

Commercial Fishing Vessel Safety and  
The National Marine Fisheries Service- United States Coast Guard  
Memorandum on Observer Safety

Report to the National Observer Program

National Marine Fisheries Service

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NMFS Office of Science and Technology

December 2014

## **Acknowledgements**

This project developed from a desire by the National Observer Program to follow up on a Worcester Polytechnic Institute (WPI) study on the effectiveness of the United States Coast Guard (USCG)- National Marine Fisheries (NMFS) 2004 Memorandum of Agreement on Observer Safety (MoA). The WPI study was conducted by a group of WPI students under the guidance of Jonathan Wendland and Jack Kemerer at the USCG, and Mike Tork with the NMFS Northeast Observer Program. They focused on the Northeast region of the United States with the intention that the WPI report would serve as a template for a national review. The NMFS National Observer Program (NOP) and National Observer Program Advisory Team (NOPAT) expressed interest in expanding the WPI report, and after discussions with the USCG, the NOP decided to move ahead with a national level analysis.

Thank you to Chris Rilling, Dennis Hansford, and Teresa Turk with the NOP for creating this project and providing information, advice, suggestions, and encouragement. Thank you to the NOPAT for providing information about regional observer programs and safety decal requirements, information about specific vessels and fisheries, and providing insightful comments on analyses.

Thank you to Jonathan Wendland, Jack Kemerer, Matthew Hooper, and Brad Soule at the USCG for providing data, answering questions, and responding to multiple data requests with patience.

Thanks to Jennifer M. Lincoln and Romy Mohelsky at the National Institute for Occupational Safety and Health (NIOSH) for providing data, answering questions, and providing advice on analyses.

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## Executive Summary

Commercial fishing is one of the most dangerous occupations in the United States due to hazardous working conditions that include adverse weather, vessel disasters, dangerous gear operations, and a working environment that can cause fatigue. Although commercial fishing vessel casualties have decreased in recent decades, due to changes in resource management decisions that ended derby style fishing seasons and emphasized crew and vessel risk mitigations, commercial fishing continues to have one of the highest occupational fatality rates in the nation.

The Magnuson-Stevens Fishery Conservation and Management Act, Marine Mammal Protection Act, Endangered Species Act, and other marine resource regulations authorize fisheries observers to collect data on board commercial fishing vessels for scientific, management, and compliance purposes; fisheries observers are indispensable to the effective stewardship of our nation's marine resources. The safety and health of fisheries observers while aboard commercial fishing vessels is a priority and the MSA's National Standard 10 requires that conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

Marine safety is a high priority for the United States Coast Guard (USCG) and the National Marine Fisheries Service (NMFS) and the two agencies have worked together to promote safety at sea. To improve observer safety, in 1998 NMFS issued a final rule (63 FR 27213; 5/18/1998) that required all commercial fishing vessels that carry observers to display a current safety decal issued within the past 2 years. A current safety decal provides proof that the vessel successfully passed a USCG dockside safety exam and is in compliance with the Commercial Fishing Industry Safety Act. In 2004, the USCG and NMFS signed a Memorandum of Agreement (MoA) to enhance compliance with this regulation and to mutually support fishing vessel safety; a NOAA-wide policy signed in December 2005 implemented the MoA.

The purpose of this report is to evaluate the effectiveness of both the safety decal requirement and the 2004 MoA to improve safety across all NMFS regions. The report includes analysis of data from the USCG on dockside safety exams, safety decal issuance, vessel losses, and data from the NIOSH Health on fatal events.

### *Dockside safety exams and safety decals*

- The number of dockside safety exams increased by 17% nationwide from 5,360 in 2002 to 6,281 in 2010. Nationwide, dockside safety exams increased after implementation of the 2004 MoA.
- The number of safety decals issued increased by 169% nationwide from 1,601 in 2002 to 4,310 in 2010. Safety decals increased after implementation of the 2004 MoA.
- The percent of all dockside safety exams that resulted in the issuance of a valid safety decal increased from 29.9% in 2002 to 68.6% in 2010 nationwide.

### *Vessel Losses*

- 78% of vessel losses occurred on vessels without a current safety decal, 1998 -2010.
- The number of vessel losses decreased significantly nationwide after implementation of the 2004 MoA<sup>1</sup>.
- 1,199 commercial fishing vessels were lost, 1998-2010.
- The majority of vessel losses occurred in the Southeast, Alaska, and the Northeast.

### *Fatal Events*

NIOSH maintains the Commercial Fishing Incident Database (CFID), a surveillance system for workplace fatalities in the commercial fishing industry in the United States. A review of the data from 2000-2010 (Lucas et al., 2014, p. 67-73) found that:

- 77% of fatal events caused by vessel losses occurred on vessels without a current safety decal.
- Fatal events decreased nationwide after implementation of the 2004 MoA.
- 545 commercial fishermen died while fishing in the U.S., 2000-2010.
- More than half of all fatalities (279, 51%) occurred after a vessel disaster. The Southeast is the only region in which the majority of fatal events were caused by falls overboard.
- Another 170 (31%) fatalities occurred when a fisherman fell overboard
- Another 56 (10%) fatalities resulted from an injury onboard.
- The remaining 40 (7%) fatalities occurred while diving or from onshore injuries.
- The majority of fatal events occurred in the Southeast, Northeast, and Alaska.

### *Fatal Events in Unobserved Fisheries*

- 63% of vessel-related fatal events occurred in fisheries without observer coverage (“unobserved”), 2000-2010.
- 86% of vessel-related fatal events in unobserved fisheries were on vessels without a current safety decal, 2000-2010.
- 56% of vessel-related fatal events in observed fisheries were on vessels without a current safety decal, 2000-2010.

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<sup>1</sup> Number of vessels do not include those that are state licensed

## Introduction

### Background

Commercial fishing is consistently one of the most dangerous occupations in the U.S. due to hazardous working conditions that include adverse weather, vessel disasters, dangerous gear operations, and a working environment that can cause fatigue. Over the past 40 years, commercial vessel losses and fatalities peaked in 1983 and had been reduced to their lowest numbers as of 2010 (Figure 1). Fishers and related fishing workers had the highest occupational fatality work injury rate in 2010 (BLS 2012) and have consistently had one of the highest occupational fatality work injury rates in recent decades.

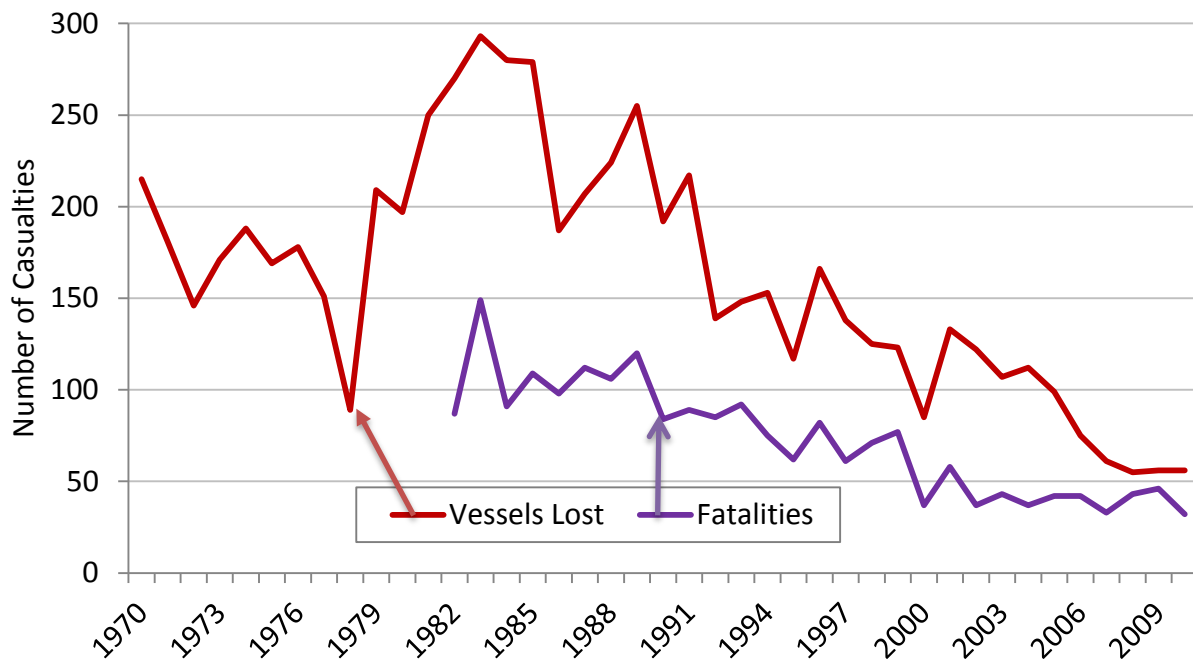


Figure 1. Number of commercial fishing vessel losses and fatalities, 1970-2010. Data from USCG.

Analysis of commercial fishing vessel casualties in the 1990s and 2000s showed the majority of fishing vessel fatalities occurred after a total vessel loss (vessel flooding, sinking, or capsizing) or fall overboard (Lincoln and Lucas 2010, USCG 2011), with the highest number of vessel losses and fatalities off Alaska, the Northeast, and the Southeast (Lincoln and Lucas 2010, USCG 2011). The following fisheries had the highest rates and numbers of fatalities in the country: Alaska - Bering Sea-Aleutian Island Pacific cod and flathead sole freezer trawl, state-wide salmon, Northeast:scallop and multi-species groundfish, Gulf of Mexico - shrimp, and West Coast - Dungeness crab (Lincoln and Lucas 2008, 2010).

Commercial fishing fatalities and vessel losses have declined since the early 1990s, likely the result of multiple factors including improved marine safety regulations such as the Commercial Fishing Industry Vessel Safety Act (CFIVSA) and new fishing management regulations such as quota-based systems which

reduce the “race to fish.” Improved vessel design, construction and gear, enhanced safety training, and safety programs tailored to problems in specific fishing fleets have also contributed to casualty reductions (Lincoln and Lucas 2010). Successful stakeholder collaborations between the fishing industry, federal agencies, state agencies, non-profits and advocacy groups have enabled these improvements.

Declines in fishing casualties in the 1990s are in part attributed to the CFIVSA, which required fishing vessels to have and maintain basic safety and survival equipment on board and complete safety training (Lincoln and Conway 1999). In 1992, the USCG began a voluntary dockside examination program to inspect vessels for compliance with CFIVSA safety regulations. A similar program was established in 1978 but terminated in the early 1980s due to budget cuts. A compliant vessel would be issued a safety decal valid for two years (Hiscock 2000). The examination covered such items as, but not limited to, life raft, hydrostatic release unit(s), emergency position indicating radio beacons (EPIRBs), and immersions suits.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), Marine Mammal Protection Act (MMPA), Endangered Species Act (ESA), and other marine resource regulations authorize fisheries observers to collect data on board commercial fishing vessels for scientific, management, and compliance purposes. The health and safety of fisheries observers while aboard commercial fishing vessels is a national priority, and the MSA’s National Standard 10 requires that conservation and management measures shall, to the extent practicable, promote the safety of human life at sea. To help improve observer safety, a final rule published in the Federal Register on May 18, 1998 (63 FR 27213) implemented measures to ensure the adequacy and safety of fishing vessels that carry observers. These measures (1) required that fishing vessels carrying observers must display a valid USCG safety decal issued within the last 2 years, (2) required that fishing vessels must allow visual examination of any item pertaining to safety or accommodations, and (3) encouraged observers to perform a pre-trip safety check to ensure all safety equipment is up-to-date .

For various reasons, including a shortage of USCG staff to perform dockside safety exams and a lack of NMFS enforcement personnel to enforce safety regulations, not all NMFS regions immediately complied with the May 1998 requirements. Thus, in 2004 the USCG and NMFS signed a MoA on Observer Safety to enhance compliance with existing NMFS and USCG safety requirements, including the safety decal requirement, on observed fishing vessels. At this time, NMFS also was working to clarify the 1998 requirements. On November 1, 2007, NMFS issued a final rule (72 FR 61815) that required the pre-trip safety check and clarified that if a vessel is required to carry an observer, but is unsafe, then that vessel is prohibited from fishing.

In 2010, students at the Worcester Polytechnic Institute (WPI) conducted an analysis of the effectiveness of the 2004 MoA on fishing vessel safety in USCG Districts 1 and 5 (roughly equivalent to the NMFS Northeast region). They found an increase in the number of dockside safety exams completed, number of safety decals issued, and the percentage of exams resulting in the issuance of a safety decal following implementation of the MoA in 2006 (WPI 2010). Additionally, there was a strong



relationship between safety decal status and vessel losses and fatalities - approximately 91% of vessel losses and 84% of fatal events<sup>2</sup> occurred on vessels without valid safety decals.

### Rationale and Objectives

The objective of this report is to update and expand the earlier WPI study to evaluate the effectiveness of the safety decal requirement across all six NMFS regions from 1998 through 2010 (Northeast<sup>3</sup>, Southeast, Northwest<sup>4</sup>, Southwest<sup>4</sup>, Alaska, and Pacific Islands) (Figure 2) from 1998 to 2010. In each NMFS region and overall this report analyzed trends in dockside safety exams, safety decal issuance, vessel losses, and fatal events before and after the 2004 MoA and before and after regional-specific safety decal implementation dates (if different from the MoA; see Table 1). It analyzed vessel losses and fatal events with safety decal status in each NMFS region, and incorporated information on fishery and compared fatal events with safety decal status in fisheries with and without observer coverage.

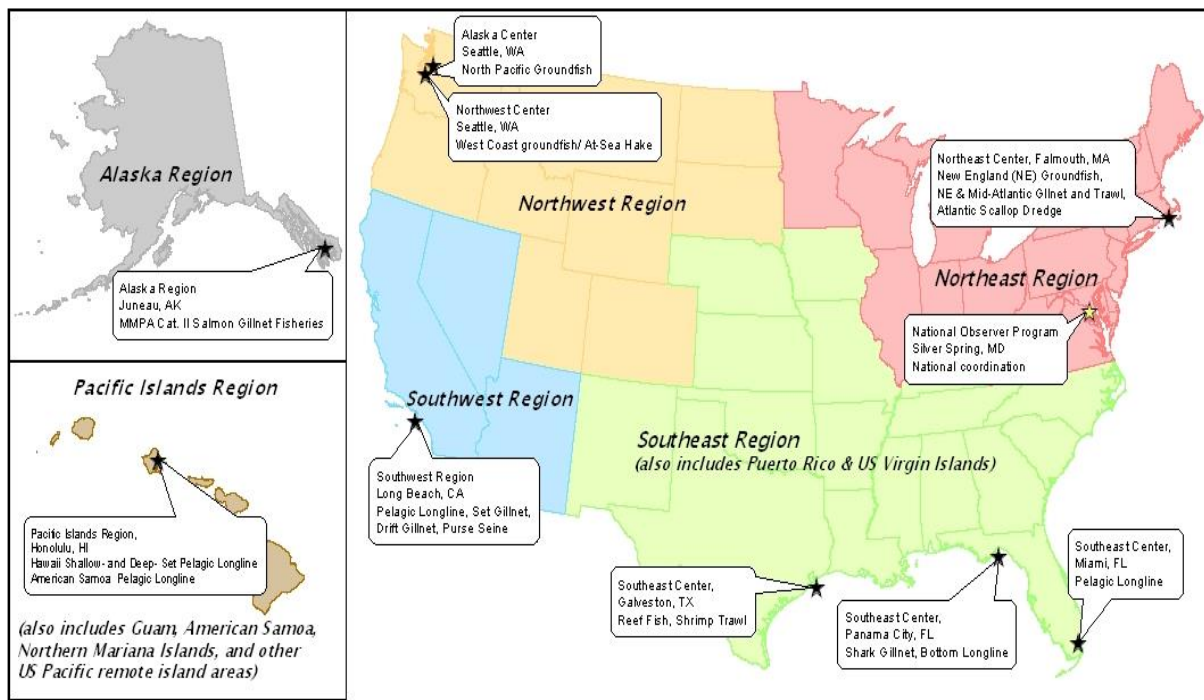


Figure 2. The six NMFS regions, with information about observer programs in each region.

<sup>2</sup> A fatal event is any incident in which one or more fatalities occurred.

<sup>3</sup> The Northeast Region has been renamed the Greater Atlantic Regional Fisheries Office (GARFO).

<sup>4</sup> The Northwest and Southwest regional offices were combined into the West Coast Regional Office (WCRO).

Table 1. NMFS regional observer programs, observed fisheries, and safety decal implementation date on observed fishing vessels.

NMFS Region	Observer Program	Fisheries Observed (not inclusive)	Safety decal required
Northeast	Northeast Fisheries	New England Groundfish trawl and sink gillnet; Mid-Atlantic coastal gillnet; NE & Mid-Atlantic small-mesh and large mesh trawl; Mid-Atlantic Ilex squid trawl; Atlantic sea scallop dredge	May 2006*
Southeast	Southeast Shrimp Trawl; Atlantic Pelagic Longline; Southeast Shark Driftnet; Shark Bottom Longline; Gulf of Mexico Reef Fish Fishery	Southeast & Gulf of Mexico (GOM) shrimp otter trawl; Atlantic, GOM, & Caribbean pelagic longline; Southeast shark and coastal teleost gillnet; Atlantic and GOM directed large coastal shark bottom longline; GOM reef fish	December 2005**
Northwest	West Coast Groundfish	West Coast groundfish limited entry; At-sea Hake mid-water trawl; state managed and open access fisheries	September 2001
Southwest	Southwest Region	California/Oregon pelagic drift gillnet; California pelagic longline; Southern California set gillnet; Southern California small-mesh drift gillnet	June 1998 <sup>†</sup>
Alaska	North Pacific Groundfish Fisheries	Bering Sea/Aleutian Islands and Gulf of Alaska groundfish trawl, longline and pot Fisheries;	June 1998
Alaska	Alaska Marine Mammal Observer Program	Southeast Alaska salmon drift gillnet fishery <sup>‡</sup>	2002 <sup>‡</sup>
Pacific Islands	Hawaii- and American Samoa-based Longline Fisheries	Hawaii-based pelagic longline fishery; American Samoa-based pelagic longline fishery	February 2004 (Hawaii-based fishery)- April 2006 (American Samoa-based fishery)

\* Closed area scallop vessels required decals in 2001.

\*\* Pelagic longline vessels required decals in June 1998.

† Observer coverage not continuous due to funding gaps.

‡ Coverage rotates among fisheries; since 2000 observers were placed on alternative platforms.

By taking a detailed look by NMFS region at vessel losses and fatal events with safety decal status this analysis also expanded upon other previous research by the USCG and National Institute of Occupational Safety and Health (NIOSH). The USCG's report *Analysis of Fishing Vessel Casualties: A Review of Lost Fishing Vessels and Crew, 1992-2010* summarized the number of vessel losses and vessel-related fatalities on commercial fishing vessels with and without current safety decal nationwide, but did not report regional trends or incorporate fishery information. NIOSH analyzed vessel-related fatal events and safety decal status on the West Coast from 2000-2006 (Lincoln and Lucas 2008) but did not include any other regions or report fishery-specific decal status in fatal events. Additionally, our analyses are specific to NMFS regions, which are different than both USCG districts and NIOSH regions.

The USCG provided dockside safety exam, safety decal issuance, and vessel loss data. These data included records from all commercial fishing vessels. NIOSH provided fatal event data that included fishery-specific information and fatal incident type, which enabled us to distinguish between commercial fishing vessel fatal events in fisheries with and without observer coverage.

## Methods and Results

### Dockside Safety Exams and Safety Decals

The number of dockside safety exams completed and safety decals issued may be two indicators of the effectiveness of the NMFS safety decal requirement. These data for all commercial fishing vessels in NMFS regions from 2002-2010 were obtained from the USCG's Marine Information for Safety and Law Enforcement (MISLE) database (see Appendix; Dockside safety exams and safety decal issuance). Analysis of dockside safety exam data was restricted to records from 2002 and later as earlier data through 20 were considered unreliable (WPI 2010). Not all safety exams resulted in an initial issuance of a safety decal, and follow-up exams may have been required. Due to inconsistencies in data entry into the MISLE database, these records include initial exams (first exam for initial decal issuance or first exam for decal reissuance of an expiring or expired decal), as well as partially completed exams and follow-up exams (to correct a previously noted deficiency). The following analysis examines both the number of safety exams conducted and the number of safety decals initially issued as a result. Trends nationwide and by NMFS region were analyzed for significant differences in variance (ANOVA) before (2002-2005) and after implementation of the MoA (2006-2010)<sup>5</sup>. Additionally, if the regional safety decal implementation date differed from the MoA implementation date, such as in the Northeast (regional implementation in May 2006, not to be confused with the MoA implementation date; see Table 1), these trends were also analyzed for significant differences in variance (ANOVA). Significance was determined by p-values < 0.10.

Nationwide the number of dockside safety exams conducted annually increased by 53%, from 5,360 in 2002 to 6,281 in 2010 (Figure 3). The number of dockside safety exams conducted in the Pacific Islands increased from 27 in 2002 to 215 in 2010, and exams in the Northeast nearly doubled, from 1,174 in 2002 to 2,019 in 2010. The other NMFS regions also experienced increases.

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<sup>5</sup> Although the MoA was signed in December 2004, it was not implemented until the issuance of a NOAA-wide policy in December 2005.

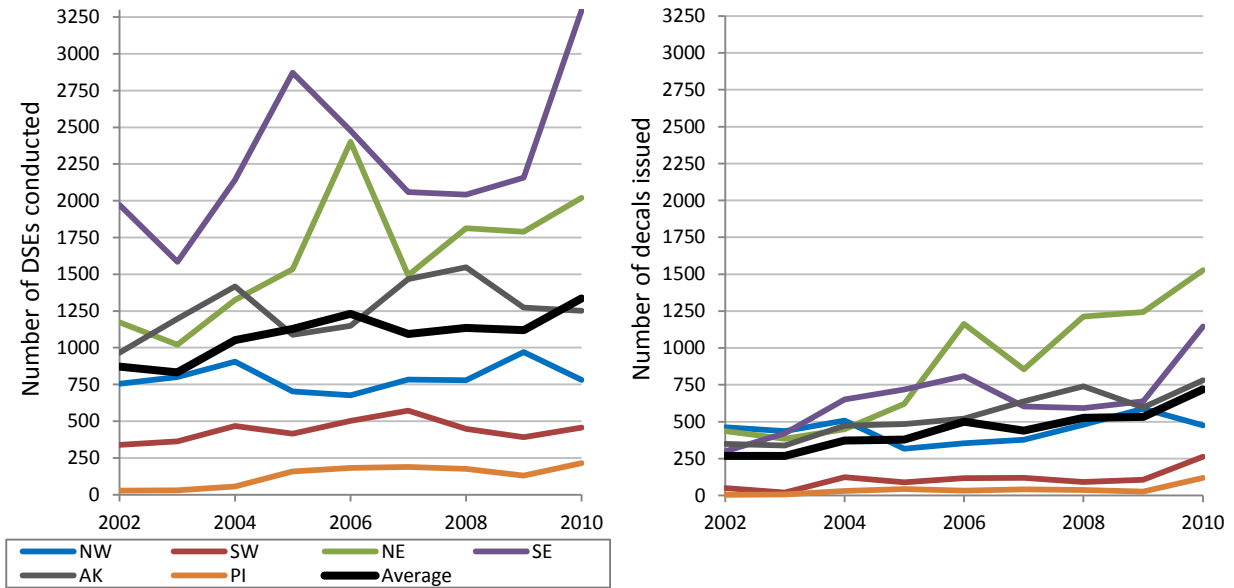


Figure 3. Number of dockside safety exams conducted and decals issued, 2002-2010. Data from USCG.

Nationwide, there was no significant difference between the number of dockside safety exams conducted from 2006 through 2010 (average of  $5,823 \pm 393$ ) and those conducted from 2002-2005 (average of  $5,367 \pm 379$  (ANOVA,  $F=6.945$ ,  $df=1$ ,  $p<0.034$ ). Regionally, the number of safety exams after implementation of the MoA increased significantly in the Northeast 2006 through 2010 and Pacific Islands 2006 through 2010.

The number of dockside safety exams conducted before and after regional-specific implementation (not to be confused with implementation of the MoA) of the safety decal requirement were evaluated for the Northeast and Southeast (sufficient data were not available to evaluate trends in the regions that required the safety decal in 2004 or earlier; see Table 1). The in the Northeast increased significantly after implementation of the decal requirement (2007-2010 versus 2002-2005, ANOVA,  $F=11.166$ ,  $df=1$ ,  $p<0.016$ ), whereas the number of dockside safety exams in the Southeast did not (2006 through 2010 versus 2002-2005, ANOVA,  $F=0.546$ ,  $df=1$ ,  $p<0.484$ ).

Stronger trends were seen in the numbers of safety decals issued (Figure 4). Nationwide, the number of decals issued increased from 1,601 in 2002 to 4,310 in 2010 (a 169% increase). The number of safety decals issued also increased significantly after implementation of the 2004 MoA (ANOVA,  $F=13.807$ ,  $df=1$ ,  $p<0.007$ ). The number of safety decals issued increased significantly, from an average of  $472 \pm 102$  before implementation of the MoA (2002-2005) to  $1,200 \pm 240$  after implementation of the MoA (2006-2010) in the Northeast (ANOVA,  $F=31.471$ ,  $df=1$ ,  $p<0.001$ ), while they did not increase significantly in the Southeast. The number of safety decals issued also increased significantly, from an average of  $411 \pm 78$  before implementation of the MoA (2002-2005) to  $655 \pm 106$  after implementation of the MoA (2006-2010) in Alaska (ANOVA,  $F=7.939$ ,  $df=1$ ,  $p<0.034$ ).

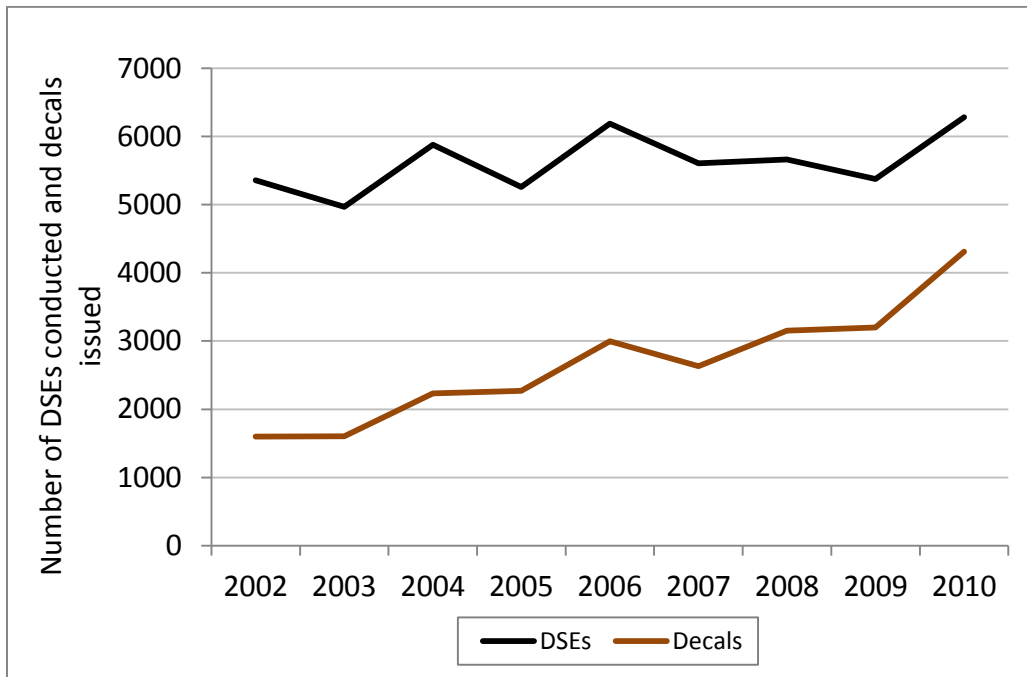


Figure 4. Total number of dockside safety exams (DSEs) conducted and safety decals issued nationwide, 2002-2010. Data from USCG.

The number of safety decals issued before and after regional-specific implementation were evaluated for the Northeast and Southeast (sufficient data were not available to evaluate trends in the regions that required the safety decal in 2001 or earlier; see Table 1). The number of safety decals issued increased significantly after implementation of the regional decal requirement in the Northeast (2007-2010 versus 2002-2005, ANOVA,  $F=25.083$ ,  $df=1$ ,  $p<0.002$ ), while they did not in the Southeast.

The percentage of dockside safety exams conducted that resulted in decals issued increased from 31% in 2002 to 54% in 2010 (Figure 5). The percentage of dockside safety exams conducted that resulted in decals issued increased significantly after implementation of the 2004 MoA, with an average of  $45.7\% \pm 5.6$ , compared to before implementation, which had an average of  $32.9\% \pm 2.0$  (ANOVA,  $F=18.297$ ,  $df=1$ ,  $p=0.004$ ).

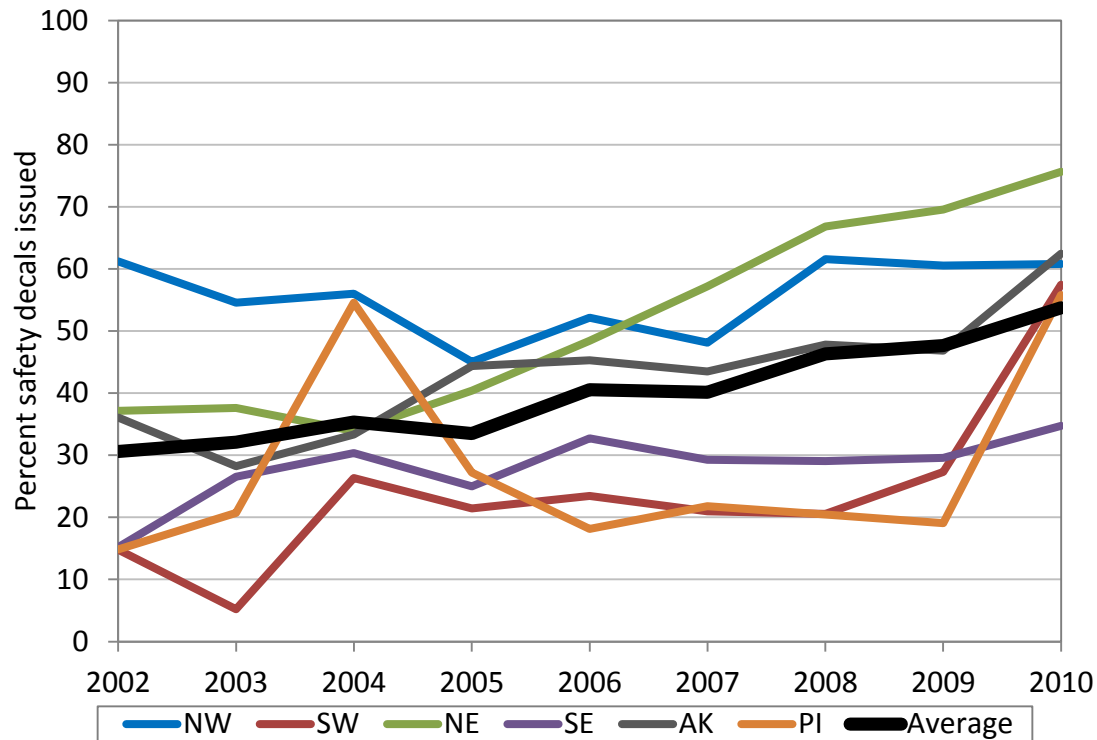


Figure 5. Percent safety decals issued of dockside safety exams conducted, 2002-2010. Data from USCG.

In summary, the number of dockside safety exams, the number of safety decals issued, and percent of exams that resulted in a safety decal being issued increased significantly across all NMFS regions from 2002-2010. Although these data are not normalized by fleet size, USCG records of documented commercial fishing vessels indicate that the number of commercially active fishing vessels decreased in recent years, from 24,332 in 1997 to approximately 20,000 in 2010. The USCG reports that increased dockside safety exams may be due in part to increased availability of USCG personnel to conduct exams (USCG 2011). As a result a greater number of commercial fishing vessels may be voluntarily taking dockside safety exams even though they are not required to have a safety decal (i.e. because they are not participants in a fishery with observer coverage).

### Vessel Losses

Decreases in vessel losses over time may be another indication that the safety decal requirement or other safety improvements in the industry are having a positive effect on fishing vessel safety. To determine whether a safety decal may contribute to fishing vessel safety, this report examined the number of vessel losses occurring on vessels with and without a current safety decal and the number of vessel losses that occurred before and after safety decals were required on observed fishing vessels. A vessel loss (“vessel loss”) is defined as an incident that causes the crew to abandon ship and the vessel to be taken out of service. Common causes of vessel loss include flooding, sinking, capsizing,

fire/explosion, or grounding. Vessel loss data for all commercial fishing vessels from 1998 through 2010 were obtained from the USCG’s MISLE database. These data include federally registered commercial fishing vessels (with a USCG certificate of documentation) and state-registered commercial fishing vessels. Additional data on vessel losses from 1992-1997 in Alaska and the Southwest was taken from USCG 2011.

Trends in vessel losses nationwide and by NMFS region were analyzed for significant differences in variance (ANOVA) before (2001-2005) and after implementation of the MoA (2006-2010). Additionally, since most regional safety decal implementation dates differed from the MoA implementation date, such as in Alaska (regional implementation of June 1998; see Table 1), vessel loss numbers were also analyzed for significant differences in variance (ANOVA) before and after regional implementation. Significance was determined by p- values < 0.10.

A total of 1,199 commercial fishing vessels were lost from 1998 through 2010. The Southeast region experienced the greatest number of vessel losses, 432, accounting for 36% of all losses from 1998 through 2010 (Figure 6). Alaska and the Northeast had the second and third most vessel losses with 256 (21.4% nationwide) and 249 (20.8% nationwide), respectively. Nationwide, vessel losses decreased 54%, from 124 in 1998 to 56 in 2010. All NMFS regions experienced decreases in vessel losses from 1998 through 2010.

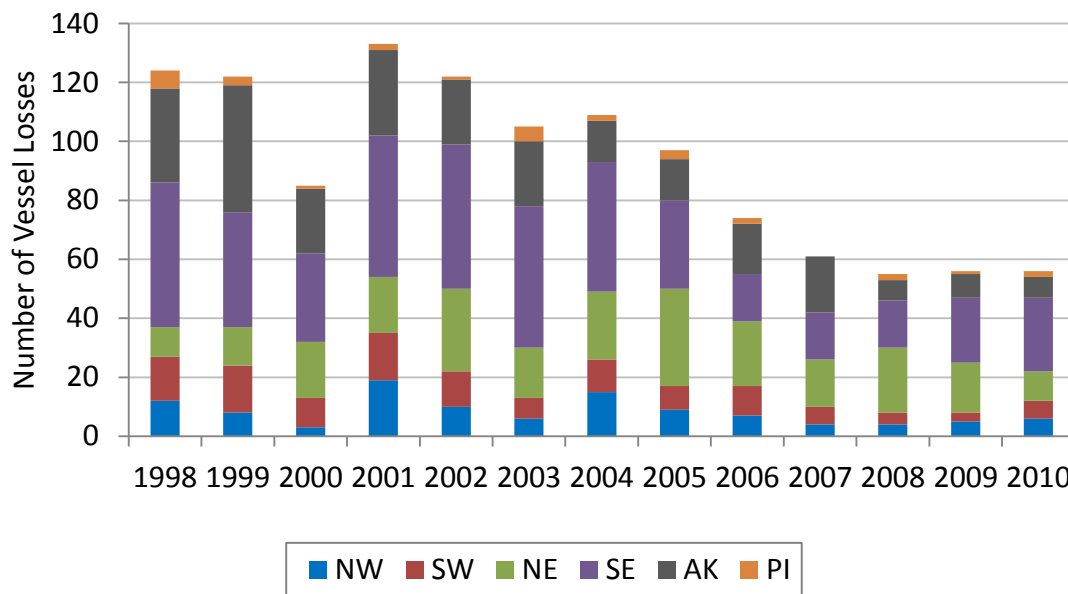


Figure 6. Number of vessels losses, 1998-2010. Data from USCG.

To evaluate the effectiveness of the safety decal on vessel losses, trends immediately before and after regional implementation of the safety decal requirement, and trends before and after implementation of the 2004 MoA, were analyzed for each NMFS region. Vessel losses dropped significantly after regional implementation in the Southeast (2006 through 2010 versus 2001-2005, ANOVA,  $F=37.872$ ,  $df=1$ ,  $p<0.000$ ), Southwest (1999-2004 versus 1992-1997, ANOVA,  $F=6.882$ ,  $df=1$ ,  $p<0.025$ ), Alaska (1999-

2004 versus 1992-1997, ANOVA,  $F=4.506$ ,  $df=1$ ,  $p<0.060$ )<sup>6</sup> and the Northeast (2007-2010 versus 2002-2005, ANOVA,  $F=4.553$ ,  $df=1$ ,  $p<0.077$ ).

Vessel losses declined significantly after implementation of the 2004 MoA nationwide, from  $113.2 \pm 14.3$  from 2001-2005 to  $60.4 \pm 8.0$  from 2006-2010, (ANOVA,  $F=52.109$ ,  $df=1$ ,  $p<0.000$ ) (Figure 7) and in all regions except the Northeast and Pacific Islands.

In summary, vessel losses decreased significantly nationwide, and across most NMFS regions, both after regional-specific decal requirements were implemented, and after the 2004 MoA was implemented. USCG analysis of vessel losses nationwide from 1992-2010 indicates that vessel losses have been declining since 2000, with significantly fewer vessel losses in 2000, 2006, 2007, 2008, 2009, and 2010 compared to the base period of 1992-1999 (USCG 2011). It is possible that the safety decal requirement had a positive effect on commercial fishing vessel safety and contributed to reductions in vessel losses. Other possible factors that could have contributed to reductions in vessel losses include: increased safety due to greater presence of USCG vessels and aircraft, increased emphasis on safety, decreased numbers of operating vessels due to Hurricanes Katrina and Rita, high fuel prices, and changes in fisheries management (USCG 2011). Vessel loss numbers are not normalized by commercial fishing fleet size, vessel length, hull material, or age due to the exclusion of state-registered vessels and may not be representative of vessel loss rates. USCG data indicates that vessel losses occur most often on longer vessels, on vessels between 11 and 30 years of age, and on wooden vessels (USCG 2011).

Overall, 77.6% of all vessel losses from 1998 through 2010 occurred on vessels without a current safety decal (Expired + None in Table 2). Vessel losses occurred on vessels without decals significantly more often than on vessels with decals nationwide (ANOVA,  $F=47.480$ ,  $df=1$ ,  $p<0.000$ ) and in all regions except for the Pacific Islands (Figure 8). The percentage of vessel losses from 1998 through 2010 on vessels without current safety decals ranged from 50% (15 of 30 losses) in the Pacific Islands to 84.3% (91 of 108 losses) in the Northwest. USCG analysis of vessel losses from 1992-2010 also found that the majority (79%) of vessel losses occurred on commercial fishing vessels without a current safety decal (USCG 2011).

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<sup>6</sup> Data 1992-1997 obtained from USCG 2011.



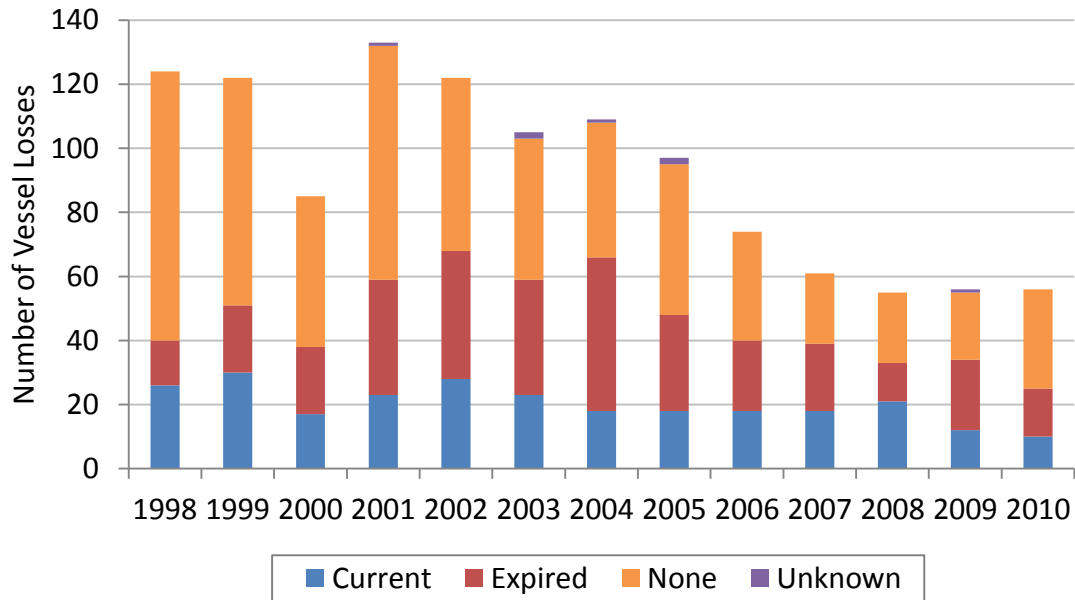


Figure 7. Number of vessel losses 1998-2010 with safety decal status. Data from USCG.

Table 2. Vessel losses by safety decal status, all NMFS regions, 1998-2010. Data from USCG.

Decal status	NW		SW		NE		SE		AK		PI		All	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Current	17	15.7	23	18.5	66	26.5	91	21.1	51	19.9	14	46.7	262	21.9
Expired	27	25.0	29	23.4	55	22.1	151	35.0	70	27.3	6	20.0	338	28.2
None	64	59.3	71	57.3	124	49.8	189	43.8	135	52.7	9	30.0	592	49.4
Unknown	0		1	0.8	4	1.6	1	0.2	0		1	3.3	7	0.6
<b>TOTAL</b>	<b>108</b>		<b>124</b>		<b>249</b>		<b>432</b>		<b>256</b>		<b>30</b>		<b>1199</b>	

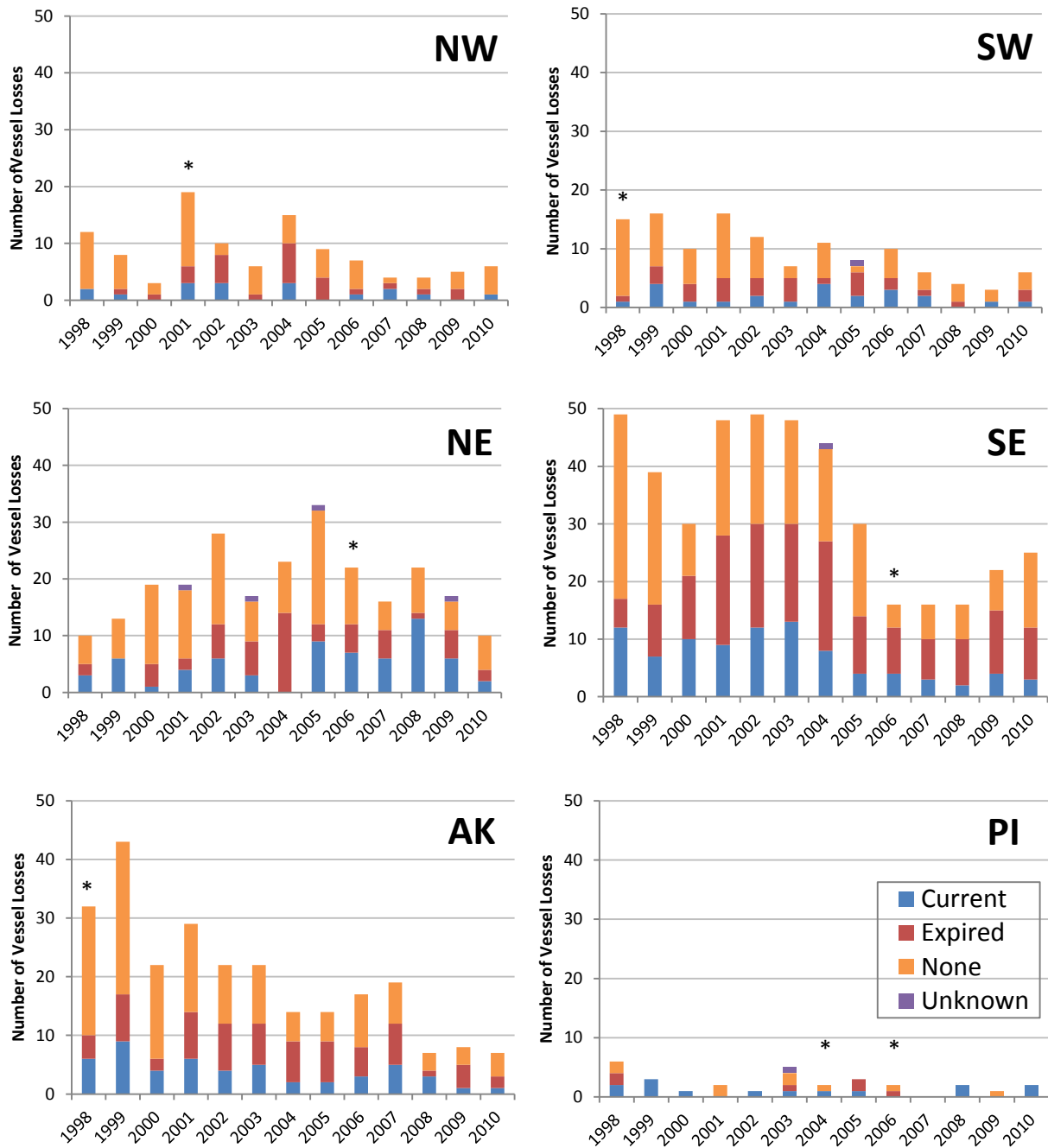


Figure 8. Vessel losses with safety decal status by NMFS region, 1998-2010. Asterisks indicate year when the regional-specific safety decal requirement was implemented for observed fishing vessels: NW= Sept. 2001; SW= June 1998; NE= May 2006; SE= December 2005; AK= June 1998; PI= Feb. 2004 (Hawaii) and Apr. 2006 (American Samoa). Data from USCG.

It again should be noted that these vessel loss numbers are not normalized by the number of commercial fishing vessels that have safety decals. Without precise commercial fishing fleet numbers and safety decal information, one cannot make specific conclusions about the specific effect of the safety decal on vessel losses.

## Vessel-Related Fatal Events

Decreases in fatal events over time may be an indication that the safety decal requirement or other safety improvements in the commercial fishing industry are having a positive effect on safety. To determine whether the safety decal requirement is having a positive effect on reducing commercial fishing vessel fatalities, This report analyzed the total number of vessel loss-related fatal incidents on vessels with and without a current safety decal and before and after the safety decal was required. This report also investigated differences between vessels in fisheries with observer coverage (“observed”) and vessels in fisheries without observer coverage (“unobserved”). Fatal event data for all commercial fishing vessels 2000-2010 (Figure 9) were obtained from the NIOSH Commercial Fishing Incident Database. NIOSH fatal event data included incident type (i.e., vessel loss, fall overboard, on-board injury, onshore injury, diving injury, or other) and fishery. This report primarily focused its analyses on fatal events, and specifically on fatal events resulting from vessel losses, which are both more representative of overall vessel safety than individual fatalities and other fatal incident types. Additionally, the majority of fatal incidents occur from vessel loss-related events (Lincoln and Lucas 2010, USCG 2011).

This report analyzed trends in vessel loss-related or “vessel-related” fatal events nationwide and by NMFS region for significant differences in variance (ANOVA) before (2001-2005) and after implementation of the MoA (2006-2010). Because most regional safety decal implementation dates differed from the MoA implementation date, such as in Alaska (groundfish fishery implementation in June 1998; see Table 1), vessel-related fatal event numbers were also analyzed for significant differences in variance (ANOVA). Numbers of vessel-related fatal events that occurred on vessels with and without current safety decals, and in observed and unobserved fisheries, were analyzed for significance in variance (ANOVA). Significance was determined by p- values < 0.10.

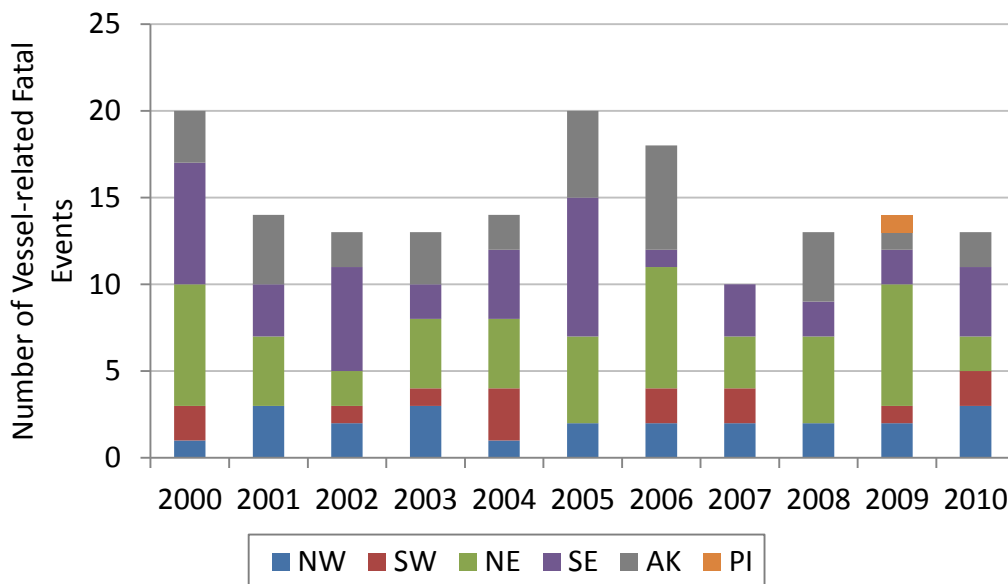


Figure 9. Vessel-related fatal events 2000-2010 by NMFS region. Data from NIOSH.

Similar to vessel losses, the majority of all fatal events from 2000 through 2010 occurred in the Southeast (35%, 148 events); the Northeast (24.6%, 104 events); and Alaska (23.5%, 99 events) (Table 3, Figure 9). The Northeast had the majority of vessel-related fatal events with 50 (30.9%), followed by the Southeast with 42 (25.9%), and Alaska with 32 (19.8%). Nationwide, all fatal events decreased by 31% from 49 in 2000 to 34 in 2010 and vessel-related fatal events decreased by 35% from 20 in 2000 to 13 in 2010.

**Table 3. Fatal events by NMFS region, 2000-2010. Data from NIOSH.**

		NW	SW	NE	SE	AK	PI	ALL
2000	All events	5	3	13	20	7	1	49
	Vessel-related	1	2	7	7	3		20
2001	All events	3		12	13	9	1	38
	Vessel-related	3		4	3	4		14
2002	All events	4	3	3	16	10		36
	Vessel-related	2	1	2	6	2		13
2003	All events	5	1	9	15	13		43
	Vessel-related	3	1	4	2	3		13
2004	All events	2	4	7	14	10	1	38
	Vessel-related	1	3	4	4	2		14
2005	All events	4		8	14	10	1	37
	Vessel-related	2		5	8	5		20
2006	All events	2	2	14	11	9		38
	Vessel-related	2	2	7	1	6		18
2007	All events	4	2	6	9	12		33
	Vessel-related	2	2	3	3			10
2008	All events	4	2	7	12	8		33
	Vessel-related	2		5	2	4		13
2009	All events	6	3	15	9	8	2	43
	Vessel-related	2	1	7	2	1	1	14
2010	All events	3	3	10	15	3		34
	Vessel-related	3	2	2	4	2		13
TOTAL	All events	42	23	104	148	99	6	422
	Vessel-related	23	14	50	42	32	1	162

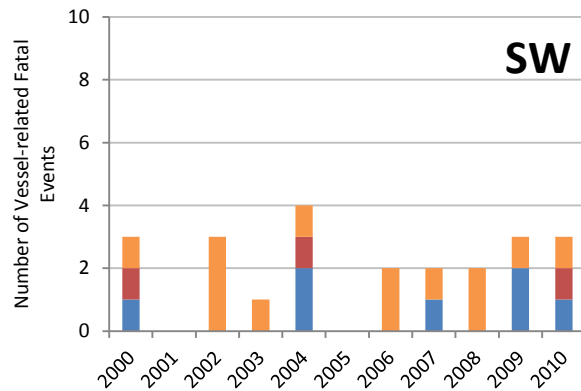
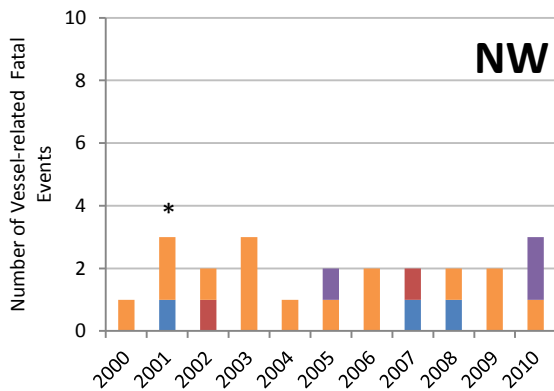
Nationwide, all fatal events and vessel-related fatal events decreased slightly from 2006 through 2010 after implementation of the MoA, compared through 2001-2005, but differences were not statistically significant (all fatal events: ANOVA,  $F=0.931$ ,  $df=1$ ,  $p<0.363$ ; vessel-related fatal events: ANOVA,  $F=0.424$ ,  $df=1$ ,  $p<0.533$ ). The Southeast was the only region to experience a significant decline in all fatal events following implementation of the MoA, from an average of  $14.4 \pm 1.1$  from 2001-2005 to  $11.1 \pm$

2.5 from 2006 through 2010 (ANOVA,  $F=6.827$ ,  $df=1$ ,  $p<0.031$ )<sup>7</sup>. The Southeast also experienced a decline, although not significant, in vessel-related fatal events from an average of  $4.6 \pm 2.4$  from 2001-2005 to  $2.4 \pm 1.1$  from 2006 through 2010 (ANOVA,  $F=3.408$ ,  $df=1$ ,  $p<0.102$ ). Similarly, there were no significant differences before and after regional-specific safety decal implementation in the Northeast or Pacific Islands. (Sufficient data were not available to evaluate trends in the regions that required the safety decal in 2001 or earlier; see Table 1).

A total of 76.5% of vessel-related fatalities occurred on vessels without a safety decal or with an expired safety decal (Table 4). Vessel-related fatal events occurred on vessels without decals significantly more often than on vessels with decals nationwide (ANOVA,  $F=38.648$ ,  $df=1$ ,  $p<0.000$ ) and in all regions except for the Pacific Islands and Southwest (Figure 10).

**Table 4. Vessel-related fatal events by safety decal status, 2000-2010. Data from NIOSH.**

Decal status	NW		SW		NE		SE		AK		PI		All	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Current	3	13.0	5	35.7	15	30.0	1	2.4	7	21.9	1	100	32	19.8
Expired	2	8.7	2	14.3	9	18.0	13	30.9	10	31.2			36	22.2
None	15	65.2	7	50.0	24	48.0	28	66.7	14	43.8			88	54.3
Unknown	3	13.0			2	4.0			1	3.1			6	3.7
<b>TOTAL</b>	<b>23</b>		<b>14</b>		<b>50</b>		<b>42</b>		<b>32</b>		<b>1</b>		<b>162</b>	



<sup>7</sup> USCG data shows a significant decrease in fatal events after implementation of the 2004 MoA (2001-2005 versus 2006-2010) for Alaska (ANOVA,  $F=11.172$ ,  $df=1$ ,  $p<0.010$ ) and the Pacific Islands (ANOVA,  $F=4.571$ ,  $df=1$ ,  $p<0.065$ ).

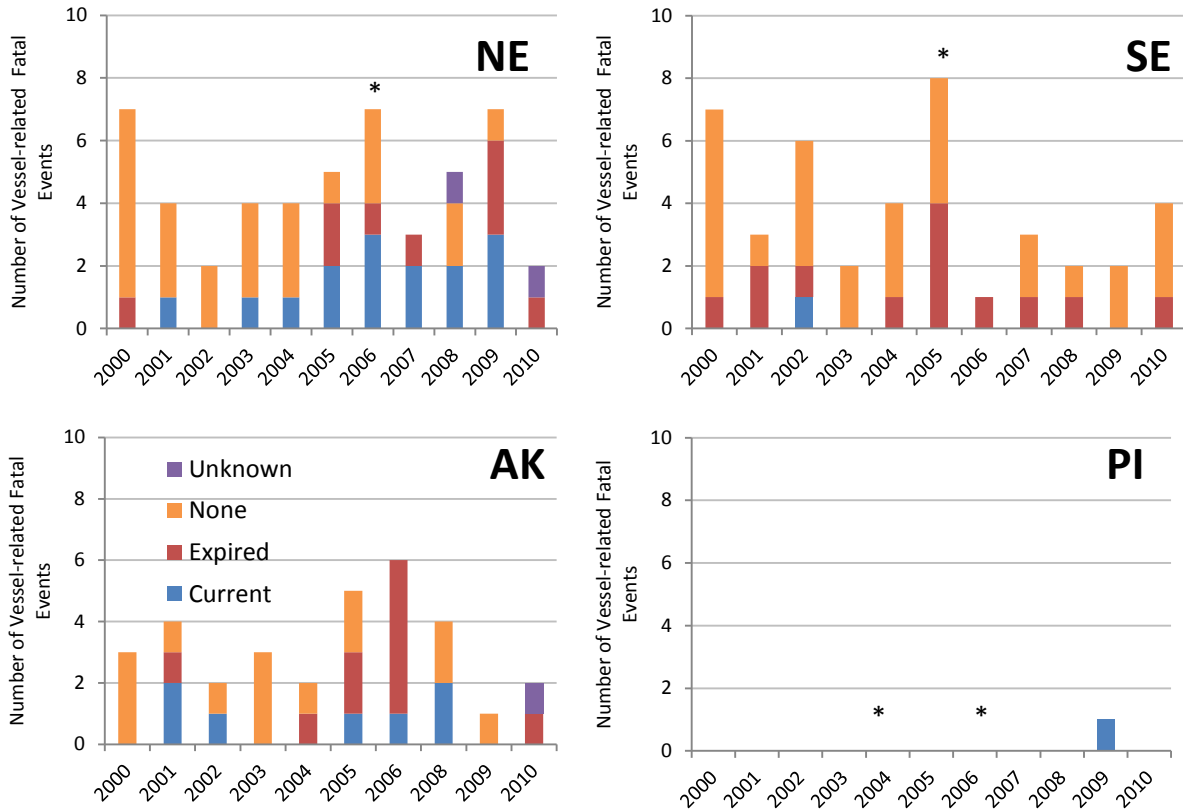


Figure 10. Vessel-related fatal events with safety decal status by NMFS region, 2000-2010. Asterisks indicate year when safety decal required for observed fishing vessels: NW= Sept. 2001; NE= May 2006; SE= December 2005; PI= Feb. 2004 (Hawaii) and Apr. 2006 (American Samoa). Alaska and Southwest required decals in June 1998.

### Vessel-Related Fatal Events in Observed and Unobserved Fisheries

NIOSH data included information about the fishery in which each vessel was participating at the time of the fatal event. Fish species, gear type, location, and date were used to determine whether the vessel was in an observed fishery. For the purposes of this analysis, a vessel was listed as “observed” if it was in a fishery with observer coverage at the time of the fatal event. This does not imply the vessel carried an observer at the time of the fatal event or during the corresponding fishing season or year. Vessel-related fatal events occurred significantly more often on vessels in unobserved fisheries than in observed fisheries nationwide (Figure 11), accounting for 63% of vessel-related fatal events from 2000 through 2010 (ANOVA,  $F=24.853$ ,  $df=1$ ,  $p<0.000$ ). The remainder occurred in observed fisheries.

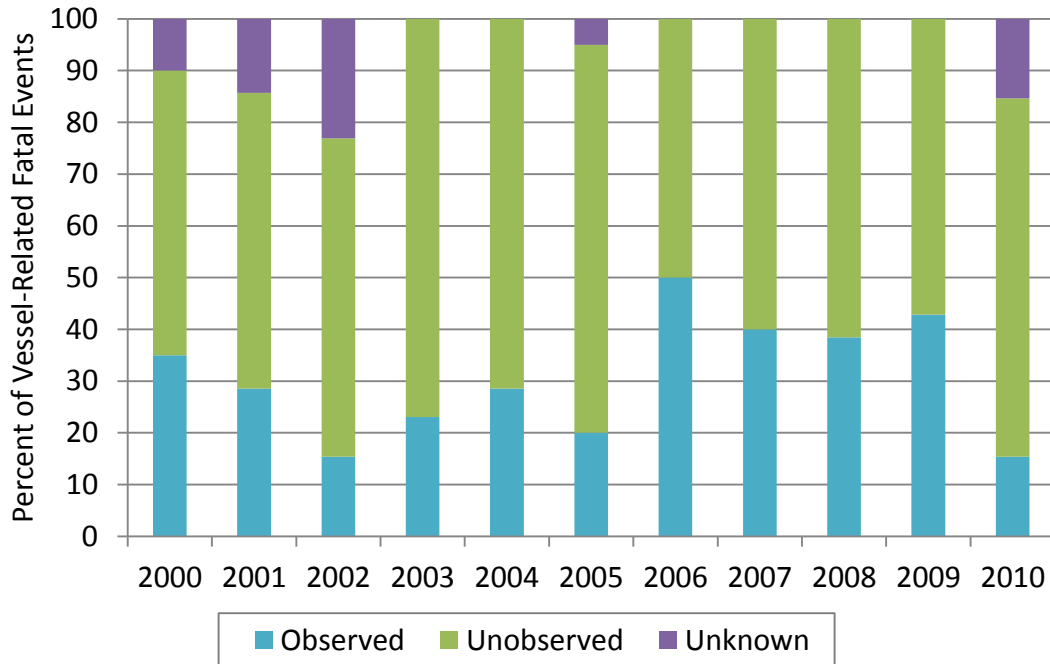


Figure 11. Percent of vessel-related fatal events that occurred in fisheries with observer coverage (observed) and fisheries without observer coverage (unobserved), 2000-2010. Data from NIOSH.

Fifty-six percent of vessel-related fatal events in observed fisheries were on vessels that did not have current safety decals (Figure 12). In contrast, 86.3% of vessel-related fatal events in unobserved fisheries were on vessels without a current safety decal. Thus vessel-related fatal events in unobserved fisheries were significantly more likely to be on vessels without a current safety decal (ANOVA,  $F=70.092$ ,  $df=1$ ,  $p<0.000$ ), whereas vessel-related fatal events in observed fisheries were not more likely to be on vessels without a current safety decal.<sup>8</sup>

<sup>8</sup> 46.4% of observed vessels and 17.6% of unobserved vessels had a current safety decal for all fatal events.

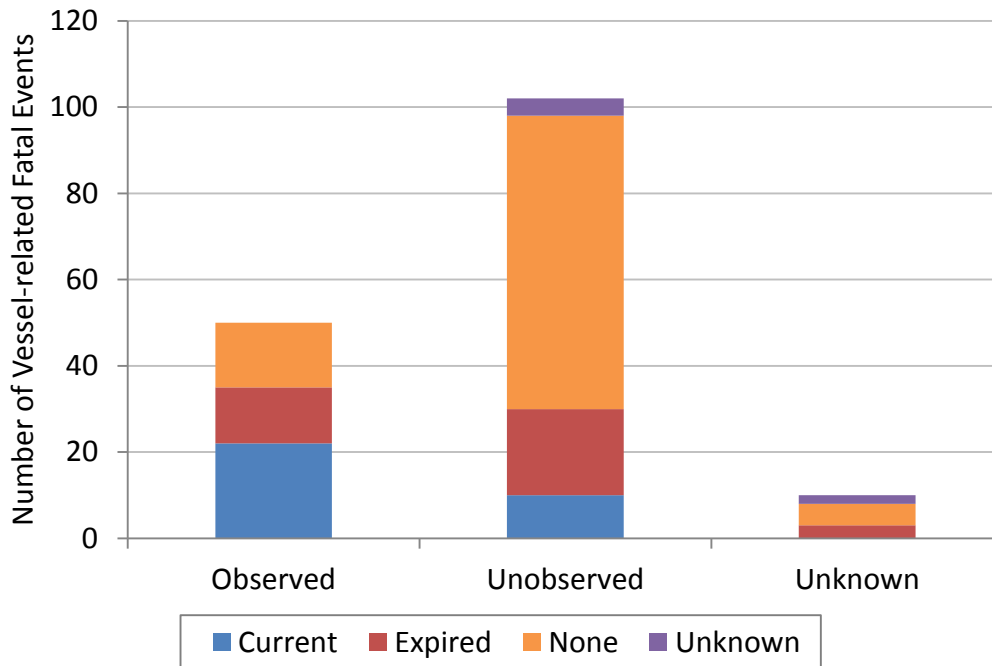


Figure 12. Vessel-related fatal events in fisheries with observer coverage (observed) and fisheries without observer coverage (unobserved), and safety decal status, 2000-2010. Data from NIOSH.

The Pacific Islands had one vessel-related fatal event (Table 5, Figure 13) which occurred in an observed tuna longline fishery.

There were 6 vessel-related fatal events in observed fisheries in the Southeast, accounting for 14% of the 42 total vessel-related fatal events from 2000-2010. The majority of fatal events, 67 of 148 (45%), and the majority of vessel-related fatal events, 12 of 42 (29%), were in the shrimp trawl fishery (Table 5, Figure 13). Unobserved state-managed shrimp fisheries accounted for 75% of shrimp vessel-related fatal events (9 of 12) and 63% of shrimp fatal events (42 of 67) in the Southeast<sup>9</sup>. Twelve percent of observed shrimp fatal events and 21% of unobserved shrimp fatal events were vessel-related; the majority of shrimp fatal events were caused by falls overboard. NIOSH reports that none of the fishermen who died after falling overboard from 2000-2009 were wearing a personal floatation device (Lincoln and Lucas 2010).

There were 30 vessel-related fatal events in observed fisheries in the Northeast, accounting for 60% of the 50 total vessel-related fatal events from 2000-2010. The Northeast is the only region in which vessel-related fatal events in observed fisheries were greater than in unobserved fisheries (Table 5 and Figure 13). There were 14 vessel-related fatal events in the multi-species fishery, 12 in the scallop fishery, and 4 in other observed fisheries. The majority of fatal events in the multi-species fishery (60%) and the scallop fishery (46%) were vessel-related. NIOSH reports that the Northeast multi-species

<sup>9</sup> Observer coverage for some state managed shrimp trawl fisheries began in 2012.



fishery had the highest fatality rate (600 deaths per 100,000 FTEs) of all fisheries (for which fatality rate could be calculated) in the United States from 2000 through 2009; the scallop fishery had the highest number of fatalities on the east coast, many of them multiple fatalities following a vessel disaster (Lincoln and Lucas 2010).

**Table 5. Fatal events in fisheries with observer coverage (observed) and fisheries without observer coverage (unobserved) and safety decal status, 2000-2010. Data from NIOSH.**

Fisheries		Current		Expired		None		Unknown		All	
		All events	Vessel only	All events	Vessel only	All events	Vessel only	All events	Vessel only	All events	Vessel only
<b>NW</b>	Observed	2		1		3	1	1		7	1
	Unobserved	7	3	3	1	17	13	3	1	30	18
	Unknown			1	1	1	1	3	2	5	4
<b>SW</b>	Observed	3	2	1	1	3	1			7	4
	Unobserved	4	3	1		7	4			12	7
	Unknown			1	1	3	2			4	3
<b>NE</b>	Observed	30	14	12	6	14	10	1		57	30
	Unobserved	7	1	4	3	30	14	4	2	45	20
	Unknown							2		2	
<b>SE</b>	Observed	10		17	4	12	2			39	6
	Unobserved	9	1	27	9	60	24	1		97	34
	Unknown			3		9	2			12	2
<b>AK</b>	Observed	18	5	5	2	4	1			27	8
	Unobserved	17	2	19	7	30	13	5	1	71	23
	Unknown			1	1					1	1
<b>PI</b>	Observed	2	1	1						3	1
	Unobserved	1				1				2	
	Unknown					1				1	

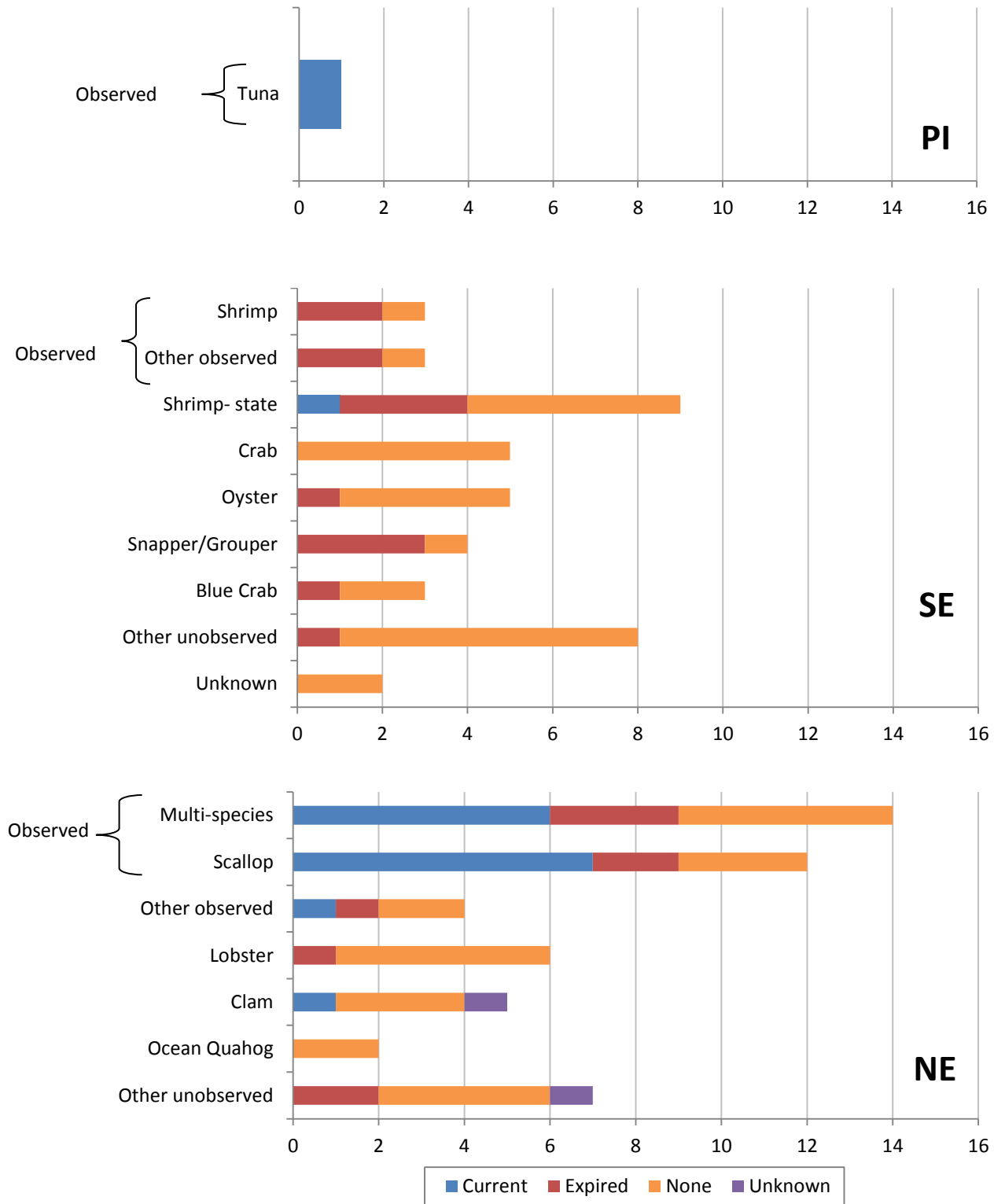


Figure 13. Vessel-related fatal events by fishery and safety decal status for the Pacific Islands, Southeast, and Northeast, 2000-2010.

Most fatal events in Alaska from 2000 through 2010, 38 of 97 (39%), and vessel-related fatal events, 13 of 32 (41%), occurred in the unobserved salmon fishery (Figure 14); these were due to falls overboard (44%) or vessel-related disasters (33%) NIOSH (2010). Data from NIOSH (2010) also show that the majority of falls overboard in the Alaska salmon fishery were on drift gillnet vessels, and the majority of vessel-related disasters in the Alaska salmon fishery were on set-net skiffs. The federally observed groundfish fishery had the second highest number of fatal events in Alaska fisheries, with 27 of 97 (28%) (Figure 14), and the second highest number of vessel-related fatal events with 8 of 32 (25%) (Figure 14). Causes of death were roughly evenly split between falls overboard, vessel-related disasters, and on-board injuries NIOSH (2010). The majority of vessel-related fatal events in the groundfish fishery were on vessels with a current safety decal (5 of 8 events) (Figure 14).

In the Northwest and Southwest, the majority of vessel-related fatal events from 2000 through 2010, 25 of 37 (68%), occurred in unobserved fisheries (Table 5), with 7 in the salmon fishery and 12 in the Dungeness crab fishery (Figure 14). Two-thirds of the fatal events in the Dungeness crab fishery were from vessel-related disasters, and nearly 90% of fatal events were vessel-related in the Northwest salmon fishery (Figure 14). NIOSH (2010) reported that all fatalities in the tribal salmon fishery occurred after skiffs capsized. There were 4 vessel-related fatal events in the Northwest and Southwest federally observed groundfish fisheries, accounting for 13.5% of the total number of vessel-related fatal events (Table 5, Figure 14).

In summary, the majority of fatal events occurred on vessels without a current safety decal and on vessels in unobserved fisheries (Table 5, Figures 13-14). USCG analysis of vessel-related fatal events from 1992 through 2010 also found that the majority of fatal events (73%) occurred on commercial fishing vessels without a current safety decal (USCG 2011). Likewise, NIOSH analysis of vessel-related fatal events from 2000 through 2006 on the West Coast found that 83% of fatal events were on vessels without a current safety decal (Lincoln and Lucas 2008). These trends are consistent, regardless of time period or region. However, without knowing the percentage of the commercial fishing vessel fleet that is without current safety decals and that operate in unobserved fisheries, it is impossible to make fleet-wide conclusions about the effect of the safety decal on vessel-related fatal events.

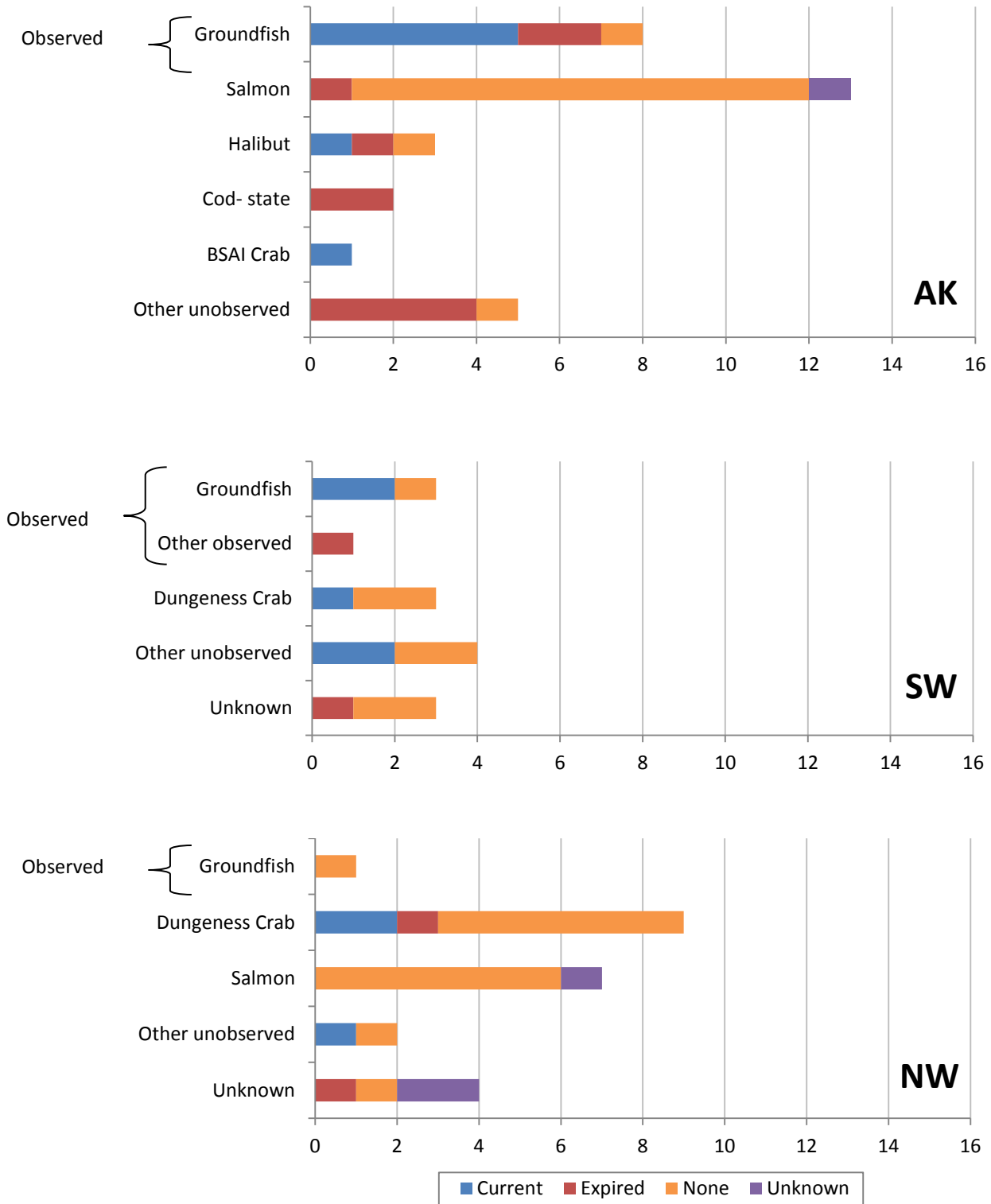


Figure 14. Vessel-related fatal events by fishery and safety decal status for Alaska, Southwest, and Northwest, 2000-2010.

## Discussion and Next Steps

Commercial fishing vessel safety has improved since the late 1990s and early 2000s, likely as a result of factors including additional marine safety regulations, new fishing management regulations, improved vessel design, gear modifications, enhanced safety training in the fishing industry, and collaborations between the fishing industry and other stakeholders to tailor safety programs to specific fishing fleets (Lincoln and Lucas 2010). USCG analysis of fatalities from 1992 through 2010 indicated that vessel losses and vessel-related fatalities have been declining since 2000, with significantly fewer vessel losses in 2000 and 2006 through 2010, and significantly fewer vessel-related fatalities in 2002, 2007, and 2010 compared to the base period of 1992 through 1999 (USCG 2011).

This report found significant increases in the number of dockside safety exams and safety decals issued nationwide and significant decreases in the number of vessel losses nationwide after implementation of the 2004 MoA. A nationwide decrease in the number of fatal events after implementation of the MoA was not significant. Many NMFS regions also experienced significant decreases in vessel losses after implementation of the MoA and/or after region-specific implementation of the safety decal requirement (if the decal was required prior to the MoA). The Southeast experienced the most dramatic decrease in vessel losses and vessel-related fatal events after implementation of the MoA. Alaska and the Northeast experienced significant increases in safety decals issued after implementation of the MoA and significant decreases in vessel losses after implementation of regional-specific safety decal requirements.

There were striking patterns regarding safety decals with vessel losses and fatal events. A total of 77.6% of vessel losses and 77.5% of vessel-related fatal events occurred on commercial fishing vessels without current safety decals. The majority of vessel-related fatal events (63%) occurred on commercial fishing vessels in unobserved fisheries, of which 86.3% did not have a current safety decal. Vessel-related fatal events on vessels requiring observer coverage also occurred more often on vessels without a decal (56%) but to a lesser degree. The exception appears to be in the Northeast and Southeast where a higher percentage of fatal events occurred on fishing vessels requiring observer coverage and with current safety decals. This is likely due to compliance with the safety decal requirement in these two regions as well as risks associated with certain observed fisheries such as the Northeast multispecies, Northeast scallop, and Southeast shrimp fisheries. The USCG (2011) investigation of vessel-related fatalities on vessels with current decals showed losses were sudden events “with little or no time to respond,” where the crew was “unable to use survival equipment or fully don survival suits.”

These patterns suggest the safety decal requirement encourages more vessels to take dockside exams and acquire safety decals, helping to reduce marine casualties, and likely improve the safety of vessels with valid safety decals by ensuring safety equipment is on board and well-maintained. In addition, it is possible that understanding of safety equipment usage and emergency procedures through interactions with USCG personnel during the exam is increasing (USCG 2011). Research has shown that survival rates after vessel losses more than double if equipment is properly used (Lincoln and Lucas 2010, USCG 2011). Many other factors have also likely contributed to reduced marine casualties including increased emphasis on safety such as additional USCG personnel to conduct dockside safety exams, respond to

emergencies, and enforced regulations; changes in fishery management regulations such as instituting catch share programs that reduce the tendency to “race to fish,” and safety programs tailored to specific fisheries (Lincoln and Lucas 2010, USCG 2011).

It is important to note the limitations of the data and analyses included in this report. Foremost, the data could not be normalized by commercial fishing vessel fleet size or fishing rate, because this report did not include the total number of commercial fishing vessels in fisheries with observer coverage, the number of commercial fishing vessels that have a current safety decal, or the number of hours or days fished. For example, this analysis showed that nearly 78% of vessel losses occurred on commercial fishing vessels that did not have current safety decals. Without knowing the fleet size and the percentage of vessels without decals, this analysis is unable to determine whether the 78% of losses without decals merely reflects the percentage of vessels without decals or whether there is a statistically significant relationship between safety decals and vessel losses. This lack of information prevented this report from drawing more specific conclusions about the causes for the decline in vessel losses and fatal events since 1998. Nonetheless, a strong correlation exists between the increasing number of safety decals issued and decreasing number of vessel losses and fatal events. Additional information would be required, however, in order to fully analyze and draw specific conclusions about the significance of these trends.

This report recommends that NMFS establish a process to determine the total number of commercial fishing vessels, including the total number of observed commercial fishing vessels, and vessels with safety decals. This report also recommends that NMFS establish a process to determine the total number of hours fished in order to calculate fishing rates. Possible data sources for fleet size include fish tickets or landings reports, NMFS federal permit databases, and USCG certificates of documentation records. NIOSH has done extensive research on fishing fleet size, average number of fishermen per vessel, and average time at sea to calculate fishery-specific fatality rates; however, this information is not available for all fisheries. Estimates may be difficult to obtain if vessels hold permits in multiple fisheries or if vessels with documentation or permits are not actively engaged in fishing (Thompson et al. 1994).

In addition to acquiring the data listed above (commercial fishing fleet size, observed fishing fleet size, fleet with current safety decals), it would be informative to examine the effectiveness of the safety decal requirement in order to encourage fishing vessel owners to take dockside exams and acquire safety decals. Specifically, it would be informative to know the:

- Percentage of vessels with current safety decals in observed fisheries.
- Percentage of vessels in observed fisheries that obtain a safety decal prior to selection for observer coverage.
- Percentage of vessels with current safety decals in unobserved fisheries.
- Motivation for vessels in unobserved fisheries to acquire a safety decal.

This information will enable more informative analyses of commercial fishing safety and fisheries observer safety.

There are other ongoing efforts to improve commercial fishing safety. The USCG Reauthorization Act of 2010, will require, among other things, all commercial fishing vessels that fish more than three nautical miles offshore to obtain a safety decal every two years (this was amended in the USCG & Maritime Transportation Act of 2012 to require a safety decal at least once every 5 years) and will require vessel operators to take safety training to include training in seamanship, stability, collision prevention, navigation, fire- fighting and prevention, damage control, personal survival, emergency medical care, emergency drills, and weather. Additional measures are also needed to prevent fatalities from vessel losses, falls overboard, and on-board injuries because dockside safety exams and CFVSA regulations focus primarily on emergency life-saving equipment and not accident prevention (Lincoln and Lucas 2010, USCG 2011). NIOSH, NMFS regional observer programs, and the fishing industry continue to tailor safety improvement programs to issues within specific fishing fleets. National Standard 10 of the MSA requires that conservation and management measures shall, to the extent practicable, promote the safety of human life at sea (MSA section 301(a)(10)). The National Standard 10 guidelines at 50 CFR 600.355 are the primary source of guidance for the consideration of safety issues in fishery management regulations. NMFS is currently working to develop additional tools to promote the consideration of safety issues within fisheries management.

## Appendix. Dockside Safety Exams and Safety Decals

Number of dockside safety exams (DSEs), safety decals issued (Decals), and percentage of safety decals issued of dockside safety exams conducted (%) by NMFS region, 2002-2010.

		NW	SW	NE	SE	AK	PI	ALL
2002	DSEs	755	338	1174	1972	967	27	5233
	Decals	462	50	436	300	349	4	1601
	%	61.2	14.8	37.1	15.2	36.1	14.8	30.6
2003	DSEs	801	364	1021	1585	1196	29	4996
	Decals	437	19	384	421	338	6	1605
	%	54.6	5.2	37.6	26.6	28.3	20.7	32.1
2004	DSEs	905	467	1325	2142	1416	55	6310
	Decals	507	123	449	650	472	30	2231
	%	56.0	26.3	33.9	30.3	33.3	54.5	35.4
2005	DSEs	702	415	1535	2871	1089	158	6770
	Decals	316	89	620	717	483	43	2268
	%	45.0	21.4	40.4	25.0	44.4	27.2	33.5
2006	DSEs	677	503	2400	2477	1150	182	7389
	Decals	353	118	1162	810	521	33	2997
	%	52.1	23.5	48.4	32.7	45.3	18.1	40.6
2007	DSEs	783	572	1493	2060	1467	188	6563
	Decals	377	120	854	603	638	41	2633
	%	48.1	21.0	57.2	29.3	43.5	21.8	40.1
2008	DSEs	778	447	1814	2041	1548	176	6804
	Decals	479	92	1212	593	740	36	3152
	%	48.1	21.0	57.2	29.3	43.5	21.8	46.3
2009	DSEs	971	392	1789	2158	1274	131	6715
	Decals	588	107	1244	638	597	25	3199
	%	60.6	27.3	69.5	29.6	46.9	19.1	47.6
2010	DSEs	781	456	2019	3295	1251	215	8017
	Decals	475	262	1527	1145	781	120	4310
	%	60.8	57.5	75.6	34.7	62.4	55.8	53.8



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