

Appendix B

Review of Safety Under the Crab Rationalization Management Program for Bering Sea and Aleutian Islands Crab Fisheries

**Jennifer M. Lincoln, PhD, CSP
Alaska Pacific Regional Office
National Institute for Occupational Safety and Health**

**CDR Christopher J. Woodley, MMA
United States Coast Guard**

Introduction

This section analyzes the safety performance of the Bering Sea / Aleutian Island (BSAI) crab fleet since 2005. As part of this analysis, the safety performance of the BSAI crab fleet from 1990-2005 is also discussed to provide more information leading up to the Crab Rationalization (CR) program. Several factors have been influential in affecting the safety of this fleet during this time frame (Woodley et.al., 2009; Lincoln & Lucas, 2010). This paper will review the following elements and will conclude with further recommendations.

1. Fatality History, 1990-1999
2. U.S. Coast Guard Stability and Safety Compliance Checks, 1999 - present
3. Crab Rationalization (CR) Program 2005 – Present
4. Further recommendations that may continue to improve BSAI crab fleet safety

Historically, the BSAI crab fisheries have been considered to be the most dangerous in Alaska, especially those crab fisheries that take place in the winter months where cold temperatures, high winds, poor weather, icing conditions and high seas have been contributing factors to crew and vessel losses (NIOSH, 1997; Lincoln & Conway, 1999). The nature of the crab fishery and its gear is hazardous. Catcher vessels average 115 feet in length, are minimally crewed with 5-6 people, and utilize steel pot gear to harvest crab. Pot dimensions are approximately 7' x 7' x 3' and pots weigh 750-850 pounds empty. Each pot is rigged with hundreds of feet of coiled line and buoys to recover the pots (Woodley & Medicott, 2001). Pots are launched and retrieved from the open deck of the vessel using powerful hydraulic pot launchers. Furthermore, when vessels transit to and from the fishing grounds, pots are stacked on the main deck in 3-5 tiers (13-27 feet) high. The combination of environmental conditions, onboard stowage of crab gear and launching and retrieving of the gear, and minimal safety regime create numerous safety hazards for this fleet.

In addition to the safety issues inherent with operations, fleet economics and fishery resource management issues also created safety concerns. The BSAI crab resource underwent a significant decline starting in the mid-1990s, resulting in major reductions in catch for some fisheries, and outright closures of three of the six major crab fisheries. While the crab resource declined substantially, the total number of vessels participating in the fisheries did not. A major fisheries management problem with the Bering Sea crab fleet during this time frame was that despite efforts to limit overcapacity and fishery participants through a license limitation plan, the catching power within the fleet greatly exceeded the available amount of crab, resulting in an extremely competitive “race for fish” in what was already a high-risk operating environment.

1. Fatality History, 1990-1999

From August 1990 through March 1999, 73 people died in the BSAI crab fisheries (Figure 1) as a result of capsizing, sinking, man overboard (MOB), and industrial accidents, such as being struck or crushed by crab pots. During this period, 50 people on 12 vessels died as the result of capsizing / sinking events. Additionally, there were 18 man overboard fatalities caused by gear entanglement, and falling/being washed overboard (Woodley et.al., 2009). When taking into account changes in workforce size, variations in season length and number of vessels participating in the fishery, workers participating in BSAI crab fisheries were experiencing an astronomical fatality rate of 770 fatalities per 100,000 full time fishermen (Lincoln & Lucas, 2008).

Bering Sea / Aleutian Island Crab Fishery Fatalities (1990-1999)

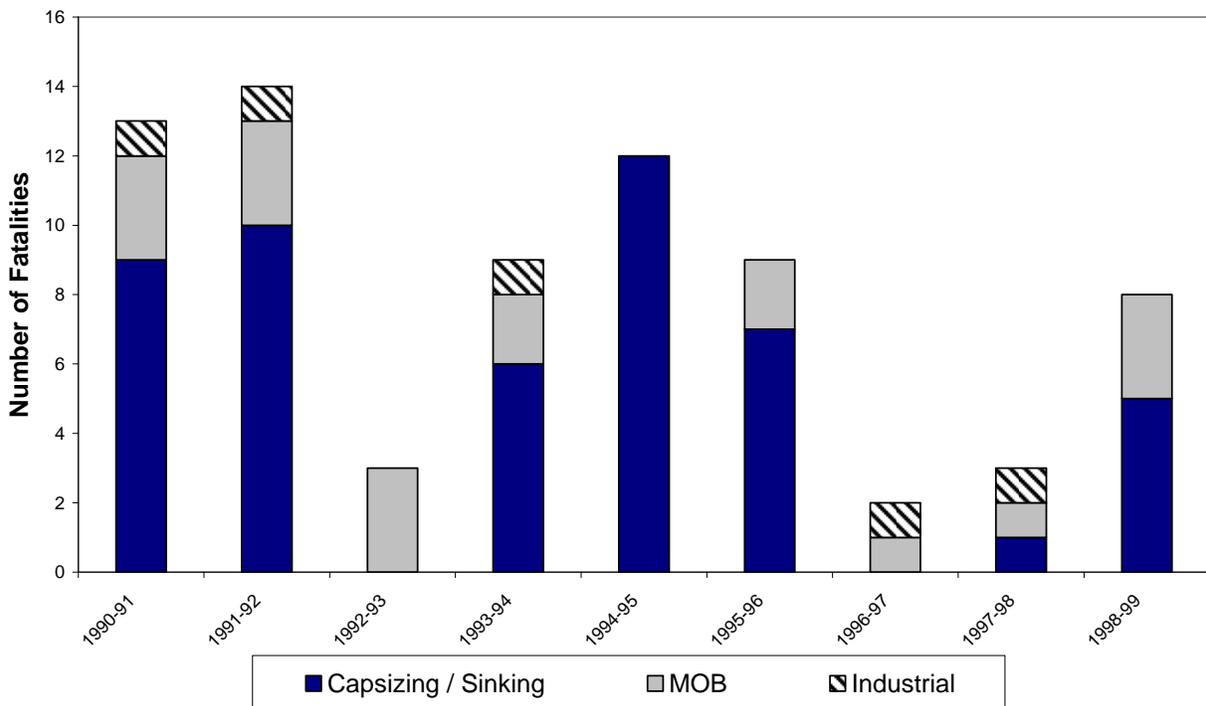


Figure (1) BSAI Crab Fishery Fatalities, 1990-1999

During this period, fatality rates were very high, despite the fleet having a high level of compliance with Coast Guard fishing vessel safety regulations that applied to the fleet. Fishing vessel safety regulations required the carriage of primary life saving equipment (survival suit, liferafts, and EPIRBs). The existing application of the safety regulations was not addressing the specific safety problems within the fleet. Of primary concern was that vessels were not in compliance with loading practices described by their stability letters.

When fully loaded with pot gear, these vessels are susceptible to capsizing, especially during icing conditions, as is common in the Bering Sea's winter months. A primary cause for many of the fatal capsizing / sinking events was vessel overloading or being fully loaded in icing conditions. At least eight

of the 12 vessels lost from 1990-1999 were enroute to or coming from the crab grounds in a loaded condition (Woodley et. al., 2009).

2. Stability and Safety Compliance Checks, 1999-present

The safety program developed for the BSAI crab fleet, known as the “At the Dock Stability and Safety Compliance Check” (SSCC) was established. To execute the program, the USCG joined the ADF&G during tank checks in multiple ports prior to the seasons. While ADF&G personnel conducted tank checks, the USCG reviewed vessel loading and stability issues with the master and checked for overloading. Vessels found to be without stability reports, overloaded, or having missing, outdated, or inoperable primary life saving equipment (i.e. immersion suits, liferafts, EPIRBs) would be issued captain of the port orders and not allowed to get underway until the safety discrepancy was corrected.

From October 1999 through January 2005, SSCCs identified 1-2 crab vessels every season that were improperly loaded and required those vessels to reduce the number of pots on board. Additionally, compliance checks found a significant number of vessels with outdated or improperly installed primary life saving equipment (Woodley et. al, 2009).

Since the establishment of the SSCC in October 1999, a total of ten lives have been lost (Figure 2). This is a significant improvement over the 1990 – 1999 time period, where the fleet lost an average of eight fishermen annually. This program has resulted in a 60% reduction in the fatality rate in the BSAI crab fleet (Lincoln & Lucas, 2008). The decline in the rate illustrates that it is not simply the result of fewer fishermen fishing.

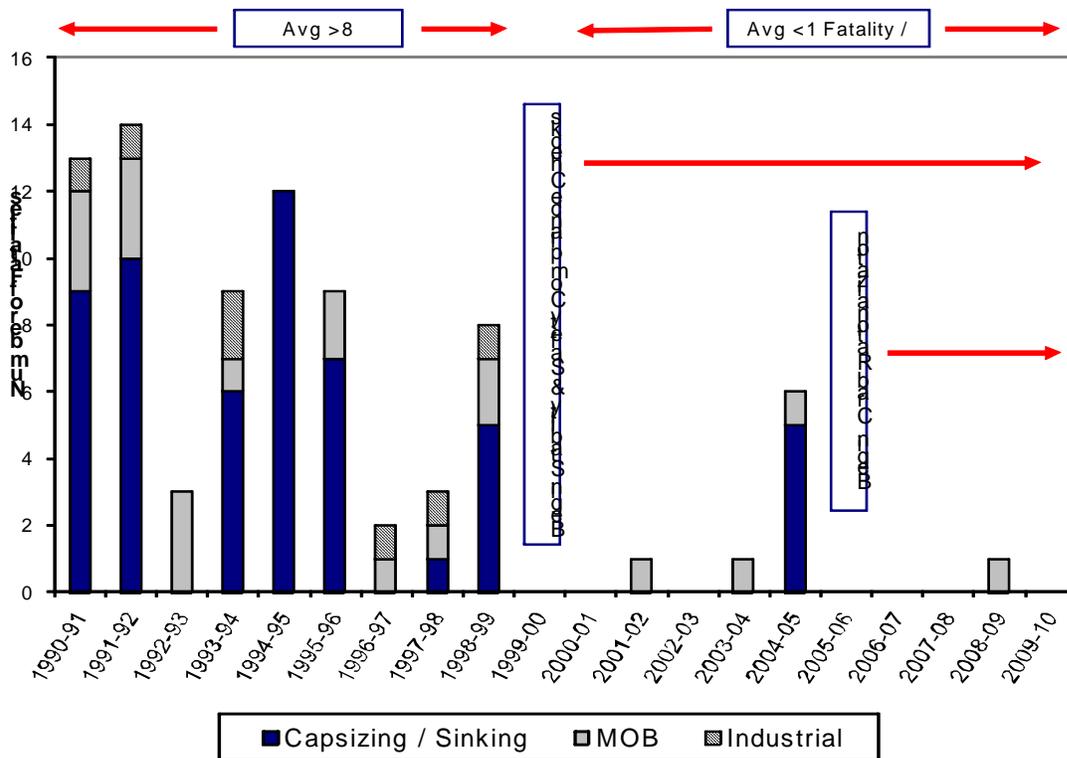


Figure (2) BSAI Crab Fishery Fatalities, August 1990-October 2010.

Other changes that occurred prior to rationalization that lessen risk and improve safety include the pre-staging of helicopters and the ability to delay openings due to poor weather. The USCG stationed a helicopter-equipped cutter on the fishing grounds during the two major crab seasons and stationed an emergency response helicopter at Cold Bay during the Bristol Bay red king crab season (in October), and at St. Paul during the Bering Sea *C. opilio* season (in January). This practice has continued under the rationalization program, but the timing of deployments is undergoing changes with the extension of crab fishing seasons and evolving needs in other fisheries. The longer seasons pose logistical and financial challenges to the USCG, as it restructures its rescue equipment and crew deployments. Also in 2001, the USCG and State of Alaska signed an interagency agreement allowing the Alaska Department of Fish and Game to delay opening a BSAI crab fishery for up to 48 hours to let bad weather pass if the USCG's ability to conduct search and rescue missions are significantly impaired.

3. Crab Rationalization (CR) Program, 2005-present

One of the primary arguments for the BSAI CR program was to improve safety of the fleet. Although fatalities of the BSAI crab fishery declined significantly since October 1999, prior to the implementation of the program, rationalization programs can improve operational safety through reducing risk. Rationalization programs are hypothesized to end the race to fish, improve economic stability within the fleet, and consolidate over-capitalized fleets which allows for more efficient vessels to harvest the quota. Rationalization programs can also lengthen the time in which fisheries take place and slow down the pace at which fishermen work. The following discussion reviews a variety of changes which have occurred as a result of the BSAI CR program, resulting in less risk and therefore safety improvements for the crews, participating vessels, and the overall operations.

Effects on the Crew: Rationalization has led to an extended fishing season and allows for a more experienced and potentially less fatigued crew.

More experienced crew: In the years leading up to the rationalization program, crews in the fisheries would actively fish crab for only a few days or weeks each year. Under the Crab Rationalization Program, most crews are active in the crab fisheries for a period of months. Table 1 shows that there has been a significant increase in the number of fishing days each season after implementation of the Crab Rationalization program. This extended employment time period provides crew with more (and more regular) experience deploying and hauling gear. Maintaining a consistent crew better maintains vessel management, improves efficiency and safe operating procedures, crew become more familiar with the vessels operation, other crew, deck rotation.

Table 1: Average days fished, Bristol Bay red king crab and Bering Sea *C. opilio*, 2001-2009/10

Season	Bristol Bay red king crab	Bering Sea <i>C. opilio</i>
2001	3	30
2002	3	24
2003	5	9
2004	3	8
2005	NA	6
2005-6	16.3	26.1
2006-7	13.3	23.6
2007-8	20.2	32.5
2008-9	22.6	33.5
2009-10	20.2	NA

Source: 2001 to 2005 is season length; 2005-6 to 2009-10 is fishing days from crab EDR data.

Less fatigued crew

The extended season created under the CR program has allowed captains to slow fishing. One matrix that can be used to measure fishery pace is the average number of pots pulled per vessel day. Table 2 shows how the rate at which pots are pulled on average has decreased. In the Bristol Bay red king crab fishery, pot lifts per vessel day have decreased by an average of 32% and in the Bering Sea C. Opilio fishery, pot lifts per vessel day have decreased by 17%. Slowing down the pace allows for crew to get more (and more regular) rest than in the derby fishery. A less fatigued crew is less likely to have accidents. Anecdotally fishermen have said that they work fewer hours in a single day allowing for more time to sleep and they are not staying up 3-4 days straight. This has not been verified across all vessels in the fleet. Crews are now pushing to be efficient as possible to catch the vessel allocation as quickly as possible so although there may be a situation that allows for more rest, there is still a push to work hard and long hours in a day.

Table 2: Pot lifts per vessel-day, Bristol Bay Red King Crab and Bering Sea Opilio

	Season	Average Days Fished	Vessels	Total Pot Lifts	Pot Lifts/vessel day
Bristol Bay Red King Crab	2001	3	230	63242	92
	2002	3	241	68328	95
	2003	5	250	128430	103
	2004	3	251	90976	121
	2005-06	16.3	89	99573	69
	2006-07	13.3	81	64325	60
	2007-08	20.2	74	101,734	68
	2008-09	22.6	77	124739	72
	2009-10	20.2	70	107058	76
	Bering Sea Opilio	2001	30	207	176930
2002		24	190	308132	68
2003		9	190	139279	81
2004		8	189	110087	73
2005		6	167	69863	70
2005-06		26.1	78	108,320	53
2006-07		23.6	70	80,112	48
2007-08		32.5	78	129,457	51
2008-09		33.5	77	148,220	57

Effects on the Vessels: *Rationalization has led to a consolidation of the fishing fleet allowing for vessels that are more fully capable of operating in their chosen service of fishing in the Bering Sea in the winter.*

Consolidation of the fleet. A major impact of the crab rationalization program has been the immediate and significant consolidation of the number of vessels participating in the fisheries due to sidelining of less efficient vessels. Prior to implementation, many vessels fished to maintain historic interests in the crab fisheries. The overall poor profitability of the highly capitalized fisheries with relatively low TACs may have economically forced some owners to postpone needed vessel maintenance. Fleet contraction resulted in the removal of many of these marginal vessels from the fleet. Table 3 illustrates the participating vessel by vessel length in the Bristol Bay red king crab and Bering Sea *C. opilio* fisheries (2001 through 2009-2010 seasons). Notice the decrease in the number of vessels in each length category starting in the 05/06 season. For each vessel length category, a larger proportion of vessels were sidelined in the smaller vessel length categories. The consolidation of the fleet resulted in an increase in the average vessel size. These larger vessels lend themselves to a larger work platform and may be able to handle the weather conditions more easily and are more fully capable of operating in their chosen service.

Table 3: Reduction of Participant Vessels by vessel length, Bristol Bay red king crab and Bering Sea *C. opilio*, 2001-2009/10

Fishery	Season	Number of vessels less than 85 feet LOA	Vessels greater than or equal to 85 feet LOA and less than 100 feet LOA	Vessels greater than or equal to 100 feet LOA and less than 125 feet	Vessels greater than or equal to 125 feet LOA
Bristol Bay red king crab	2001	10	45	107	68
	2002	12	47	111	71
	2003	14	50	112	74
	2004	15	49	115	72
	2005-06	1	12	45	31
	2006-07	2	13	39	27
	2007-08	1	11	36	26
	2008-09	1	10	39	27
	2009-10	2	9	33	26
		93% reduction	77% reduction	66% reduction	62% reduction
Bering Sea <i>C. opilio</i>	2001	6	38	94	69
	2002	4	35	87	64
	2003	3	42	84	61
	2004	5	32	88	64
	2005	4	28	83	52
	2005-06		9	37	32
	2006-07		10	32	28
	2007-08		10	39	29
	2008-09		9	37	31
2009-10	1	10	31	27	
		~100% reduction	71% reduction	60% reduction	53% reduction

Sources: ADFG fishtickets and NMFS RAM catch data (for 2005-2006 through 2009-2010)

Mandatory Dockside Safety Exams. In addition to fleet consolidation, starting in September 2005, vessels participating in the BSAI crab fisheries are now required to have a current and valid USCG safety decal before vessel registration is issued to participate in the fishery (5 AAC 39.670(8)). However it is important to note that, a dockside exam does not focus on vessel seaworthiness but only on the required survival equipment on board the vessel. Vessel operators are also now required to call the USCG 24 hours prior to leaving port when carrying pot gear so that the USCG can confirm they have a decal and participated in the SSCC before they depart.

Operations: *Rationalization has led to more efficient operations and reduces the cost associated with safety measures and exercising caution*

Delay Departure: The rationalization program has resulted in several improvements in efficiency that can allow for reduced risk in the fishery. For instance, individual allocations and spreading the season out allows more flexibility in choosing to stay in port if weather is predicted to be poor. Anecdotally fishermen say that they delay going out if the weather is bad. They are also more likely to suspend fishing on grounds during periods of bad weather.

Vessel Cooperatives: The creation of a “Super Coop” that combines 12 individual coops and accounts for 70% of the quota allows for more flexibility for all vessels within these coops. This Super Coop allows for the ability to pass IFQ from one vessel to another. It gives the participants the ability to get vessels off the grounds when weather is turning bad. (Personal communication Jake Jacobsen, October 25, 2010)

Fewer Pots: Since the Crab Rationalization Program has ended the race to fish, there is less emphasis on catching power leading to less incentive to overload vessels. From 2007-2009, the majority of the fleet (~75%) participated in the SSCC exams in Dutch Harbor, Kodiak and King Cove. During these checks, the USCG records information from the stability instructions such as age of stability instructions and number of pots allowed. Complete data are available for vessels that participated in the SSCC exams in Dutch Harbor. All vessels during those 3 years were operating within the parameters of stability instructions. The average age of stability instructions was 11 years with a range of 0-28 years. The USCG in Dutch Harbor found that each year the vessels were carrying fewer pots than their stability instructions allowed. In 2007, overall the fleet out of Dutch Harbor was carrying 77% of what was allowed in their stability letters, in 2008 82% and in 2009 85%. Data from prior years are not available.

Other Factors: *Rationalization has led to operational changes that have required attention.*

Efficiency: There are factors that may limit the ability of harvesters to take full advantage of these risk reduction opportunities that the Rationalization Program allows. These factors include a continued desire to minimize days at sea to reduce operational costs, as well as the persistence of the work ethic of individuals who have been historically employed largely because of their ability to work fast for long periods of time. The effect of these factors on fishing practices may subside over time, but currently are still valued and exist within the fleet.

Delivery Dates: In the first couple of years of the Crab Rationalization Program, there was discussion by harvesters that rigid delivery dates established by processors were resulting into a “race” to meet pre-established delivery schedules and in some cases were becoming a detriment to safety. However, over the last few years, efforts have been made by both harvesters and processors to address this issue. Processors have demonstrated additional flexibility to accommodate harvester delays in season especially if those delays arose from safety concerns expressed by captains. In addition harvesters, working more efficiently through cooperatives, have worked to meet scheduling needs of processors. Crab processing is labor intensive, and timing of deliveries is important for processors in order to reduce the costs of keeping crews on hand, standing by to process crab. Both harvesters and processors are trying to be as efficient as possible. Delivery dates are still a stressor, but they don’t seem to be rising up to the level of a safety issue.

Delivery Relief: The CR program includes several measures to protect revenues and employment in fishery-dependent coastal communities with a history of participation in the BSAI crab fisheries. As a consequence, there are requirements for vessels to land catch in certain communities. Regional landing requirements have created a situation where captains have less flexibility to take sea conditions into account when deciding where to deliver crab. Processors in the north region are especially sensitive to

delivery schedules, since processing crews are positioned in the Pribilof Islands (the only northern communities with crab processing) exclusively to process crab. Unexpected circumstances in the Bering Sea *C. opilio* fishery, together with the more rigidly scheduled deliveries are argued to have led some vessels to take greater risks in all of the first 5 years of the program. In 2007, icing problems were compounded by a disabling fire on one of the two floating processors scheduled to operate in the North region. With limited processing capacity scheduled for the North region, deliveries were delayed, and, at one point, three crab vessels were trapped in the ice temporarily outside St. Paul harbor.

All parties (harvesters, communities, processors) have made progress in coming up with a solution to this safety issue. The development of the “Super Coop” and Virtual Reserve Pool has allowed for constructive conversations regarding solutions for emergency relief. Reportedly, members of the Super Coop expect to handle most of the ice events by working within their member vessels to shuffle and manage quota more easily when these delivery issues occur. (Jake Jacobsen, October 25, 2010)

Traveling through ice no doubt poses threats to fishing vessels and crews. Vessels are not only at greater risk of loss, but also may suffer hull, propeller, and rudder damage. In some instances this damage may not be easily detectable. This issue should be addressed through the development of a satisfactory provision for emergency relief from regionalization to alleviate risks associated with regional landing requirements.

4. Further recommendations that may continue to improve BSAI crab fleet safety

Safety improvements in this fleet have occurred since the 1990s. In order to maintain the progress made in saving lives and reducing risk, hazards to the fleet must continue to be monitored. Although fewer fatalities have occurred, these fisheries do take place in a harsh environment, in the winter, in a remote location on uninspected vessels.

Continue the BSAI Crab Rationalization Program: The BSAI CR program has clearly demonstrated the ability to improve safety by making foundational changes which increase fishing time, reduce an emphasis on catching power, allow large, more efficient and safer vessels to remain in the fishery, and improve crew experience. These are areas that are typically difficult to control through Coast Guard safety regulations.

Develop a Provision for Emergency Delivery Relief to alleviate the safety problem: The CR program has resulted in one identified unintended consequence resulting in a safety detriment. A solution should be developed to alleviate safety risks associated with regional landing requirements.

Continue Safety and Stability Compliance Checks: Given the exceptionally challenging operating conditions of the Bering Sea, it is still necessary that the USCG continue emphasizing the safety of these vessels through fleet-wide dockside prevention efforts. The USCG should continue checking the stability and safety compliance checks and industry should continue updating and operating within the limits of the vessel specific stability instructions.

Update Stability Letters: Data collected by MSD Unalaska over the past 3 years indicates that 69 percent of vessels examined at the dock have stability letters that are older than 5 years old. Naval architects that prepare stability letters for the BSAI crab fleet recommend that stability letter be evaluated every five years and that new stability letters be prepared as necessary. Incline tests should be conducted at intervals no longer than 10 years. The Coast Guard should focus attention on vessels with stability letters greater than five years, and determine if new stability letters are needed.

Increase crew professionalism through more safety training: NIOSH data shows that survivors of vessel losses were 50% more likely to have taken a marine safety class within the previous 5 years (Lincoln, 2006). In addition, during the investigation of the F/V Alaska Ranger, crewmembers who had taken a marine safety class were significantly more likely to have gotten into a liferaft and therefore survived that event (at press). All fishermen should learn and know how to use basic lifesaving equipment like immersion suits, life rafts, and EPIRBs. Safety experts recommend taking a marine safety class at least once every 5 years.

Prevent fatalities due to falls overboard. Falls overboard continue to be large problem in this fishery and no intervention efforts have been widely implemented within the fleet to either prevent falls overboard or to survive a fall overboard. To prevent fatalities due to falls overboard, vessel owner/operator should develop a vessel policy regarding when the crew wears a PFD on deck. Falls overboard occur without warning or time to prepare so therefore a PFD stowed away onboard will not help float a fisherman who has fallen overboard. Wearing a PFD on deck is the single most important thing a fisherman can do to increase survivability following a fall overboard. There are many new styles of PFDs which have been evaluated by fishermen in real working conditions and are comfortable to work in on deck (at press).

Improve Tracking of Safety Issues in the BSAI crab fleet: The National Marine Fishery Service prepares annual reports on the performance of BSAI rationalized crab fisheries, including a section on safety. To improve monitoring of safety performance within the fleet, fishing vessel safety professionals from NIOSH and from the Coast Guard should work with NMFS to publish information which better measures fleet safety performance.

5. Conclusions

This paper analyses that safety performance of the BSAI crab fleet since rationalization of the fleet in 2005, provides a historical perspective of fatalities and fatality rates, and a discussion of the various impacts that have resulted in fewer lives lost and less risk.

Great strides have been made in improving safety in the BSAI crab fleet. However, risks still remain. Successful interventions must continue and industry should consider the recommendations listed above to further reduce the risk of operating in the Bering Sea environment.

References:

- Lincoln & Conway, 1999. Lincoln JM, Conway GA. Preventing Commercial Fishing Deaths in Alaska. *Occup Environ Med* 1999 Oct; 56(10): 691-695.
- Lincoln, J. 2006. Fresh Seafood at a Price: Factors Associated with Surviving Fishing Vessel Sinkings in Alaska, 1992-2004. Unpublished doctoral dissertation, Johns Hopkins University, Baltimore, Maryland.
- Lincoln & Lucas, 2008. J. Lincoln and D. Lucas, "Commercial Fishing Fatalities-California, Oregon, and Washington, 2000-2006." *MMWR* 2008; 57(16); 426-429.
- Lincoln & Lucas, 2010. J. Lincoln and D. Lucas, "Commercial Fishing Deaths—United States, 2000-2009." *MMWR* 2010; 59 (27); 842-845.
- NIOSH, 2007. Commercial Fishing Fatalities in Alaska Risk Factors and Prevention Strategies. Anchorage, AK: US Department of Health and Human Services, CDC, National Institute for

Occupational Safety and Health; 1997. Current Intelligence Bulletin #58. DHHS (NIOSH) Publication No. 97-163. Available at http://www.cdc.gov/niosh/97163_58.html.

NPFMC, Three-Year Review of the Crab Rationalization Management Program for Bering Sea and Aleutian Island Crab Fisheries, November 12, 2008.

Woodley et.al. 2009. Woodley CJ, Lincoln JM, Medlicott CJ. Improving Commercial Fishing Vessel Safety through Collaboration. Proceedings of the Marine Safety and Security Council. Spring 2009. Pg. 38-44.

Woodley & Medlicott, 2001. Woodley CJ and Medlicott CJ. "A review of an 'At the Dock' Stability & Pot Loading Survey." *Proceedings of the Marine Safety Council*, Vol.58, No.2: 40-43.