Overboard
 - Cause of Fall Overboard
 - Contributing factor
- On-board Injuries

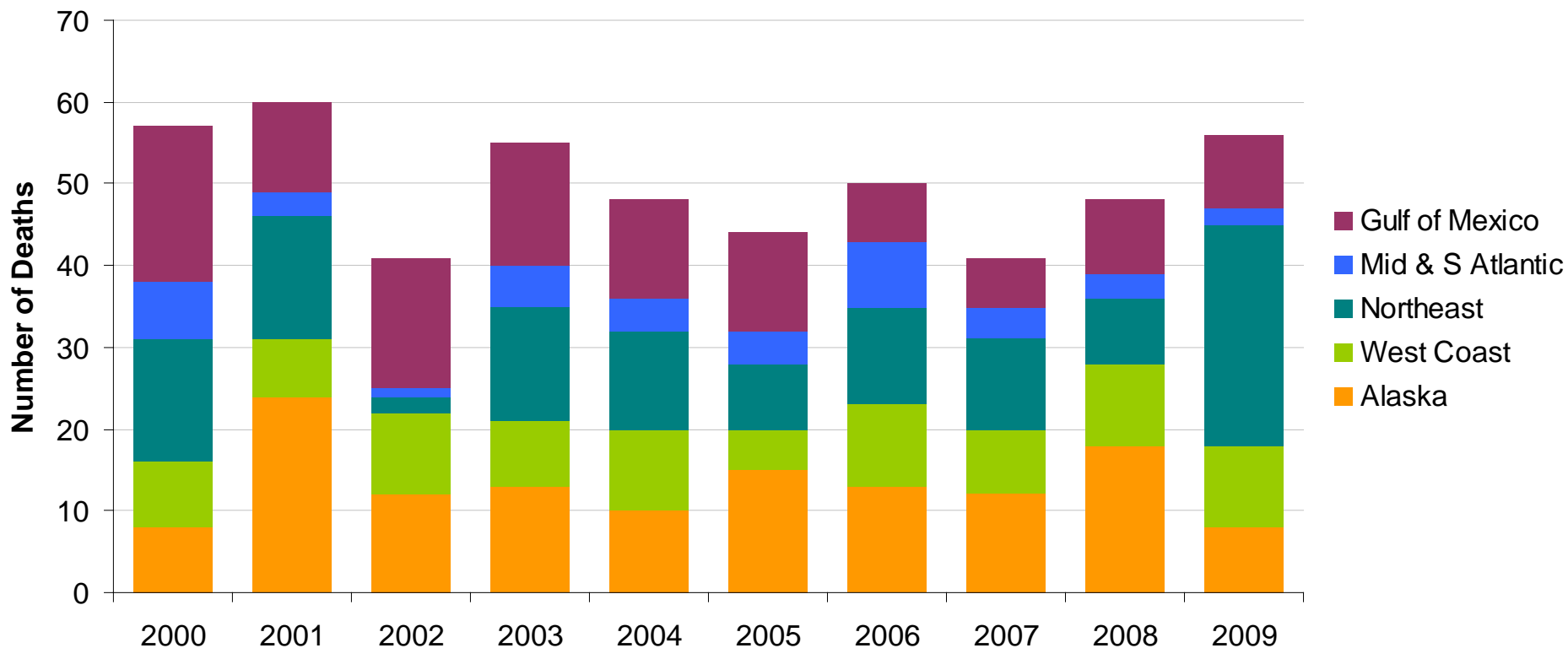


Fisheries

- Geographic Location
 - Alaska
 - Westcoast
 - Northeast Atlantic
 - Mid & South Atlantic
 - Gulf of Mexico
- Species sought



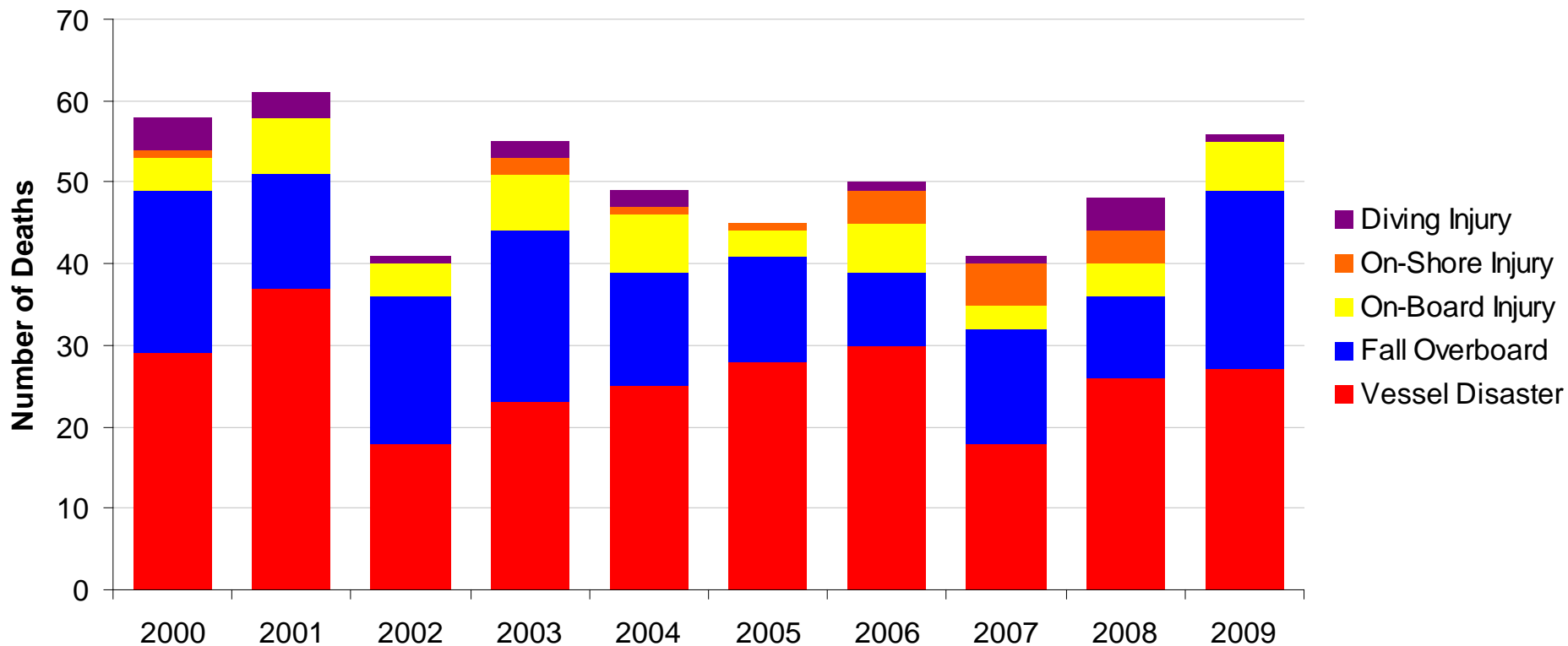
US Commercial Fishing Fatalities by Year and Region, 2000-2009 (N=504*)



*Chart excludes 6 deaths in Hawaii and 1 in Canadian waters during transit to AK



US Commercial Fishing Fatalities by Year and Incident Type 2000-2009 (N=504)



Source: NIOSH Commercial Fishing Incident Database



- **Vessel Disasters (261, 52%)**
- Falls Overboard



Vessel Disasters: Initiating Event

Initiating Event	Number	Percent
Flooding	37	25%
Instability	24	16%
Struck by Large Wave	23	16%
Collision/Allision	13	9%
Prop Entanglement	6	4%
Fire/Explosion	6	4%
Other	22	
Unknown	17	



Vessel Disasters: Cause of Flooding (n=37)

Initiating Event	Number	Percent
Down-Flooding	14	38%
Below Waterline Flooding	10	27%
Swamping (Open Skiff)	8	22%
Unknown Cause	5	14%

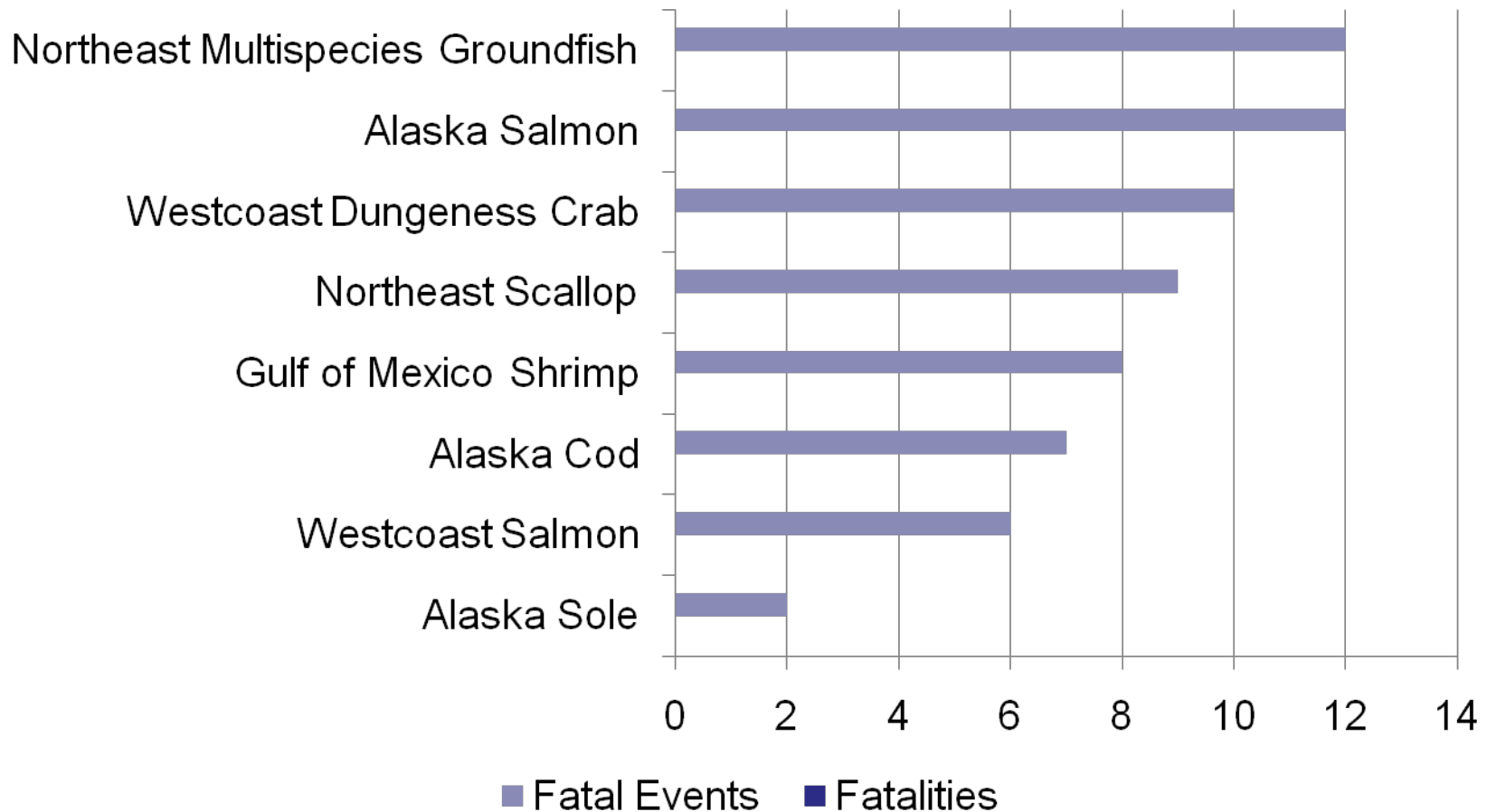


Vessel Disasters: Cause of Instability (n=24)

Initiating Event	Number	Percent
Overloading	10	42%
Hauling up Heavy Net	6	25%
Shifting Load	3	13%
Icing	2	8%
Structural Modifications	1	4%
Slack Tank	1	4%
Unknown	1	4%

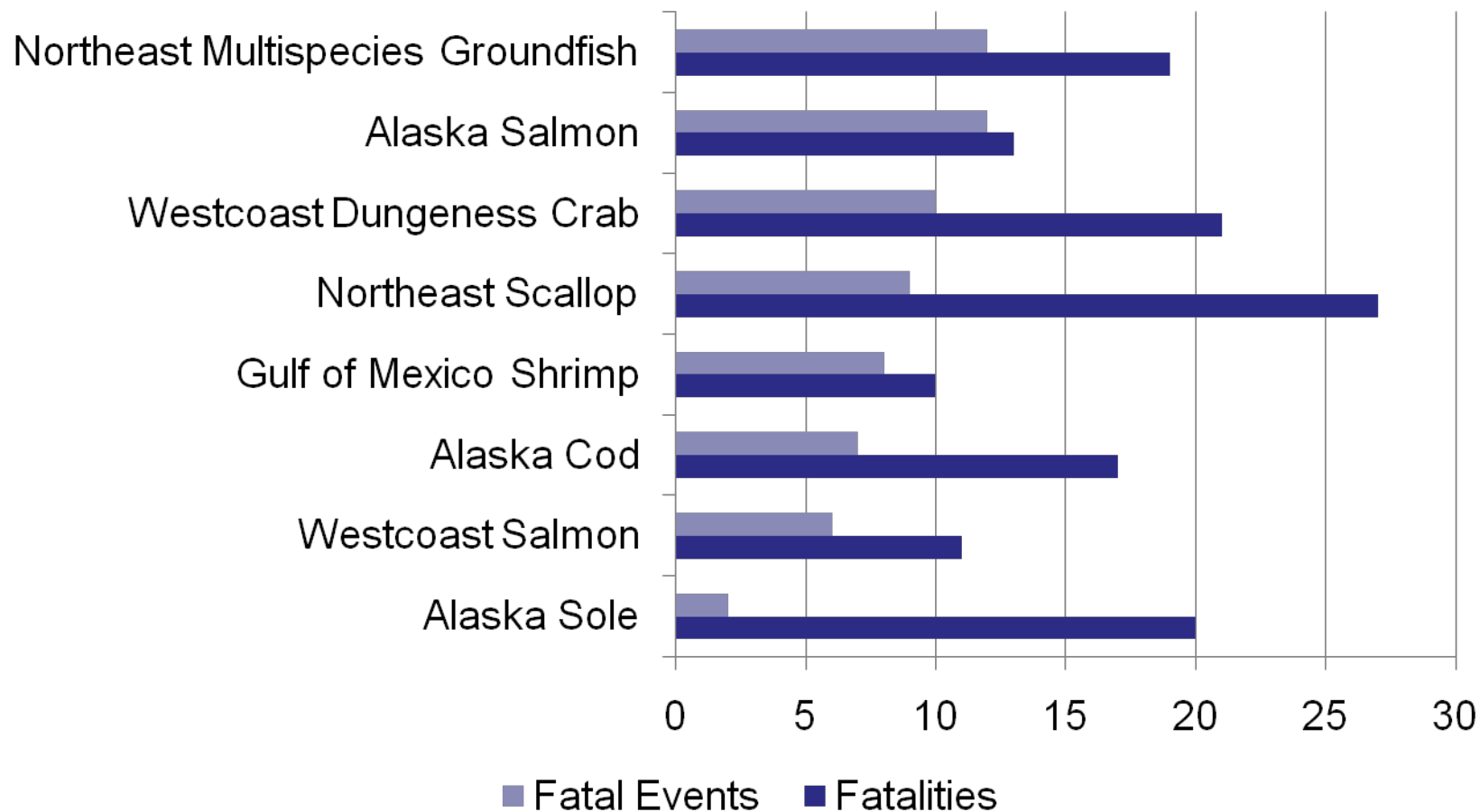


Vessel Disaster: Fatal Events by Fishery





Vessel Disaster: Fatalities and Fatal Events by Fishery





Risks Vary by Fishery

- Northeast groundfish
 - 50% instability due to hauling net and flooding
- Alaska salmon
 - 58% were set net skiffs
- Westcoast Dungeness crab
 - 100% heavy weather and many while crossing bar
- Northeast scallop fleet
 - instability, gear caught on the bottom, and collision



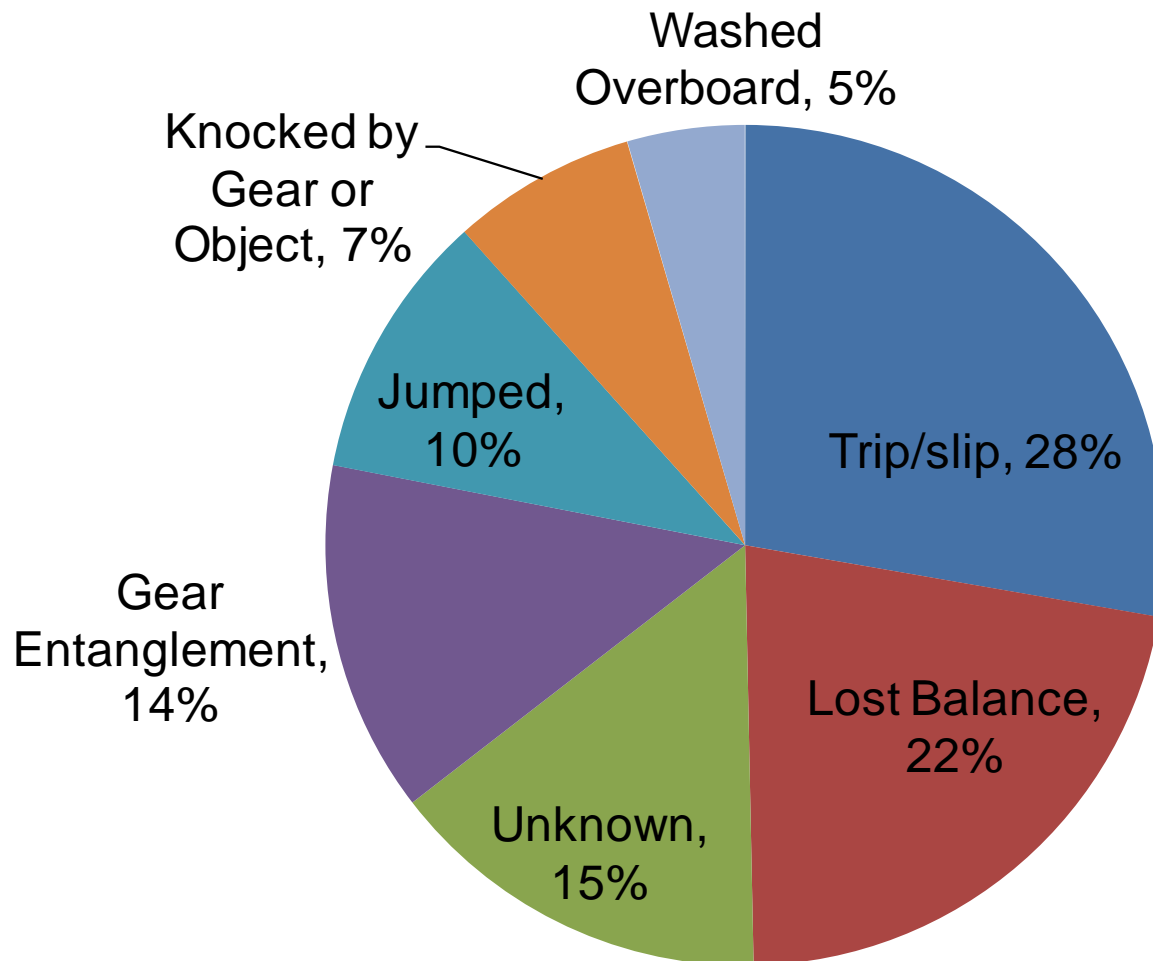
- Northeast scallop and Groundfish fleets
 - intervention focusing on the relationship between vessel stability and gear handling.
- Alaska salmon and West coast Dungeness crab fleet
 - interventions focusing on issues of operating in heavy weather



- Vessel Disasters
- **Falls Overboard (155, 31%)**

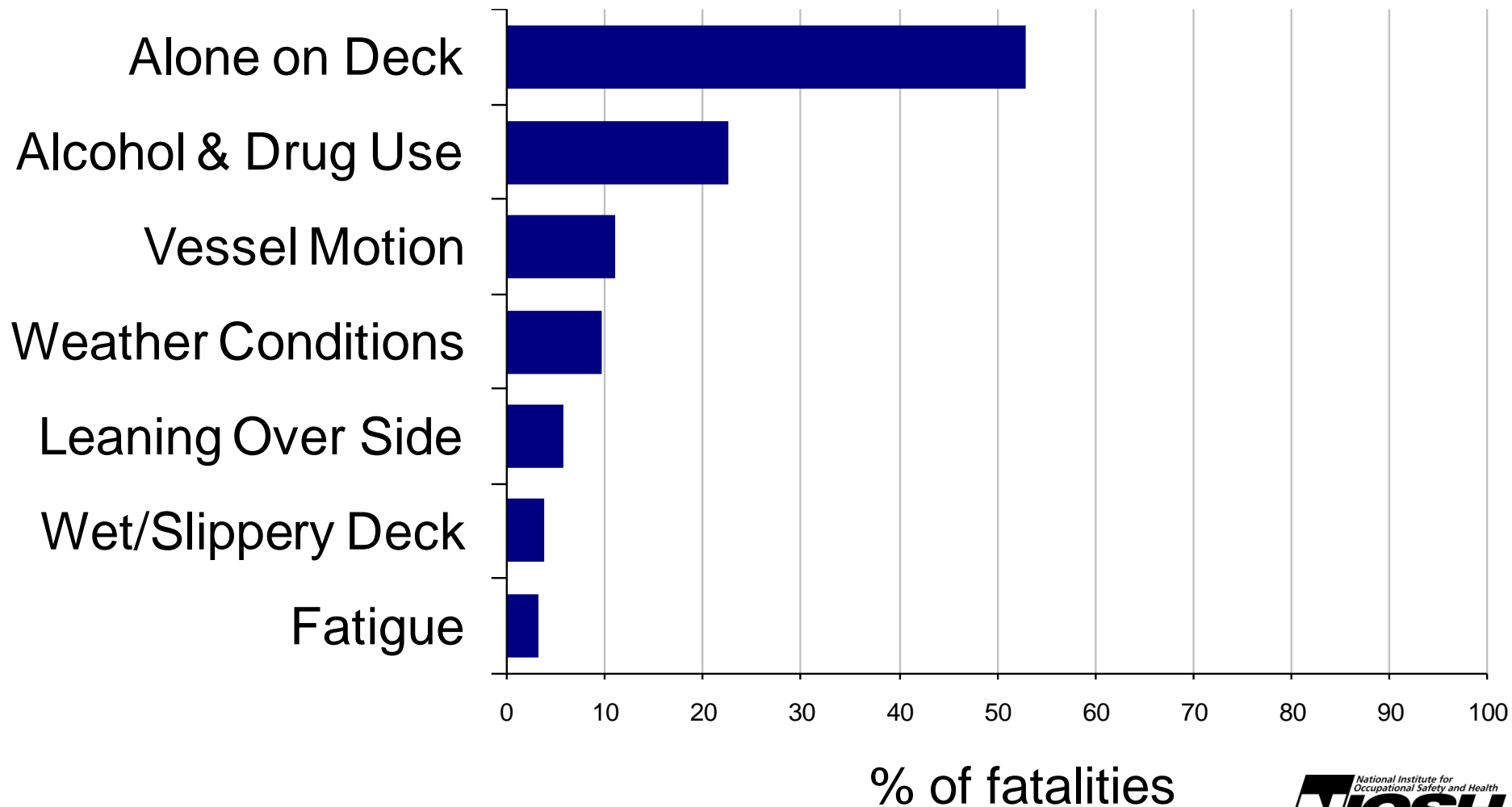


Falls Overboard: Causes



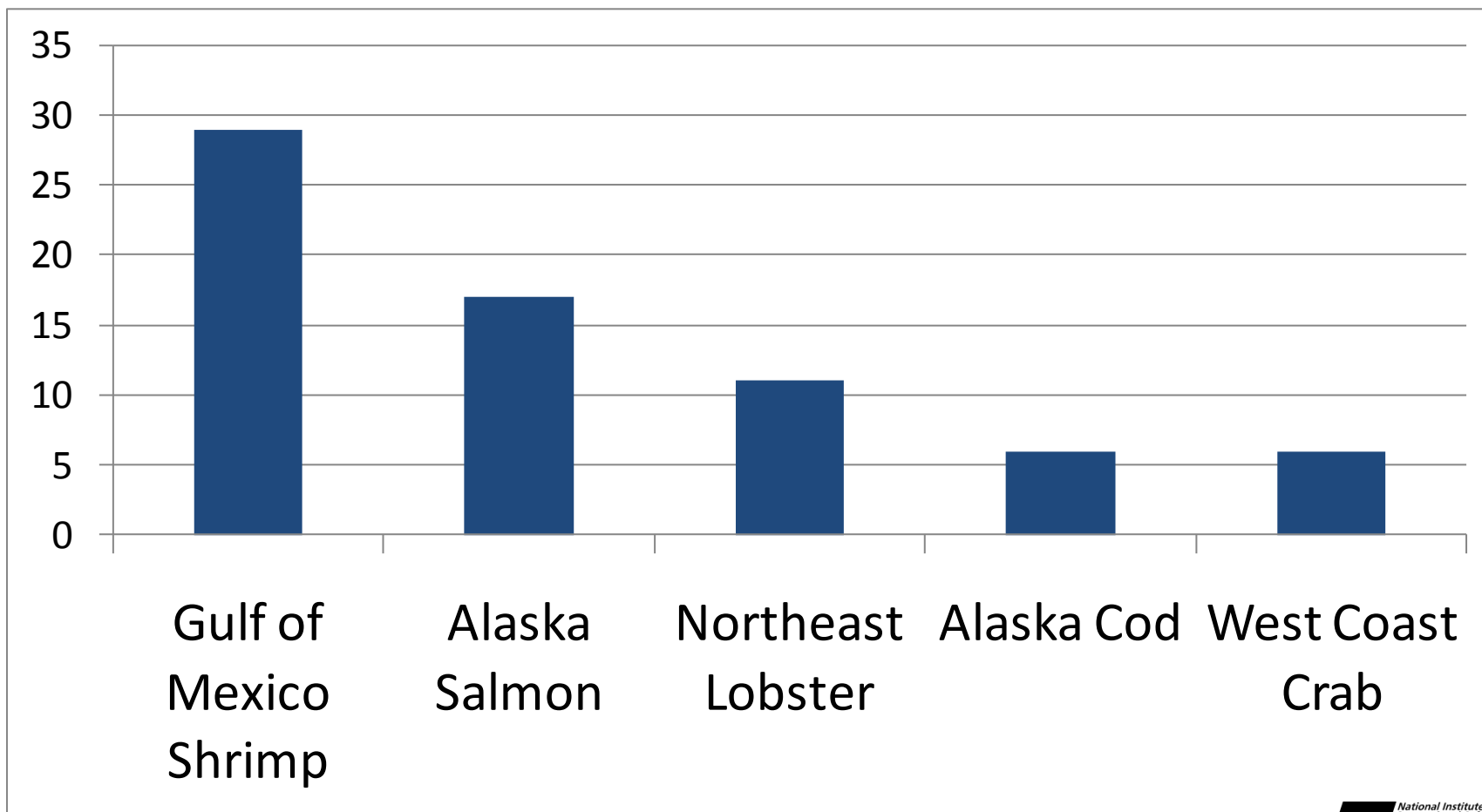


Falls Overboard: Contributing Factors





Falls Overboard: By Fishery with highest number of fatalities





Reasons to focus on a fishery hazard

- Numbers of Fatalities
- Number of Fatal Events
- Fatality Rates

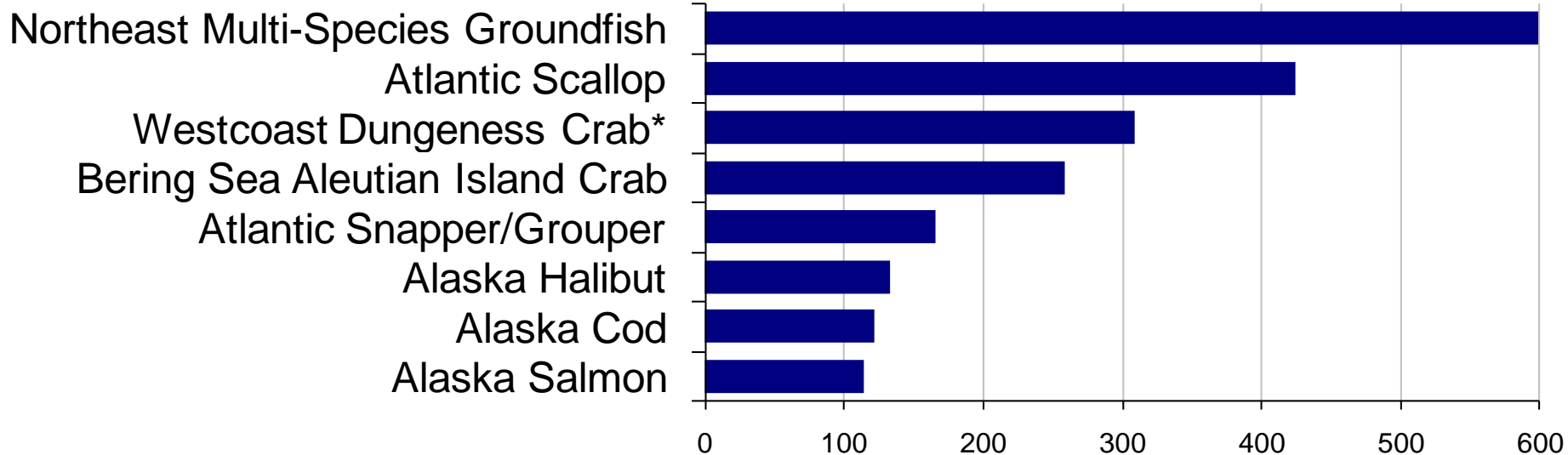
Workforce Estimates

- Vessel Landings
- Length of Openings
- Average Crew Size





Fatality Rates for Selected US Fisheries, 2000-2009



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

Conclusions

- Vessel Disasters
 - Majority of Fatalities
 - Fisheries have different risk factors
- Falls overboard
 - 1/3 of all fatalities
 - 0 were wearing PFDs
 - Majority alone



NIOSH Research Beyond Surveillance



Development of a Hatch and Door Monitor System for Commercial Fishing Vessels

**Robert W. McKibbin and Chelsea C. Woodward
CDC/NIOSH Alaska Pacific Regional Office**



**RMS Queen Mary
Southampton, 1936**



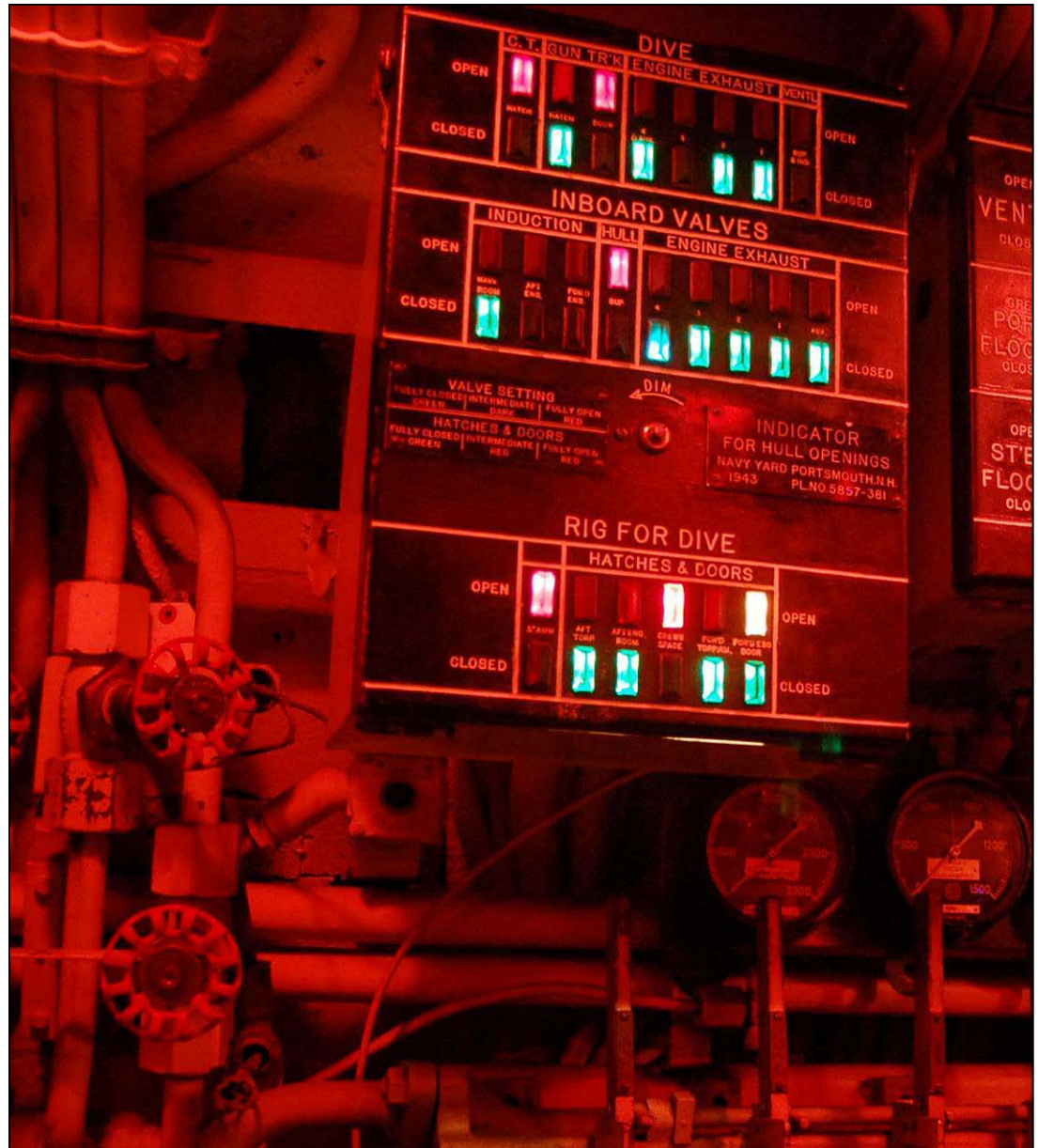
**Watertight doors indicator
and control mechanism**





USS Pampanito

**Hull opening status panel
“Green Board”**





Design Criteria

- NIOSH engineers met with fishermen, naval architects, US Coast Guard, hatch manufacturers, marine engineers, and safety managers:
 - Capable of being retrofitted to a variety of doors
 - Use off-the-shelf components
 - Cost effective
 - Easy to use and maintain
 - Not impair passage through the door
 - Withstand salt water environment



Hinged Dutch



Quick Acting



Multi-dog



Hinged, Vertical Mount



Lift-out, Flush Mount



Quick Acting



Drop Bolt



Detail Design and Installation

- Select test vessels
- Select sensors for each hatch and door
- Develop electrical schematic
- Fabricate brackets and mount sensors
- Run cables from various doors to the bridge
- Mount junction boxes, logic box, and green board
- Complete wiring, adjust sensors, and verify “all green”



F/V Gladiator
38-meter trawler-catcher, crew of 5
Trident Seafoods Corp



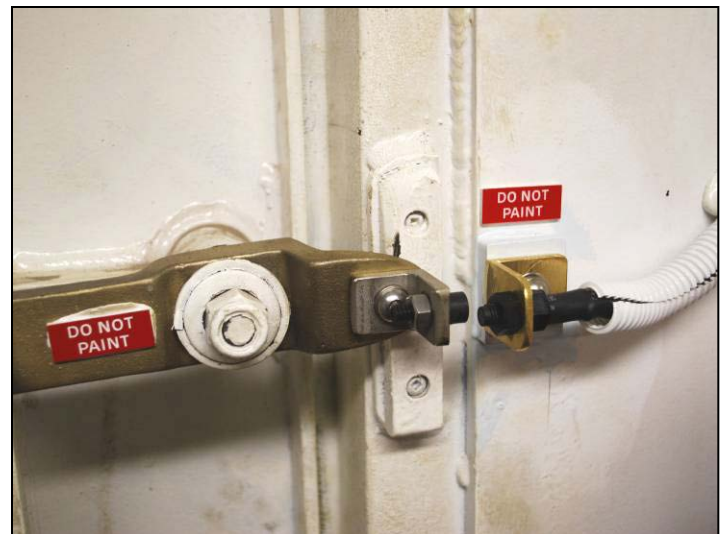
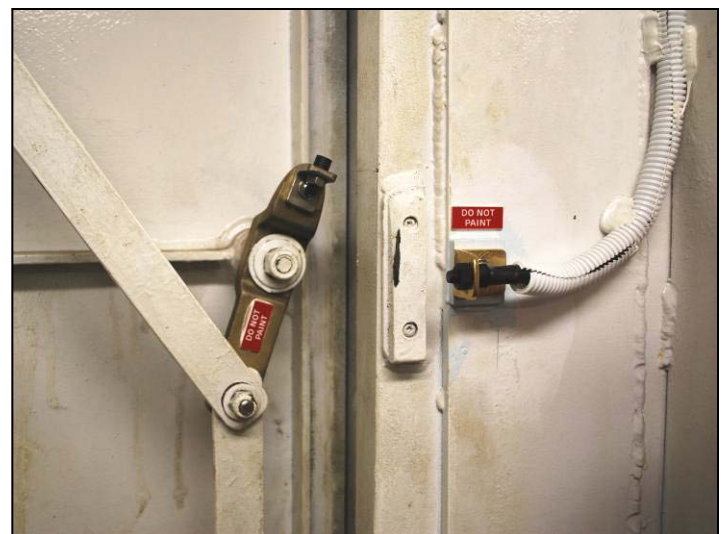
F/V Lilli Ann
43-meter freezer-longliner
American Seafoods Group, LLC



Inductive

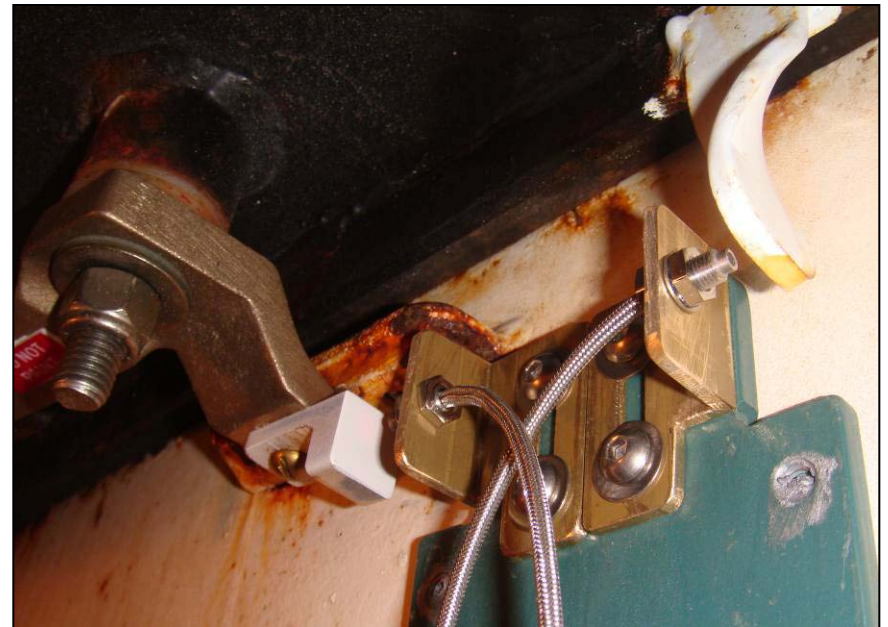


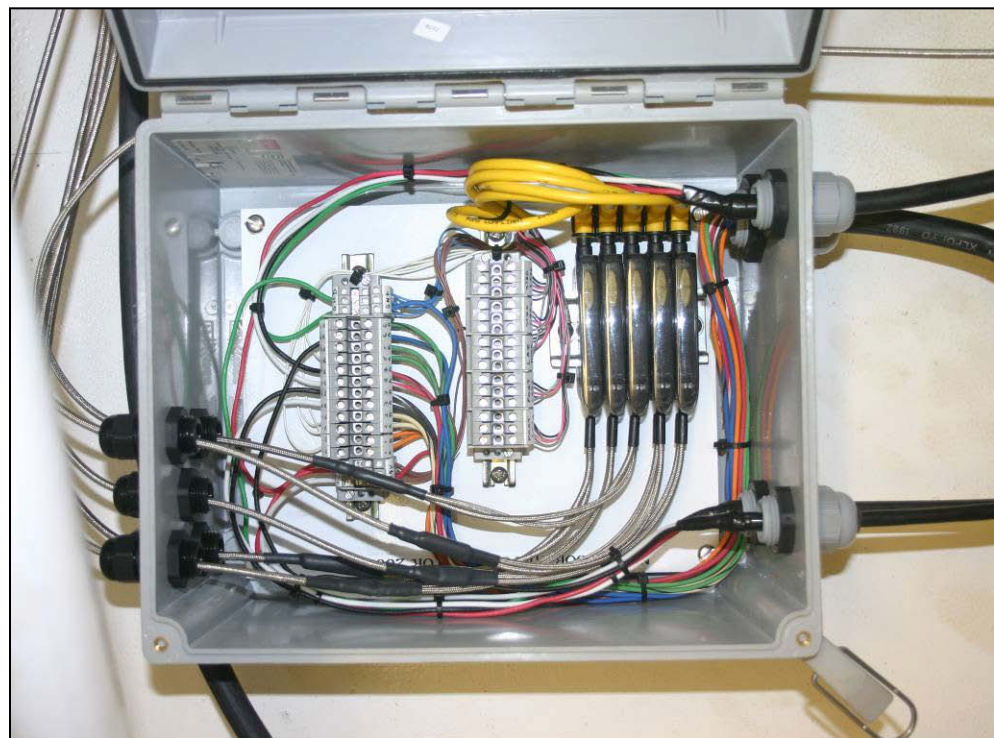
Magnetic





Fiber Optics







**Logic controller
final voltage check**

**Green board
final assembly**





<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	AFT ENGINE ROOM
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	LAZARETTE DOOR
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	STBD GANTRY
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	PORT GANTRY
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	STBD LAZ HATCH
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	PORT LAZ HATCH

<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	STBD FUEL LOCKER
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	RAIN GEAR LOCKER
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	GALLEY DOOR
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	BOW HATCH
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	FWD SHAFT ALLEY
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	REEFER HATCH

BRIGHT
DIM

NIOSH HATCH & DOOR
MONITOR SYSTEM



Current and Future Work

- Continue monitoring the two installed systems
- An additional vessel— just a lazerette monitor
- Transfer results to industry

Personal Flotation Devices (PFDs) and Commercial Fishermen: Preconceptions and Evaluations in Actual Use

Devin L. Lucas, MS

Jennifer M. Lincoln, PhD

Theodore D. Teske, MA



The findings and conclusions in this presentation have not been formally disseminated by CDC/NIOSH and should not be construed to represent any agency determination or policy.



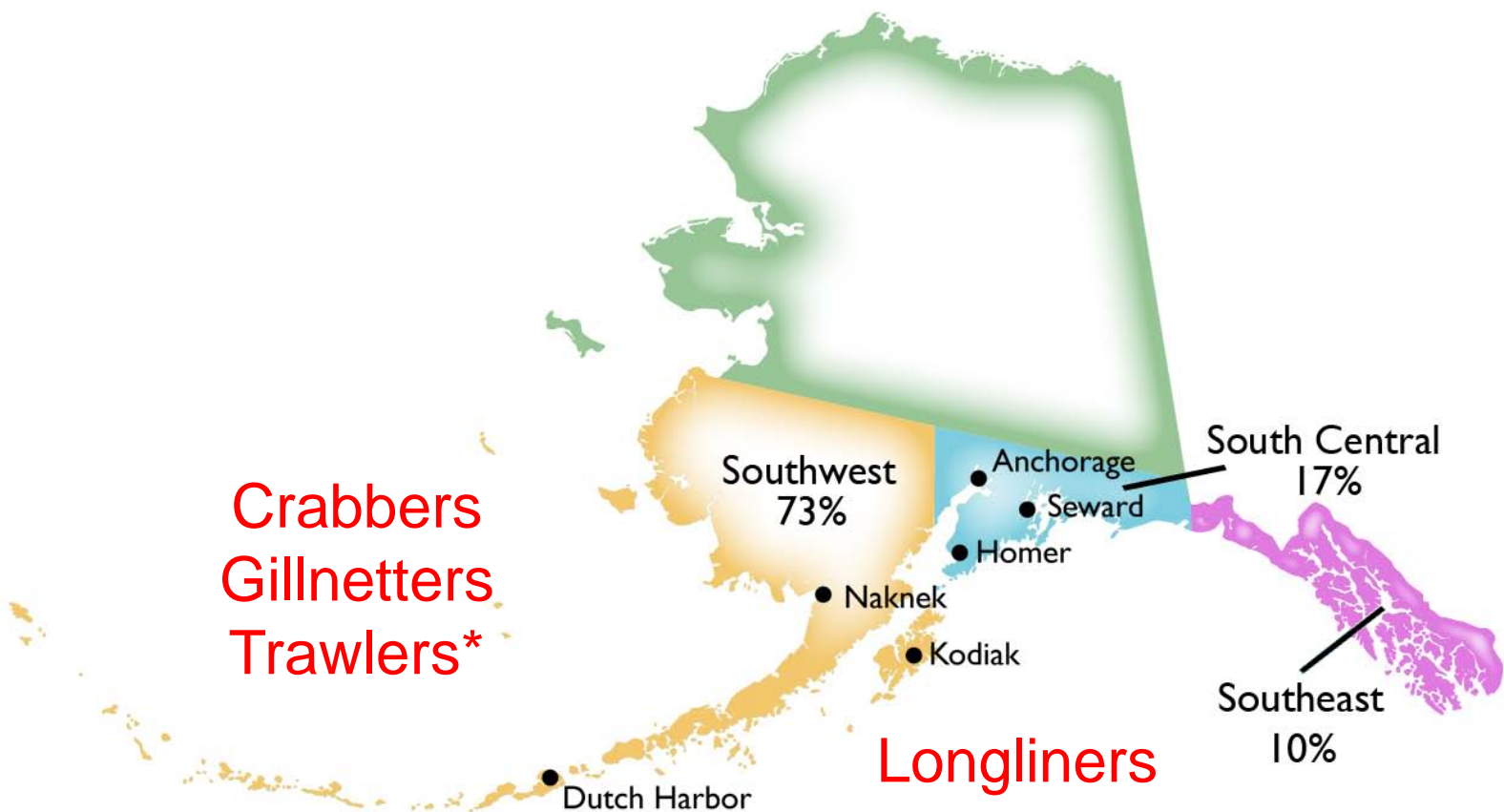
Purpose of this study: “Wearability”

- Measure perceptions of risks of falling overboard and beliefs about PFDs
- Evaluate new styles and types of PFDs
 - Are there new PFDs which overcome fishermen’s complaints?

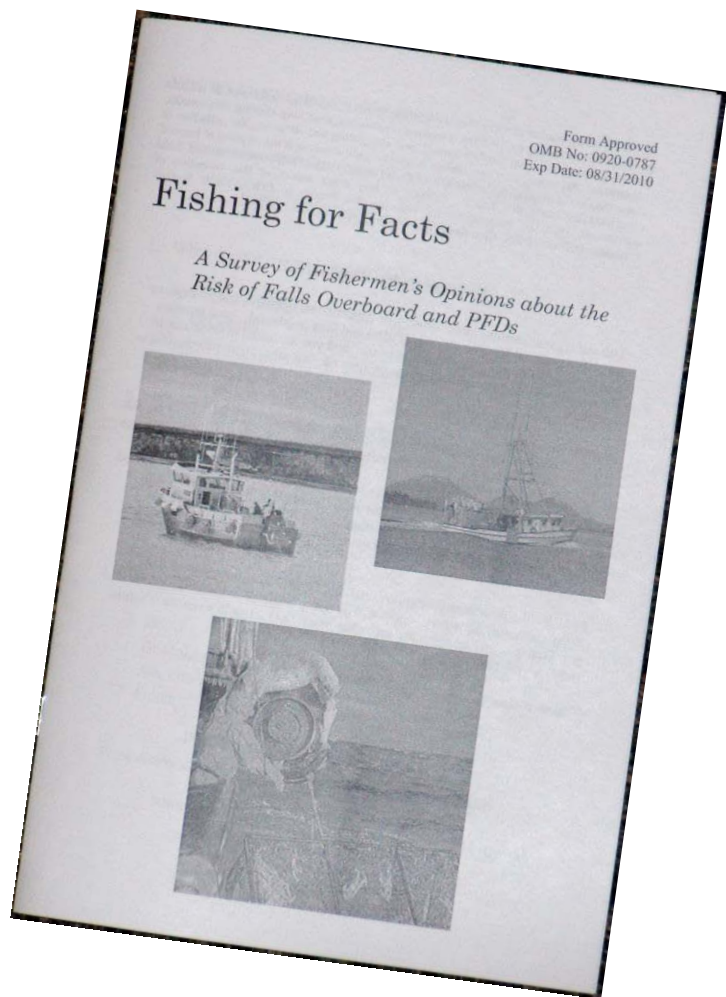




Falls Overboard by Region, Alaska, 1990-2005 (n=71)



Phase 1 Questionnaire



- Perceptions of risk
- Attitudes/beliefs about PFDs
- Experiences with falls overboard



Wearing PFDS...
2% shows weakness
83% smart thing to do
45% uncomfortable

How often do you wear a PFD?
19% always (0%-51%)
37% never (12%-64%)
Varied across fisheries



Phase 2 PFD Evaluations

- The six PFD models are randomly assigned to fishermen
- 216 fishermen will complete the PFD evaluations (54 on each gear type)
- Wear the PFD for one month
- Complete evaluation
 - day 1
 - day 30





PFDs Incorporated into Rain Gear



- Guy Cotten rain gear
- PFD built into suspenders
 - Auto inflate
 - Rubberized cover



- Stormy Seas inflatable
- Clips into Grundens bibs
 - Auto inflate
 - Lightweight, low profile



- Regatta rain gear
- PFD built into bibs
 - Foam in chest and back
 - High visibility

Stand-alone PFDs



Stearns inflatable PFD

- Auto inflate
- Low profile
- Less expensive



Stearns vest

- Foam buoyancy
- Mesh ventilation
- Less expensive



Mustang inflatable PFD

- Auto inflate
- Hydrostatic activation
- Rubberized cover



Phase 2 Response Rate
89% initial
68% after 30 days





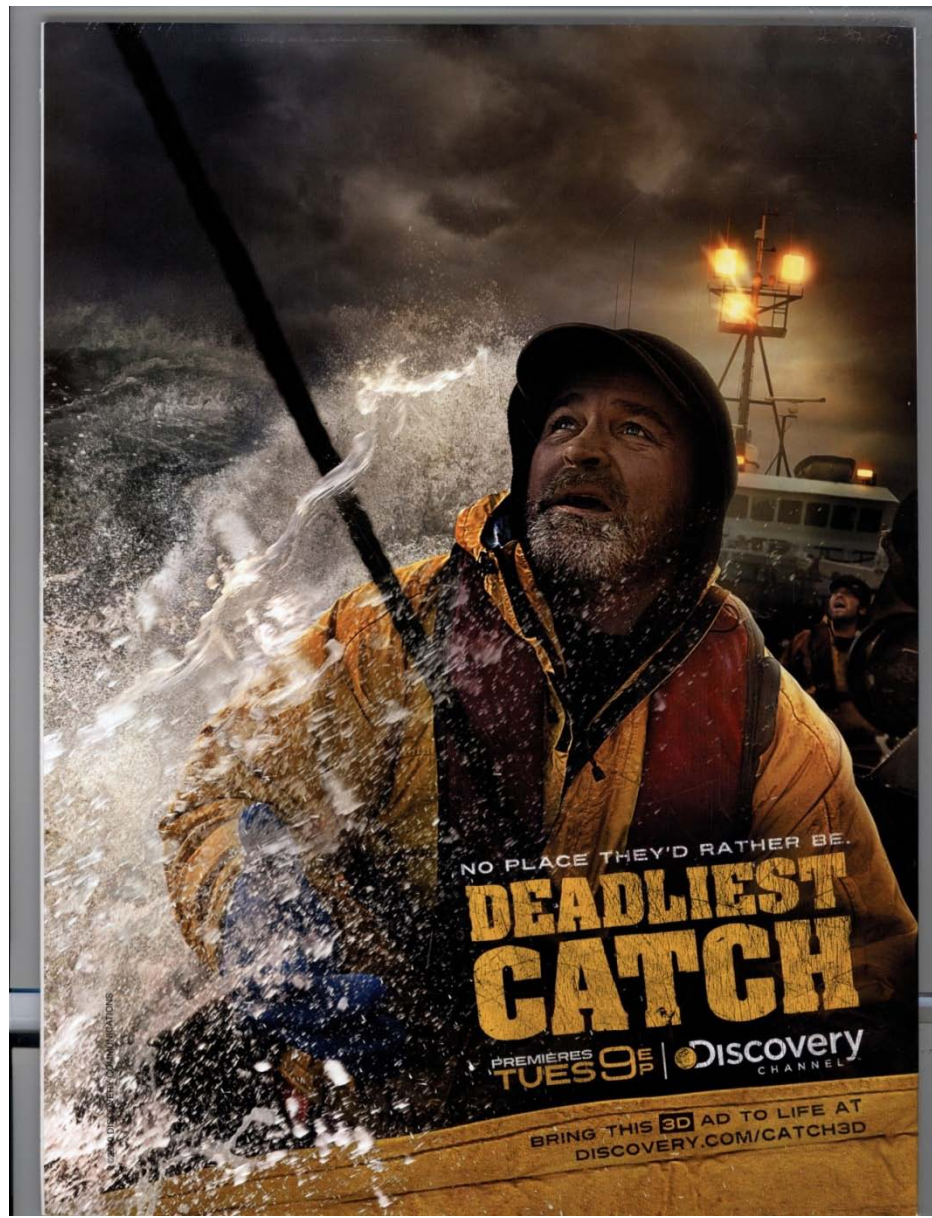
- Impossible to make “just one”
- Consult with fishermen!!
- Lots of concern over auto inflate
 - “I like mine because I don’t have to rely on inflation working”
- Incorporate other safety features
 - D-rings and straps for lifting, radar reflectors, PLBs, strobes, reflector tape
- Design like a football uniform





Unexpected findings

- Overwhelming desire to participate
- Did not know about the PFDs
- PFDs weren't available in local retail outlets
- Fishermen are **VERY** willing to provide input on work gear designed for them



An investigation of deck winch operation identified two major safety hazards:

1. no entanglement protection,
2. hydraulic controls out of reach of the winch.





NIOSH
E-stop
button

Purse seine winch



Recent Accomplishments

- E-Stop licensed to Emerald Marine
- Winch manufacturer committed that all new winches will have an E-stop
- 8 retrofit kits installed this summer





Aging Survival Equipment

Age of Survival Suits

**Does an older suit
provide adequate
protection?**

**54% >14yrs failed
pressure test**

**46% condemned (avg.
age 18 yrs.)**

**Failed seams & poor
fabric condition**



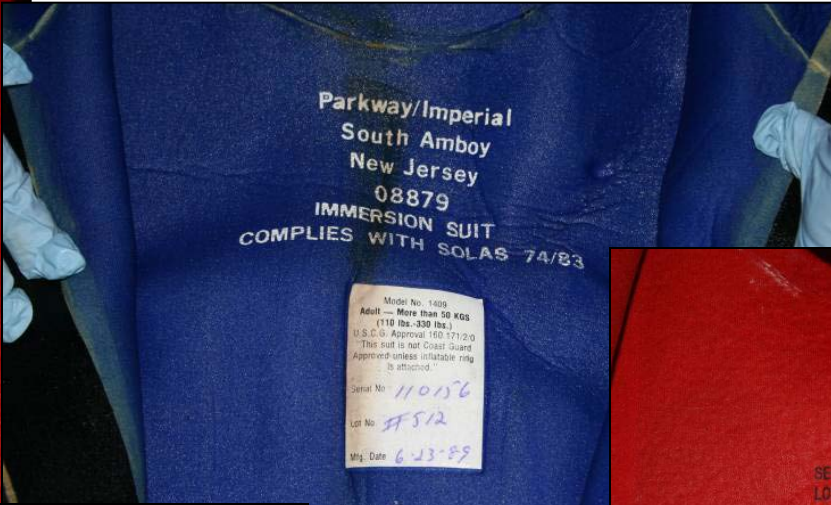


(NVIC) No 01-08

- Deterioration may not be detected
- Suits subjected to an air pressure test at intervals not exceeding three years
- More frequently for suits >10 years old

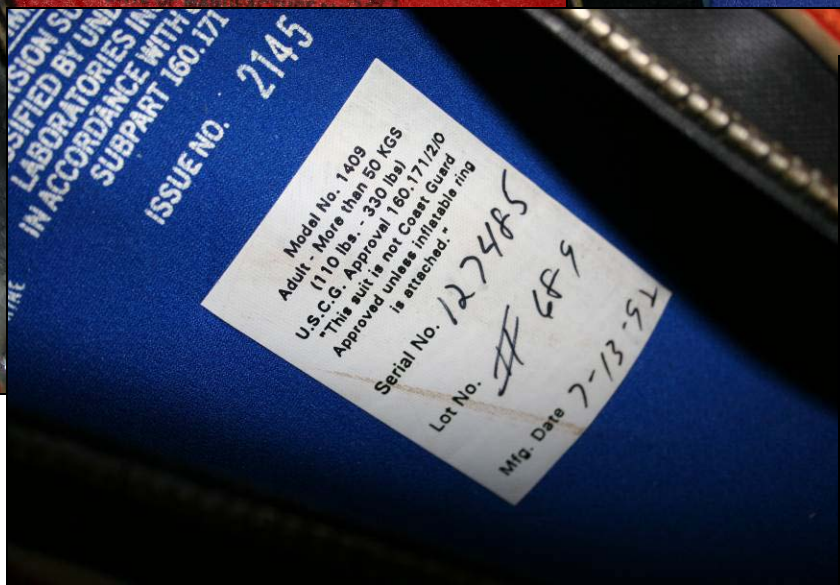
ALASKA PACIFIC

REGIONAL OFFICE



Model No. 1409
Adult - More than 50 KGS
(110 lbs.-330 lbs.)
U.S.C.G. Approval 160.171/2/0
This suit is not Coast Guard
Approved unless inflatable ring
is attached.

Serial No. 110156
Lot No. #512
Mfg. Date 6-23-89





Model Approaches

- **Larger seafood companies**
 - **Regular replacement**
 - E.g. 1000 suits in 4 years (American Seafood)
 - Replacement every 10 years (Trident Seafood)
 - **Annual Inspection**
 - **Annual Servicing**
- **United States Coast Guard**