FINAL REPORT

Development of a Surveillance Strategy to Guide Injury Prevention Efforts in the North Pacific Commercial Fishing Industry

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1.1 Background

Fishing is a vital industry in Washington (WA) State, with over 3,500 employees estimated to participate in commercial fishing and processing activities in WA waters alone (TCW Economics, 2008). In addition, some Washington-based commercial fishing enterprises deliver catches from distant water fisheries, such as waters off Alaska, to Washington ports for processing and distribution to world markets (TCW Economics, 2008). Fishing is among the most dangerous industries in the country (US Department of Labor, 2012). Commercial fishing fatalities have been well described (Lincoln & Lucas, 2008; Thomas et al., 2001), but less is known about non-fatal commercial fishing injuries. Nonfatal fishing injuries are prevalent and associated with substantial health and economic consequences for fishermen and the industry as a whole (Leigh, 2011; Marshall et al., 2004; Thomas et al., 2001). The lack of a comprehensive nonfatal injury surveillance system or central insurance industry clearinghouse contributes to difficulties in characterizing nonfatal fishing injuries.

In this project, we collaborated with commercial fishing employer, insurance, government, and healthcare partners to describe the landscape of data sources on nonfatal fishing injuries and began to develop a strategy for nonfatal fishing injury surveillance. Our goal was to use established methods for evaluating sources of nonfatal commercial fishing injuries (World Health Organization, 2001) that could, in the future, contribute to a formal surveillance system for injury data collection, analysis, and dissemination.

1.2 Methods

Project work was organized into three phases between March 2012 and November 2013 and was carried out primarily in the greater Seattle, WA area. In Phase 1**,** we conducted informal meetings and discussions with potential commercial fishing partners to better understand the commercial fishing

industry and data sources relevant to nonfatal fishing injuries. In Phase 2, we evaluated sources of nonfatal fishing injury data from commercial fishing employer, insurance, government, and healthcare partners. Characteristics of data sources (e.g. comprehensiveness, quality, reliability, timeliness, representativeness, practicality, and sustainability) were evaluated for their potential utility in a surveillance system using World Health Organization methods (World Health Organization, 2001). We also analyzed data from selected data sources using descriptive statistics. Results and data source characteristics were compared across data sets. Phase 3 involved disseminating information obtained during the project to commercial fishing partners. All procedures for Phases 2 & 3 were approved by the University of Washington (UW) Institutional Review Board and were formalized in data sharing agreements between partners and the UW Office of Sponsored Programs, with the exception of data from the United States Coast Guard (USCG). USCG data was obtained via the Freedom of Information Act (www.foia.gov).

1.3 Results

There are various points where injury data may be collected when a commercial fishing injury occurs and during subsequent treatment. These data may be captured in employer, insurance, government, and/or healthcare records. We found that clinic and hospital data were difficult to access and that it is unlikely that the occupation of patients is captured or coded in many healthcare records. Marine medical access programs that we contacted tended to treat more patients with illnesses (rather than injuries) and had a large proportion of non-commercial cases. Employer data was difficult to access, mainly because of concerns about confidentiality. We report results from our analyses of data from two specific data sources: the United States Coast Guard and an independent claims adjustment firm.

USCG Marine Information for Safety and Law Enforcement (MISLE) data

Injuries occurring on a vessel that involve more than first aid for treatment are required to be reported to the USCG and are recorded in the USCG information system, MISLE. A total of 465 MISLE records (2002-2011) from USCG districts 13 (Pacific Northwest) and 17 (Alaska) were included in this analysis. Eighty-six percent of incidents occurred in waters off Alaska, and 14% occurred in waters off Oregon and Washington. Almost half of all injuries in the dataset occurred in the Bering Sea.

The most prevalent accident types were "crushed between objects" (n=98, 21%), "struck by moving object" (n=91, 20%), and "fall onto surface" (n=88, 19%). Fractures were the most prevalent primary injury type (n=84, 18%), followed by lacerations (n=54, 11.6%). The most common accident types associated with fractures were "fall onto surface" (n=29, 35%) and "crushed between objects" (n=23, 27%). Wrists/hands were the most prevalent body region injured (n=127, 27%), and the two most prevalent injury types for wrist/hand injuries were lacerations (n=28, 22%) and amputations (n=25, 20%). These injury types were most commonly associated with contact with objects, either being crushed between objects (n=59, 46%) or struck by moving objects (n=20, 16%). Neck and back injuries were most commonly associated with overexertion (n=18, 35%) and falls onto surfaces (n=17, 33%). Leg injuries were most commonly associated with falls onto surfaces (n=14, 26%) and being crushed between objects (n=12, 23%). Shoulder injuries were most commonly associated with falls onto surfaces (n=12, 44%) and being struck by moving objects (n=6, 22%). Specific vessel type and fishery information was missing for most records.

Strengths of the USCG data included our ability to access the data, which we accomplished by filing a Freedom of Information Act request. Occupational injuries were extracted from MISLE

without difficulty because the system allows for queries to specify commercial fishing vessels and nonfatal injuries.

The dataset also had several limitations. Direct access to the MISLE information system would have improved our ability to characterize the data by providing additional individual level data. Information on fishery and vessel type is necessary when identifying risk factors and targeting safety interventions. However, fishery was not specified for 94% of the records, and most of the vessel information was either not specific or missing. Further, a coding system that provides specific details on injuries, such as equipment or gear being used and location of the accident on the vessel, is needed if MISLE data are to be effectively used in a surveillance system. Additionally, information in MISLE on events or exposures associated with accidents could be improved.

USCG MISLE records appear to represent more severe and acute injuries that occur in the commercial fishing industry, as the system tends to capture accidents that involve medical evacuation of injured personnel. Less severe injuries are probably underrepresented in MISLE because they are not reported.

Claims adjuster data

A total of 582 claims (2003-2012) from 165 fishing vessels, most of which occurred in waters off Alaska, from a Seattle-based independent claims adjuster were included in the analysis. The median age of claimants was 34 years. Median medical and total claim costs were $2,480 and $11,231, respectively. Hand injuries were most prevalent, followed by back, leg, and shoulder injuries. The median (mean) total cost of hand injuries was $8,561 ($38,918), and shoulder injuries had the highest median total costs ($21,096), compared to back, leg, and wrist injuries. The most common cause of back and shoulder injuries was overexertion/bodily reaction and of leg injuries was

slips, trips, and falls. Hand and wrist injuries were most common in processing and deck workers and were most commonly caused by contact with objects and equipment (predominantly cases of fish). Handling frozen fish was the process most commonly associated with hand and wrist injuries. There was a large proportion of missing fishery data, and the distribution of fisheries was representative of the clientele.

Strengths of the claim adjuster data source included the electronic nature of the database, the willingness of the adjuster to share data with us, the availability of cost data, and the relative comprehensiveness of the data set. Limitations include the lack of generalizability of any one insurance data source, as the fisheries represented in each data source depend on the client distribution. Certain variables were not coded or entered consistently, and it was difficult to analyze claims where multiple body parts were injured given the way body part was coded. Certain variables of interest for an injury surveillance system were of less interest to the adjuster and therefore not specifically collected and had to be inferred, were not categorized with much granularity, or had a large percent missing. Other variables of interest, including the equipment, process, and specific exposure causing the injury were not collected as separate variables but instead had to be imputed from incident descriptions.

1.4 Conclusions & Recommendations

This project met its aim of evaluating non-fatal commercial fishing injury data sources. We identified insurance data sources, in particular, as holding promise for future use in fishing injury surveillance. This project defined critical steps toward prioritizing, developing, and evaluating interventions aimed at preventing nonfatal injuries in the WA commercial fishing industry.

Role of the marine insurance industry

The marine insurance industry in all likelihood offers the most complete and representative data to use in nonfatal injury surveillance. Under the Merchant Marine Act of 1920, or Jones Act, crew members can make claims and collect maintenance and cure costs from their employers/vessel owners if they are injured or become ill in the service of a vessel, regardless of the cause and if they are docked or at sea. Protection and indemnity (P&I) insurance responds to Jones Act claims and compensates vessel owners if they suffer a financial loss due to accidents or loss caused by the vessel.

Although not consistently enforced, according to the Commercial Fishing Industry Vessel Safety Act of 1988, the marine insurance industry also has a legal obligation to provide vessel casualty statistics and is liable for a monetary penalty if they do not comply (Title 46 U.S. Code, Section 6104). This act states that:

a. The Secretary shall compile statistics concerning marine casualties from data compiled from insurers of fishing vessels, fish processing vessels, and fish tender vessels.
b. A person underwriting primary insurance for a fishing vessel, fish processing vessel, or fish tender vessel shall submit periodically to the Secretary data concerning marine casualties that is required by regulations prescribed by the Secretary.
c. After consulting with the insurance industry, the Secretary shall prescribe regulations under this section to gather a statistical base for analyzing vessel risks.
d. The Secretary may delegate to a qualified person that has knowledge and experience in the collection of statistical insurance data the authority of the Secretary under this section to compile statistics from insurers.

Generalizability of any one insurance data source is limited, as the marine insurance industry is comprised of a patchwork of underwriters, brokers, and adjusters, some of which work together on the

same claims. A central insurance industry data clearinghouse would help to consolidate the data and avoid replicate records in the dataset. The Marine Index Bureau, which is an organization that developed an insurance fraud database that aggregates claim information from multiple sources, is a promising source of data, but acquiring permission to access the database will be challenging.

In order to move forward with the development of a surveillance strategy to guide injury prevention efforts, stakeholders must collaborate on deciding who will be responsible for maintaining a database or system by which to store data and agree on a consistent manner to enter data, including consensus on data elements and how to code them. Use of electronic databases and consistency in data collection would be ideal. Systematic collection of fishery and vessel type, particularly, but also equipment, working process, and specific exposure information as separate variables in data sources would aid in characterizing injuries. A more standardized set of categories in drop down menus for staff to select from when entering data into electronic records would likely improve consistency in these variables.

Non-fatal injury surveillance may be best managed on a regional level, since fisheries and vessels vary largely by region. Coordination of regional surveillance systems is essential, so that data are collected in a consistent manner across regions and can be aggregated to investigate injury data on a national level.

2 BACKGROUND

Fishing is a vital industry in Washington state, with commercial fish landings in Washington waters totaling over 109 million pounds and generating approximately $65 million annually (TCW Economics, 2008). Over 3,500 employees are estimated to participate in commercial fishing and processing activities in WA waters alone, not including tribal fisheries (TCW Economics, 2008). In addition, some Washington-based commercial fishing enterprises deliver catches from distant water fisheries, such as waters off Alaska, to Washington ports for processing and distribution to world markets (TCW Economics, 2008). Fishing is also among the most dangerous industries in the country. Data from the US Bureau of Labor Statistics indicate that, during 2000-2010, the annual average fishing fatality rate was about 30 times higher (124 deaths per 100,000 workers) than among all US workers (4 per 100,000) (US Department of Labor, 2012). In addition, nonfatal fishing injuries are prevalent, associated with substantial morbidity, and contribute to the estimated $186 billion total annual costs attributed to occupational nonfatal injuries in the US (Leigh, 2011; Marshall, et al., 2004; Thomas et al., 2001).

2.1 Commercial fishing fatalities

Commercial fishing *fatalities* have been well described. The National Institute for Occupational Safety and Health (NIOSH) designed the Commercial Fishing Incident Database (CFID) to track US commercial fishing fatalities by compiling fatality data from multiple sources, including the US Coast Guard, law enforcement agencies, death certificates, news media, and state-based occupational fatality surveillance programs (NIOSH, 2011). Analysis of CFID data has revealed that the commercial fishing fatality rate in CA, OR, and WA was approximately double the US fishing fatality rate between 2000 and 2006, and the highest fatality rate was in the Dungeness crab industry (463 per 100,000 FTE), a major industry in the Pacific Northwest (Lincoln & Lucas, 2008). The majority of fishing deaths have occurred

after vessel disasters, falls overboard, and from trauma caused by equipment on deck (Lincoln & Lucas, 2010; Thomas et al., 2001). This information has been used to focus prevention activities, including efforts to optimize personal flotation device (PFD) use (Lucas et al., 2012) and develop and implement an emergency stop (e-stop) button for winches, which provides a way to quickly stop deck winches if a crew member becomes entangled. (Lincoln et al., 2008).

2.2 Nonfatal injuries

Compared with fatal fishing injuries, relatively little is known about nonfatal fishing injuries. The lack of a comprehensive nonfatal injury surveillance system or central insurance industry clearinghouse contributes to difficulties in characterizing nonfatal fishing injuries. Further, many fishermen are self-employed or have a small number of employees and are therefore not included in data collected by the US Department of Labor. In WA in particular, other limitations include: 1) the complex fishing insurance landscape, which precludes the use of typical data sources such as the WA State Fund Workers' Compensation claims databases; and 2) limitations in data sources such as the WA trauma registry, which, unlike the Alaska trauma registry, does not include industry and occupation information (Sears et al., 2011).

In other settings outside of WA, the frequency of injuries among commercial fishermen has been described using ship logs, recall survey questionnaires, and medical records (Cross, 1985; Lawrie et al., 2003; Marshall et al., 2004; Matheson et al., 2005; Thomas et al., 2001). In a Scottish fishing cohort (n = 1157), 75% of workers reported at least one serious injury in their fishing career (Lawrie et al., 2003). Reported causes of fishing injuries include falls and slips, strains and sprains, getting caught up in nets, laceration and puncture wounds from knives and hooks, and getting caught or injured by machinery such as cables and crab pot launchers (Chauvin & Le Bouar, 2007; Jensen et al., 1996; Jensen, 2006; Marshall et al., 2004; Matheson et al., 2005; Norrish & Cryer, 1990; Thomas et al., 2001). However, the relative

frequencies and characteristics of these injuries have not yet been characterized in a systematic manner in the WA fishing industry or in the US overall.

2.3 Injury surveillance

Surveillance is defined as the ongoing systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of health practice, closely integrated with the timely dissemination of these data to those who need to know (Centers for Disease Control and Prevention, 1988). A **surveillance system** includes a functional capacity for data collection, analysis, and dissemination linked to public health programs. In **passive surveillance**, relevant information is collected in the course of doing other routine tasks. In order to make the best use of available resources to address the problem of commercial fishing injuries, four questions must be addressed (World Health Organization, 2001):

1. Who and how many are being injured and in what ways?
2. What are the risks that contribute to injury?
3. How can one intervene, and which interventions best reduce the risks and the harm?
4. How does one make the best use of available resources to stop people from being injured or to reduce the harm done?

A good injury surveillance system should provide answers to the first two questions and could help answer the second two questions.

2.4 Project aims & goals

In this project, we aimed to collaborate with commercial fishing employer, insurance, government, and healthcare partners to describe the landscape of data sources on WA nonfatal fishing injuries and to

begin to develop a strategy for nonfatal fishing injury surveillance. Our goal was to use established methods (World Health Organization, 2001) for evaluating sources of nonfatal commercial fishing injuries that could, in the future, contribute to a formal passive surveillance system for injury data collection, analysis, and dissemination, with an ultimate goal of prioritizing interventions to reduce injury risk.

3 METHODS

3.1 Project timeline, phases, & protection of human subjects

To achieve project goals during the 21-month project period, project work was organized into three phases. In **Phase 1** (approximately months 1-8), we conducted informal meetings and discussions with potential commercial fishing partners to better understand the commercial fishing industry and data sources relevant to nonfatal fishing injuries. Partners were not asked for personal information or opinions; therefore, Institutional Review Board (IRB) approval was not required for the first phase. In **Phase 2** (approximately months 9-18), we evaluated sources of nonfatal fishing injury data from selected sources. In **Phase 3**, we disseminated information obtained during the study to commercial fishing partners (approximately months 19-21). All procedures for Phases 2 & 3 were approved by the UW IRB (Human Subjects application #43695, Subcommittee EG under Expedited Category 5) and were formalized in data sharing agreements between partners and the UW Office of Sponsored Programs (OSP), with the exception of data from the US Coast Guard. US Coast Guard data was obtained via the Freedom of Information Act (www.foia.gov).

3.2 Project setting

The project was carried out primarily in the Greater Seattle, WA area. Meetings with commercial fishing partners were conducted at employer, insurance, government, or healthcare partner

offices; by teleconference, or at mutually agreed upon locations. Evaluation of data sources and analyses of data were carried out at the University of Washington (UW).

3.3 Assessment tools, data sharing agreements, & statistical analyses

3.3.1 Phase 1: Meetings with partners

Initial commercial fishing contacts were obtained via the Project Advisor, Dr. Jennifer Lincoln, and partners were contacted by the project team. Before meeting, the team provided written documentation to partners describing the goals of the project and the meeting agenda (**Appendix I**). The goals of the meetings were to: 1) begin to build rapport; 2) describe the project and obtain feedback on study plans; 3) understand the partner's organization, the organization's role in the commercial fishing industry, and potential data sources associated with the organization; 4) and identify additional resources for better understanding the commercial fishing industry and relevant data sources. Hand written notes were taken at meetings. No formal assessment tools were used during meetings.

In addition, a poster was presented at the Pacific Marine Expo in November 2012, describing the project rationale and goals. The Pacific Marine Expo is an event tailored to the marine industry with displays set up by commercial fishing industry vendors, fishing associations, and government agencies. This event provided an opportunity to network with commercial fishing safety professionals, insurance companies, fishing vessel owners and operators, and crewmembers of fishing vessels.

3.3.2 Phase 2: Data source evaluation & data analysis

Continued conversations were pursued with potential data source partners, with discussions focusing on general characteristics of data sources (e.g. comprehensiveness,

quality, reliability, timeliness, representativeness, practicality, and sustainability). Initial characterization of potential data sources was performed using a data source evaluation tool developed *a priori* to include data elements of interest, using existing fatality and other databases as examples, and established methods for evaluating whether data sources have favorable injury surveillance characteristics (World Health Organization, 2001) (**Appendix II**).

For data sources that appeared to have promising surveillance characteristics and that were potentially accessible, a data source agreement was pursued with the corresponding data source partner (**Appendix III**). Identifying information was not pursued due to privacy concerns of data source partners. After the data sharing agreement was finalized and IRB approval obtained, data was transferred to the UW project team and analyzed using descriptive statistics. Results and data source characteristics were descriptively compared across datasets.

3.4 Phase 3: Dissemination

In November of 2013, a press release was sent to the editors of the *National Fisherman* and *Fishermen's News*, describing the project. Future dissemination activities may be organized by the Pacific Northwest Agricultural Safety and Health Center and the NIOSH Alaska Pacific Office.

4 RESULTS

4.1 Meetings with commercial fishing partners

We conducted numerous meetings with potential commercial fishing partners based in Seattle, WA, including staff in the USCG District 13 office, several insurance brokers and adjusters, seafood companies, and fishing associations. We also contacted healthcare providers on the Washington coast and in Seattle as well as those who manage the George Washington University Maritime Medical Access program. Members of the project team also attended several vessel and dockside tours, a safety class for employees of a catcher-processor vessel, and the Seattle Fisherman's Memorial Banquet (http://www.seattlefishermensmemorial.org/).

General information about the commercial fishing industry, relevant to nonfatal injuries and data collection, was obtained during meetings and discussions with partners. We found that although seafood companies and vessels are based in Washington State, most fishing activities occur in the Bering Sea and other waters off Alaska. Additional information on Alaska and Pacific Northwest fisheries and technical details about fishing vessels can be found in online resources, such as the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (http://www.nmfs.noaa.gov/index.html) and the Alaska Department of Fish and Game (http://www.adfg.alaska.gov/index.cfm?adfg=fishingCommercialByFishery.main) websites.

4.1.1 Injury reporting and capture

During our conversations with fishing partners, we learned about the various points where injury data may be collected when an injury occurs and during subsequent treatment (Figure 1). Injuries occurring on a vessel that involve more than first aid for treatment are required to be reported to the US Coast Guard (USCG) and are recorded in the USCG

information system, MISLE (section 4.2.1). If an injury does not require more than first aid and does not render the injured worker unfit to perform duties, it may be self-treated or treated with first aid on the vessel. Employers may also record injuries that occur on their vessels (section 4.2.4) and may seek the assistance of a remote medical access program (telemedicine) for medical advice about how to treat the injury on the vessel. Injuries treated via medical access programs may be recorded in medical access program databases (section 4.2.3). If an injured worker is severely injured and, for example MedEvaced (helicoptered) to a hospital, documentation of that injury will be available in hospital or MedEvac records. If an injured worker requires outpatient clinic care, documentation of the clinical course of that injury will be available in outpatient clinic records. Maritime workers who become injured in the service of a vessel may also file Jones Act or Longshore and Harbor Workers' Compensation Act claims. Information about these claims may be captured in insurer or claims adjuster databases (section 4.2.2).

4.2 Data sources

A summary of data source evaluation characteristics, using the WHO framework (World Health Organization, 2001), is shown in Figure 2. We did not have enough information on all possible data sources to conduct a comprehensive evaluation, so the project team rated characteristics for each data source on a sliding scale from least favorable to most favorable. Specific data sources are discussed in further detail in the following subsections.

Figure 1. Life cycle of an injury, from the perspective of injury data capture.

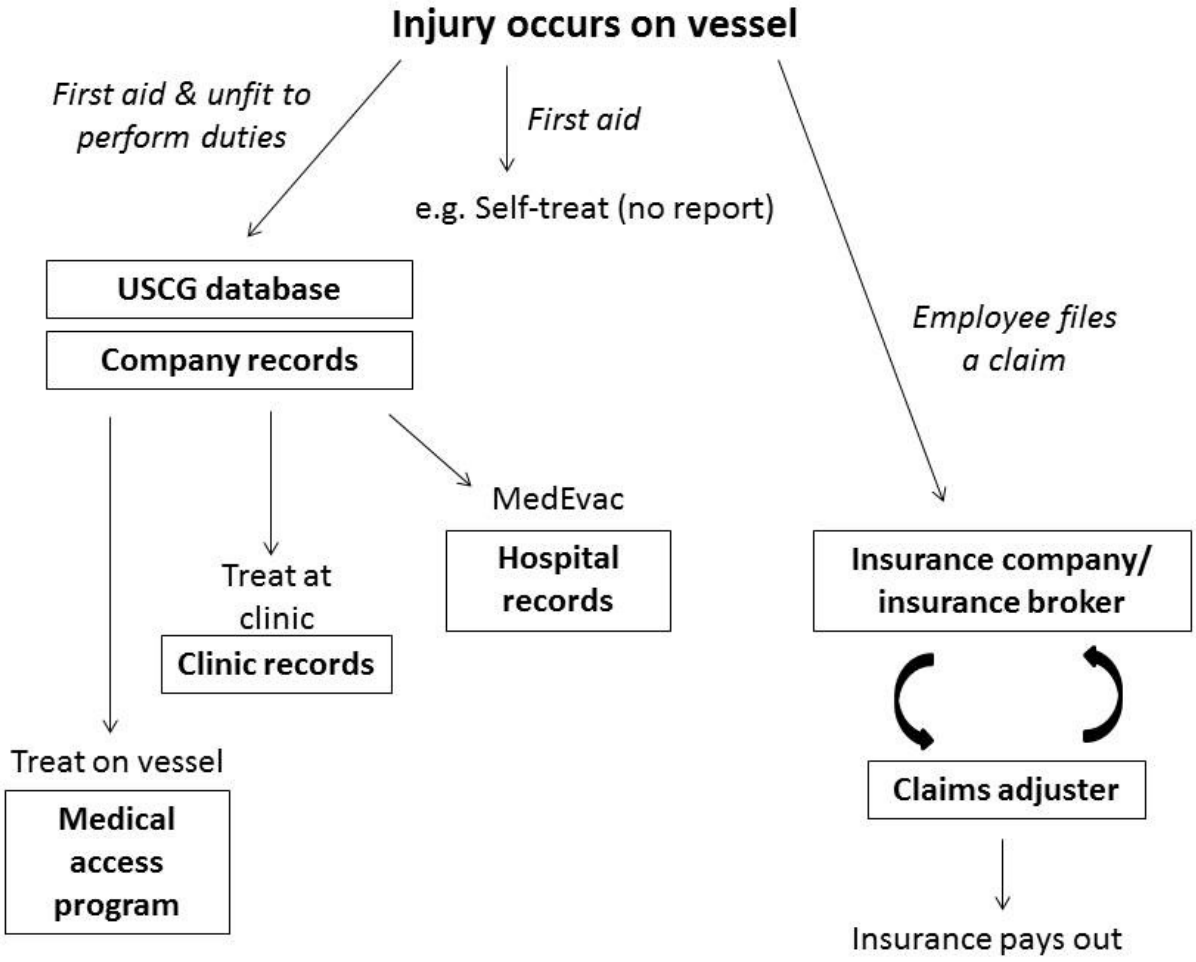


Figure 2. Summary of nonfatal commercial fishing injury data source evaluation characteristics.

Characteristic	USCG	Claims adjuster	Insurer/broker	Clinic/hospital	Medical access program	Companies
Practical/ sustainable (e-database, process for data capture in place, etc.)	●	●	●	◉	◉	◉
Generalizable	◉	◉	◉	○	○	○
Timely (could access data with some degree of frequency – not just once)	◉	◉	?	?	?	?
Quality	◉	◉	?	?	?	?
Acceptability (data source partner willing to provide data/be involved)	●	●	○	○	○	○
Comprehensive (has data elements of interest)	◉	◉	?	○	◉	?
Major issues	Under-reporting, skewed toward severe injuries, fishery/vessel information not reliable	Fishery/vessel information not consistently captured, adjustment firms vary in how they collect information	Difficult to access	Occupation not coded	Difficult to access, large percent of non-commercial, non-injury cases	Difficult to access

Least favorable ○ ◉ ◉ ● **Most favorable**

Adapted from WHO 2001

4.2.1 Government – United States Coast Guard (USCG)

Background

Marine accidents, including injuries that need medical treatment beyond first aid, are required to be reported to the USCG (Code of Federal Regulations, title 46, sec. 4.05-1). Accident details are reported using the CG-2692 form (http://www.uscg.mil/forms/cg/CG_2692.pdf) and then entered in the USCG Marine Information for Safety and Law Enforcement (MISLE) system. USCG data has been successfully used to examine fishing injuries in other states (Day et al., 2010).

Methods

Selection criteria

The USCG extracted casualty data from MISLE for analysis on December 13, 2012. Casualty was defined as a marine accident, which may or may not involve personnel, or a personnel injury or death. Since the focus of the project was on North Pacific fisheries, requested data was limited to USCG districts 13, which covers maritime and inland waterways of the Pacific Northwest, and 17, which covers maritime and inland waterways of Alaska.

The USCG used the following criteria to extract vessel casualty data from MISLE:

- Service of vessel at time of casualty recorded as fishing vessel (commercial fishing or fish processing)
- At least one person on vessel listed as injured, dead, or missing
- Vessel casualty occurred between 2002 and 2011

There were a total of 583 casualties involving 660 personnel and 325 vessels. Some vessels were involved in accidents on more than one occasion, and there were multiple personnel involved in some accidents. Each record in the dataset represented one personnel casualty.

Since the focus of the analysis was on nonfatal occupational injuries, all casualties listed as dead or missing were excluded (n=149) as well as those who were classified as passengers (n=5), visitors (n=4), and external victims (n=1). Those with injuries resulting from assaults or that were self-inflicted (n=7) as well as those with existing medical conditions (n=8) or diseases (n=1) were also excluded. Twenty records were excluded because the latitude & longitude data were missing, or the incidents occurred inland or on rivers. A total of 465 records were included in the analysis.

Selected variable descriptions

Location: Several variables provided information on the location of the vessel casualty, including *USCG prevention unit*, *body of water*, and *latitude & longitude*. A categorical variable was created to group USCG prevention units by district, with District 13 representing prevention units in the Pacific Northwest (primarily Oregon and Washington), and District 17 representing prevention units in Alaska. A new categorical location variable based on the latitude & longitude was also created. The latitude & longitude was plotted on a map using http://batchgeo.com/, and the record was assigned a category based on the geographical placement of the casualty.

Job title: There were eight different job titles in the dataset. These were grouped into three categories: crew, operator, and owner. Placement into categories was based on the job title and verified with USCG personnel.

Fishing vessel: Several variables described fishery or type of fishing vessel including *vessel service*, *vessel type*, *vessel subtype*, and *fishery*. Data regarding *vessel length*, *date vessel was built*, and *hull material* were provided but not used. These data are generally more useful when looking at fatalities because they are factors more likely associated with sunken or capsized vessels, which are events usually linked to fatalities (Dr. Jennifer Lincoln, personal communication).

Accident type: The USCG used a variable labeled *accident type* to describe events or exposures that were believed to have caused injuries. A new variable was created to code the USCG accident types according to the Bureau of Labor Statistics (BLS) Occupational Injury and Illness Classification System (OIICS) for Event or Exposure (OIICS v. 2.01; http://wwwn.cdc.gov/wisards/oiics/). There were variables in the dataset intended to describe events that occurred just before (*preceding event type* and *preceding event class*) and when the injury occurred (*initial event type* and *initial event class*). These variables were not used because anywhere from 83-90% of the data was missing or labeled as unspecified, depending on the variable. If specified, many of the preceding event types were the same as the initial event types. Additionally, it was difficult to understand some of the descriptions.

Injury information: A variable labeled *injury severity* categorized injuries using USCG definitions of injury severity levels (**Appendix IV**). Injury severity descriptions were developed by a working group comprised of multiple organizations and was adopted for use in MISLE (Ms. Kristin Williams, personal communication). There were also variables that classified the *type of injury*, *body region injured*, *organ system affected*, and *aspect* if applicable. In some cases, this information was broken down by primary and secondary injury. Primary injury information for the *type of injury* and *body region injured* were the two variables used for characterizing injuries. *Organ system affected* was not used because of possible misclassification, as it requires a good understanding of anatomy to determine this correctly. Most of the information on secondary injuries was missing, possibly because there were not many secondary injuries, they were not recorded, or they were not considered separate from primary injuries.

Weather-related variables: There were five variables related to weather: *precipitation*, *wave height*, *wind speed*, *air temperature*, and *water temperature*. All weather-related variables were missing at least 90% of the data, so they were not used in the analysis.

Results

Personnel casualties were predominantly male crew members (Table 1). All vessels were flying the United States flag.

Table 1. Gender and job category information of injured personnel from Districts 13 and 17 in 2002-2011 USCG MISLE records.

Gender (n=420)*	Frequency (%)
Male	403 (96%)
Female	17 (4%)
Job category (n=465)*	**Frequency (%)**
Crew	439 (94%)
Operator	17 (4%)
Owner	9 (2%)

*45 records were missing gender information.
**Crew job titles: contractor employee, crew member, employee; Operator job titles: master, operator, person in charge; Owner job titles: owner, managing owner.

From 2002-2011, 86% (n=400) of the incidents occurred in waters off Alaska, and 14% (n=65) occurred in waters off Oregon and Washington according to geographical categories based on latitude & longitude (Table 2, Figure 3). More accidents were reported by vessels in Alaska waters, probably because there are a greater number of large seafood companies operating catcher-processor vessels that employ 100-200 employees, and these companies may be more likely to report incidents to the USCG. Operations in Oregon and Washington waters tend to be small family-run businesses with no more than a dozen crew members, and they may be less likely to report incidents. Additionally, more fishing takes place in Alaska waters, so it makes sense that more injuries would occur off Alaska compared to Oregon and Washington.

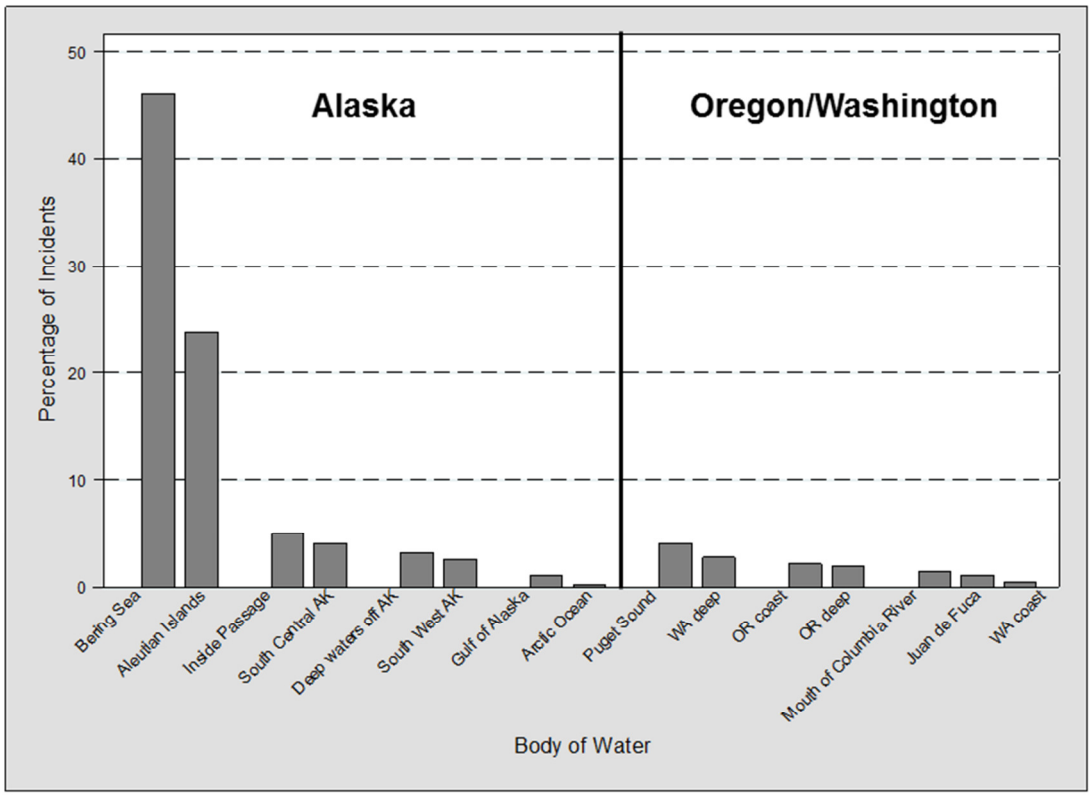
Of the 465 casualties, approximately one-fifth (n=59) occurred in Alaska waters in 2006, which is considerably higher when compared to other years. Almost half (n=214, 46%) of all injuries from 2002-2011 occurred in the Bering Sea.

Vessels were classified as fish catching vessels (n=231, 49.7%), fish catching-processing vessels (n=227, 48.8%), fishing support vessels (n=6, 1.3%), and general (n=1, 0.2%), according to the *vessel type* variable. The fishing support vessels were all fishing tenders. Catching-processing vessels were broken down into trawler-processors (n=102, 45%), longliner-processors (n=27, 12%), and general vessels and general catcher-processors (n=98, 43%). The *vessel subtype* variable provided more specific information on some of the fish catching vessels, although almost 40% of the vessels were classified as "general" (183/465). The *fishery* variable did not offer much specific information as 94% of the records were classified as "unspecified."

Table 2. New location names and descriptions based on latitude & longitude of incidents in USCG MISLE records.

USCG District	Location name	Description of incident location
13	Puget Sound	In Puget Sound near Seattle or Tacoma, near the San Juan Islands, in Hood Canal, or along the coast toward the Strait of Georgia
13	Mouth of Columbia River	At or near mouth of Columbia River; could not distinguish difference between OR and WA
13	Juan de Fuca	In Strait of Juan de Fuca or at the entry to the Strait of Juan de Fuca
13	OR coast	Approximately 10 miles from OR coastline or closer, (CG541 occurred along northern CA coastline but was included in this category)
13	WA coast	Approximately 10 miles from WA coastline or closer
13	OR deep	Approximately 10 miles from OR coastline or farther out
13	WA deep	Approximately 10 miles from WA coastline or farther out
17	Aleutian Islands	Approximately 10 miles from Aleutian Islands or closer, also included Kodiak Island
17	AK deep	Approximately 10 miles south of the Aleutian Islands in the Pacific Ocean or farther out
17	Bering Sea	In Bering Sea, at least 10 miles away from Aleutian Islands or coastline; did include incidents if they occurred on islands in the Bering Sea, also includes incidents that were close to the Kamchatka Peninsula
17	Arctic Ocean	Arctic Ocean or Chukchi Sea
17	Inside Passage	Along the Inside Passage (route from BC to AK)
17	SC	South central Alaska, including waterways near Kenai and Seward
17	SW	South west Alaska, including Bristol Bay area and Nunivak Island
17	Gulf of Alaska	In Gulf of Alaska, at least 10 miles away from coastline or island

Figure 3. Percentage of nonfatal injuries by location in Districts 13 and 17 in 2002-2011 USCG MISLE records (n=465).



We used the USCG *accident type* variable instead of the accidents recoded using BLS OIICS to investigate events or exposures associated with injuries because we felt the USCG *accident type* provided more specific information (Table 3). The most prevalent accident types were "crushed between objects" (n=98, 21%), "struck by moving object," (n=91, 20%), and "fall onto surface" (n=88, 19%) (Figure 4).

Table 3. USCG accident types recoded to reflect OIICS Event/Exposure coding and frequency of accident types in 2002-2011 USCG MISLE records from Districts 13 and 17 (n=465).

OIICS Event/Exposure Description (OIICS code) v2.01	USCG Accident Type	Frequency	Percent
Overexertion and bodily reaction, unspecified (70)	Overexertion Injury- Strain or sprain	38	8
Caught in or compressed by equipment or objects (64)	Contact Injury- Crushed between objects	98	21
	Contact Injury- Line handling/caught in	16	3
Struck against object or equipment (63)	Contact Injury- Collision with Fixed Object	29	6
Struck by object or equipment (62)	Contact Injury- Struck by Moving Object	91	20
Contact with objects and equipment, unspecified (60)	Contact Injury- Other	34	7
Exposure to oxygen deficiency, n.e.c (56)	Noncontact Injury- Asphyxiation	1	0
Exposure to air and water pressure change (54)	Noncontact Injury- Diving	1	0
Exposure to harmful substances or environments, unspecified (50)	Noncontact Injury- Exposure	16	3
	Noncontact Injury- Burn	14	3
	Noncontact Injury- Dangerous Atmosphere	11	2
Fall, slip, trip, unspecified (40)	Contact Injury- Fall onto surface	88	19
	Contact Injury- Fall into water	9	2
Nonclassifiable (9999)	Other Injury Type	10	2
	Noncontact Injury- Other	6	1
	Unknown Injury Type	3	1

Fractures were the most prevalent primary injury type, making up approximately 18% (n=84) of all injuries, followed by lacerations (n=54, 11.6%). Almost 10% (n=45) of primary injuries were recorded as unknown (Table 4, Figure 5). The most common accident types associated with fractures were “fall onto surface” (n=29, 35%) and “crushed between objects” (n=23, 27%).

Figure 4. Accident types associated with nonfatal injuries in 2002-2011 USCG MISLE records from Districts 13 and 17 (n=465).

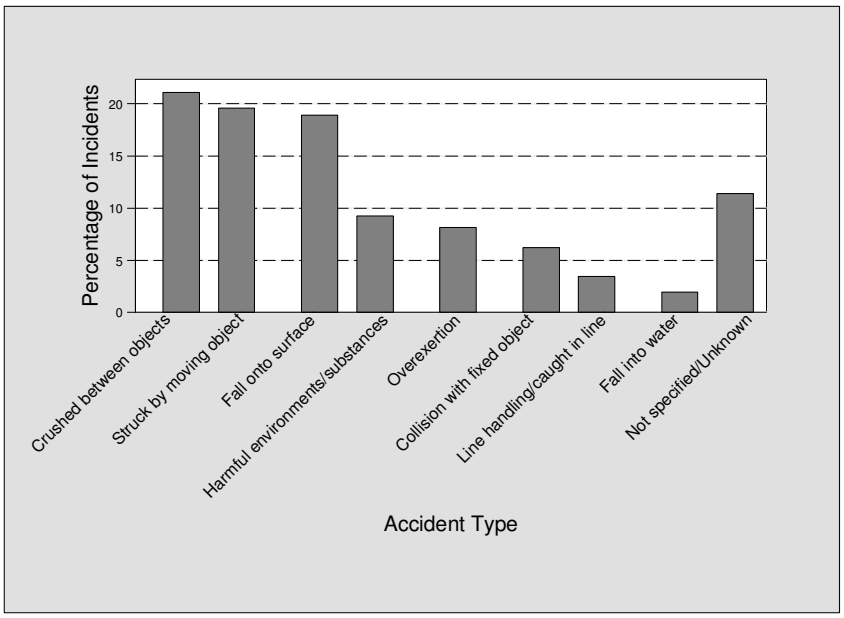
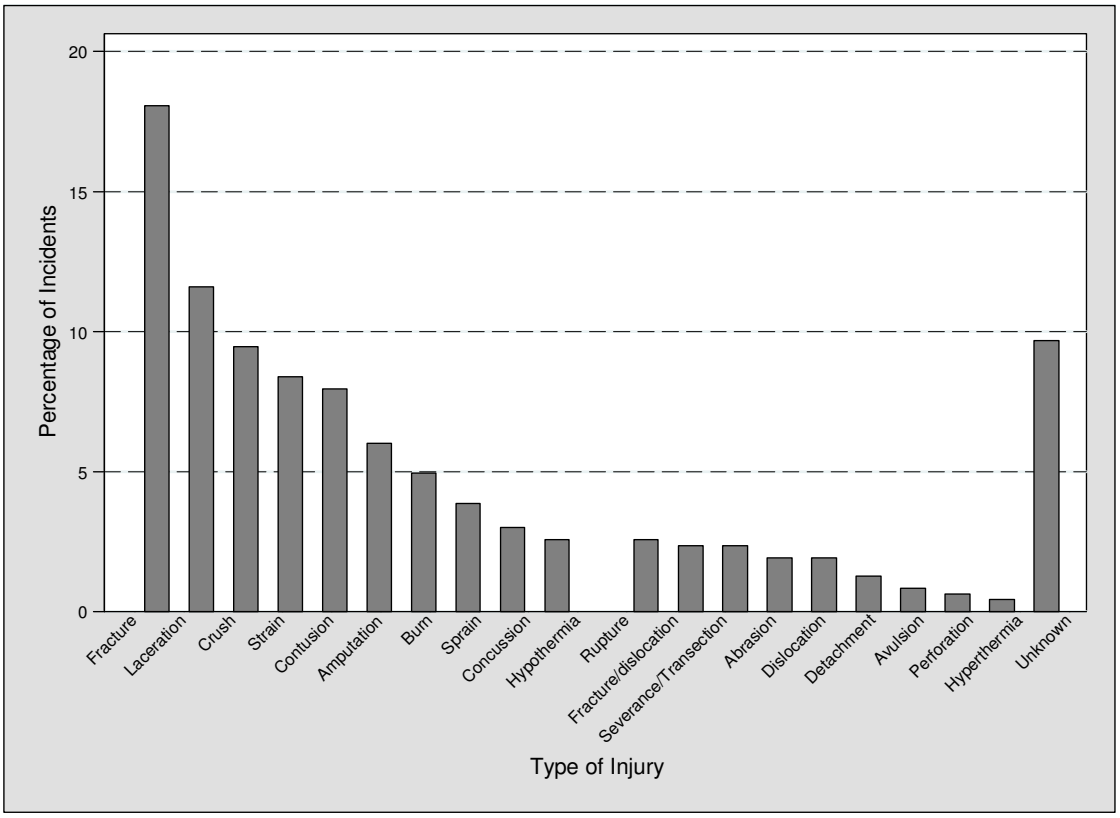


Table 4. Frequency (%) of primary injury types in 2002-2011 USCG MISLE records from Districts 13 and 17.

Primary injury type	Frequency (%)
Fracture	84 (18.1%)
Laceration	54 (11.6%)
Crush	44 (9.5%)
Strain	39 (8.4%)
Contusion	37 (8.0%)
Amputation	28 (6.0%)
Burn	23 (5.0%)
Sprain	18 (3.9%)
Concussion	14 (3.0%)
Hypothermia	12 (2.6%)
Rupture	12 (2.6%)
Fracture/dislocation	11 (2.4%)
Severance/Transection	11 (2.4%)
Abrasion	9 (1.9%)
Dislocation	9 (1.9%)
Detachment	6 (1.3%)
Avulsion	4 (0.9%)
Perforation	3 (0.7%)
Hyperthermia	2 (0.4%)
Unknown	45 (9.7%)
Total	**465 (100.0%)**

Figure 5. Percentage of primary injury types in 2002-2011 USCG MISLE records from Districts 13 and 17 (n=465).

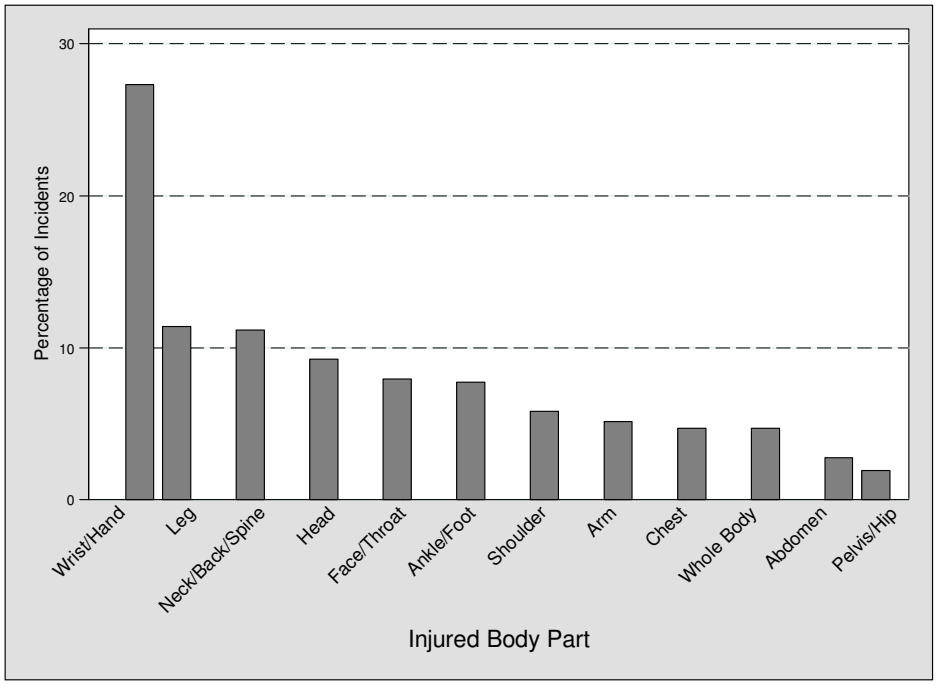


Wrists/hands were the most prevalent body region injured, making up 27% (n=127) of the injuries (Table 5, Figure 6). The two most prevalent injury types for wrist/hand injuries were lacerations (n=28, 22%) and amputations (n=25, 20%).

Table 5. Frequency (%) of body part injured in 2002-2011 USCG MISLE records from Districts 13 and 17 (n=465).

Body part	Frequency (%)	
Wrist/Hand	127	(27%)
Leg	53	(11%)
Neck/Back/Spine	52	(11%)
Head	43	(9%)
Face/Throat	37	(8%)
Ankle/Foot	36	(8%)
Shoulder	27	(6%)
Arm	24	(5%)
Chest	22	(5%)
Whole Body	22	(5%)
Abdomen	13	(3%)
Pelvis/Hip	9	(2%)
Total	**465**	**(100%)**

Figure 6. Frequency of primary body part injured in 2002-2011 USCG MISLE records from Districts 13 and 17 (n=465). Leg is lower leg, lower limbs, thigh, or knee; arm is forearm, upper limbs, upper arms, or elbow.



Wrist or hand injuries were most commonly associated with contact with objects, either being crushed between objects (n=59, 46%) or struck by moving objects (n=20, 16%) (Table 6). Neck and back injuries were most commonly associated with overexertion (n=18, 35%) and falls onto surfaces (n=17, 33%). Leg injuries were most commonly associated with falls onto surfaces (n=14, 26%) and being crushed between objects (n=12, 23%). Shoulder injuries were most commonly associated with falls onto surfaces (n=12, 44%) and being struck by moving objects (n=6, 22%).

Table 6. Frequency (%) of selected body regions injured by selected accident types in 2002-2011 USCG MISLE records from Districts 13 and 17 (n=465).

Accident type	Body region					
	Wrist/Hand (n=127)	**Leg (n=53)**	**Neck/Back (n=52)**	**Head (n=43)**	**Face/Throat (n=37)**	**Shoulder (n=27)**
Crushed between objects	59 (46%)	12 (23%)	2 (4%)	0 (0%)	0 (0%)	0 (0%)
Fall onto surface	7 (6%)	14 (26%)	17 (33%)	8 (19%)	2 (5%)	12 (44%)
Struck by moving object	20 (16%)	10 (19%)	12 (23%)	17 (40%)	15 (41%)	6 (22%)
Overexertion-strain or sprain	0 (0%)	4 (8%)	18 (35%)	0 (0%)	0 (0%)	5 (19%)
Collision with fixed objects	1 (1%)	5 (9%)	1 (2%)	8 (19%)	2 (5%)	4 (15%)
Exposure to harmful environments/substances	7 (6%)	1 (2%)	1 (2%)	4 (9%)	12 (32%)	0 (0%)

Strengths & Limitations

All marine injuries that need medical treatment beyond first aid are required to be reported to the USCG. In general, the USCG is contacted when a crew member requires medical evacuation, so it is likely that MISLE records represent the most severe and acute

injuries that occur in the commercial fishing industry. Less severe injuries and chronic conditions are probably underrepresented in the USCG MISLE information system.

The USCG dataset was relatively easy to obtain, and occupational injuries were extracted from MISLE without too much difficulty because the system allows for queries to specify commercial fishing vessels and nonfatal injuries.

We were able to access data by filing a Freedom of Information Act request. However, because we did this, it was difficult to access certain individual level data, such as age and alcohol and drug use. Direct access to the MISLE system would have improved our ability to characterize the data by providing additional individual level data. In addition, direct access would have also allowed us to view notifications, which are cases when vessels report an incident to the USCG but they are not investigated. The vessel operator still submits a CG-2692 form, and the data are entered into MISLE. The notifications may capture some of the less severe injuries.

Because we did not have access to MISLE, the unique identifier, or *Activity ID*, for each record would have been helpful in linking the records to the online investigation reports (http://cgmix.uscg.mil/IIR/IIRSearch.aspx). Linking accidents in the dataset to the online investigation report could have been done with some confidence by matching dates, but also required extrapolating other information in the dataset to make sure there was consistency with the narrative.

While the investigation reports do have information on job duties and location of the person on the vessel at the time of the accident, the information would need to be coded and added to the MISLE system. Another option would be to reformat the CG-2692 form and include choices to select from on job duties and location of person on the vessel instead of text

boxes. However, this may be difficult given the number of choices that would need to be included.

Complete information on fishery and vessel type is important when identifying risk factors and targeting safety interventions. Fishery was not specified for 94% of the records and most of the vessel information was either not specific or missing. Further, a coding system that provided specific details on injuries, such as equipment or gear being used and location of the accident on the vessel, is essential if MISLE data are to be used in a surveillance system. Specific coding for exposures and hazards, such as the Jensen code, which is tailored toward the commercial fishing industry, could be adopted for use in the MISLE system (Jensen et al., 2003).

The inconsistencies of several variables made it difficult to analyze the data. For example, the location variables did not always match up with each other. Prevention units in one district sometimes reported accidents that occurred in another district and latitude & longitude data did not always match up with the *body of water* variable. Having fewer location variables, using a standardized list of water bodies, or populating a water body variable based on the latitude& longitude entered into MISLE are possible ways to ensure consistency between variables. Standardized lists may also be helpful when entering in data for job titles.

Information in MISLE on events or exposures associated with accidents as well as injury data could be improved. The accident types coded using the BLS OIICS codes for Events and Exposures were not used in the analysis because some of the categorizations did not match well between MISLE and BLS OIICS. The variables intended to describe events that occurred just before (*preceding event type* and *preceding event class*) and when the injury occurred (*initial event type* and *initial event class*) have the potential to be useful in

determining the cause of an injury but were either missing or vague for most records. It appears as if there is not a standardized list of events and classes to select from, which would help in making these variables useful. The reliability of injury severity information is questionable and was not used. For example, amputation of the wrist/hand should be categorized as serious by the USCG definition but were listed as minor, moderate, severe, or unspecified. It is possible that wrist/hand amputations categorized as moderate were finger amputations, but we could not confirm this. More information is also needed on how primary and secondary injury classifications are determined.

4.2.2 Insurance

Background

The Merchant Marine Act of 1920, better known as the Jones Act, allows crew members to make claims and collect maintenance and cure costs from their employers/vessel owners if they are injured or become ill in the service of a vessel, regardless of the cause and if they are docked or at sea. Under the Jones Act, the claimant is entitled to past and future lost wages due to the injury, payments for pain and suffering, and benefits to dependents in the event of the claimant's death (Johnson, 1996).

Protection and indemnity (P&I) insurance responds to Jones Act claims and compensates vessel owners if they suffer a financial loss due to accidents or loss caused by the vessel. P&I insurance pays for injured crew members' maintenance and cure costs, covers defense costs in personal injury lawsuits, pays to repair damages caused by the owner's vessel to another's property, and pays for death or injury to people caused by the owner's vessel.

The Longshore and Harbor Workers' Compensation Act (LHWCA) covers maritime workers not covered by the Jones Act, such as dock workers. Under this act, a worker is entitled to temporary compensation of a portion of their wage as well as compensation for medical costs, disability, and rehabilitation.

Commercial fishing vessel owners/operators typically buy insurance policies through brokers. The role of a broker is to find the best policy for an owner's needs. They may approach various underwriters to find the best policy. Sometimes brokers are affiliated with underwriter companies, though many are independent.

The insurance policy is an agreement between the vessel owner (insured) and the underwriter (insurer). The underwriter is the company that agrees to pay if there is a loss after the deductible is met, in exchange for premiums. If there is a payment to be made for an injured crew member or a claim, an insurer may commission an adjuster to determine the amount of damage. Adjusters may work independently or for an insurer, and some large commercial fishing companies have in-house adjusters to estimate the amounts of payments.

Methods

Selection criteria

One adjustment firm provided us with 2081 protection & indemnity (P&I) fishing injury claim records from 2003 to 2012. The electronic data collection system used by the firm was updated in 2008, and claims entered into the system before and during the update were missing a substantial amount of data (greater than 20% for many variables of interest). Therefore, claims in 2008 or earlier were excluded (n=1236). Incidents occurring in states outside of our primary region of interest, the waters off Washington, Alaska, and Oregon; were excluded

(n=28), as were incidents occurring on rivers and lakes (n=13). We excluded all incidents occurring on passenger or recreational vessels (n=14) and if the claimant was described as "on shore", "visitor", "passenger", or "pilot" (n=7). If incidents did not occur during active duty, they were excluded (i.e. the *operation* field indicated the incident occurred when the claimant was off-duty or involved in vessel maintenance or fire and boat drills) (n=15). Deaths, illnesses, and pre-existing conditions were also excluded (n=8, n=135, n=19, respectively). Finally, we excluded claims that were identified as non-commercial fishing claims by the *season/fishery* variable (n=24). Our final study sample consisted of 582 claims from 165 vessels.

Selected variable descriptions

Location: Location was initially categorized into bodies of water, and then grouped into states off which the body of water was located.

Vessel type: There were 18 different types of vessels described, which were categorized into six groups. The incident description was used to impute recreational and passenger vessels by searching for phrases that made it clear the boat was not used for commercial fishing, and these records were excluded.

Body part affected: The *body part affected* variable was coded using BLS OIICS for Part of Body Affected. If body part data was missing, the incident description field was used to impute the body part affected when it was possible.

Position: The *position* variable described the job held (as described by position on the vessel) by the claimant at the time of injury. Positions were grouped into seven categories according to job duties and verified by a safety specialist in the commercial fishing industry.

Cause of Incident: The *cause of incident* was grouped into eight categories using BLS OIICS for Event or Exposure. Claims originally coded as unspecified (n=72) were placed within BLS OIICS groups after three project team members independently read incident descriptions for the claims, selected the best fitting category, and compared their choices and discussed discrepancies until a consensus was reached. If the cause of incident was "exposure to harmful substances or environments," a new variable was created to specify the exposure if the information was available.

Season/Fishery: Season/fishery data was grouped into nine categories.

Equipment: The incident description field was used to impute the type of equipment, or gear, involved in injuries. We were able to deduce this information for 304 claims.

"Jensen" working process: A system for coding injuries by working processes on industrial trawlers was developed by Jensen et al (Jensen et al., 2003). The framework was used by NIOSH statistician/epidemiologist Devin Lucas to code processes specifically related to longliners and trawlers, and we used this reformatted system to code the adjuster's claims. We specifically used the *incident description* text and *location* and *cause of incident* variables to determine the working process at the time of injury.

More details on the analysis of the claims adjuster dataset can be found in **Appendix V**.

Results

There were between 100 and 200 claims per year from 2009-2011. The median age of claimants was 34 years. No gender information was available. Median medical and total claim costs were $2,480 and $11,231, respectively. Mean costs were substantially higher than median costs, indicating right-skewed cost distributions. Nearly all claims (n=535, 92%) occurred in waters off Alaska.

The majority of claims occurred on the deck (n=227, 45%), in the factory (n=76, 15%), and in the freezer/cargo hold (n=76, 15%) (Table 7).

Table 7. Frequency (%) of claims by location where injury occurred on vessel in Alaska, Washington, and Oregon waters from 2009-2012.*

Location on Vessel	Frequency	Percent
Deck	227	45%
Factory	76	15%
Freezer/Cargo Hold	76	15%
Not Specified	54	11%
Crew Quarters/Galley	34	7%
Dock/Shore	19	4%
Engine Room	15	3%
Other Vessel/Skiff	5	1%
Water	2	0.4%

* 74 (12.7% missing)

The most prevalent causes of all incidents were “overexertion/bodily reaction” (n=193, 38%), “contact with objects/equipment” (n=158, 31%), and “slips/trips, and falls” (n=110, 22%) (Table 8).

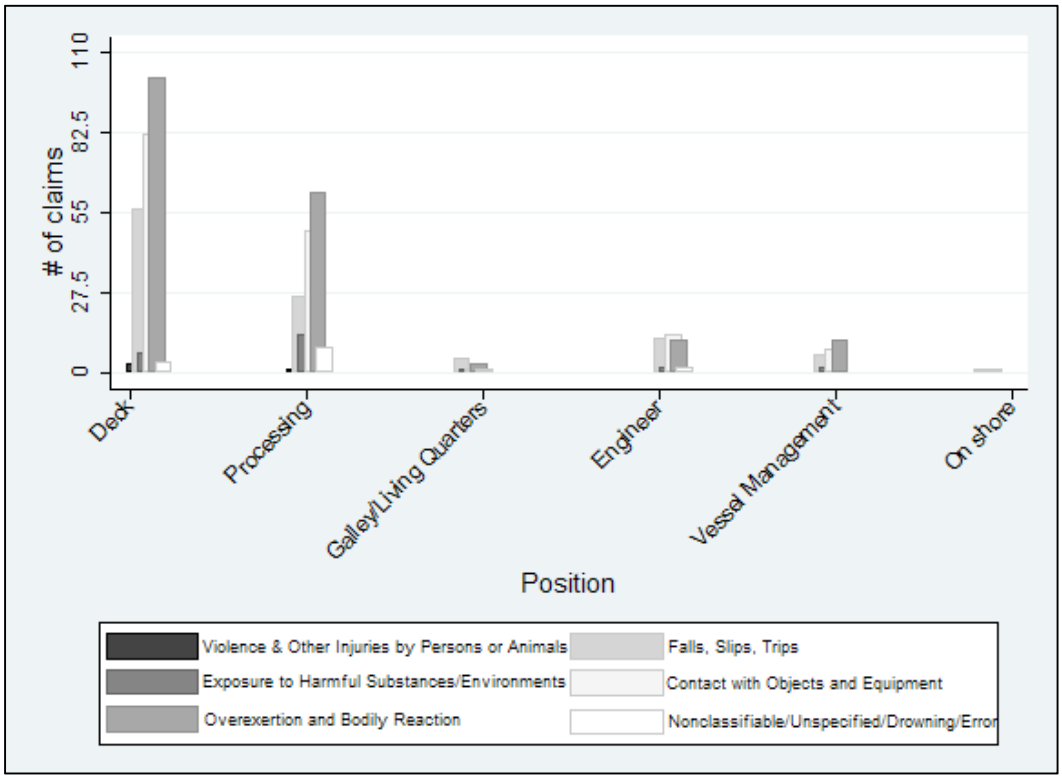
Table 8. Frequency (%) of claims by cause of incident in Alaska, Washington, and Oregon waters from 2009-2012.*

Cause of Incident	Frequency	Percent
Overexertion/Bodily Reaction	193	38%
Contact with Objects/Equipment	158	31%
Slips/Trips/Falls	110	22%
Exposure to Harmful Substances/Environment	25	5%
Nonclassifiable/Unspecified/Drowning/Human Error	18	4%
Violence/Other Injuries by Persons	4	1%
Fires and Explosions	2	0.4%

* 72 (12.4% missing)

"Overexertion/bodily reaction" and "contact with objects/equipment" were particularly common for deck and processing workers (Figure 7).

Figure 7. Cause of incident of claim by position on vessel in Alaska, Washington, and Oregon waters from 2009-2012.*



* 72 (12.4% missing) for cause of incident; 79 (13.6% missing) for position

The most common body parts injured were the hand (n=94, 19%), back (n=75, 15%), leg (n=70, 14%), and shoulder (n=68, 13%) (Table 9).

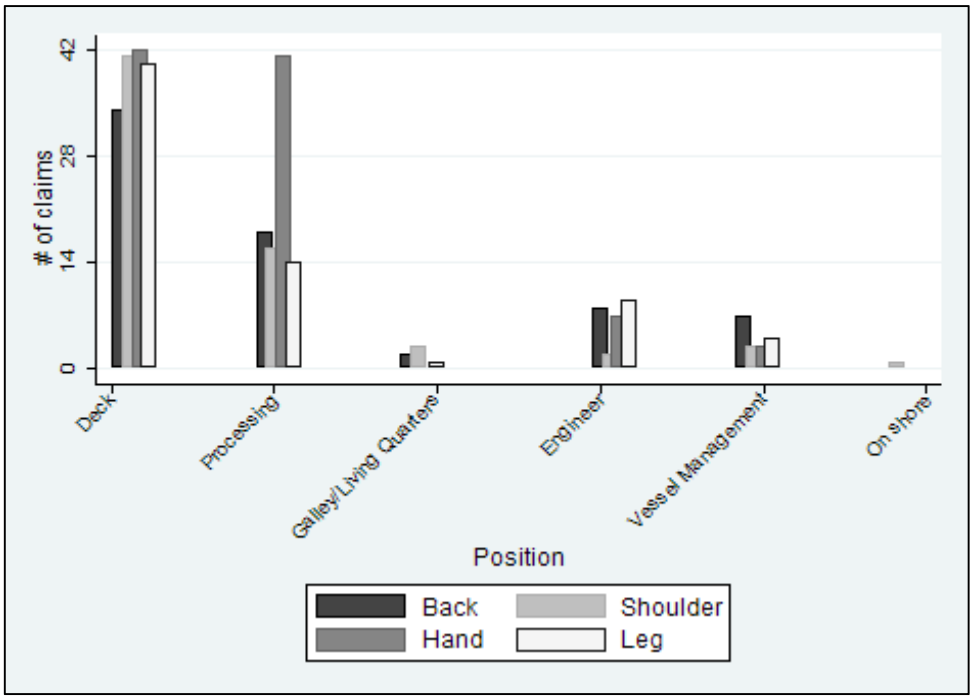
Table 9. Frequency (%) of claims by body part affected in Alaska, Washington, and Oregon waters from 2009-2012.*

Body Part Affected	Frequency	Percent
Hand	94	19%
Back	75	15%
Leg	70	14%
Shoulder	68	13%
Pelvic region	31	6%
Arm	27	5%
Foot	24	5%
Wrist	22	4%
Face	17	3%
Ankle	16	3%

* 78 (13.4% missing); top 10 body parts injured included in table

Hand injuries were markedly more common than other body part injuries in processing workers (Figure 8).

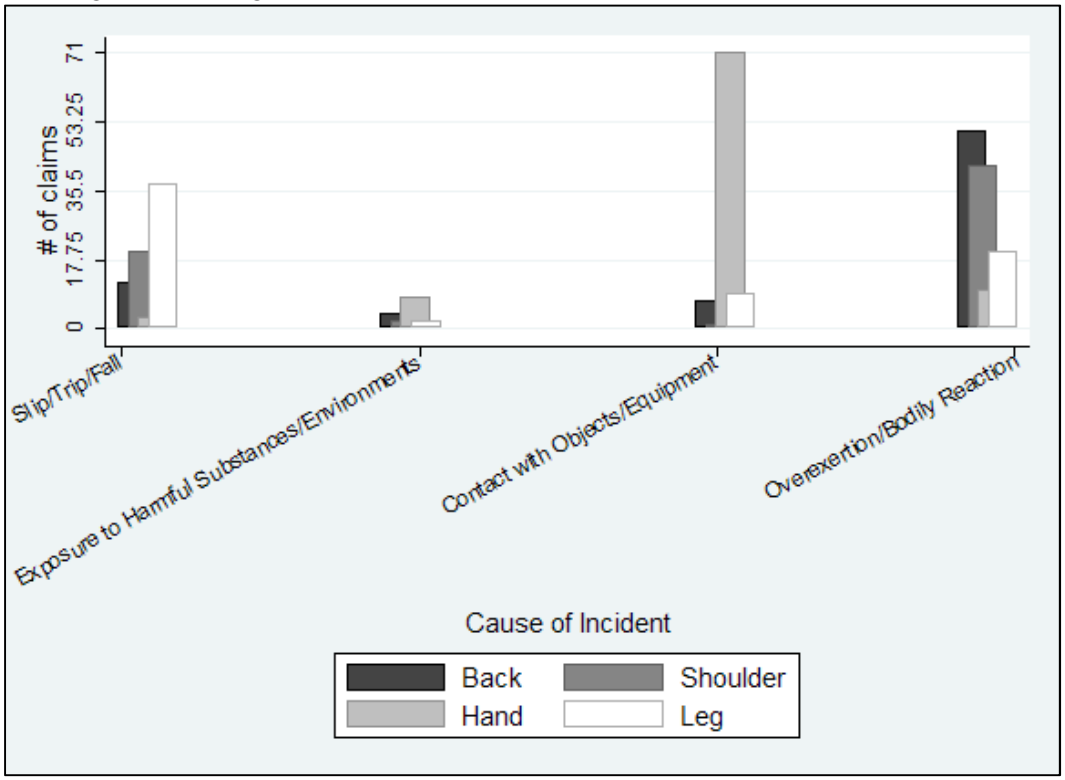
Figure 8. Injured body part reported in claim by position on vessel in Alaska, Washington, and Oregon waters from 2009-2012.*



* 78 (13.4% missing) for body part; 79 (13.6% missing) for position

"Overexertion/bodily reaction" was the most common cause of back and shoulder injuries (Figure 9). "Contact with objects and equipment" was the most common cause of hand injuries. "Slips, trips, and falls" were the most common cause of leg injuries. The median (mean) total cost of hand injuries was $8,561 ($38,918). Shoulder injuries had the highest median total costs ($21,096).

Figure 9. Selected injured body part reported in claim by selected cause of injury in Alaska, Washington, and Oregon waters from 2009-2012.*



* 78 (13.4% missing) for body part; 72 (12.4% missing) for cause of incident

Although a large percentage of fishery data were missing (n=151, 26%), cod, black cod, and pollack were the top fisheries among claims with fishery information, reflecting the clientele of the adjustment firm. The most common Jensen activity associated with hand and wrist injuries was handling frozen fish (Table 10).

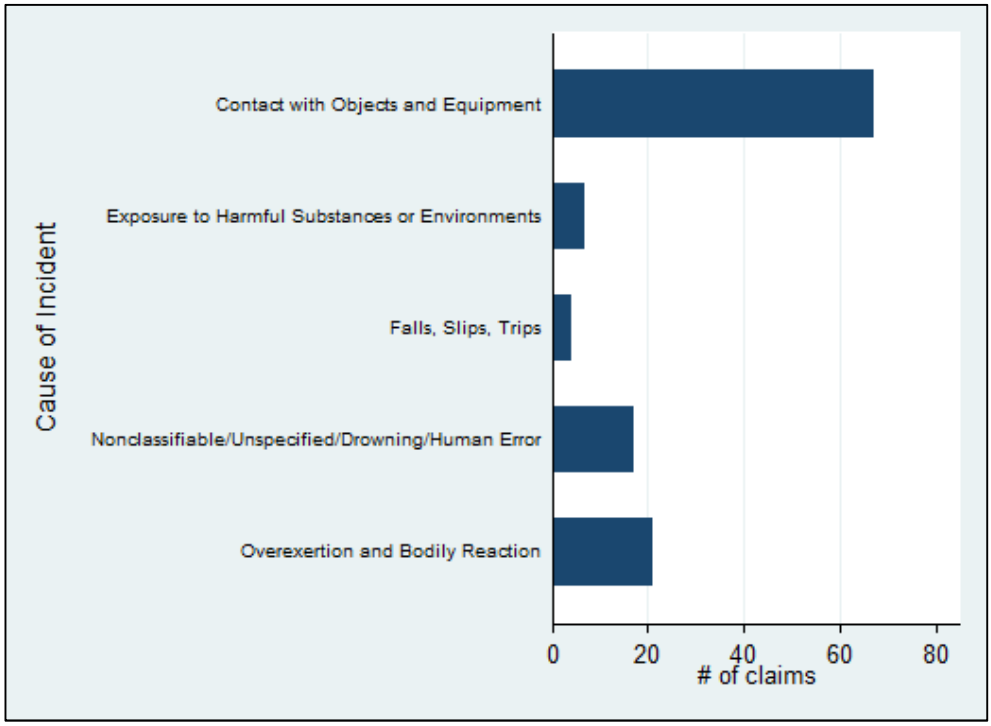
Table 10. Jensen activity classification for claims in Alaska, Washington, and Oregon waters from 2009-2012.*

Body part affected	Frequency	Percent
Handling frozen fish	46	41%
Stacking blocks	6	5%
Offloading	6	5%
Unclassifiable	22	20%
Handling gear on deck	15	13%
Processing catch	14	12%
Other	10	9%
Working in engine room	6	5%

* 32 (5.5% missing)

The most common cause of hand/wrist injuries was contact with objects and equipment (Figure 10). Half of the hand/wrist claims caused by contact with objects and equipment were caused by cases of fish.

Figure 10. Hand and wrist injuries by cause of incident reported in claims in Alaska, Washington, and Oregon waters from 2009-2012.*



* 78 (13.4% missing) for body part; 72 (12.4% missing) for cause of incident

In summary, hand injuries were most prevalent, followed by back, leg, and shoulder injuries in this insurance adjuster's data set. The median (mean) total cost of hand injuries was $8,561 ($38,918). The median cost of shoulder injuries was higher than that of hand, back, and leg injuries ($21,096). The most common cause of back and shoulder injuries was overexertion/bodily reaction and of leg injuries was slips, trips, and falls. Hand injuries were most common in processing and deck workers and were most commonly caused by contact with objects and equipment (predominantly cases of fish). Handling frozen fish was the process most commonly associated with hand and wrist injuries. There was a large proportion of missing fishery data, and the distribution of fisheries was representative of the clientele.

Strengths & Limitations

Strengths of this particular claim adjuster data source included electronic nature of the database, the willingness of the adjuster to share data with us, the availability of cost data, and the relative comprehensiveness of the data set. Limitations include the lack of generalizability of any one insurance data source, as the fisheries represented in each data source depend on the client distribution. Certain variables in the adjuster data set that we analyzed were not coded/entered consistently (different staff entering data probably differed in their use of categories for certain variables, resulting in many different categories per variable – e.g. for the position on vessel). It was also difficult to analyze claims where multiple body parts were injured given the way body part was coded. Certain variables of interest for an injury surveillance system were of less interest to the adjuster and were therefore not specifically collected and had to be inferred (e.g. fishery, inferred from season and vessel), were not categorized with much granularity, or had a large percent missing (e.g. vessel type). Other variables of interest, including the equipment, process, and specific exposure causing the injury

were not collected as separate variables but instead had to be imputed from incident descriptions. In general, we found that not all insurance industry data sources used electronic databases and different insurers and adjusters do not collect exactly the same information.

4.2.3 Healthcare

Three healthcare data sources were explored: 1) hospitals; 2) clinics; and 3) marine medical access programs. We talked with several healthcare providers in hospitals and clinics in Washington that injured fishermen may frequent, including the Beach Clinic in Westport, Grays Harbor Community Hospital in Aberdeen, Swedish Medical Center Seattle-Ballard Campus, and several tribal clinics. The main barrier to accessing hospital and clinic records on commercial fishing injuries is that these records are not easily separated from other non-commercial/non-occupational fishing injuries. Although pilot testing of capturing industry and occupation data in electronic health records is underway (https://www.fbo.gov/index?s=opportunity&mode=form&id=d08ff8e1144d2bfe8ffc9fdb5c9a96a7&tab=core&_cview=0), the practice is not yet widespread. Therefore, it is currently difficult to extract information efficiently and on a large scale about commercial fishing injuries from hospital and clinic records (except in clinics, such as the Dutch Harbor clinic in Alaska, that see a large proportion of injured and ill crew members).

Marine medical access programs provide remote medical services to commercial and non-commercial vessels. Services include telemedicine, clinical case management, training, and recommendations for medical equipment. We contacted a marine medical access program but discovered that: 1) commercial fishing injuries (versus non-commercial injuries and illnesses) only account for a small proportion of their business; 2) injury type/severity

information is available for injuries, but cause/incident information is not routinely collected; 3) not all clients call unless the injury is severe; 4) access to their database is difficult because management of the database is outsourced to a vendor.

Finally, as previously mentioned, the Alaska Trauma Registry contains information on occupation and has been used to characterize commercial fishing fatalities (Thomas et al., 2001). However, the WA trauma registry does not include industry and occupation information yet (Sears et al., 2011), and we therefore did not pursue the WA trauma registry as a source of nonfatal commercial fishing injury data. Data from the Alaska Trauma Registry, however, could be further analyzed to obtain information about nonfatal commercial fishing injuries; however, this data may tend towards more severe injuries because the injured individual needs to be hospitalized for more than 24 hours to be included in the Alaska Trauma Registry.

4.2.4 Employer

There are many seafood companies based in Seattle, Washington. Some of the large seafood companies operate catcher/processor vessels and systematically keep records of injuries that occur on their vessels. Additionally, some of these employers have in-house claims adjusters to manage injured workers' claims and track the cost of injuries. The two seafood company contacts we established provided us with an overview of their safety programs but were not able to facilitate data sharing agreements with the companies, primarily because of concerns about confidentiality. Although we could keep the company names confidential, it may have been possible for them to be identified through certain data elements.

5 CONCLUSIONS & RECOMMENDATIONS

This project defined critical steps that we hope will eventually lead to the prioritization, development, and evaluation of interventions aimed at preventing nonfatal injuries in the commercial fishing industry. In our evaluation of existing nonfatal commercial fishing injury surveillance data sources, we found that more complete and systematic collection of fishery and vessel type particularly, but also equipment, working process (e.g. using Jensen or similar coding), and specific exposure information as separate variables (not embedded in free text fields) would aid in characterizing injuries. A more standardized set of categories (e.g. using OIICS or Jensen coding) in drop down menus for staff to select from when entering data into information systems and electronic databases would likely improve consistency in these variables. Adding an occupation code to trauma registries and hospital and clinic records would also help in capturing commercial fishing injuries. Being able to identify whether records from different data sources represent the same cases by using identifying information or another method is also important for enumerating unique injuries. Because we were only able to access two datasets, we did not have enough information on all possible data sources to conduct a comprehensive evaluation using the WHO framework as was originally proposed (see Figure 2 for a summary data source evaluation). Despite this limitation, we feel that the strategy we outlined will aid in developing a system for tracking nonfatal injuries in the commercial fishing industry.

Role of the marine insurance industry

We identified insurance data sources, in particular, as holding promise for future use in fishing injury surveillance. The marine insurance industry in all likelihood offers the most complete and representative data to use for a nonfatal injury surveillance system, as insurance data as a whole likely captures both chronic and acute injuries from most, if not all, fisheries, and contains claims from both small

and large clients. According to the Commercial Fishing Industry Vessel Safety Act of 1988, although not systematically enforced, the marine insurance industry also has a legal obligation to provide vessel casualty statistics and is liable for a monetary penalty if they do not comply (Title 46 U.S. Code, Section 6104). This act states that:

a. The Secretary shall compile statistics concerning marine casualties from data compiled from insurers of fishing vessels, fish processing vessels, and fish tender vessels.
b. A person underwriting primary insurance for a fishing vessel, fish processing vessel, or fish tender vessel shall submit periodically to the Secretary data concerning marine casualties that is required by regulations prescribed by the Secretary.
c. After consulting with the insurance industry, the Secretary shall prescribe regulations under this section to gather a statistical base for analyzing vessel risks.
d. The Secretary may delegate to a qualified person that has knowledge and experience in the collection of statistical insurance data the authority of the Secretary under this section to compile statistics from insurers.

The generalizability of any one insurance data source is limited, as the marine insurance industry is comprised of a patchwork of underwriters, brokers, and adjusters, some of which work together on the same claims (e.g. a particular insurer may work with an independent adjuster). A central insurance industry data clearinghouse would help to consolidate the data and avoid replicate records in the dataset. We inquired into using the Marine Index Bureau database (*http://www.iso.com/Products/ISO-ClaimSearch/Marine-Index-Bureau-info-to-prevent-maritime-claims-fraud.html)*, an insurance fraud database that aggregates claim information from multiple sources, but permission from individual data owners would have been required for us to access this data source. This is a promising source of data and should be pursued.

In order to move forward with the development of a nonfatal fishing injury surveillance system, stakeholders must collaborate on deciding who will be responsible for maintaining a database or system by which to store data and agree on a consistent manner to enter data, including consensus on data elements and how to code them. The use of electronic databases and consistency in data collection across the industry is essential for injury data to be analyzed and used to inform injury risk reduction measures.

Non-fatal injury surveillance may be best managed on a regional level, since fisheries vary largely by region and vessel types and fishery-specific gear, which are often factors involved in occupational injuries, depend on the fishery. Coordination of these regional surveillance systems is essential, so data are collected in a consistent manner across regions and can be aggregated to investigate injury data on a national level.

Injury prevention recommendations

As a starting point, a more detailed study of the most common and costly injuries described in this project would provide valuable insight. In addition, collaborations with commercial fishing industry professionals who are interested in safety and health may result in ideas that could be refined, developed into actual products or interventions, and evaluated.

In the datasets we analyzed, hand injuries were common. Upon further investigation in the claims adjuster dataset, it became apparent that many of these injuries were caused by hands being crushed between boxes of frozen fish as workers were offloading vessels. Our claim adjuster partner suggested development of a safety glove with a protective component to prevent these hand injuries. We are now working with the claims adjuster to determine the feasibility of manufacturing an actual safety glove to prevent crushing, either by creating a new glove or modifying an existing safety glove.

On some of the vessels we toured, vessel operators and crew shared anecdotes about injuries and safety measures they implemented to prevent future injuries. For example, on one crabbing vessel we visited, the crew members told us that crab pots would hit the deck when they were placed on the pot launcher, sometimes injuring the crew member operating the launcher by crushing their feet. They addressed this problem by modifying the launcher and deck, so the pots would not hit the deck and crush the operator's feet. Sharing instructions on how this crew made modifications might prevent injuries on other crabbing vessels. Information on injuries and preventative efforts could be collected by conducting interviews with vessel operators and crew members and discussing interventions with safety professionals who work in the commercial fishing industry. These interventions could be evaluated and the interventions and evaluation results shared on websites or in a booklet of practical safety solutions for the commercial fishing industry.

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7 APPENDICES

7.1 Appendix I: Initial Contact with Commercial Fishing Partners

Hello,

Thank you for setting aside time to meet with us as we initiate the pilot project that you very kindly provided a letter of support for ("Development of a surveillance strategy to guide injury prevention efforts in the Washington commercial fishing industry"). The project is being funded through the University of Washington (UW) Department of Environmental & Occupational Health Sciences.

There will be three of us from the UW working on the main aspects of this project: June Spector (Assistant Professor), Jen Krenz (Research Scientist), and Hannah Frenkel (Undergraduate). Jennifer Lincoln (NIOSH Alaska Pacific Regional Office) is serving as a project advisor. The eventual goal of the project is to develop a surveillance strategy for tracking nonfatal injuries in the commercial fishing industry as a first step in injury prevention.

There are three initial steps of the project: 1) enhance our own general knowledge about commercial fishing from a variety of perspectives by talking informally with experts in the insurance industry, health providers that treat injured commercial fishing workers, employers, and other agencies; 2) determine what *types* of data elements (*not* actual data) relevant to commercial fishing injuries are collected by commercial fishing partners, how data are collected, and why data are collected; 3) depending on what is learned in the first two steps, we may be interested in exploring ways to share *de-identified* data relevant to commercial fishing injuries.

Here is a tentative agenda of topics we would like to cover during the first meeting:

1. Introduction of UW project team
2. Overview of project aims
3. Introduction of your company and involvement in fishing industry
4. Review list of data elements– we are interested in knowing whether you collect any of the types of data elements listed below, if there are other data elements you routinely collect, and why
5. Introduction to how you approach collecting and processing your data

Please contact Jen Krenz (jkrenz@uw.edu, (206) 616-8904 if you have any questions before our meeting. We look forward to meeting with you.

Best Regards,

Jen Krenz

DATA ELEMENTS:

Demographic information
- *Age at time of injury
- *Gender
- Race
- Residence
- Years working in industry

Injured person
- On board position/Primary position of worker
- Personal protective equipment (PPE) used
- Type of PPE used
- Alcohol
- Drugs

Event information
- Date
- Time
- *Fishery
- Species

Vessel information
- Length
- Year built
- Hull material
- Gear type
- Vessel type
- Vessel activity during incident

Environment
- Body of water
- *Vessel location
- Incident location onboard
- Latitude
- Longitude
- Weather related
- Wave height
- Wind speed
- Air temperature
- Water temperature

Cause
- *Primary cause
- Contributing factors
- Fatalities associated

Injury data
- *Event or exposure
- Severity
- *Intentional/unintentional
- Level of care
- *Nature of injury
- *Body part
- Primary source
- MedEvac or not
- Diagnosis code(s)

Outcomes
- Return to work status (e.g. light duty, off work)
- Missed work days
- Healthcare utilization
- Medical only costs
- Total costs

7.2 Appendix II: Data source evaluation tool

I. Data source identification:	**Variable coding**	**Variable type**	**# Response categories**	**Sample data categories/description, comments**
Data source name	Name of company/organization	string		
Data source type	1. Insurance 2. Employer 3. Association 4. Clinic 5. USCG 6. Other	categorical	6	
Data source contact name	Name or contact person	string		
Data source contact e-mail	Contact e-mail	string		
Data source contact phone	Contact phone number	string		
II. Data source properties:				
Data source type	1. Manual 2. Electronic	categorical	2	
Consistent injury description/coding	1. Inconsistent descriptions/coding used for each injury 2. Fairly consistent descriptions/coding used for each injury and/or methods have changed over time 3. Consistent method of description/coding used for each injury but could not compare with other data sources 4. Includes national or international standardized methods of description/coding for each injury (e.g. OIICS)	categorical	4	
Flexibility (information collected)	1. Impossible to modify the information collected 2. Possible but not easy to modify the information collected 3. Easy to modify the information collected	categorical	3	
Flexibility (collection method)	1. Impossible to modify way in which data are collected 2. Possible but not easy to modify methods for collection 3. Easy to modify way in which data are collected	categorical	3	

Utility	1. Obtaining data of interest involves a substantial amount of cost/staff effort/resources 2. Obtaining data of interest involves a moderate amount of cost/staff effort/resources 3. Obtaining data of interest does not involve much cost/staff effort/resources	categorical	3	
Ease of obtaining updated data	1. Very difficult to obtain data from data source more than once 2. Able to obtain data from data source but only on the order of every year or so 3. Regularly able to obtain data from data source (e.g. on the order of months)	categorical	3	
Data scope/representativeness (fisheries)	1. Could capture injuries occurring in only one type of fishery in a given location(s) 2. Could capture injuries occurring in multiple fisheries in a given location(s), but data are probably not representative of all fisheries in that location(s) 3. Injuries data likely representative of all fisheries in a given location(s)	categorical	3	
Data scope/representativeness (location)	1. Could capture injuries occurring in one town only 2. Could capture injuries occurring in multiple towns or states but unlikely to be geographically representative of all fishing injuries in WA/AK 3. Could capture injuries occurring in multiple towns/states and likely to be geographically representative of injuries in these towns/states	categorical	3	
Ability to identify changes over time that could affect generalizability	1. No 2. Yes	categorical	2	
Shortest potential time from injury date to availability of data	1. ≥12 months 2. ≥6 months, <12months 3. ≥3 months, <6months 4. <3 months	categorical	4	
Missingness	1. >20% missing information on injuries/injury events + other key variables* 2. 10-20% missing information on injuries/injury events + other key variables* 3. <10% missing information on injuries/injury events and other key variables*	categorical	3	

Specificity	1. Very difficult to distinguish nonfatal traumatic fishing injuries from other traumatic and non-traumatic injuries 2. Able to distinguish nonfatal traumatic fishing injuries from other traumatic and non-traumatic injuries, but requires some effort 3. Easily able to distinguish nonfatal traumatic fishing injuries from other traumatic and non-traumatic injuries	categorical	3	
Stakeholder willingness to be involved in surveillance strategy	1. Data source staff/personnel not willing to participate in surveillance strategy 2. Data source staff/personnel somewhat willing to participate in surveillance strategy 3. Data source staff/personnel very willing to participate in surveillance strategy	categorical	3	
Resolution	1. Incident-level data only (cannot identify whether a specific injury occurred in a specific person) 2. Can determine that a specific injury occurred in a specific person but not whether this is a new vs repeat data capture event/healthcare visit for this injury in this person (no time information) 3. Can determine that a specific injury occurred in a specific person and whether this is a new vs repeat data capture event/healthcare visit but not whether this is a new vs repeat injury for this person (incidence versus prevalence) 4. Can differentiate different injuries in different people, new vs repeat data capture event/healthcare visit for this injury, and new vs repeat injury for this person	categorical	4	
Individual-level data	1. No, no individual-level data 2. No, but individual-level data available (subject ID present) 3. Yes	categorical	3	
Longest potential time period of available data	1. < 1 year 2. ≥1 year, <5 years 3. ≥5 years, <10 years 4. ≥10 years	categorical	4	

Denominator available	1. No 2. Yes, but no time component (just total N, for prevalences) 3. Yes, with time component (e.g. FTEs, for rates)	categorical	3	
Able to differentiate whether injury occurred in WA or AK	1. No 2. Yes	categorical	2	
Secure/confidential data storage and transfer possible	1. No 2. Yes (or unnecessary because no personal identifiers)	categorical	2	
III. Data source elements:	**Available from data source?**			
Demographic information				
ID number	1. No 2. Yes	categorical	2	Unique identifier for individual (will vary by data source)
Birthdate or age	1. No 2. Yes	categorical	2	MM/DD/YYYY; age in years
Gender	1. No 2. Yes	categorical	2	Male Female Unknown
Race	1. No 2. Yes	categorical	2	Caucasian African-American Pacific Islander Asian American Indian Other
Residence	1. No 2. Yes	categorical	2	City, State or country outside US where person resides primarily
Years working in industry	1. No 2. Yes	categorical	2	Number of years of experience in the commercial fishing industry
Host/Injured person				

On board position/Primary position of worker	1. No 2. Yes	categorical	2	Cook Deckhand Diver Engineer Fishery observer Mate Operator (Skipper) Other Owner Owner/Operator Processor Unknown
Alcohol	1. No 2. Yes	categorical	2	Tested-was blood tested for presence of alcohol Suspected-no tests performed, but investigators believe it was a factor Not suspected-no alcohol tests performed and not suspected by investigators Unknown
Illegal drugs	1. No 2. Yes	categorical	2	Cocaine Ecstasy Heroin LSD Marijuana Meth Opium PCP Other/Not specified Unknown Not suspected
PPE used	1. No 2. Yes	categorical	2	Yes No
Type of PPE used	1. No 2. Yes	categorical	2	Provide information on type of PPE used (eg. gloves, hard hats, eye protection, etc.)
Event information				
Incident ID	1. No 2. Yes	categorical	2	Unique identifier for incident (will vary by data source)
Date of incident/injury	1. No 2. Yes	categorical	2	MM/DD/YYYY

Time of incident/injury	1. No 2. Yes	categorical	2	HH:MM
Fishery	1. No 2. Yes	categorical	2	Shellfish Groundfish Pelagic fish Other Unknown
Species	1. No 2. Yes	categorical	2	Black Cod/Sablefish BSAI Crab Cod Cucumber Geoduck Halibut Hearing Ocean Perch Other Crab Other Groundfish Other Pelagic Other Shellfish Pollock Rockfish Salmon Scallop Shrimp Sole Unknown Unknown groundfish Unknown pelagic Unknown Shellfish Urchin
Vector/Vessel information				
Vessel ID	1. No 2. Yes	categorical	2	Unique identifier for vessel (will vary by data source)
Length	1. No 2. Yes	categorical	2	Length in feet
Year built	1. No 2. Yes	categorical	2	YYYY

Hull material	1. No 2. Yes	categorical	2	Steel Wood Fiberglass Aluminum Other Unknown
Gear type	1. No 2. Yes	categorical	2	Pot/trap (pots or traps used to collect shellfish or finfish) Longline (long line of hooks fixed between two anchors) Drift gillnet (gill-net with one end drifting and the other end attached to the bow or stern of vessel) Set gillnet (gill-net fixed between two anchors or moved to beach with tide) Seine (net towed on each end to make a circle, with a bottom forming a bag) Troll (line with hooks dragged from long beams extending from port and starboard sides of vessel) Trawl (tows a cylinder shaped net with one end open and other end closed along the bottom or through pelagic zone) Dredge (drags large metal dredge along bottom) Dive (air compressor used to supply air to a diver) Jig (Single hook on each line bounced up and down in water) Bandit rigged (Hook and line on manual or powered reel, several fixed to a vessel) Cast net (net is cast out) Unknown (gear type is unknown) No fishing gear (fishing vessel with no fishing gear)

Vessel type	1. No 2. Yes	categorical	2	Catcher (cabin motor boat that has fishing gear and catches fish) Catcher/Processor (catches and processes fish) Processor (only processes fish) Tender (receives and transports fish) Set net skiff (open motor boat that is used to operate a set-net operation) Seine net skiff (an open motor boat that accompanies a seiner and tows one end of the net) Other skiff (open motor boat used for something other than set net fishing or seining) Light boat (boat with lights used to attract squid to the surface) Dive boat (used to support dive operations) Unknown
Vessel activity during incident	1. No 2. Yes	categorical	2	Fishing (setting nets, pots, lines, etc.) Vessel operations (maneuvering vessel in some way) Tendering operations (transferring, personnel, supplies, or fish from one vessel to another) Mooring operations (making the vessel fast to a pier or anchoring the vessel) Vessel maintenance (completing maintenance aboard the vessel, such as a dockside period
Environment				
Body of water	1. No 2. Yes	categorical	2	Body of water in which incident occurred
Vessel location	1. No 2. Yes	categorical	2	In port (tied to pier or moored) At sea (not made fast to an structure or object)
Incident location onboard	1. No 2. Yes	categorical	2	Wheel house Cabin Bunk house Deck Processing plant Freezer hold Engine room Other
Latitude	1. No 2. Yes	categorical	2	Decimal degrees

Longitude	1. No 2. Yes	categorical	2	Decimal degrees
Weather related	1. No 2. Yes	categorical	2	Yes No Unknown
Wave height	1. No 2. Yes	categorical	2	Height of waves, swells, or seas measured in feet at time of incident
Wind speed	1. No 2. Yes	categorical	2	Gust speed in MPH at time of incident
Air temperature	1. No 2. Yes	categorical	2	Air temperature in degrees F at time of incident
Water temperature	1. No 2. Yes	categorical	2	Water temperature in degrees F at time of incident
Agent/Cause				
Primary cause	1. No 2. Yes	categorical	2	Asphyxiation Contact with crew member Contact with object Contact with sharp object Contact with cold water Decompression Sickness Equipment Related Fall onto surface Fall Height Fire Gear Entanglement Inhalation Poisoning Slip Stab/puncture wounds Struck by gear or object Trip

Contributing factors	1. No 2. Yes	categorical	2	Air quality Alcohol Climbing ladder or rigging Caught in net reel Caught in winch Confined Space Drugs Falling gear/object Fatigue Fire/Explosion Gear malfunction Hydraulic door closed Improper rigging of load In danger zone Lack of Training Lost Balance None Ropes on deck Struck by large wave Struck by weapon Swinging gear/object Toxic liquid Trip/Slip Unknown Vessel Motion Wet/Slippery Deck Working Pot Stack
Fatalities associated with incident	1. No 2. Yes	categorical	2	Yes No Unknown
Injury data				
Event or exposure	1. No 2. Yes	categorical	2	Burns Contact with surface Crushing Laceration Smoke inhalation Exposure to harmful substances Assault/Violent Act Fall overboard Dive Related Incident Other

Severity	1. No 2. Yes	categorical	2	Minor: The injury is minor or superficial. No medical treatment was required. Moderate: The injury exceeds the minor level, but did not result in broken bones (other than fingers, toes, or nose) loss of limbs, severe hemorrhaging, muscle, nerve, tendon, or internal organ damage. Professional medical treatment may have been required. If so the person was not hospitalized from more than 48 hours within 5 days of the injury. Serious: The injury exceeds the moderate level and requires significant medical/surgical management. The person was not hospitalized for more than 48 hours within 5 days of the injury. Severe: The injury exceeds the moderate level and requires significant medical/ surgical management. The person was hospitalized for more than 48 hours within 5 days of the injury and, if in intensive care, was in for less than 48 hours. Critical: The injury exceeds the moderate level and requires significant medical/surgical management. The person was hospitalized and intensive care for more than 48 hours within 5 days of the injury.
Intent	1. No 2. Yes	categorical	2	Unintentional (accident) Intentional self-harm (premeditated and aimed at self-harm) Intentional assault (Interpersonal violence) Unknown
Level of care	1. No 2. Yes	categorical	2	On board (treated by crew member) EMT (treated by emergency medical technician) Clinic (treated at a clinic) Hospital (treated at hospital) Unknown (treatment unknown)
Nature of injury	1. No 2. Yes	categorical	2	Nature of injury e.g. OIICS manual
Body part	1. No 2. Yes	categorical	2	Body part e.g. from OIICS manual

Primary source	1. No 2. Yes	categorical	2	Primary source e.g. from OIICS manual
Medevac	1. No 2. Yes	categorical	2	Yes No Unknown
Diagnosis code	1. No 2. Yes	categorical	2	ICD-9
Outcomes				
Return to work	1. No 2. Yes	categorical	2	Day of injury with no restrictions Day of injury with restrictions Missed work because of injuries Specialist referral and additional treatments required and missed work
Missed work days	1. No 2. Yes	categorical	2	Number
Healthcare utilization	1. No 2. Yes	categorical	2	Number and type of healthcare visits/procedures
Medical only costs	1. No 2. Yes	categorical	2	$
Total costs (missed work + medical)	1. No 2. Yes	categorical	2	$

OIICS = Occupational Injury & Illness Coding System

7.3 Appendix III: Sample data sharing agreement

Limited Data Set Use Agreement
Between
XXX
And
University of Washington

This Data Use Agreement for Protection of Limited Data Set (LDS) is entered into between XXX, hereinafter referred to as XXX, and the

University of Washington

4333 Brooklyn Ave. NE

Box 359472

Seattle, WA 98195-9472

Telephone: (206) 543-4043

Facsimile: (206) 685-1732

E-mail: osp@uw.edu

hereinafter referred to as the Recipient or UW, effective August 1, 2012.

PURPOSE OF ACTIVITIES

It is the purpose of this Agreement to share XXX data with UW Assistant Professor, June Spector, and UW Research Scientist, Jennifer Krenz. The data will be used in a research project to describe nonfatal injuries in the commercial fishing industry.

Recipient will only use or disclose the LDS for the following limited purposes:
(Check all applicable boxes.)

_x__ Research

___ Public Health

___ Health Care Operations

Therefore, it is mutually agreed that:

DEFINITIONS:

"**Disclosure**" means the release, transfer, provision of access to, or divulging in any other manner of information outside the entity holding the information.

"**Use**" means the sharing, employment, application, utilization, examination, analysis, canonization, or commingling with other information.

"Limited Data Set" is protected health information that excludes the following direct identifiers of the individual or of relatives, employers, or household members of the individual: Names; Postal address information, other than town or city, State, and zip code; Telephone numbers; Fax numbers; Electronic mail addresses; Social security numbers; Medical record numbers; Health plan beneficiary numbers; Account numbers; Certificate/license numbers; Vehicle identifiers and serial numbers, including license plate numbers; Device identifiers and serial numbers; Web Universal Resource Locators (URLs); Internet Protocol (IP) address numbers; Biometric identifiers, including finger and voice prints; and Full face photographic images and any comparable images.

"Protected Health Information" means Individually Identifiable Health Information that is (i) transmitted by electronic media, (ii) maintained in any medium constituting electronic media, or (iii) transmitted or maintained in any other form or medium. "Protected Health Information" shall not include (i) education records covered by the Family Educational Right and Privacy Act, as amended, 20 U.S.C. §1232g(a)(4)(B)(iv).

"Individually Identifiable Health Information" means a subset of health information, including demographic information collected from an individual, and (i) is created or received by a health care provider, health plan, employer or health care clearinghouse and (ii) relates to the past, present or future physical or mental health or condition of an individual; and (a) identifies the individual, or (b) with respect to which there is a reasonable basis to believe that the information can be used to identify an Individual.

STATEMENT OF WORK:

The parties to this Agreement shall furnish the necessary personnel, equipment, material and/or service(s) and otherwise do all things necessary for or incidental to the exchange of data as set forth in the *Statement of Work,* Attachment A*,* attached hereto and incorporated herein.

PERIOD OF PERFORMANCE:

Subject to its other provisions, the period of performance of this Agreement shall commence on

August 1, 2012, and be completed on June 30, 2013, unless terminated sooner as provided herein.

PAYMENT:

This is a non-financial Agreement. In no event shall either party seek compensation for work performed under this Agreement.

RECORDS MAINTENANCE:

Records and other documents, in any medium, furnished by one party to this Agreement to the other party, will remain the property of the furnishing party, unless otherwise agreed. Recipient will not disclose or make available this material to any third parties without first giving notice to the furnishing party and giving it a reasonable opportunity to respond.

OBLIGATIONS OF RECIPIENT:

Section 1. Use or Disclosure of LDS. Recipient shall not use or disclose the LDS received from XXX in any manner that is not specifically authorized by this Agreement or that would constitute a violation of federal law, specifically the Health Insurance Portability and Accountability Act of 1996 and any regulations enacted pursuant to its provisions ("HIPAA Standards") and Washington state law. Recipient shall ensure all directors, officers, employees, contractors, and agents use or disclose the LDS only in accordance with the provisions of this agreement and federal and state law. Recipient must obtain specific authorization in the form of another written Data Use Agreement to use or disclose the information disclosed by XXX for any purpose other than that specifically authorized herein.

Section 2. Minimum Necessary. Recipient represents that the LDS contains the minimum necessary information to accomplish the purpose identified.

Section 3: Safeguards Against Unauthorized Use or Disclosure of LDS. Recipient agrees to implement all safeguards appropriate to prevent the unauthorized use or disclosure of the LDS.

Section 4: Reporting of Unauthorized Use or Disclosure of LDS. Recipient shall report in writing any unauthorized use or disclosure of the LDS not provided for in this Agreement within five (5) working days of becoming aware of an unauthorized use or disclosure. Recipient shall take immediate steps to stop the unauthorized disclosure and cure the breach of confidentiality. Written notification will be made to the following person:

XXX

e-mail: XXX

Section 5. Agreements with Third Parties. Recipient agrees to ensure that any agents, including any subcontractors, will be bound to the same restrictions and conditions that apply to Recipient**.**

Section 6: Contact with Individuals. Recipient agrees not to identify the information contained in the LDS and not to contact the individuals who are the subject of the LDS.

Section 7: Immediate Termination. XXX may terminate its participation in this Agreement immediately upon written notice to the Recipient without liability for such termination, in the event that: (1) XXX determines that Recipient has violated a material provision of this Agreement; (2) The Recipient or any employee, officer, or agent is named as a defendant in a criminal proceeding for the violation of state or federal privacy and confidentiality laws.

GENERAL TERMS AND CONDITIONS

Section 8. Severability. If any provision of this Agreement, or any other agreement, document, or writing pursuant to or in connection with this Agreement, is found to be wholly or partially invalid or unenforceable; the remainder of the agreement is unaffected.

Section 9. Waiver. No term or provision of this Agreement shall be deemed waived and no breach excused unless waiver or excuse of breach is in writing and signed by the party against whom such waiver or excuse is claimed.

Section 10. Indemnification. The parties agree to defend (if requested), indemnify, and hold each other harmless from and against any loss, claim, or damage arising from the negligent acts or omissions of their own officers, employees, students, or agents in the performance of their duties under this agreement.

_____	_____
Limited Data Set Recipient	XXX
_____	_____
Authorized Signature	Authorized Signature
_____	_____
Printed Signatory's Name	Printed Signatory's Name
_____	_____
Date	Date

Attachment A

STATEMENT OF WORK

The parties shall furnish the necessary personnel, equipment, material and/or services and otherwise do all things necessary for or incidental to the performance of work as set forth below.

PURPOSE: The overall purpose of this project is to describe nonfatal injuries in the commercial fishing industry.

Data will be used for research by:

June T. Spector

University of Washington Assistant Professor

Phone: (206) 897-1979

Fax: (206) 744-9935

E-Mail: spectj@uw.edu

Jennifer Krenz

University of Washington Research Scientist

Phone: (206) 616-8904

Fax: (206) 616-2687

E-Mail: jkrenz@uw.edu

DESCRIPTION OF DATA

This Agreement governs the transfer and access to the following data:

> XXX protection & indemnity (crew) and protection and indemnity (miscellaneous) claims records concerning nonfatal fishing injuries (*not* illnesses) from 2003-2012. **No direct identifiers will be requested or obtained.** Each claim record will include the following information, if available:
>
> - Vessel type
> - Incident (yes versus no)
> - Date/time of incident
> - Date reported by claimant

  - Vessel location at time of incident
  - Incident location (on vessel)
  - Cause of incident
  - Activity (of claimant) at time of incident
  - Operations (of vessel) at time of incident
  - Incident description
  - Body part affected
  - Age of claimant at time of incident
  - Position (job) of claimant
  - State of residence of claimant
  - Status of claim (open versus closed)
  - Medical costs
  - Maintenance costs
  - Unearned wages
  - Total costs
- XXX will direct Recipient to general information about which types of vessels at which times of year correspond to which fisheries. Recipient will use this information, in combination with information about vessel type and date of incident, to determine the fishery that best corresponds to each claim record.

DATA CLASSIFICATION DECLARATION

Data described in this data sharing agreement is assessed to be in the following data (confidentiality) classification:

☐ PUBLIC

A data classification for data whose access is unrestricted. It applies to all data that is not classified as CONFIDENTIAL or RESTRICTED CONFIDENTIAL.

☒ CONFIDENTIAL

A data classification for data that, due to its sensitive or private nature, requires limited and authorized access.

☐ RESTRICTED CONFIDENTIAL

A data classification for the most sensitive medical and business data within the agency. It is confidential (as defined above); however, with a need for added protection. Its unauthorized access would seriously and adversely impact the XXX, its customers, employees or business partners.

ACCESS TO DATA

Method of Access/Transfer

The data shall be provided by XXX in the following format:

☒ Encrypted USB storage device, provided by Recipient

☐ Electronic-mail

☐ US or CMS mail

☐ Electronic file transfer

☐ On-line application

☐ Facsimile

☐ Other _____

Frequency of Data Exchange

☒ One time: data shall be delivered by 10/1/12 (date)

☐ Repetitive: frequency or dates _____

☐ As available

Authorized Access to Data

Access to "Confidential" or "Restricted Confidential" information is limited to individual UW staff who are specifically authorized. In accordance with the terms contained herein and prior to making the data available, the UW shall notify all staff with access to the data of the use and disclosure requirements.

USE OF DATA

XXX data will be used for research to study nonfatal commercial fishing injuries. With regard to the use of data, the UW and XXX specifically agree to the following:

1. The UW shall request and must receive written permission from XXX at XXX, or his designee, for any use of data for research beyond the scope of this Agreement.

2. Data will be analyzed by Recipient using descriptive statistics. Data analyses will include the following: 1) demographic, job, and fishery characteristics will be summarized; 2) different injury types will be grouped together and summarized (e.g. number/frequency of different injury types); 3) any relationship between injury types and other variables will be examined (e.g. injury types will be cross-tabulated with factors such as cause of injury/incident and fishery).

3. Data will only be reported by Recipient in a summary manner such that no individual or vessel is identifiable. If there is only one record characterized by a specific date and location, location data will be combined to encompass a large enough unit area and/or dates will be combined into a large enough time group (e.g. group of weeks or months) such that there is >1 record per given date and location.

4. XXX reserves the right to receive the following at no charge: a) a detailed briefing of approximately 1 to 2 hours in length on the findings, analysis, and/or conclusions of all related

research performed outside of the scope of this Agreement; and b) copies of work products and/or publications.

5. To the extent that the activities performed under this Agreement are intended to be objective and unbiased, XXX's right to review and comment upon work products in progress shall not include any attempts to violate the integrity of the process. XXX will not place content or editorial restrictions on the UW with regard to any materials submitted by the UW for publication, which are, in whole or part, work products delivered as part of this Agreement.

SECURITY OF DATA

The UW shall take due care to protect the shared data from unauthorized physical and electronic access, as described in this Agreement, to ensure compliance with all appropriate federal laws or applicable provisions of Washington State law.

Data Handling

The UW shall comply with the data handling requirements as follows:

Strict procedures to minimize the possibility of accidental release of information will be implemented and are expected to be fully effective. Data will be transferred from XXX to Recipient on an encrypted USB flash drive, provided by Recipient. Only June Spector and Jennifer Krenz will have access to the USB encryption key, which will be stored in a locked file cabinet in June Spector's UW office, which will be locked when not occupied. June Spector and/or Jennifer Krenz will be with the USB flash drive at all times during data transport. The USB flash drive will never be left unattended in a car or other unsecure location. All UW computers used for this project will be password protected. Data will be directly transferred to UW computers after transport. Research records will be accessible only to authorized UW research staff and will be kept in locked files and/or in password protected computer files in a UW office that is locked when not occupied. The USB flash drive will be kept in a locked file cabinet in June Spector's UW office.

Data Disposition

Data on the encrypted USB flash drives will be erased immediately after transfer to UW computers. Destruction of any printed materials will be by shredding or use of certified, marked and locked bins (for shredding).

TERMINATION OF ACCESS

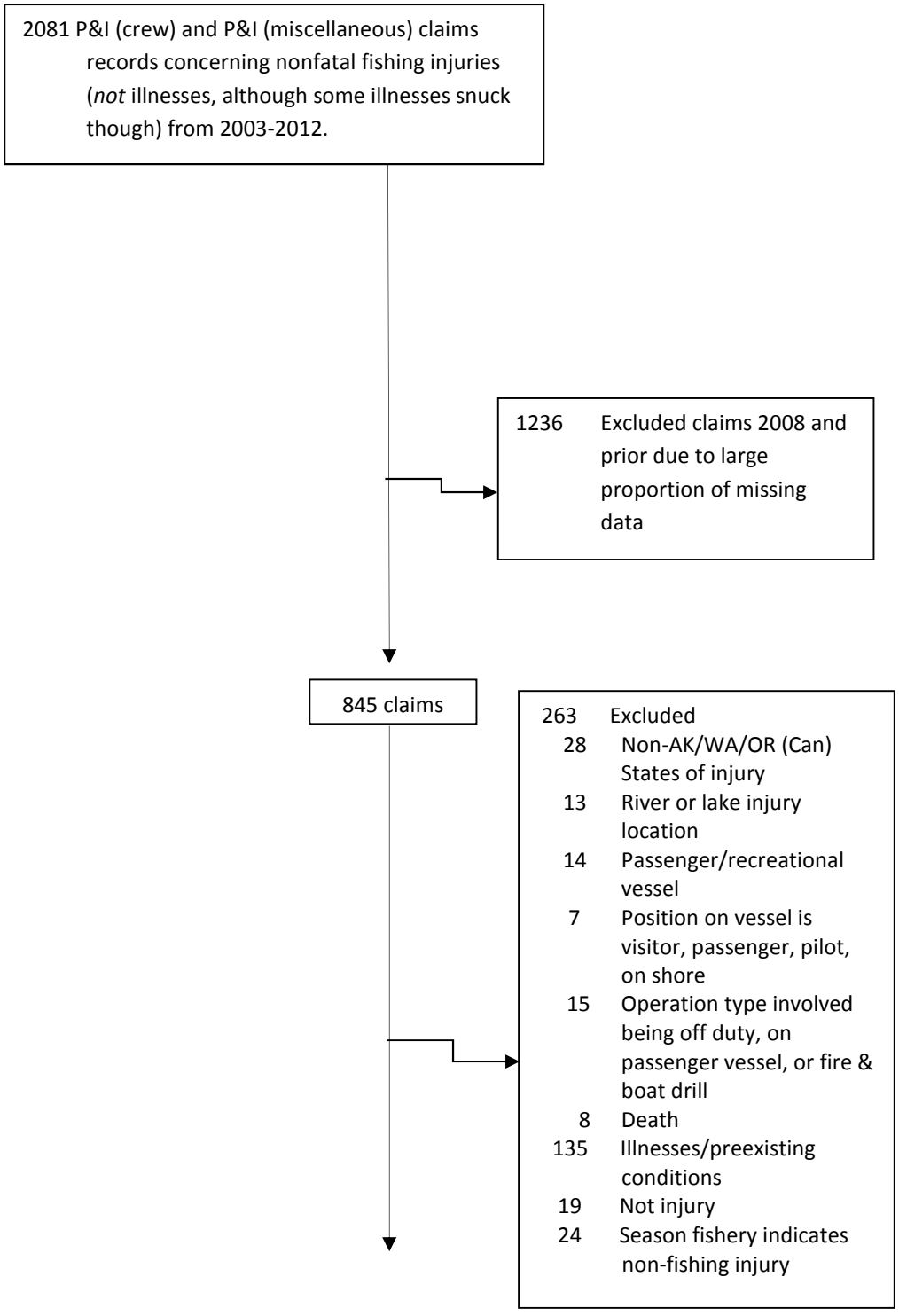
Each party may at its discretion disqualify an individual authorized by the other party from gaining access to data. Notice of termination of access will be by written notice and become effective upon receipt by the other party. Termination of access of one individual by either party does not affect other individuals authorized under this Agreement

7.3 Appendix IV: United States Coast Guard injury severity level descriptions

Severity	Description	Example
Minor	The injury is minor or superficial. No professional medical treatment was required.	Minor/superficial scrapes (abrasions), minor bruises, minor cuts, digit sprain, first degree burn, minor head trauma with headache or dizziness, minor sprain/strain
Moderate	The injury exceeds the minor level, but did not result in broken bones (other than fingers, toes, or nose), loss of limbs, severe hemorrhaging, muscle, nerve, tendon, or internal organ damage. Professional medical treatment may have been required. If so, this person was not hospitalized for more than 48 hours within 5 days of the injury.	Broken fingers, toes, or nose, amputated fingers or toes, degloving of fingers or toes, dislocated joint, severe sprain/strain, second/third degree burns covering 10% or less of body (if face included, move up one cagtegory), herniated disc
Serious	This injury exceeds the moderate level and requires significant medical/surgical management. The person was not hospitalized for more than 48 hours within 5 days of the injury.	Broken bones (other than fingers, toes, or nose), partial loss of limb (amputation below elbow/knee), degloving of entire hand/arm or foot/leg, second/third degree burns covering 20-30% of body (if face included, move up one category), bruised organs
Severe	The injury exceeds the moderate level and requires significant medical/surgical management. The person was hospitalized for more than 48 hours within 5 days of the injury and, if in intensive care, was in for less than 48 hours.	Internal hemorrhage, punctured organs, severed blood vessels, second/third degree burns covering 30-40% of body (if face included, move up one category), loss of entire limb (amputation of whole arm/leg)
Critical	The injury exceeds the moderate level and requires significant medical/surgical management. The person was hospitalized and in intensive care for more than 48 hours within 5 days of the injury.	Spinal cord injury, extensive second- or third-degree burns, concussion with severe neurological signs, severe crushing injury, internal hemorrhage, second/third degree burns covering 40% or more of body, severe/multiple organ damage

7.4 Appendix V: Details on analysis of claims adjuster dataset

Study population



582 claims

Variable descriptions

We re-categorized many variables to increase the number of claims in each group. Re-categorizing also helped standardize the fields, as adjusters in the firm used different language when entering claims information into their database. Six variables were re-coded into broader categories by grouping similar responses. These variables included state where the incident occurred, position of claimant on the vessel, type of fishing vessel, location of the incident on the vessel, season/fishery, state of residence of the claimant. Body part injured and the cause of incident were recoded using OIICS. Continuous variables for costs and age were not recoded. Several binary variables such as death, illness, and no injury were added and coded as 0 or 1 for whether or not a claim included death, illness or no injury.

Claim type: The claim type variable was used by the adjustment firm to pull claims for our use. They pulled claims that were categorized as Protection and Indemnity (P&I, a type of marine insurance). We were given claims that were labeled "P&I, Crew" and "P&I, Miscellaneous". These were re-coded numerically as 1 and 2, respectively.

Location: Location was initially categorized into bodies of water, and then grouped into states off which the body of water was located. A variable indicating type of water body, such as ocean or lake, where the incident occurred was later added. This resulted in a total of three location variables, one specifying body of water where the incident occurred, one specifying the state where the incident occurred, and one specifying the type of body of water where the incident occurred.

Vessel type: The vessel type variable included 18 types of vessels, which were categorized into six groups based on purpose. The categories were commercial fishing, trawler/processors, crabbers, passenger/recreational, non-fishing/non-passenger, and other.

Date of incident: Dates were split into a month, day, year format in order to allow us to easily group incidents by time period.

Time of incident: Time of incident was cleaned in order to correct for inconsistencies in data entry.

Operation: Operation was left unchanged.

Body part affected: The body part affected variable was coded using the OIICS categorization. New binary variables were then created for each body part involved, and coded as either 0 (body part not involved) or 1 (body part involved). This was done to aid in the data analysis as well as helping to capture incidents where multiple body parts were injured.

Position: The position variable, which described the job held by the claimant, contained thirty-five possible positions. These were categorized and coded into seven groups, by job duty. The categories were checked with an expert in commercial fishing and positions were then further categorized based on their suggestions. The final categories were Deck; Processor; Galley/Living Quarters; Engineer; Captain; Technician; Mate; Combination; Diver; On shore; and Visitor/Passenger/Pilot/QC.

Cause of Incident: The cause of incident variable originally contained forty-one possible entries. These were then re-coded into eight categories using OIICS for event or exposure.

Season/Fishery: The season/fishery category contained twenty-one unique entries, which were then grouped into nine categories. This category included both fisheries as well as some vessel types such as research, passenger, and off-shore vessel, claims with these vessel types were excluded from analysis due to lack of relevance to this project.

State of residence: The state of residence for claimants included all 50 U.S. states, and were categorized into the seven states with the largest number of claimants (WA, OR, AK, ID, FL, HI) as well as an eighth category, other, for states not captured in the previous categorization.

Death: The variable, death, was created to identify claims that resulted in death, which we would not use in the analysis. 0 was used to indicate that the incident did not result in death and 1 was used to indicate that a death did occur.

Illness: The illness variable was created to identify claims where the incident involved an illness, not an injury, as well as incidents caused by a pre-existing condition. 0 was used to indicate that an illness or pre-existing condition was not involved, and 1 was used to identify claims where an illness or pre-existing condition was involved.

No injury: The binary variable, no injury, was created to indicate incidents where an injury was not involved in a claim. 0 indicates an injury was involved, 1 indicates that no injury was involved.

Imputation of missing data

We imputed missing data for claims from other variable fields for that claim. The incident description was a field where the adjuster entered a short description of the claim, and this was used to impute missing body parts and vessel types. New variables were also created to better

describe the data, such as a variable to indicate that the claimant had died, a variable to indicate that the claim involved an illness or pre-existing condition, and a variable to indicate that no-injury was involved in the claim. These were imputed from incident description. Variables to enhance the detail of other variables were also added such as an equipment variable which identified equipment involved in injuries and an exposure variable to indicate the substance or environmental condition a claimant was exposed to that resulted in their injury. A variable was also created to indicate type of body of water the claims occurred in. Additionally, a field was added to better define the working process that was involved during an injury, using an adapted version of the Jensen classification system.

Vessel type: Vessel type contained a great deal of missing data, with 1476 out of the total 2081 claims missing (71%). The incident description was used to impute recreational and passenger vessels using words and phrases that made it clear the boat was not used for commercial fishing. Examples include the use of the following words in descriptions- pool, hot-tub, lido deck, show, and passenger. 37 recreational/passenger vessels were identified in this way, decreasing the missingness to 1402 out of 2,081 (67%), before excluding variables. Vessels that were considered recreational were able to be imputed from the incident description (n=37). This was done through identifying words or phrases associated with recreational vessels such as pools, hot-tub, cruise, lido deck, show, and passenger.

Body part affected: The body part affected variable in the dataset from the adjustment firm had significant missing data, with 1,036 missing fields out of the total 2,081 incidents (50%). Where possible, the incident description field was used to impute the body part involved in incidents where the body part affected field was blank. The imputations were saved in a new variable (bodypartaffectedinpute). Fields that initially included the body part involved in a claim were

combined with the imputed body parts in the new variable, with the missing fields reduced to 605 out of 2081 (29%).

Individual Body Parts: A new variable was created for each body part contained in the body part affected variable. The body part affected variable was used to impute whether or not a particular body part was injured in each claim.

Illness: The incident description and cause of incident fields were used to determine whether or not a claim was due to an illness or pre-existing condition.

Cause of incident: Claims originally coded as unspecified (n=72), were re-categorized into the OIICS groups after three people independently read the incident description for each claim and chose the best fitting category. The three coding schemes were then consolidated and claims were coded based on an agreed upon category.

Death: Incident description was used to identify claims where the claimant had died.

No injury: The incident description was used to identify claims where no injury had occurred.

Equipment: The equipment variable was created to better describe the cause of injury. The incident description field was used to impute what type of equipment was involved in the injury (n=304).

Exposure: For claims where the cause of incident was categorized as "exposure to harmful substances or environments", a new variable was created to identify the exposure. The incident description was used for these imputations (n=20).

Vessel Location Water Body: Claims were coded based on whether the incident occurred in an ocean (coded as 0) or lake/river (coded as 1). The vessel location variable was used to determine the type of body of water the incident occurred in.

Jensen: Dr. Olaf Jensen created a system for coding fishing injuries by working processes, the framework of which was used by a NIOSH epidemiologist, Devin Lucas, to code processes specifically related to longliners and trawlers. This reformatted system was used to code the adjuster's claims, using incident description, location, and cause of incident to determine the working process at the time of injury. 550 out of 582 were imputed, leaving 5% missing.

Variable	Variable Type	Categorization
Claim ID	*Continuous*	2090 to 12951
Claim Type	*Binary*	P&I, Crew P&I, Miscellaneous
Vessel Type	*Categorical*	Commercial Fishing Trawler/Processor Crabber Supply/Tender Passenger/Recreational Combination Other
Incident	*Binary*	False True
Date of Incident	*Ordinal*	Day-Month-Year
Date of Incident Year	*Ordinal*	3 to 12
Time of Incident	*Continuous*	Four digit, 24 hour scale
Position	*Categorical*	Deck Processor Galley/Living Quarters Engineer Captain Technician Mate Combination Diver On shore Visitor/Passenger/Pilot/QC
Vessel Location	*Categorical*	Body of water where location occurred, 90 possible entries.
Vessel Location State	*Categorical*	Alaska WA OR/Willamette River CA/WA/OR Other
Vessel Location Water Body	*Binary*	Ocean/etc Rivers/Lakes
Location on Vessel	*Categorical*	Deck Factory Crew Quarters/Galley Freezer/Cargo Hold Dock/Shore Engine Room Other Vessel/Skiff Not Specified Water
Cause of Incident	*Categorical*	Violence and Other Injuries by Persons or Animals Transportation Incidents

		Fires and Explosions Falls, Slips, Trips Exposure to Harmful Substances or Environments Contact with Objects and Equipment Overexertion and Bodily Reaction Illness/Pre-existing condition Nonclassifiable/Unspecified/Drowning/Human Error Pre-existing Condition/Illness
Operation	*Categorical*	At Anchor Cargo Handling Fire and Boat Drill Fishing Operations Moored to dock Not Specified Off Duty On Passenger Vessel Shore Tour Underway Vessel Maintenance
Incident Description	--------	Free form field
Body Part Affected	*Categorical*	Cranial Region, including skull Ear Face Neck, Including Throat Chest, including ribs, internal organs Back Abdomen Pelvic Region Multiple Trunk Shoulder Arm Wrist Hand Multiple Upper Extremity Leg Ankle Foot Body Systems Multiple Body Parts Neck/Back Shoulder/Back Other Body Parts Skin Nonclassifiable
Season Fishery	*Categorical*	Cod/Black Cod Pollack Crab Tuna Cargo Ship Miscellaneous Fish Tugboat/Dredge Unknown Non-Fish
Age at time of	*Continuous*	0 to 88

incident		
State of Residence	*Categorical*	WA OR CA AK ID FL HI Other
Status	*Binary*	Closed Open
Medical	*Continuous*	Cost in dollars
Maintenance	*Continuous*	Cost in dollars
Unearned Wages	*Continuous*	Cost in dollars
Total Costs	*Continuous*	Cost in dollars
Death	*Binary*	No death Death
Illness	*Binary*	No illness/pre-existing condition involved Illness/pre-existing condition involved
No Injury	*Binary*	No injury involved Injury involved
Equipment	*Categorical*	Equipment involved in incident
Exposure	*Categorical*	Exposure involved in incidents where cause of incident was Exposure to Harmful Substances or Environments