Comparing risk between fleets

Table 1: Fatality rates for two fleets: multi-species groundfish trawl and non-tribal Dungeness crab. During 2005–2014, the non-tribal Dungeness crab fleet experienced a significant decrease in both the number and rate of fatalities compared to other occupations. As a result of the change in our calculation methods, the fishing fatality rates what is used by other agencies and academic institutions, and allows the fatality rates to be compared across different fleets.

<table>
<thead>
<tr>
<th>Fleet</th>
<th>Fatality Rate (per 10,000 FTEs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Coast Multi-Species Groundfish Trawl</td>
<td>24.9</td>
</tr>
<tr>
<td>Northeast Multispecies Groundfish Trawl</td>
<td>41.3</td>
</tr>
<tr>
<td>Atlantic Drift Gillnet</td>
<td>10.2</td>
</tr>
<tr>
<td>Northeast Multi-Species Groundfish Trawl</td>
<td>28.0</td>
</tr>
<tr>
<td>Atlantic Scallops</td>
<td>20.3</td>
</tr>
<tr>
<td>Alaska Salmon Drift Gillnet</td>
<td>13.3</td>
</tr>
<tr>
<td>Northeast Multispecies Groundfish Trawl</td>
<td>20.3</td>
</tr>
<tr>
<td>Gulf of Mexico</td>
<td>3.6</td>
</tr>
<tr>
<td>Northeast Multispecies Groundfish Trawl</td>
<td>24.9</td>
</tr>
<tr>
<td>Alaska Groundfish Freezer Trawl (A80)</td>
<td>24.9</td>
</tr>
<tr>
<td>Atlantic Trawl</td>
<td>20.3</td>
</tr>
<tr>
<td>Alaska Salmon Trawler</td>
<td>13.3</td>
</tr>
<tr>
<td>Alaska Halibut/Sablefish/Lingcod Trawler</td>
<td>1.3</td>
</tr>
<tr>
<td>Atlantic Trawl</td>
<td>10.2</td>
</tr>
<tr>
<td>Alaska Salmon Trawler</td>
<td>6.1</td>
</tr>
<tr>
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<td>13.3</td>
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</table>

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. To calculate this, we can use the formula:

\[
\text{Fatality Rate} = \frac{\text{Number of Fatalities}}{\text{Number of FTEs} \times \text{Operating Days} \times 24 \text{ Hours}}
\]

Fleets with higher fatality rates are more dangerous than fleets with lower rates.

How do we calculate a fatality rate?

We have 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, fishermen, and operating days are in the fleet each year. This information is used to estimate “full-time equivalent” fishermen (FTEs).

Recommendations

**Vessel Disasters**

- Take a marine safety class at least every five years.
- Safety training for fishermen is available, affordable, and necessary. All fishermen should be able to recognize hazards before they happen and take the proper actions.
- All fishermen should be trained on vessel survival techniques, life rafts, EPIRBs, and fire extinguishers to prepare their crew for survival in an emergency.
- Conduct monthly drills for abandon ship, fire, and flooding. The practical knowledge learned in safety training should be applied each month (DR), allowing fishermen to refresh their skills needed in an emergency.
- Conduct vessel drills for vessel rescue and re-boarding.
- Ensure watertight integrity of the vessel.
- Use fall protection and fall restraint equipment when working above water or more than 5 feet above a solid surface.
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- 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. To calculate this, we can use the formula:

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\]

- Use safe fall protection practices.
- When working above water or more than 5 feet above a solid surface, use fall protection. Use proper personal protective equipment, including fall restraint, fall arrest, and fall arrest equipment, not body belts or ropes around the waist. Use hardhats, chains, and ropes to prevent falls through deck openings, edges, and stairwells.
- Do not use cranes to hoist workers unless the crane is specifically approved for lifting personnel.
- Protect against electrical hazards.
- De-energize electrical equipment before inspection or repair, and use a lockout tagging out program. Keep electrical tools properly maintained, and use appropriate personal protective equipment.

**Falls Overboard**

- Wear a PFD on deck.
- Nationwide, none of the fishermen who died from falling overboard were wearing a PFD when they drowned. PFDs can keep fishermen afloat, giving the crew time for rescue.
- In a man-overboard alarm system, a man-overboard alarm is not restrained, delaying recovery time and reducing chances of survival. A man-overboard system will alert the crew that a fall overboard occurred, and a device with GPS capabilities can signal the fisherman’s location to assist in search and recovery efforts.
- Add effective recovery devices and re-boarding ladders. A rescue sling or similar device is more effective than a life ring for bringing a crewmember back on the vessel. If a fisherman falls alone, a plan should be in place for him 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.

**Onboard Fatality**

- Install safety devices on deck machinery.
- Emergency-stop buttons have been developed specifically for deck machinery on fishing vessels, and they are being tested in other machinery. Stationary guarding and auxiliary stops are also being tested. More information about engineering solutions for fishing vessels can be found at: gid.gishealth.org/fishing/engineering/
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**Diving Fatalities**

- Dive with an experienced, alert tender. Be familiar with vessel operations, safety equipment, and procedures for both vessel and dive emergencies.
- Be prepared for a dive emergency. Be prepared to administer first aid, including the use of oxygen delivery system.
- Maintain diving equipment. Ensure that compressors and other equipment used in diving operations are in good working condition.

National Institute for Occupational Safety and Health

Commercial Fishing Safety Research and Design Program

2010–2014

West Coast Fatal Fishing Events

Data Hoy

• Total Fatal Event
• Fatal Fall Overboard
• Non-Fatal Fall Overboard
• Diving Fatality

Nevada

• Total Fatal Event
• Fatal Fall Overboard
• Non-Fatal Fall Overboard
• Diving Fatality

Onboard Fatalities

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About this Report

During the 15-year period 2000–2014, 115 deaths occurred in West Coast fisheries, averaging almost eight fatalities annually (Figure 1). During the first decade (2000–2009), 85 fatalities occurred, for an average of nearly nine deaths per year. For the most recent five-year period (2010–2014), 30 commercial fishing fatalities were recorded, averaging six fatalities annually. This recent period experienced both the lowest (two deaths) and highest (nine deaths per year). For the most recent five-year period (2010–2014), 30 commercial fishing fatalities were recorded, averaging six fatalities annually. This recent period experienced both the lowest (two deaths) and highest (nine deaths per year).

Figure 1

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<tr>
<th>Year</th>
<th>Number of Fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>6</td>
</tr>
<tr>
<td>2001</td>
<td>8</td>
</tr>
<tr>
<td>2002</td>
<td>7</td>
</tr>
<tr>
<td>2003</td>
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<td>2004</td>
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<td>2005</td>
<td>7</td>
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<tr>
<td>2006</td>
<td>8</td>
</tr>
<tr>
<td>2007</td>
<td>7</td>
</tr>
<tr>
<td>2008</td>
<td>8</td>
</tr>
<tr>
<td>2009</td>
<td>8</td>
</tr>
</tbody>
</table>

Two falls overboard involved fishing gear: one fisherman was entangled in gear and another was knocked overboard by gear. The first incident involved a fisherman losing his balance and falling overboard. None of the four falls overboard were a personal flotation device (PFD). The causes of the three onshore fatalities during 2010–2014 were falling from being hit or falling asleep. The onshore fatality involved being caught by the tide and washed offshore. To help prevent vessel disasters, maintain proper watch and ensure watertight integrity of the vessel.

Conclusions

Vessel disasters were the most fatalities during 2010–2014. A total of 15 vessel disasters occurred on the West Coast during this time period (Figure 4), placing 911 crewmembers at risk of immersion and death. While 91% of crewmembers involved in vessel disasters survived, 12 disasters resulted in 18 fatalities. Poor weather was reported to have contributed to five (36%) of the 12 fatal vessel disasters and two (11%) of the 7 nonfatal vessel disasters. The leading causes of fatal vessel disasters were striking rocks, flooding, and being struck by large waves. Likewise, the leading causes of nonfatal vessel disasters were striking rocks and flooding. Off the 18 vessel disasters caused by striking rocks, 56% involved fatigue or a crewmember being asleep at the helm. Off the 7 vessel disasters initiated by flooding, the cause of flooding was known for only seven, with four full hulls, one open sea valve, one water entry in the garboard, and one washing within an open skiff. Of the seven vessel disasters caused by instability, almost all were due to overloading, with only one due to turning at a high speed. The Dungeness crab fleet experienced the highest number of vessel disasters (24), followed by five of which were fatal and 19 nonfatal. The salmon fleet experienced almost a quarter of all vessel disasters (16, 23%), three of which were fatal and 13 nonfatal.

Safety training for fishermen is available, affordable, and saves lives.
Vessel disasters resulted in the most fatalities during 2010–2014. A total of 69 vessel disasters occurred on the West Coast during this time frame (Figure 4), placing 190 crewmembers at risk of immersion and death. While fishermen should use PFDs while working on deck to stay afloat if a fall overboard occurs, all crewmembers should be trained in proper man-overboard recovery procedures by participating in monthly drills. Use of overboard alarms and effective recovery devices may improve chances of successfully locating a man-overboard and bringing the crewmember back onboard the vessel. When fishermen choose to fish alone, they should ensure ways to re-board their vessels without assistance, in case a fall overboard occurs.

Drivers and tenders should be trained in proper operational and emergency procedures in order to prevent injury or death from rapid ascents, gear entanglements, and other circumstances. Crewmembers should be alert while working at the helm and saves lives.

Figure 4

Causes of Vessel Disasters, West Coast, 2010–2014 (30 Total)

<table>
<thead>
<tr>
<th>Vessel Disaster Type</th>
<th>Number of Disasters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Vessel Disasters (30)</td>
<td></td>
</tr>
<tr>
<td>Nonfatal Vessel Disasters (17)</td>
<td></td>
</tr>
<tr>
<td>Fatal Vessel Disasters (13)</td>
<td></td>
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</table>

About this Report

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Two falls overboard involved fishing gear: one fisherman was entangled in gear and another was knocked overboard by gear. The first incident involved a fisherman losing his balance and falling overboard. None of the four falls overboard victims were wearing personal flotation devices (PFDs). The causes of the three onboard fatalities during 2010–2014 were falling from rigging, being caught in moving engine parts, and electrocution. The onboard fatalities involved being caught by the tide and washed offshore.

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During the 15-year period 2000–2014, 115 deaths occurred in West Coast fisheries, averaging almost 8 fatalities annually (Figure 1). During the first decade (2000–2009), 85 fatalities occurred, for an average of nearly nine deaths per year. For the most recent five-year period (2010–2014), 30 commercial fishing fatalities were recorded, averaging six fatalities annually. The recent period experienced both the lowest (two deaths) and the highest (14 deaths) number of annual fatalities that occurred during the 15-year period. Four total vessel disasters, which resulted in eight crewmember deaths, contributed to the highest number of fatalities during 2010–2014. Compared to the previous 10-year period (2000–2009) during which there were 21 total fatal vessel disasters, this recent five-year period has shown a decrease in the number of fatal falls overboard, with four fatalities.

Fatalities occurred in 12 fleets along the West Coast during 2010–2014, with seven fleets experiencing two or more fatalities (Figure 2). The Dungeness crab fishery experienced the highest number of fatalities in the region, with eight crewmember deaths. In the tribal Dungeness crab fleet, four fatalities occurred during separate vessel disasters and one fatality as the result of a fall overboard. In the tribal Dungeness crab fleet, two fatalities occurred due to vessel disasters, coming to rest with the community fishing fleet. In the tribal Dungeness crab fleet, one vessel disaster initiated by flooding, the cause of flooding was known for only seven, with four hull breaches, an open sea valve, water entry from the gunnels, and swamping of an open skiff. Of the seven vessel disasters caused by instability, almost all were due to overloading, with only one due to turning at a high speed. The Dungeness crab fishery experienced almost a quarter of all vessel fatalities (24, 60%), five of which were fatal and 19 nonfatal. The salmon fishery experienced almost a quarter of all vessel fatalities (16, 23%), three of which were fatal and 13 nonfatal.

Vessel disasters included striking rocks, fires, and explosions. Of the 15 vessel disasters, 66% were fatal and 34% nonfatal. The salmon fishery experienced almost a quarter of all vessel disasters (16, 23%), three of which were fatal and 13 nonfatal.

Figure 2

Commercial Fishing Fatalities by Incident Type, West Coast, 2010–2014 (115 Total)

<table>
<thead>
<tr>
<th>Incident Type</th>
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<tr>
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Data Key

- Fatal Vessel Disaster
- Fatal Onboard Fatality
- Fatal Onshore Fatality
- Fatal Fall Overboard
- Fatal Diving Fatality

Diving Fatality

Onshore Fatality

Onboard Fatality

Fatal Fall Overboard

Vessel disasters resulted in the most fatalities during 2010–2014. A total of 69 vessel disasters occurred on the West Coast during this time period (Figure 4), placing 190 crewmembers at risk of immersion and death. While divers and tenders should be trained in proper operational and emergency procedures in order to prevent injury or death from rapid ascent, gear entanglement, and other circumstances. Crewmembers should be alert while the diver is in the water and prepared to administer first aid in case of an emergency.

Vessel disasters occurred in 12 fleets along the West Coast during 2010–2014, with seven fleets experiencing two or more fatalities (Figure 3). The Dungeness crab fishery experienced the highest number of fatalities in the region, with eight crewmember deaths. In the sablefish groundfish trawl fleet, a single vessel disaster resulted in four fatalities during separate incidents, with two incidents involving rapid ascent and two gear entanglement.

Figure 2

Commercial Fishing Fatalities by Incident Type, West Coast, 2010–2014 (115 Total)

Figure 3

Causes of Vessel Disasters, West Coast, 2010–2014 (69 Total)

Figure 4

To help prevent vessel disasters, maintain proper watch and ensure watertight integrity of the vessel.

Figure 5

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About this Report

The National Institute for Occupational Safety and Health (NIOSH) is the federal government agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness. In 2010, NIOSH published an in-depth study of commercial fishing fatalities that occurred during 2000–2009. NIOSH recently completed a five-year update (2010–2014) of the previous study in order to identify current risks among fisheries in different regions of the country: the Northeast, Alaska, the Gulf, and the West Coast. This document is one in a set of four reports summarizing the most recent fatality and vessel disaster data for US fishing regions.

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**Recommendations**

**Vessel Disasters**
- Take a marine safety class at least every five years.
- Use a man-overboard alarm system.
- Install safety devices on deck machinery.
- Take a marine safety class at least every five years.
- Protect against electrical hazards.
- Maintain proper watch.
- Dive with an experienced, alert tender.
- Be prepared for a dive emergency.
- Use safe fall protection practices.
- Conduct monthly drills for abandon ship.
- Conduct man-overboard drills monthly.

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**Comparing risk between fleets**

**Commercial fishing fleets have different numbers of vessels, fishermen, and seasons 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.**

<table>
<thead>
<tr>
<th>Fleet Name</th>
<th>Number of Vessels</th>
<th>Fatalities</th>
<th>FTEs</th>
<th>Fatality Rate per 10,000 FTEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Coast Multi-Species Groundfish Trawl</td>
<td>2,000</td>
<td>× 24 Hours</td>
<td>2,000 Hours (standard 40-hour work week for the year)</td>
<td>= # of Fatalities per 10,000 FTEs</td>
</tr>
<tr>
<td>Atlantic Clam/Quahog Dredge</td>
<td>10,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atlantic Squid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Why use a fatality rate?**

To determine the risk of fatalities in different fleets, we need to consider the number of vessels in each fleet, the number of fishermen, and the length of time that they spend working and exposed to potential hazards. By calculating fatality rates, we can compare the risk for fatalities between different fleets.

**How do we calculate a fatality rate?**

We know many fatalities occurred in each fleet. Based on our data collection from US Coast Guard investigation reports and documents with vessel names, we were able to calculate fatality rates for each fleet. The results of these calculations answer the question: “How many fatalities have occurred in each fleet?”

**Fatality rates are calculated for fleets that experienced five or more fatalities during a 10-year period (2005–2014) and where workforce estimates were available.**

**Fleet Fatality Rates, 2005–2014**

**Falls Overboard**
- Wear a PFD on deck.
- Ensure that the fisherman who died from falling overboard were wearing a PFD when they drowned. PFDs can help fishermen avoid, giving the crew time for rescue.
- Conduct man-overboard alarm system.
- If a man-overboard alarm system is not installed, alerting recovery time and reducing chances of survival. A man-overboard system will alert the crew that a fall overboard occurred, and a device with GPS capabilities can signal the fisherman’s location to assist in search and recovery efforts.
- Add effective recovery devices and re-boarding devices. A rescue sling or similar device is more effective than a life ring for bringing a crewmember back on the vessel.
- Conduct man-overboard drills monthly. Recovery procedures should be practiced regularly to ensure all crewmembers are prepared to respond to a fall overboard.

**Onboard Fatalities**
- Install safety devices on deck machinery.
- Emergency-stop buttons have been developed specifically for deck machinery on fishing vessels.
- The National Institute for Occupational Safety and Health (NIOSH) is testing other machinery. Stationary guarding and auxiliary equipment are also being tested. More information about engineering solutions for fishing vessels can be found at: cdc.gov/niosh/topics/fishing/engineering/using-systems-to-prevent-falls.
- Use safe fall protection practices. When working above water or more than 10 feet above the water, use fall protection. Wear personal protective equipment, such as harness equipment, belts or ropes around the waist. Use hardhats, chaps, and ropes to prevent falls through deck openings, edges, and stairwells. Do not use cranes to hoist workers unless the crane is specifically approved for lifting personnel.
- Protect against electrical hazards. On-engineered electrical equipment before inspection or repair, and use a lock out/tag out program. Keep electrical equipment before inspection or repair, and use a lock out/tag out program. Keep electrical equipment in good working condition.

**Onboard Fatalities and Diving Fatalities**
- Dive with an experienced, alert tender. Be familiar with vessel operations, safety equipment, and procedures for both vessel and dive emergencies. This information was available through TIDE for diving into the water.
- Be prepared for a dive emergency. Be prepared to administer first aid, including the use of an oxygen delivery system.
- Maintain diving equipment. Ensure that compressors and other equipment used in diving operations are in good working condition.

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**National Institute for Occupational Safety and Health**

**Commercial Fishing Safety Research and Design Program**

**West Coast Fatal Event: 2014**

**Data Key**

- **# Vessels**
- **# Crew per Vessel**
- **# Operating Days**
- **Total Number of Fatalities**
- **FTEs**

### Onboard Fatalities

**Fatal Vessel Disaster, 2010–2014**

**Diving Fatalities**

**Fatal Fall Overboard, 2010–2014**

**Comparison of Fatality Rates by Fleet, 2005–2014**

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- Add effective recovery devices and re-boarding devices. A rescue sling or similar device is more effective than a life ring for bringing a crewmember back on the vessel.
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**National Institute for Occupational Safety and Health**

**Commercial Fishing Safety Research and Design Program**

**West Coast Region**
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.

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

\[
\text{Fatality Rate (per 10,000 FTEs)} = \frac{\text{# of fatalities}}{\text{# of FTEs} \times 24 \text{ Hours}}
\]

Why use a fatality rate?
To determine the risk of fatalities in different fleets, we need to consider the number of weeks in each fleet, the 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 how many people are working with each type of fleet. The rate allows us to compare risk between fleets that have different numbers of vessels and fishermen.

How do we calculate a fatality rate?
We know 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 operating days are in the fleet each year. This information is used to estimate “full-time equivalent” fishermen (FTEs). To calculate FTEs:

\[
\text{# Vessels} \times \text{# Crew per Vessel} \times \text{Operating Days} = \text{# of FTEs}
\]

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 from various sources. Fatality rates were not calculated for two fleets: multiple-species groundfish trawl and non-tribal Dungeness crab. During 2005–2014, the non-tribal Dungeness crab fleet experienced a significant decrease in both the number and rate of crewmember fatalities.

Here’s how we calculate FTEs:

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Onboard Fatalities
Onboard fatalities refer to deaths that occurred on a vessel. The probability of death on deck from a fall overboard is much higher than that of death from an onshore fatality. The probability is increased for those fishermen who are not wearing a personal flotation device (PFD) when they drowned. PFDs can keep fishermen afloat, giving the crew time for rescue.

Onshore Fatalities
An onshore fatality refers to a death that occurred onshore due to a vessel disaster, such as a shipwreck or explosion. These fatalities are not necessarily the result of a workplace incident, but can be adapted and retrofitted onto winches or other machinery. Stationary guarding and auxiliary equipment are also being tested. More information about engineering solutions for fishing vessels can be found at: cdc.gov/niosh/topics/fishing

Use safe fall protection practices. When working above water or more than 5 feet above a solid surface, use fall protection. Wear personal flotation devices and comply with regulations to ensure that personal protective equipment is worn.

Ensure that vessels are prepared to administer first aid, including the use of an oxygen delivery system.

Onboard fatality rates are calculated for vessels that experienced five or more fatalities during a 10-year period (2005–2014) and where workforce estimates were available from various sources. Fatality rates were not calculated for two fleets: multiple-species groundfish trawl and non-tribal Dungeness crab. During 2005–2014, the non-tribal Dungeness crab fleet experienced a significant decrease in both the number and rate of crewmember fatalities.

Onshore fatality rates were calculated for the West Coast Region (Figure 5). Along the West Coast, workforce estimates were available for eight fleets over the 10-year time period. Workforce estimates were not available for other fleets, so fatality rates could not be calculated for these fleets. Fatality rates published in this report cannot be compared to rates published in previous NIOSH studies.

For this study, we’re using an updated method for calculating FTEs. This improved method matches what is used by other agencies and academic institutions, and allows the fatality rates to be compared to other occupations. As a result of the change in our calculation methods, the fishing fatality rates published in this report cannot be compared to rates published in previous NIOSH studies.

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Fatality rates for two fleets: multi-species groundfish trawl and non-tribal Dungeness crab. During 2005–2014, the non-tribal Dungeness crab fleet experienced a significant decrease in both the number and rate of fatalities. Fatality rates published in this report cannot be compared to rates published in previous NIOSH studies.

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