**Recommendations**

**Vessel Disasters**

- Take a marine safety class at least every five years. Safety training for fishermen is available, affordable, and saves lives. All fishermen should learn and know how to use basic life-saving equipment like immersion suits, life rafts, EPIRs, and fire extinguishers to improve their chances of survival in an emergency.
- Conduct routine drills for abandoned ship, fire, and flooding. The practical knowledge learned in safety training should be applied each month during drills, allowing fishermen to reinforce the skills needed in an emergency.
- Ensure watertight integrity of the vessel. The hull and through-hull penetrations should be regularly inspected and maintained. Doors and hatches should remain closed to eliminate leaks, especially in rough weather. Maintain and test high water alarms before each trip.
- Maintain proper watch. Vessel owners and operators should be familiar with vessel management policies and use watch alarms to prevent groundings and collisions.

**Falls Overboard**

- Use a man-overboard alarm system. Many fishermen who died from falling overboard were not witnessed, delaying recovery time and reducing chances of survival. A man-overboard alarm system should be in place for them to re-board their vessel unassisted after a fall. 
- Conduct man-overboard drills monthly. Recovery procedures should be practiced regularly to ensure all crewmembers are prepared to respond to a fall overboard.
- Use engineering controls to prevent vessel entanglement. Fishermen should use devices, such as line lockers, so that crewmembers can easily locate and recover a vessel after a fall overboard. More information on engineering solutions for fishing vessels can be found at cdc.gov/niosh/topics/fishing/engineering/.

**Onboard Fatalities**

- Install safety devices on deck machinery. Emergency-stop buttons have been developed specifically for deck machinery on fishing vessels and can be adapted and installed onto winches or other machinery. Stationary guarding and auxiliary equipment are also being tested. More information about the engineering solutions for fishing vessels can be found at cdc.gov/niosh/topics/fishing/engineering/.

**Diving Fatalities**

- Be alert and focused while the diver is in the water. Administer first aid, including the use of an oxygen delivery system, if needed. Vessel operations should be suspended until the diver can be assisted and saved.
- Maintain dives' various positions. Ensure that all equipment is in good working order. Vessel owners and operators should be aware of the potential dangers associated with diving operations and should train their crew before each dive.

**Vessel Safety Systems**

- Inflatable life rafts, life jackets, and/or life jackets to ensure the deck in case of loose lines that could potentially entangle a crewmember or drag them overboard. More information on engineering solutions for fishing vessels can be found at cdc.gov/niosh/topics/fishing/engineering/.

**Safety Training**

- Be prepared to perform emergency procedures for both vessel and dive emergencies.
- Be alert and focused while the diver is in the water.
- Maintain dives' various positions. Ensure that all equipment is in good working order.

**Fatality Rates**

- Use FTEs (full-time equivalents) to calculate fatality rates. FTEs are used to estimate fishing effort and are calculated as follows: # of Fatalities / # of FTEs × # of FTEs / # of Vessels × # of Crew / # of Vessels × # of Days / # of Vessels

- Use a man-overboard alarm system. Many fishermen who died from falling overboard were not witnessed, delaying recovery time and reducing chances of survival. A man-overboard alarm system should be in place for them to re-board their vessel unassisted after a fall.

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During the 15-year period 2000–2014, 225 commercial fishing deaths occurred in East Coast fisheries, averaging 15 fatalities annually (Figure 1). During the first decade (2000–2009), 160 fatalities occurred, for an average of nearly 17 deaths per year. For the most recent five year period (2010–2014), 65 fatalities were recorded, averaging 13 fatalities annually. During 2000–2009, the majority of fatalities in the region were caused by vessel disasters, however, during 2010–2014, vessel disasters and falls overboard resulted in the same number of deaths on the East Coast.

Vessel disasters accounted for 37% of all deaths during 2010–2014 (Figure 2). Vessel disasters are sinkings, groundings, fires, or other events that force vessel operators to abandon ship. Drowning following a fall overboard caused the same number of fatalities as vessel disasters (22). Of the seven crewmembers who died from falls overboard, one was a suicide. The remaining onboard fatalities involved two vessel disasters, two vessel capsizings, one vessel grounding, one vehicle fatality, and one suicide. The majority of onboard fatalities occurred while checking traps and lines. The second highest number of fatalities occurred in the scallop fishery, with three deaths caused by vessel disasters, two vessel deaths caused by falls overboard, and one death caused by an onboard injury.

Fatalities caused by vessel disasters during 2010–2014 were distributed across 75 vessels, with 26 of these vessels involved in more than one fatality. The vast majority of fatalities occurred on the East Coast (Figure 1). None of the fishermen were wearing a personal flotation device (PFD) when they drowned. In 19 (87%) of these cases, the falls occurred while the vessel was at sea. In 8 (36%) of these falls, the fishermen were alone on the vessel (7) or alone on deck (1). Of the falls overboard for which causes were known, four (18%) were caused by gear entanglements.

Conversely, the proportion of deaths due to vessel disasters increased during 2010–2014. Since none of the fishermen were wearing a PFD when they fell overboard and drowned, increasing their use when on deck should be a priority. Gear entanglements are still a concern and prevention strategies, such as the use of line bins and draggers at the stern, should continue.

During 2010–2014, 22 crewmembers died from drowning after falling overboard, contributing to 37% of fatalities in the region. The leading cause of death was falling overboard after a vessel capsize or other vessel disaster (18). The second leading cause of death was being struck by large waves and flooding, while the leading causes for nonfatal events were flooding and drowning at sea.

Vessel disasters and falls overboard resulted in the same number of fatalities on the East Coast during 2010–2014.

Vessel deaths on the East Coast during 2010–2014 were a leading cause of commercial fishing fatalities during 2010–2014. A total of 109 vessel disasters occurred on the East Coast during this time period (Figure 4), placing 242 crewmembers at risk of injury, immersion, and death. While there are regulations in place that mandate survival equipment to be carried onboard commercial fishing vessels such as life rafts, EPIRBs, and in some instances, keepers, two vessel deaths occurred by falls overboard, and one death caused by an onboard injury. Despite increased use and availability of personal flotation devices (PFDs), fatalities caused by vessel disasters continued to occur.

During 2000–2009, the majority of fatalities in the region were caused by vessel disasters, however, during 2010–2014, vessel disasters and falls overboard resulted in the same number of deaths on the East Coast. Vessel disasters accounted for 37% of all deaths during 2010–2014 (Figure 2). Vessel disasters are sinkings, groundings, fires, or other events that force vessel operators to abandon ship. Drowning following a fall overboard caused the same number of fatalities as vessel disasters (22). Of the seven crewmembers who died from falls overboard, one was a suicide. The remaining onboard fatalities involved two vessel disasters, two vessel capsizings, one vessel grounding, one vehicle fatality, and one suicide. The majority of onboard fatalities occurred while checking traps and lines. The second highest number of fatalities occurred in the scallop fishery, with three deaths caused by vessel disasters, two vessel deaths caused by falls overboard, and one death caused by an onboard injury.

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During 2010–2014, 22 crewmembers died from drowning after falling overboard, contributing to 37% of fatalities in the region (Figure 4). None of the fishermen were wearing a personal flotation device (PFD) when they drowned. In 19 (87%) of these falls, the fatalities occurred while the vessel was at sea. In 8 (36%) of these falls, the fishermen were alone on the vessel (7) or alone on deck (1). Of the falls overboard for which causes were known, four (18%) were caused by gear entanglements.

Safety training for fishermen is available, affordable, and saves lives.

About this Report

The National Institute for Occupational Safety and Health (NIOSH) is the federal agency responsible for conducting research and making recommendations for the prevention of workplace injury and illness. In 2010, NIOSH published an in-depth study of commercial fishing deaths on the East Coast. NIOSH recently completed a five-year update (2010–2014) to the previous study in order to identify current hazards among fishers in the different regions of the country: Alaska, West Coast, East Coast, and the Gulf of Mexico. This document is one in a set of four reports summarizing the most recent fatality and vessel disaster data for US fishing regions.
During 2010–2014, 22 crewmembers died from drowning after falling overboard, contributing to 37% of fatalities in the region (Figure 5). None of the fishermen were wearing a personal flotation device (PFD) when they drowned. In 12 (55%) of these cases, the falls occurred while not wearing a PFD because the fishermen were alone on the vessel (7) or alone on deck (5). Of the falls overboard for which causes were known, four (36%) were caused by gear entanglements.

Compared to 2000–2009, fishing fleets operating on the East Coast during 2010–2014 had a lower percentage of fatalities caused by vessel disasters. However, many fishermen were at serious risk of injury, immersion, and death. While there are regulations in place that mandate survival equipment to be carried onboard commercial fishing vessels such as life rafts, EPIRBs, and immersion suits, fishermen should practice using the equipment by attending marine safety training and conducting regular emergency drills. Efforts to prevent hazards leading to vessel disasters such as vessel instability, collisions, flooding, and entanglement gear on the ocean floor should be continued.

Consequently, the proportion of deaths due to falls overboard increased during 2010–2014. Since none of the fishermen were wearing a PFD when they fell overboard and drowned, increasing their use when it docks should be a priority. Boating arrangements will still be a concern and prevention strategies, such as the use of life line and rope lockers, should be more widely adopted and evaluated for effectiveness. Mooring-alarm and re-boarding buttons should be used to help in the event a fall overboard occurs, particularly when fishermen are working alone.

Vegetation disaster and falls overboard resulted in the same number of fatalities in the East Coast during 2010–2014. These are leading causes of commercial fishing fatalities during 2010–2014. A total of 109 vessel disasters occurred on the East Coast during this time period (Figure 4), placing 242 crewmembers at risk of death. Vessel disasters caused the same number of fatalities as vessel disasters (22). The leading causes of fatal events were being struck by large waves and flooding, while the leading causes for nonfatal events were flooding and drifting rocks.

Causes of Vessel Disasters, East Coast, 2010–2014 (109 Total)

Vessel disasters accounted for 37% of all deaths during 2010–2014 (Figure 2). Vessel disasters are accidents involving capsizing, grounding, fire, or other events that force the crew to abandon ship. Drowning following a fall overboard caused the same number of fatalities as vessel disasters (22). Of the seven crewmembers who died from injuries sustained in vessel disasters, six (86%) were working alone on the vessel, and one was a suicide. The remaining onboard fatalities involved one crewmember working alone in the cockpit, one being struck by equipment, and one who suffered multiple fatal injuries when he was pulled out of a channel marker. Five crewmembers died from injuries sustained while diving. Lastly, four fishing fatalities resulted with a channel marker. Five crewmembers died from injuries who suffered multiple fatal injuries after his vessel collided in equipment, one being struck by equipment, and one fatalities involved two crewmembers becoming entangled on gear. A total of 22 fatalities occurred in 19 different fisheries along the East Coast, with five contributing to almost half (48%) of the deaths (Figure 3). The lobster fishery had the highest number of fatalities with more death caused by falls overboard (50%) than vessel disasters (30%). There were also two fatalities that occurred when divers were checking traps and lines. The second highest number of fatalities occurred in the scallop fishery, with three deaths caused by falling overboard, two vessel disasters, and one death caused by an burn injury.
Vessel disasters were a leading cause of commercial fishing fatalities during 2010–2014. A total of 109 vessel disasters occurred on the East Coast during this time period (Figure 4), placing 242 crewmembers at risk of immersion and death. While 91% of the 242 fatalities related to vessel disasters survived, 18% died in 22 fatalities. The leading cause of fatal events were being struck by large waves and flooding, while the leading causes for nonfatal events were flooding and striking rocks.

Conclusions
Compared to 2000–2009, fishing fleets operating on the East Coast during 2010–2014 had a lower percentage of fatalities caused by vessel disasters. However, many crewmembers were at serious risk of injury, immersion, and death.

While there are regulations in place that mandate survival equipment to be carried onboard commercial fishing vessels such as life rafts, EPIRBS, and immersion suits, fishermen should practice using the equipment by attending marine safety training and conducting regular emergency drills. Efforts to prevent hazards leading to vessel disasters such as vessel instability, collisions, flooding, and striking gear on the ocean floor should be continued.

Conversely, the proportion of deaths due to falls overboard increased during 2010–2014. Since none of the fishermen were wearing a PFD when they fell overboard and drowned, increasing their use when on deck should be a priority. Boarding ladders should be used to help in the event a fall overboard occurs, particularly when fishermen are working alone.

Safety training for fishermen is available, affordable, and saves lives.
Install safety devices on deck machinery.
Ensure watertight integrity of the vessel.
Take a marine safety class at least every five years.
Conduct man-overboard drills monthly.
Be prepared for a dive emergency.
Use a man-overboard alarm system.
Dive with an experienced, alert tender.

Commerical fishing fleets have different numbers of vessels, fishermen, and season lengths. Because of these operating differences, we cannot simply use the number of fatalities in each fleet to compare their risk for fatalities. Instead, we calculate fatality rates to measure risk. Risk is the probability of a fatality occurring.

Fatality rates were calculated for fleets that experienced five or more fatalities during a 10-year period (2005–2014) and where workforce estimates were available (Figure 6). During this period, the highest fatality rates on the East Coast were observed in the West Coast Non-Tribal Dungeness Crab fleet (7.7 fatalities per 10,000 FTEs) and the lowest rates were observed in the Atlantic Scallop fleet (0.07 fatalities per 10,000 FTEs). During 2005–2014, no overall trends in rates were observed in most East Coast fleets; however, the Atlantic scallop fleet did experience a significant decrease in both the number and rate of crewmember fatalities.

Comparing risk between fleets

Vessel Disasters

Falls Overboard

A fall overboard can be anticipated and avoided by using a fall arrest system. Once a fall occurs, a device with GPS capabilities can alert the vessel’s location to assist in search and recovery efforts. Many falls occur on deck, and a fall arrest system can successfully prevent fatalities. A man-overboard alarm system may be effective in reducing the number of fatalities due to falls overboard.

Use a man-overboard alarm system. Man-overboard alarm systems that work locally can alert the vessel of a fatality immediately. A device with GPS capabilities can alert the vessel’s location to assist in search and recovery efforts. Many falls occur on deck, and a man-overboard alarm system can successfully prevent fatalities.

Recovery procedures should be practiced regularly to ensure all crewmembers are prepared to respond to a fall overboard.

Use engineering controls to prevent your entanglement. Many falls occur due to entanglement with lines or cables on the vessel. To prevent entanglement, use engineering controls, such as line lockers to ensure the deck is free of loose lines.

Line lockers can be adapted and retrofitted onto winches or other machinery. Stationary guarding and auxiliary-lighting systems can be developed specifically for deck machinery on fishing vessels. Engineering solutions for fishing vessels can be found at cdc.gov/niosh/docs/wp-solutions/2005-137/default.html.

Onboard Fatalities

Install safety devices on deck machinery. Emergency-stop buttons have been developed specifically for deck machinery on fishing vessels and can be adapted and retrofit to ensure the safety of all crewmembers. These devices are also being tested. More information about engineering solutions for fishing vessels can be found at cdc.gov/niosh/docs/wp-solutions/2005-137/default.html.

Recomendations

Vessel Disasters

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Comparing risk between fleets

Commercial fishing fleets have different numbers of vessels, fishermen, and season lengths. Because of these operating differences, we cannot simply use the number of fatalities in each fleet to compare their risk for fatalities. Instead, we calculate fatality rates to measure risk. Rate is the probability of a fatality occurring.

Fatality rates were calculated for fleets that experienced five or more fatalities during a 10-year period (2005–2014) and whose workloads estimates were available (Figure 6). During this period, the highest fatality rate on the East Coast was in the West Coast Multi-Species Groundfish Trawl fleet. During 2005–2014, no overall trends in rates were observed in most East Coast fleets; however, the Atlantic scallop fleet did experience a significant decrease in both the number and rate of crewmember fatalities.

Fatality rates were calculated using updated methods for calculating FTEs. This improved method matches workforce estimates with exposure data, which has been used by other agencies and academic institutions, and allows the fatality rates to be compared across fleets and across time.

For this study, we're using an updated method for calculating FTEs. This improved method matches workforce estimates with exposure data, which has been used by other agencies and academic institutions, and allows the fatality rates to be compared across fleets and across time.

Why use a fatality rate?

To determine the risk of fatalities in different fleets, we need to consider the number of vessels in the fleet, number of fishermen, and the length of time that they spend working and exposed to potential hazards. By calculating rates, we can take into account operating differences, we cannot simply use the number of fatalities in each fleet to compare their risk for fatalities.

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How do we calculate a fatality rate?

We know how many fatalities occurred in each fleet, based on our data collection from US Coast Guard investigation reports and documents from various agencies. For many of the fleets around the US, we also know how many vessels, crewmembers, and FTEs there are. This information is used to estimate "full time equivalent" (FTEs) for each fleet.

Here’s how we calculate FTEs:

1. # Vessels × # Crew per Vessel × # Operating Days / 24 Hours = # FTEs
2. # FTEs [2,000 hours (standard 40-hour work week for the year)] × # of Fatalities = Fatality Rate (per 10,000 FTEs)

Here’s how we compare the fatality rate:

<table>
<thead>
<tr>
<th>Fleet</th>
<th># Vessels</th>
<th># Crew per Vessel</th>
<th># Operating Days</th>
<th># FTEs</th>
<th>Fatality Rate (per 10,000 FTEs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Coast Bagged Buoys</td>
<td>800</td>
<td>5</td>
<td>240</td>
<td>16,000</td>
<td>0.33</td>
</tr>
<tr>
<td>Atlantic Clam/Quahog Dredge</td>
<td>800</td>
<td>5</td>
<td>240</td>
<td>16,000</td>
<td>0.25</td>
</tr>
<tr>
<td>Atlantic Scallop</td>
<td>800</td>
<td>5</td>
<td>240</td>
<td>16,000</td>
<td>0.12</td>
</tr>
<tr>
<td>Alaska Salmon Tender</td>
<td>800</td>
<td>5</td>
<td>240</td>
<td>16,000</td>
<td>0.10</td>
</tr>
<tr>
<td>Alaska Salmon DR/P</td>
<td>800</td>
<td>5</td>
<td>240</td>
<td>16,000</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Here’s how we use FTEs to calculate a fatality rate:

Fatality Rate (per 10,000 FTEs) = # Fatalities / # FTEs

Recomendations

Vessel Disasters

Take a mine safety class at least every 5 years. Training for firefighters is available, affordable, and saves lives. All fishermen should learn and know how to use basic firefighting equipment like immersion suits, life rafts, EPIRBs, and fire extinguishers to improve their chances of survival in an emergency.

Falls Overboard

A visible on-board alarm system can be used to signal the fisherman’s location to assist in search and rescue efforts. Many falls overboard are not witnessed, delaying recovery time for fishermen who died from falling overboard. Be alert and focused while the diver is in the water. Train the crew to recognize when a diver is in distress and implement procedures for both vessel and dive emergencies.

Diving Fatalities

Install safety devices on deck machinery. Emergency-stop buttons have been developed specifically for deck machinery on fishing vessels and can be adapted and retrofit onto winches or other deck equipment. If they are not installed, crewmembers should be in place for them to re-board their vessel unassisted after a fall.

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Onshore Fatalities

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Fatality Rate (per 10,000 FTEs)

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