
# Improving Commercial Fishing Vessel Safety Through Collaboration

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**Commercial fishing in Alaska's Bering Sea/Aleutian Island (BSAI) crab fleet has long been one of the most dangerous occupations in the United States, and was popularized in the Discovery Channel's series "The Deadliest Catch." Stemming in part from the devastating losses of the Seattle-based crab vessels F/V *Americus* and F/V *Altair* in February 1983 (a combined total of 14 fatalities), Congress passed the Commercial Fishing Industry Vessel Safety Act in 1988.**

The Commercial Fishing Industry Vessel Safety Act of 1988 provided the first Coast Guard authority for development of safety regulations for commercial fishing vessels. The act focused on improving the survivability of commercial fishermen after a casualty. Despite the improvement in safety from the regulations under the act, there is no authority to require regularly scheduled safety compliance examinations, and commercial fishing vessels remain classified as "uninspected." This legal framework has prompted extensive collaboration to improve safety. The regulations developed under the act require survival equipment, including life rafts, immersion suits, emergency position indicating radio beacons (EPIRBs), and also some training in emergency drills and the use of this emergency equipment.[1] These safety regulations had their intended effect in Alaska commercial fisheries, which experienced a 67 percent decline in total commercial fishing deaths and a 38 percent decline in the commercial fishing fatality rate from 1990 to 1999.[2] However, the shellfish fisheries in Alaska had the highest fatality rate of all fisheries in the state.[3]

The Bering Sea/Aleutian Island crab fleet, which figured so prominently in the development of the safety legislation and regulations, continued experiencing staggering losses. During the 1990-1999 crab seasons, an average of eight lives were lost annually as a result of vessels capsizing or sinking, man overboard incidents, and industrial accidents.[4] In October 1999, an innovative regional safety program focusing on the prevention of vessel loss was developed to address the hazards of this dangerous fishery.

### Crab Fishery Information and Operations—The Olympic Years

Catcher vessels (which catch and deliver live crabs to shore-based or floating processing vessels) engaged in

| BSAI Crab Harvest Volume *Comparison 1990-2006*[5] | | | |
|---|---|---|---|
| **Year** | **1990-1994** | **1995-1999** | **2000-2004** |
| **Harvest Volume** | 288 million pounds | 158 million pounds | 43 million pounds |

**Table 1**

BSAI crab fisheries are highly specialized for crab fishing service. The average vessel gross tonnage is less than 200, vessel length is between 90 and 120 feet, and each vessel has a crew of five to six people. These vessels utilize pot gear to harvest the crabs, with pot dimensions approximately seven feet by seven feet by three feet and each pot weighing 750-850 pounds.[6]

Prior to the start of the season, vessels typically arrive in the ports of Dutch Harbor, Akutan, King Cove, St. Paul, and Kodiak to purchase bait, fuel, and groceries for the season. During this time, vessels also load pot gear, stacking the gear on deck in tiers. The first tier is stacked on end, and subsequent tiers are stacked flat. Combined, these tiers measure approximately 15-20 feet high from the deck. Once vessels had loaded all gear and completed a tank check and registration, they would depart from these multiple ports simultaneously en route to the crab fishing grounds. Once on the fishing grounds, the season would begin at a time predetermined by the Alaska Department of Fish and Game (ADF&G), and vessels would begin fishing.

The Bering Sea/Aleutian Island crab fisheries are managed jointly by the National Marine Fisheries Service and the ADF&G. Fleetwide harvest levels, known as the guideline harvest level, are determined by the Alaska Department of Fish and Game for each fishery on an annual basis. In an "Olympic" fishery, there is no quota assigned to individual vessels. Vessels compete directly with each other to maximize catch and revenues within the limitations of the guideline harvest level. From 1990 through 2005, there were approximately six major geographically and species-specific commercial crab fisheries conducted annually in the BSAI management area. The major seasons typically began in August for eastern and western Aleutian Island golden king crab, followed by blue and red king crab seasons in the Pribilof and St. Matthew Islands in September, Bristol Bay red king crab in October, eastern and western Bering Sea bairdi crab in November, and Bering Sea opilio crab in January.[7]

The BSAI crab resource underwent a significant decline during this time period, resulting in major reductions in catch for some fisheries and outright closures of three of the six major crab fisheries. Table 1 shows this decline in five-year increments.

**Economic Pressure**

While the crab amounts declined substantially, the total number of vessels participating in the fisheries did not. The biggest fisheries management problem with the Bering Sea crab fleet was that despite efforts to limit overcapacity and fishery participants through a license limitation plan, the catching power within the fleet far exceeded the available amount of crabs. As a result, the average vessel in the crab fleet was making less money. The annual ex-vessel value (average value of crab harvest per vessel) of the Bering Sea Crab harvest from the major crab fisheries was well below the decade average, falling from $1.75 million per vessel in 1990 to $0.7 million per vessel from 1995-1998.[8]

In such in a highly competitive fishing environment, a vessel with greater catching power has a better chance to catch more fish and obtain a greater economic reward. This was one of the major factors that transformed this economic problem into a safety problem.[9] In the Bering Sea crab fleet, the catching power or capability of a vessel is directly related to a critical vessel safety feature: the number of pots a vessel is able to carry.[10] As more vessels have entered the fisheries and crab stocks have declined, there has been a proportional reduction in per vessel harvest and income. In an attempt to recapture this lost share, some vessel owners have increased their harvesting capability by investing in the ability to carry additional pots.[11] The safe carriage

**Pursuing Enhanced Authority**

In 2006, as part of its FY08 legislative proposal, the Coast Guard recommended a provision that sought to authorize a pilot program for dockside crew survivability exams to conduct mandatory dockside crew survivability examinations on uninspected U.S. commercial fishing vessels in two geographic areas for a period of five years.

In the 110th Congress, the Coast Guard and Maritime Transportation Subcommittee of the House Committee on Transportation and Infrastructure introduced a more robust fishing vessel safety provision for FY09 as part of H.R. 2830, the Coast Guard Authorization Act of 2008, which passed the House of Representatives. Section 307 of H.R. 2830 would have mandated dockside fishing vessel examinations and crew training.

The Coast Guard continues to pursue expanded authority for mandatory dockside examinations of commercial fishing vessels in order to improve vessel safety in this vital industry.

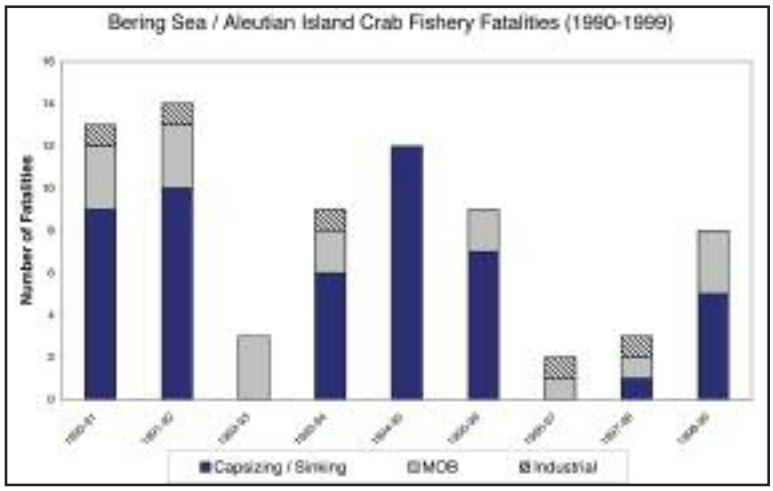


**Figure 1: BSAI Crab Fishery Fatalities 1990-1999 (USCG/NIOSH, unpublished data, 2008).**

of additional pots often necessitates expanding the vessel dimensions through increasing the length or beam of the vessel.[12] Because such investments are extremely expensive (e.g., a million dollars or more), not all owners can afford or are willing to take such measures, especially with the poor fishery outlook.

A much simpler and less expensive way to increase catching power is to carry additional pots without any vessel modifcation. For example, a vessel that normally carries 120 pots can increase its catching/earning power by 20 percent by adding 24 additional pots. Under the existing regulatory regime, the number of pots that a vessel can carry is limited by the vessel's stability booklet/letter, or ADF&G pot limits for certain fisheries. Adding pots beyond the vessel's stability requirements raises the center of gravity, decreases the freeboard of the vessel, and lessens the vessel's righting arm. In less technical terms, adding more pots to the vessel puts weight up higher, pushes the vessel lower in the water, and decreases the vessel's ability to right itself from external heeling forces such as wave action, wind action, or internal forces such as free surface effect, improper loading, or tank management.[13] Crab vessels are particularly susceptible to certain kinds of catastrophic casualty events. When fully loaded with pot gear, they are susceptible to capsizing, especially during icing conditions, as is common in the Bering Sea's winter months.

**Vessel Loss History and Fatality Rates 1990-1999**

From October 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.[14]

During this period, 50 people on 12 vessels died as the result of capsizing/sinking events.[15] At least eight of the 12 vessel losses occurred when the vessels were en route to or coming from the crab grounds in a loaded condition. A primary cause for many of these fatal capsizing/sinking events was vessel overloading or being fully loaded in icing conditions. According to USCG investigations, at least three of the 12 vessels lost were determined to be overloaded. When taking into account changes in workforce size, variations in season length, and number of vessels participating in the fishery, workers participating in crab fisheries in the Bering Sea were experiencing an astronomical fatality rate of 768 fatalities per 100,000 full-time fishermen.[16]

**Partnerships and Program Development**

Many stakeholders saw the need to develop a tailored program to address the specific hazards these vessels faced. The BSAI crab fleet historically had a high level of participation with the voluntary dockside exam (VDE) program. A voluntary dockside exam is conducted when USCG fishing vessel safety personnel are invited aboard the vessel at the master's request to examine required safety equipment. If the vessel is in full compliance, a VDE decal is issued. Although there was a high level of participation with the program (58 percent of the fleet had a current VDE decal in October 1999), there was a general recognition that the program was not addressing the safety problems within the fleet.

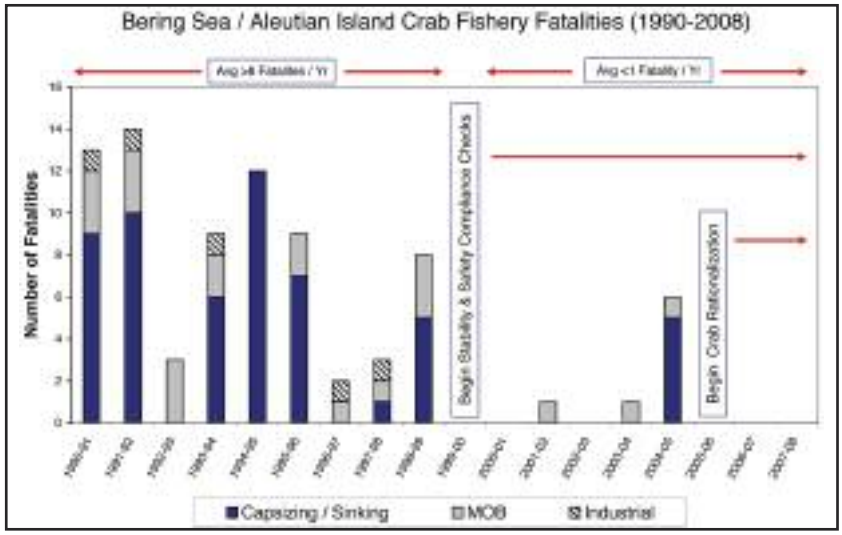


**Figure 2: BSAI Crab Fishery Fatalities 1990-2008 (USCG/NIOSH, unpublished data, 2008).**

To have the largest impact on reducing vessel losses and fatalities, the desired safety program would need to prevent capsizing events and specifically target the practice of vessel overloading. Because this kind of targeted safety intervention program had never been attempted before, it was critical to establish a strong agency/industry partnership to achieve maximum effectiveness.

The "At the Dock Stability and Safety Compliance Check" (SSCC) program that developed from this effort yielded impressive results. From October 1999 to January of 2005, the only fatalities associated with the fleet were three man overboard fatalities. Capsizing events had ceased. One exception happened on January 15, 2005, when the F/V *Big Valley* capsized, resulting in five fatalities. A subsequent investigation revealed that the vessel departed Dutch Harbor in a grossly overloaded condition and had not been the subject of an SSCC examination. It was also noted during the investigation that the vessel had been found to be overloaded in two previous SSCC exams, and had been directed to remove pots.

The loss of the vessel revealed the shortcomings in the USCG's ability to contact 100 percent of the fleet prior to the start of the season, and also revealed that the weight of crab pots had increased significantly since the issuance of most of the fleet's stability letters. Specifically, the F/V *Big Valley* was carrying approximately 55 crab pots (weighing 780 pounds each) instead of 31 pots (weighing 600 pounds each) as allowed by the vessel's stability report.

But even with this accident, in the seven years since this enforcement program was established, only eight lives have been lost, or slightly more than one life annually. This is a significant improvement over the 1990–1999 time period, where the fleet lost an average of eight fishermen annually.

**Overall Results**

The results of this program can be measured in the reduction of fatalities. Figure 2 depicts this decline in fatalities since implementation of the SSCC. Since its implementation in October 1999, and since the conclusion of the Olympic fisheries in January 2005, the USCG conducted at-the-dock stability checks and compliance examinations 12 times in October and January of each year prior to the crab seasons. The decline in the number of fatalities is real. According to NIOSH, this program has resulted in a 60 percent reduction in the fatality rate in the BSAI crab fleet.[18] The reduction in the

## STABILITY CHECK

The safety program developed for the BSAI crab fleet, known as the "At the Dock Stability and Safety Compliance Check," was cooperatively established through a partnership of the 13th and 17th Coast Guard Districts, the Alaska Crab Coalition (a crab industry group), the North Pacific Fishing Vessel Owners' Association, the National Institute for Occupational Safety and Health (NIOSH) Alaska Field Office, and ADF&G. By working closely with NIOSH to develop robust casualty analysis that could withstand industry and scientific scrutiny, the USCG was in a strong position to approach the Alaska Crab Coalition and the North Pacific Fishing Vessel Owners' Association to propose an intervention strategy that would:

- Increase USCG interaction with the crab fishing industry.
- Provide a mechanism to review stability and safety issues with vessel masters.
- Allow for mandatory dockside compliance examinations of required vessel safety equipment.
- Deter overloading of the crab vessels.

The Bering Sea/Aleutian Island crab industry leadership was very receptive to this kind of program because it placed a high value on safety and responsible vessel operations. The program was viewed in large part by the crab industry as a leveling of the playing field. The crab industry endorsed the program, offering strong support to senior USCG leadership through numerous public forums. Bringing together these various partners proved invaluable in implementing a viable and workable approach that would address key areas of concern without imposing an unnecessary burden on the crab fleet.

To execute the program, the USCG at Marine Safety Detachment Unalaska, accompanied by personnel from Marine Safety Office Anchorage, 17th USCG District, and the 13th USCG District, joined with ADF&G to conduct tank checks in multiple ports.[17] While ADF&G personnel conducted tank checks, the USCG reviewed vessel loading and stability issues with the master and checked for overloading. Operating in this manner, the ADF&G/USCG team would be on each vessel for a total of 10-15 minutes. Vessels found to be without stability reports, overloaded, or having missing, outdated, or inoperable primary lifesaving equipment (i.e. immersion suits, life rafts, EPIRBs) would be issued captain of the port orders and not be allowed to get underway until the safety discrepancy was corrected.

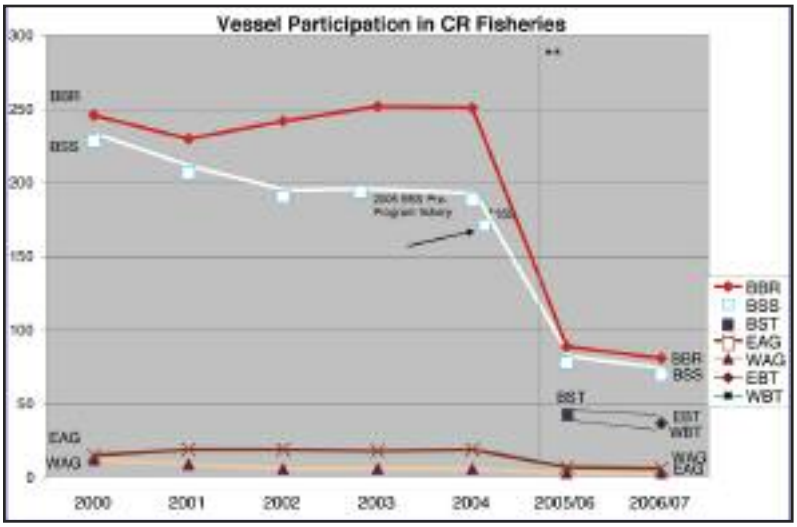


**Figure 3: Vessel Participation in CR Fisheries.[19] BBR = Bristol Bay red king crab, BSS = Bering Sea opilio crab, BST = Bering Sea Tanner crab, EAG = eastern Aleutian Island golden king crab, WAG = western Aleutian Island golden king crab, EBT = eastern Bering Sea bairdi crab, and WBT = western Bering Sea bairdi crab.**

fatality rate takes into account the reduction in the size of the fleet.

### Bering Sea Crab Rationalization

In 2005, the BSAI crab fishery management regime underwent comprehensive and dramatic change with the implementation of the BSAI crab rationalization (CR) program. This quota-based system provides allocations of crab resources to vessels, processing companies, and vessel masters.[20] The CR program includes several measures to protect revenues and employment in fishery-dependent coastal communities with a history of participation in the Bering Sea/Aleutian Island crab fisheries.[21] As a consequence, there are requirements for vessels to land catch in various communities.

Under this new system, the "Olympic" fishery is over. Vessels no longer maximize catch and income through a "race" to fish. Instead, vessel owners are issued a quota based upon their percentage of annual average catch, as recorded during certain qualifying years within the fishery. Vessel owners may fish that quota without competition from other vessel operators or concern that someone else will harvest their catch. Additionally, vessel owners may form cooperatives and lease or sell their quota to be harvested by another vessel. Cooperatives must use a hired master to harvest cooperative quota share, and vessels must be owned in part by a cooperative member.[22]

A primary goal of the crab rationalization program was to improve safety in the crab fleet by ending this race to fish, improving economic stability within the fleet, and allowing more efficient (and hopefully safer) vessels to harvest the quota. At the time of this publication, the CR program was in the midst of completing its 36-month review, as required by the North Pacific Fishery Management Council, and empirical safety data is incomplete at this time.

Based upon interviews with individual owners and operators, there are several changes brought about by the CR program that indicate safety is improving.

**Casualty Rates/SAR Cases.** Since the beginning of the CR program in August 2005, there continue to be no vessel losses for vessels participating in the rationalized crab fisheries.[23] However, USCG cutter time has increased from 10 days to 135 days annually due to the fleet taking advantage of the opportunities provided by the CR program to spread out their fishing effort over time.

**Increases in Fishing Season Length/Lack of a Derby Start.** There has been a significant increase in the number of fishing days for the fleet. In the final years of the Olympic-style Bristol Bay red king crab fishery, the season length had been reduced to three to four days. Under the new crab rationalization program, the average days fished per vessel was 26 days for the 2005/06 season and 21 days for the 2006/07 season.[24] Substantial season length increases have been noted for the Bering Sea opilio fishery as well. Ending the derby start has also provided masters the opportunity to ensure that the vessel and crew are fully ready before getting underway.

**Reduction in Vessels.** A major impact to the fleet following crab rationalization was the immediate and significant consolidation of fleet due to the sidelining of less efficient vessels and the extensive use of vessel cooperatives.[25]

**Crab Gear Carried and Fishery Pace.** Under the Olympic-style fisheries, vessels would maximize catching power to improve their ability to quickly locate and

***Comparison of* Olympic vs. Rationalized Crab Fishery [26]**

| | Harvest Volume | Average Pot Lifts Per Vessel Day | Average Pots Carried Per Vessel |
|---|---|---|---|
| **1992 Bristol Bay Red King Crab** (Olympic Style) | 16.9 Million | 107 | 294 |
| **2005 Bristol Bay Red King Crab** (Crab Rationalization) | 16.5 Million | 37 | 177 |

**Table 2**

## AT THE DOCK STABILITY AND SAFETY COMPLIANCE CHECK (SSCC) PROGRAM RESULTS

**Increased USCG interaction with the crab fishing industry.** USCG personnel have conducted At the Dock Stability and Safety Compliance Check (SSCC) examinations simultaneously in multiple western Alaska ports for every major crab fishery in western Alaska since October 1999. The goal for each crab season was to conduct mandatory compliance examinations of 60 to 70 percent of the crab fleet (160–175 vessels) at the dock prior to the start of the season. In determining which vessels were boarded, no distinction was made between vessels with current fishing vessel safety decals (approximately 58 percent of the fleet) and vessels with no decals (42 percent of the fleet) because the primary focus was on vessel loading practices.

In addition to these dockside operations, USCG personnel began attending nightly price negotiation meetings as well as annual crab industry meetings to review program results and familiarize themselves with crab fishery issues. These direct visits to vessels and industry meeting attendance greatly increased USCG/crab industry/fishery manager interactions, allowing development of a sustained and mutually beneficial relationship.

**Provided a mechanism to review stability-related issues with vessel masters.** During the course of the SSCC examinations, USCG personnel reviewed vessel stability letters with vessel masters. The stability information lists the number of pots that can be carried by the vessel safely in non-icing conditions, and have specific tank and hold loading instructions or reduced pot loadings for icing conditions. Reviewing stability information at the dock provided an ideal opportunity to emphasize the importance of vessel stability and to correct any vessel loading problems.

**Allowed examination of vessel safety equipment.** Another program focus was to examine primary lifesaving equipment. This included spot checks of immersion suits, life rafts, and EPIRBs to ensure all required equipment was properly serviced and installed correctly. During the first season, approximately 50 percent of the vessels had major safety deficiencies associated with primary lifesaving equipment. Because compliance checks were conducted at the dock and prior to the start of the season, corrections of deficiencies related to primary lifesaving equipment could be addressed immediately with minimal disruption to vessel operations. Five years into the program, primary lifesaving deficiencies were noted on less than five percent of the boats examined—a 90 percent decline in this type of discrepancy. Additionally, the number of vessels participating in the fishing vessel safety decal program increased from approximately 58 percent in 1999 to 95 percent in 2005.

**Deterred overloading.** The main goal of the program was to provide a deterrent to overloading. By flooding individual ports with USCG marine safety personnel and having those personnel conduct mandatory compliance examinations at the dock for a large number of crab boats prior to the start of the season, the opportunity for detection of overloading was greatly increased. One to two vessels were detected in an overloaded or improperly loaded condition, and were directed to remove pots. Because compliance checks were conducted at the dock and prior to the start of the season, the removal of pots could be done safely and with minimal disruption to vessel operations.

catch crab in the intensely competitive derby fishery. Since the implementation of the CR program, the number of pots carried has been decreased significantly, reducing the emphasis on catching power and potentially providing a greater margin of safety. Table 2 provides a comparison between the 1992 Bristol Bay red king crab season and the 2005 Bristol Bay red king crab season.

Of further interest is the reduction in the number of pot lifts per vessel per day. This is an indicator of fishery pace, and demonstrates that the fishery has slowed down considerably under the CR program, providing more opportunity for crew rest and reducing crew fatigue.

### A Look Ahead

Despite these notable changes in operational behavior, which can improve safety, the crab rationalization program alone is not enough to make all safety problems disappear. With implementation of the program, other influences have developed that could negatively impact safety.

Interviews with individual masters have indicated that since the program dictates a percentage of the catch be delivered to pre-designated processors, there are times when vessels are forced to deliver to ports where waterway conditions are poor due to winter icing.[27] In addition, vessel masters have also expressed concern about rigid delivery dates established by processors and the implications of having to "race" to meet preestablished delivery schedules.

Given the exceptionally challenging operating conditions of the Bering Sea, it is still necessary for the USCG and agency/industry partners to continue emphasizing the safety of these vessels through fleet-wide dockside prevention efforts. The SSCC examination process relied on the "race to fish" to maximize USCG exposure to the fleet in a short time frame.

To maintain the USCG's ability to have extensive interactions with the crab fleet, the ADF&G and NMFS have changed their regulations to require that vessels participating in the CR fisheries have a current fishing vessel safety decal. This adjustment provides the USCG with regular opportunity to visit the vessels to ensure compliance with safety requirements. It also provides suitable leverage to hold a vessel in port if there are serious safety concerns detected that need to be addressed before the vessel is permitted to get underway.

***About the authors:***
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**Endnotes:**

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2. The fatality rate is the number of fishermen who died per 100,000 full-time equivalent fishermen. NIOSH, 2002. "Surveillance and prevention of occupational injuries in Alaska: A decade of progress, 1990-1999." Cincinnati (OH): National Institute for Occupational Safety and Health. Pub. No. 2002-15. 49.
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8. Natural Resources Consultants, Inc., 1999. "Status of Washington based commercial fisheries and the fleets future utilization of Fisherman's Terminal." Seattle: Natural Resources Consultants, Inc.
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18. CDC, 2008. (see endnote 16)
19. NOAA, 2008. "Bering Sea and Aleutian Islands Crab Rationalization Program Report Fishing Year 2007/08." NOAA Fisheries Service (NMFS) Alaska Region Restricted Access Management.
20. Steven Hughes and Chris Woodley, 2007. "Impacts on Alaska fishing fleets and their crews due to transition from open access to quota based fishery management regimes." *International Maritime Health*, 2007, 58 – No. 1-4.
21. NOAA, 2008. (see endnote 19)
22. Ibid.
23. On January 6, 2009, after preparation of this article, the first fatality in the BSAI crab fishery occurred on the F/V *Seabrooke* due to a fall overboard. This was the first fatality in this fishery since January 2005.
24. Gunnar Knapp, 2006. "Economic Impacts of BSAI Crab Rationalization on Kodiak Fishing Employment and Earnings and Kodiak Businesses Anchorage." University of Alaska Institute of Social and Economic Research.
25. NOAA, 2008. (see endnote 19)
26. Bowers et al., 2008. (see endnote 5)
27. Personal communications, January 2007.

## CONCLUSIONS

1. The At the Dock Stability and Safety Compliance Check examination program developed among the USCG, partner agencies, and the BSAI crab industry has had a significant positive impact in reducing vessel loss and subsequent fatalities in the BSAI crab industry by 75 percent.
2. The high level of coordination and communication among all stakeholders, particularly between the USCG and the crab industry, should be used as a model for other fishing vessel safety intervention programs.
3. A critical component of the program was conducting mandatory compliance examinations at the dock, where serious safety concerns could be identified and remedied without placing the vessel or the crew in danger.
4. The At the Dock Stability and Safety Compliance Check examination increased visibility and participation in the USCG fishing vessel safety decal program.
5. Major safety improvements such as reducing vessel losses and subsequent casualties in the Bering Sea crab fleet occurred with the implementation of the At the Dock Stability and Safety Compliance Checks, before the start of the BSAI crab rationalization program.
6. The crab rationalization program has significantly reduced, if not completely eliminated, the "race to fish."
7. An increased number of fishing days, increased flexibility for masters to choose when to fish, and reduced emphasis on catching power and large pot loads potentially have safety benefits and contribute to eliminating vessel losses.
8. Under its current construct, there are incentives in the BSAI crab rationalization program to "race" to meet prearranged landing dates or locations. This "race" and its potential inflexibility may create safety hazards for the fleet.
9. Despite safety improvements, it is still imperative that owners provide well-maintained vessels and professionally trained crews to operate in this fishery, and it is also necessary that the USCG and agency/industry partners continue dockside compliance and casualty prevention efforts.
10. A significant and continued commitment on the part of the vessel owners and fishery managers is necessary to ensure that other economic factors or fishery management decisions do not negatively impact safety.


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