




FATALITY INVESTIGATION REPORT


INCIDENT HIGHLIGHTS


 **DATE:**
January 19, 2016


 **TIME:**
8:15 p.m.


 **VICTIMS:**
52-year-old male Crewman
37-year-old male Crewman
31-year-old male Crewman

 **INDUSTRY/NAICS CODE:**
Commercial Fishing/114

 **EMPLOYER:**
Commercial Crab Fishing

 **SAFETY & TRAINING:**
Safety meetings & training were limited at this employer

 **SCENE:**
Employees were returning from fishing in heavy seas and rough weather and the vessel capsized. Only the Captain survived.

 **EVENT TYPE:**
Saltwater immersion drowning

Crab fishing vessel capsizes and drowns three crew members

REPORT#: 2016-06-1, 2, 3 **REPORT DATE:** Mar. 2020

SUMMARY

On January 19, 2016, a commercial fishing vessel left a harbor on Oregon's coast with four crewmembers to place crab pots. The vessel's Captain proceeded out, despite being warned about poor weather conditions and heavy seas. He was escorted across the bar by a Coast Guard motor lifeboat. That afternoon while crabbing, the vessel's external lights failed and the Captain decided to return to port. While returning across the bar, a wave washed over the stern, capsizing the vessel. It rolled and broke apart on the rock jetty. A rescue locator beacon (Emergency Position Indicating Radio Beacon or EPIRB) on the vessel activated, and was noted by the local Coast Guard station. Search and rescue operations began shortly after. The Captain was thrown from the capsized vessel, swam clear of the debris, and was pushed by waves onto the jetty. He found someone to take him to the Coast Guard station where he reported the incident. He refused medical treatment and the required drug and alcohol testing, and left the station. One crewmember was recovered later that evening, deceased. A second crewmember was found approximately three weeks later, also deceased. The third missing crewmember was not found but was presumed deceased.

(Full report begins on p.5)

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FATALITY INVESTIGATION REPORT

CONTRIBUTING FACTORS

Key contributing factors identified in this investigation include:

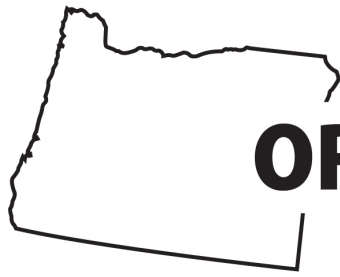
- Crossing the bar to fish during especially adverse weather conditions.
- Generator failure resulting in the Captain's decision to return to port.
- Failure to request U. S. Coast Guard escort for the return bar crossing.
- None of the crewmembers were wearing Personal Floatation Devices (PFD).
- Failure to secure the cabin door in heavy seas.
- Inadequate training (drills) for possible "abandon ship" and "man overboard" scenarios.

RECOMMENDATIONS

Oregon Fatality Assessment and Control Evaluation (OR-FACE) investigators concluded that to help prevent similar occurrences, employers should:

- Confirm major vessel repairs are adequate prior to sailing, especially prior to sailing in rough seas and inclement weather.
- Before deciding to fish and venture to sea, Captains must consider weather conditions and vessel suitability.
- If the decision is made to cross the bar in especially rough seas, the Captain should request and obtain a Coast Guard escort for both departing and returning crossings.
- Vessel Owners/Employers and/or Captains should require crewmembers to don personal flotation devices (PFDs) when on deck, especially in rough seas and/or when crossing the bar.
- Secure all potential water infiltration points in rough seas, including doors, windows, and hatch covers.
- Captains should routinely assess job hazards and provide regular, monthly safety training and drills, including for man overboard scenarios.
- Captains should encourage crewmembers to seek out available regional safety training.

(Recommendations section starts on p. 8)



OREGON

State **FACE** Program

Fatality Assessment & Control Evaluation

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Oregon Fatality Assessment and Control Evaluation (FACE) Program

The Oregon Fatality Assessment and Control Evaluation (OR-FACE) Program is a project of the Oregon Institute of Occupational Health Sciences at Oregon Health & Science University (OHSU). OR-FACE is supported by a cooperative agreement with the National Institute for Occupational Safety and Health (NIOSH) (grant #U60OH008472) through the Occupational Public Health Program (OPHP) of the Public Health Division of the Oregon Health Authority. OR-FACE reports are for information, research, or occupational injury control only. Safety and health practices may have changed since the investigation was conducted and the report was completed. Persons needing regulatory compliance information should consult the appropriate regulatory agency.

OR-FACE supports the prioritization of safety interventions using a hierarchy of safety controls, where top priorities are hazard elimination or substitution, followed by engineering controls, administrative controls (including training and work practices), and personal protective equipment.



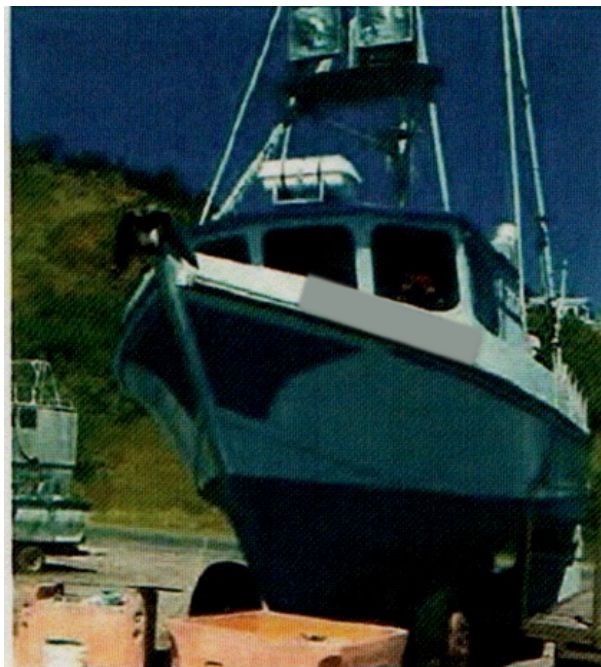
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Google map of the port involved in the incident.



Photograph of the vessel several years prior to the incident.



INTRODUCTION

On January 19, 2016, four crab fishermen (Captain and three crew) were returning from a day of setting crab pots at sea off the coast of southern Oregon. Their 40-foot vessel experienced mechanical problems causing them to head back to port (the generator that powered their external lights failed). It was raining heavily and the seas were rough, with reported 8 to 10 foot swells and winds over 30 mph. As the Captain attempted to maneuver back to the bay, a large wave hit the vessel at the entrance to the bay, also known as “the bar”. When the vessel was initially swamped, the Captain reported hearing an “explosion.” The vessel turned sideways and was rolled over two to three times. It hit the rock jetty, and all four crewmembers were thrown into rough seas. The Coast Guard dispatched a rescue vessel and helicopter when the vessel’s Emergency Position Indicating Radio Beacon (EPIRB) activated. The Captain was thrown from the vessel, swam clear of the debris, and waves pushed him onto a jetty. He then walked to shore to get help from the Coast Guard. Coast Guard members were already searching when the Captain reported the incident at the Coast Guard station. The Captain refused medical treatment and did not submit to the required post-incident drug and alcohol testing. The Coast Guard found one crewman (52 year old male) near the jetty, approximately three-quarters of the way toward the shore. He was pronounced dead at that time. The other two crewmembers were not found during the initial search. A second crewman (31 year old male) was found approximately 3 weeks later when he washed ashore about 40 miles to the north. The third crewman (37 year old male) was not found and was presumed drowned. The cause of death for the three workers was salt water drowning (or presumed salt water drowning).

OR-FACE received the initial notification of the incident from its ongoing surveillance of programmed Google alerts. This investigation report is based on review of the Coast Guard Marine Information for Safety and Law Enforcement (MISLE) Incident Investigation Report (2017) and NIOSH commercial fishing safety research and recommendations. A phone discussion was also completed 10/30/19 with Mr. Greg Merten, US Coast Guard (USCG) Civilian Search And Rescue (SAR) Planner, Columbia River Division.

HISTORICAL BACKGROUND

The National Institute for Occupational Safety and Health (NIOSH) reports of commercial fishing fatalities from 2000 to 2009 and 2010 to 2014 both concluded that the Oregon Dungeness crab fishing occupation is one of the most hazardous nationally (NIOSH, 2010; 2017). This comparison includes deaths that occur in the Alaskan commercial fishing industry. Despite efforts to reduce these fatalities, a number of common hazards persist. According to the 2010 report, from 2000-2009, “...86 commercial fishing deaths occurred off the West Coast” (p. 2). It continued with, “The Dungeness crab fishery experienced the highest number of occupational deaths with 27 fatalities...Vessel disasters caused the most deaths among the Dungeness crab fisherman (78%)” (ibid, p. 2). Vessel disasters are particularly hazardous, as multiple crews are often at risk of injury or fatality per event. According to the 2017 NIOSH report covering 2010 to 2014, “the Dungeness crab fishery experienced the highest number of fatalities in the region, with eight crewmember deaths” (p. 3). The report stated, “Poor weather was reported to have contributed to five (38%) of the 12 fatal vessel disasters and six (11%) of the 57 non-fatal disasters” (ibid, p. 4). Drowning due to falls overboard was also listed as a cause of fatalities in both NIOSH reports.

INCIDENT BACKGROUND

Prior to the incident investigated in this report, the crab season had been delayed from the normal December 1, 2015 start to January 1, 2016 due to high levels of domoic acid in the crabs, as well as the crabs being undersized. Domoic acid is a toxin that accumulates in shellfish consumed by crabs. The toxin arises from *Pseudo-nitzschia*, a marine planktonic diatom (algae) that is consumed by shellfish. Unprecedented blooms of *Pseudo-nitzschia* occurred between 2015-16 off the US West Coast (California Sea Grant College Program, University of California, San Diego, 2016; University of California, Santa Cruz, 2017). In addition, the vessel was being repaired, which added 19 additional days to their delay to start their season. According to the Oregon Crab Commission, “The peak harvest occurs during the first eight weeks of the season with up to 75% of the annual production landed during this period. Crab fishing efforts traditionally decrease in the spring as fishermen gear up for other coastal fisheries...” (Oregon Dungeness Crab Commission, 2019).

Despite a radioed warning from the Coast Guard prior to going out over the bar in rough seas, the Captain decided to proceed. In the Coast Guard MISLE report, the Captain was asked about his intention to cross the bar in the heavy weather conditions and “...answered that he was aware of the bar conditions and would still head offshore, because they had not worked much due to maintenance of the boat” (MISLE Incident Investigation Report, 2017). The Coast Guard escorted the vessel across the bar, and they were able to place crab pots until about 4:30 PM when the generator powering the external lights failed. The Captain decided to return to port. According to local news reports, they hoped to repair the generator and head back out. When they reached the bar inward bound, the Captain did not request a US Coast Guard escort. A Coast Guard escort can improve recovery chances for crewmembers if conditions put their vessel at-risk for a capsizing or man overboard event. Despite the especially rough seas, and in particular the rough bar conditions, the crew hadn’t donned PFDs, which may have also improved their survival chances.

In reviewing the weather history, the weather was significantly calmer the next morning; winds less than 7 mph, and no rain. There is no information about the forecast for January 20, nor if the Captain had looked at alternative dates for initiating fishing.

EMPLOYER

The Captain was in charge of the three crewmembers. The Captain had operated the same vessel at least since 2010 based on public records and been engaged in crab fishing during those years, among other related work.

WRITTEN SAFETY PROGRAMS and TRAINING

According to the Coast Guard report, the decedents’ employer lacked a policy of practicing monthly safety drills. The Coast Guard had noted this in previous examinations, and no emergency drills were completed in January 2016, prior to the incident.

WORKER INFORMATION

All of the decedents were male and had several years of experience in the fishing industry; however, their employment duration with the Captain was not reported. It was reported by the press, based on interviews

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with friends and family of the crewmembers, that at least two of them were knowledgeable, experienced, and aware of the hazards related to doing this work. There was no mention regarding crew agreements in the Coast Guard's investigation report. Such crew agreements are considered a good safety practice, and a sample crew agreement posted by researchers at Oregon State University is available (Commercial Fishing Crew Member Agreement, n.d.).

INCIDENT SCENE

The port involved is an active commercial deep water coastal harbor. The incident occurred as the vessel was coming back to the port after setting crab pots in inclement weather. The United States Coast Guard Auxiliary considers vessels less than 65 feet to be "small" (United States Coast Guard Auxiliary, 2009), and weather warnings had been issued for small vessels (i.e., Small Craft Advisory) on the day of the incident.

The vessel was crossing the "bar" which is where the deeper ocean waters and the shallower river waters meet. The change can result in additional significant wave and current effects, especially when the weather is severe as it was in this incident. The US Coast Guard has published specific information for the various bar crossings along the Pacific Northwest (United States Coast Guard, 2020).

WEATHER

Weather was considered to be a critical factor in the incident. The Coast Guard report stated that waves were reportedly 8 to 10 feet high and winds were over 30 mph. Rain was also heavy on the day the vessel sank.

According to historical weather data (Weather Underground, 2019), the average outdoor temperature on January 19 at the port city was 54 degrees Fahrenheit (F) and 1.74 inches of rain fell. Average wind speed was reported as 23 mph that day. (National Weather Service, Weather Prediction Center, 2020).

INVESTIGATION

The Coast Guard investigation reported that the vessel sank in part because the Captain decided to go to sea in inclement weather. National Institute of Occupational Safety and Health (NIOSH) Researchers have identified sailing in adverse weather conditions as a significant factor in a number of fatalities. Warnings were posted and a Coast Guard officer spoke directly with the Captain to provide further warning about the small craft advisory in effect. The National Weather Service Small Craft Advisory "... means that winds and seas will create a potential hazard to smaller vessels and inexperienced mariners" (National Oceanic and Atmospheric Administration, National Weather Service, 2019). The National Weather Service notes "there is no precise definition of a small craft", but cautions that "Any vessel that may be adversely affected by Small Craft Advisory criteria should be considered a small craft. Other considerations include the experience of the vessel operator, and the type, overall size, and seaworthiness of the vessel" (ibid). The National Oceanic and Atmospheric Administration does separate vessels into different classes by length. (National Oceanic and Atmospheric Administration, 2015). This particular vessel was a class III (40 – 65 ft).

As stated in the Historical Background section, reviews of Dungeness crab fishing fatalities identify vessel disasters as causing the majority of fatalities, often with more than one person killed in a single disastrous

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event. Weather is a recognized contributing factor to vessel disasters, either causing sinkings or knocking crewmembers overboard. Having watertight openings such as an aft door open while transiting across the bar was another potential contributing factor. With such openings closed, the vessels may stay afloat for a longer period of time and create more opportunity for actions leading to survival and/or rescue.

Not requiring the use of PFDs, especially given the weather and significant waves at the bar, increased the risk of drowning. There were no PFDs or immersion suits used by the Captain or crew. The vessel may have rolled and broken apart too quickly for the crewmembers to don immersion suits. PFDs could have been put on prior to crossing.

The U. S. Coast Guard Marine Information for Safety and Law Enforcement (MISLE Incident Investigation Report), (2017) stated the employer “...failed to conduct drills with the crew...” (ibid). The report noted that in 2012 the vessel examination revealed a deficiency related to maintaining a drill log for conducted safety drills. The safety decal in 2012 was provided once the drill deficiency was corrected. There were no drills conducted in January 2016 according to this report.

CAUSE OF DEATH

According to Oregon Vital Records data, the cause of death was determined to be saltwater immersion drowning for both of the recovered crewmembers. Saltwater drowning is assumed to be the case for the missing crewmember.

CONTRIBUTING FACTORS

Occupational injuries and fatalities are often the result of one or more contributing factors or key events in a larger sequence of events that ultimately result in the injury or fatality. OR-FACE investigators identified the following factors that may have contributed to this incident:

- Crossing the bar to fish during especially adverse weather conditions.
- Generator failure resulting in the Captain’s decision to return to port.
- Failure to request U.S. Coast Guard escort for the return bar crossing.
- None of the crewmembers were wearing Personal Floatation Devices (PFD).
- Failure to secure the cabin door in heavy seas.
- Inadequate training (drills) for possible “abandon ship” and “ocean immersion” scenarios.

RECOMMENDATIONS/DISCUSSION

- ***Recommendation #1: Confirm major vessel repairs are adequate prior to sailing, especially prior to sailing in rough seas and inclement weather.***

Discussion: If the generator for the outside lights was working properly, the Captain may have remained at sea and not attempted the bar crossing in rough conditions. Once vessel repairs were made, testing and confirmation that all systems were operational should have occurred prior to sailing in rough weather. A best practice is to conduct sea trials in a low risk environment to confirm repairs were effective and complete. Without these lights the crew could not see to continue fishing. They were able to wire one external light directly to the battery and used it on their return as they crossed the bar and approached the jetty. There is no information regarding the age or maintenance history of the generator that failed, or whether any testing efforts were made to confirm vessel repairs were complete and functional. The local news reported that the Captain and crew hoped to return to port and repair the generator, and then go back out to sea to continue fishing on the day of the incident. If they had returned to port safely and repaired the generator, rushing back to sea without testing of the generator under less hazardous conditions would not have been advised.

- ***Recommendation #2: Before deciding to fish and venture to sea, Captains must consider weather conditions and vessel suitability.***

Discussion: It is not known whether the Captain examined the weather forecast before making his decision to fish on the particular day in question, or whether he deliberated with his crewmembers about his decision. According to Weather Underground's history for this port, on the day after the incident there was no rain and winds were less than 7 miles/hour until 10:30 am (Weather Underground, 2019). On the day of the incident, there was a small craft advisory that applied to the size of the Captain's vessel. After deciding to fish, the Captain received warnings of this advisory from the Coast Guard via radio, but remained committed to his decision and transited out to sea with a Coast Guard escort. After the generator failed, the Captain had additional weather-related decisions to make. When the captain decided to return, the weather was just as bad and the bar conditions just as hazardous. While all but one of the external lights were not functioning, it may have been a viable option for the Captain to stay at sea until conditions improved before returning to port.

- ***Recommendation #3: If the decision is made to cross the bar in rough seas, the Captain should request and obtain a Coast Guard escort for both departing and returning crossings.***

Discussion: Having the Coast Guard on scene would improve the chances of recovery in the face of a capsizing or other disaster. Even with the activation of the emergency locator beacon it took time before Coast Guard search and rescue efforts could begin. With rough seas and harsh weather conditions, finding people floating in the sea is very difficult. It may also be so rough that a response is not possible, despite the Coast Guard's best efforts. The presence or absence of an escort could factor into the decision to postpone the crossing until better conditions exist.

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- ***Recommendation #4: Vessel Owners/Employers and/or Captains should require crewmembers to don personal floatation devices (PFDs) when on deck, especially in rough seas and/or when crossing the bar.***

Discussion: Captains/employers should require routine use of PFDs when outside the cabin, especially in rough conditions. The Captain and crewmembers did not use PFDs, nor were immersion suits donned before they crossed the bar. However, it is acknowledged that the vessel capsized so quickly that the opportunity to don immersion suits may have been absent or extremely limited. Had the Captain not been thrown clear of the debris and pushed by waves partly onto the jetty, he may not have survived. The lack of PFD use has been noted as a key factor in fatalities for this industry for a number of years. Newer PFD styles and options are available that improve the wearer's ability to move and work. It is a best safety practice for a Captain to require PFD use at all times while on deck. Given the extreme weather and the fact the Captain had a watcher to warn of large waves, PFDs should have been required for everyone on deck prior to crossing the bar.

- ***Recommendation #5: Secure all potential water infiltration points in rough seas: doors, windows, and hatch covers.***

Discussion: The aft cabin door was open while crossing the bar to facilitate verbal communications between the Captain and crewmembers. Once the vessel started rolling, this likely increased the speed at which the vessel filled with water. While at sea in heavy weather, doors, windows, and hatch covers should be closed. While communication is critical under hazardous conditions, it is possible a big wave warning could have been accomplished by pounding on a closed aft cabin door.

- ***Recommendation #6: Captains should routinely assess job hazards and provide regular, monthly safety training and drills, including for man overboard scenarios.***

Discussion: It is possible that the boat capsized so quickly in the current incident that there might not have been sufficient time to enact emergency lifesaving procedures. However, it is an employer's responsibility to ensure that crewmembers are trained and prepared for emergencies. The Captain had not performed monthly drills, which are designed to ensure crewmembers know how to properly don immersion suits, deploy life rafts, and use other lifesaving equipment. It is possible that monthly drills could increase crewmembers' general awareness of the hazards of rough seas and establish a stronger safety climate on board. While it is the Captain who ultimately makes navigational decisions for a vessel, regular safety drilling and a stronger safety climate could contribute to workers more consistently wearing PFDs and/or speaking up if they felt their Captain was making a hazardous decision.

- ***Recommendation #7: Captains should encourage crew members to seek out available regional safety training.***

Discussion: In addition to regular drilling, Captains can encourage crewmembers to take available safety training. For example, Clatsop Community College in Astoria, Oregon offers a range of Marine Safety and drill conductor classes. The College reports willingness to offer classes in off campus locations as needed, but it should be acknowledged, there would be a higher level of effort for fishermen in other parts of the state to arrange and access such training. Some additional commercial fishing safety classes are available through the Alaska Marine Safety Education Association (2016), and the Oregon Sea Grant (2020). The US

Coast Guard coordinates with both entities to schedule and promote the trainings. Expanded training for crew members could further strengthen preparedness and safety climate on a Captain's vessel (see Oregon State University, 2020 for examples).

GENERAL DISCUSSION

The characteristics of the incident described in this report are relatively common in vessel disasters based on reviews of prior incident reports (NIOSH 2010; NIOSH 2017). Although there have been some minor reductions in fatality rates in recent years, vessels in the Dungeness crab fishing industry continue to go to sea in hazardous weather, cross the bars without Coast Guard escorts, and allow employees to work on deck without PFDs.

Newer low-profile PFDs are available that will only activate if submerged. To encourage PFD use, Captains could supply crewmembers with multiple PFD options and allow crewmembers to choose and wear a preferred type. But in all cases, Captains must be the driving force in requiring their use.

Monthly safety drills are required, but are often considered optional for many of the small commercial fishing vessels (less than 65 feet), yet they would benefit the most. Per the US Coast Guard requirements:

Drills must be conducted and instruction must be given to each individual on board the vessel at least once each month. Contingencies that must be covered in drills include:

- Abandoning the vessel
- Fighting a fire in different locations on the vessel
- Recovering an individual from the water (i.e., man overboard)
- Minimizing the effects of unintentional flooding
- Launching survival craft and recovering lifeboats
- Donning immersion suits and other wearable PFDs
- Making distress calls and using visual distress signals
- Activating the general alarm
- Reporting inoperative alarms, fire detection systems.

Northwest Dungeness crab fishing has been identified as a high-risk occupation. In 2015 a requirement went into effect for commercial fishing vessels that operate beyond 3 nautical miles of the baseline of U.S. territorial sea, and/or have more than 16 individuals on board (or are a fish tender vessel in the Aleutian trade; United States Coast Guard, 2014). Specifically, a current (unexpired) safety decal or a dockside safety examination was required by October 15, 2015. At each examination, vessels will be issued a safety decal that is valid for 2 years, and another dockside safety examination is required at least once every 5 years. Given the hazardous nature of the industry, it would be recommended best practice for commercial fishing vessels to obtain and keep current a valid safety decal every two years, even if not mandated to do so. It would also be best practice to stay in compliance with the mandatory dockside safety examination every 5 years.

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There have been some voluntary pre-season safety examinations conducted by the Coast Guard in the industry. These could continue on an annual basis to promote safety and create ongoing educational opportunities. Education on safety and vessel stability could be part of these examinations. Other areas of emphasis in examinations, or educational outreach, that should be completed by everyone prior to going to sea include:

- Preventive vessel maintenance
- Weather forecasts and decision making
- Specific bar crossing hazards and procedures
- Water tight integrity training
- Regular training in the deployment and use of life boats

Education and outreach efforts could address the above factors, as well as the importance of ensuring monthly training in the use of immersion suits and PFDs. In the Northeastern region of the US, outreach efforts to lobstermen have included the deployment of “lifejacket vans” to make it easier for fishermen to access, try on, and afford PFDs (Northeast Center for Occupational Health and Safety, 2019). Similar efforts, tailored to regional needs of particular fishing fleets, would be a promising avenue to pursue. The option for requesting Coast Guard escorts both in and out of the bar should be widely publicized.

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REFERENCES

1. Weather Underground. (2019). *The Weather Underground Family of Sites*. Retrieved Oct. 1, 2019, from <https://www.wunderground.com/history/>
2. National Institute for Occupational Safety and Health (NIOSH). (July, 2019). Commercial Fishing Safety – West Coast. *CDC.gov*. Retrieved from https://www.cdc.gov/niosh/topics/fishing/westcoastregion.html#anchor_1561411663
3. National Institute for Occupational Safety and Health (NIOSH). (July, 2017). Commercial Fishing Fatality Summary West Coast Region. *CDC.gov*. Retrieved from: <https://www.cdc.gov/niosh/docs/2017-172/pdf/2017-172.pdf?id=10.26616/NIOSH PUB2017172>
4. Centers for Disease Control and Prevention. (July, 2010). Commercial Fishing Deaths – United States, 2000-2009. *CDC.gov*. Retrieved from https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5927a2.htm?s_cid=mm5927a2_w

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5. The Journal of the American Medical Association (JAMA). (October, 2008). Commercial Fishing Fatalities – California, Oregon, and Washington, 2000-2006. *Jamanetwork.com*
Retrieved <https://jamanetwork.com/journals/jama/fullarticle/182662?resultClick=1>
6. National Institute for Occupational Safety and Health (NIOSH). (November, 2010). Fatal Occupational Injuries in the U.S. Commercial Fishing Industry: Risk Factors and Recommendations West Coast Region. *CDC.gov*. Retrieved from <https://www.cdc.gov/niosh/docs/2011-104/>
7. University of California, Santa Cruz. (August, 2017). What causes algal blooms to become toxic? *UCSC.edu*. Retrieved from: <https://news.ucsc.edu/2017/08/domoic-acid.html>
8. California Sea Grant College Program, University of California, San Diego (July, 2016). Natural Biotoxins in California Crabs: Domoic Acid. *UCSD.edu*. Retrieved from:
<https://caseagrant.ucsd.edu/sites/default/files/Biotoxins-SU16-FAQ-v2.pdf>
9. Oregon Dungeness Crab Commission. (October, 2019). The Dungeness Crab Fishery. *OregonDungeness.org*. Retrieved from: <http://oregondungeness.org/fishery/>
10. Coast Guard Marine Information for Safety and Law Enforcement (MISLE Incident Investigation Report) (May, 2017) *Commercial Fishing Vessel (O.N. 603032) Investigating Officer's Report*. U.S. Coast Guard Marine Safety Unit Portland.
11. United States Coast Guard Auxiliary (February, 2009). SC – Small Craft Facility Training Guide. *USCGAAN.com*. Retrieved from: [http://www.uscgaan.com/cd/SCF/NS-SC02-Small%20Craft%20Facility%20Program%20Training%20Guide%20\(02-08-09\).pdf](http://www.uscgaan.com/cd/SCF/NS-SC02-Small%20Craft%20Facility%20Program%20Training%20Guide%20(02-08-09).pdf)
12. National Oceanic and Atmospheric Administration, National Weather Service (October, 2019). Marine Forecasts: Coastal Warning Display Signals. *NWS.NOAA.gov*. Retrieved from:
<https://www.weather.gov/marine/cwd>
13. Oregon State University (n.d.). Commercial Fishing Crew Member Agreement. *OregonState.Edu*. Retrieved from:
https://health.oregonstate.edu/sites/health.oregonstate.edu/files/labs/kincl/pdf/sample_crew_agreement_final.pdf
14. Alaska Marine Safety Education Association (2016). Marine Safety Training for Commercial Fishermen. *AMSEA.org*. Retrieved from: <https://www.amsea.org/commercial-fishermen>
15. Oregon State University, Oregon Sea Grant (2020). FFAST: Fishermen First Aid & Safety Training. *Seagrant.Oregonstate.edu*. Retrieved from: <https://seagrant.oregonstate.edu/ffast-fishermen-first-aid-safety-training>
16. United States Coast Guard (January, 2020). Marine Safety Information Bulletin, number 01-20: Crossing Hazardous Bars in the Pacific Northwest. *FishSafeWest.info*. Retrieved from:
http://www.fishsafewest.info/PDFs/MSIB_Hazardous_Bars_Final.pdf

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17. United States Coast Guard (December, 2014). Marine Safety Information Bulletin, number 18-14: Implementation of New Requirements for Commercial Fishing Vessels. *FishSafeWest.info*. Retrieved from: http://www.fishsafewest.info/PDFs/MSIB_CFVSReq.pdf
18. Oregon State University (2020). FLIPP Resources for Commercial Fishermen. *Health.OregonState.Edu*. Retrieved from: <https://health.oregonstate.edu/labs/osh/resources/flipp>
19. National Oceanic and Atmospheric Administration (2015). Length of Vessel by Class. *Omao.noaa.gov*. Retrieved from: <https://www.oma.noaa.gov/learn/small-boat-program/resources/length-vessel-class>
20. National Weather Service, Weather Prediction Center (2020). WPC Surface Analysis Archive. *Wpc.ncep.noaa.gov*. Retrieved from: https://www.wpc.ncep.noaa.gov/archives/web_pages/sfc/sfc_archive_maps.php?arcdte=01/19/2016&selmap=2016011912&maptype=namussfc
21. Northeast Center for Occupational Health and Safety (2019). Researchers Launch New Van to Make Lifejackets Affordable for Lobstermen. *Necenter.org*. Retrieved from: <https://www.necenter.org/press-room/fishing-research/>

INVESTIGATOR INFORMATION

Steve Eversmeyer, CIH, CSP, Contract Fatality Investigator/Outreach Specialist, OR-FACE Program conducted this investigation. The report was reviewed and received input from Ryan Olson, PhD, Director, OR-FACE Program, the OR-FACE Publications Review Panel, and personnel from the National NIOSH FACE program and NIOSH Western States Division.

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