Journal of Agromedicine

ISSN: 1059-924X (Print) 1545-0813 (Online) Journal homepage: https://www.tandfonline.com/loi/wagr20

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To cite this article: Emily Ruth Day MPH , Daniel K. Lefkowitz PhD , Elizabeth G. Marshall PhD & Mary Hovinga PhD (2010) Utilizing United States Coast Guard Data to Calculate Incidence Rates and Identify Risk Factors for Occupational Fishing Injuries in New Jersey, Journal of Agromedicine, 15:4, 357-362, DOI: 10.1080/1059924X.2010.510104

To link to this article: https://doi.org/10.1080/1059924X.2010.510104

Published online: 15 Oct 2010.

Journal of Agromedicine, 15:357–362, 2010

ISSN: 1059-924X print/1545-0813 online
DOI: 10.1080/1059924X.2010.510104

Taylor & Francis
Taylor & Francis Group

ORIGINAL RESEARCH

Utilizing United States Coast Guard Data to Calculate Incidence Rates and Identify Risk Factors for Occupational Fishing Injuries in New Jersey

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ABSTRACT. Commercial fishing has high rates of work-related injury and death and needs preventive strategies. Work-related fatal and nonfatal injury rates for New Jersey (NJ) commercial fishermen who suffered unintentional traumatic injuries from 2001 to 2007 are calculated using data from the United States Coast Guard (USCG) Marine Safety and Pollution Database and estimated denominator data. Fatalities were compared to those ascertained by the NJ Fatality Assessment Control and Evaluation (FACE) surveillance system. For the study years, 225 nonfatal injuries and 31 fatal injuries were reported. Among nonfatal injuries, the causes by frequency were fall onto surface, crushed between objects, struck by moving object, line handling/caught in lines, collision with fixed objects, fall into water, and other noncontact injuries. The distribution of fatal injuries differed, with the most frequent cause as crushed between objects. Falls into water and several noncontact injuries accounted for most of the other fatalities. The large majority (96%) of nonfatal injuries were contact injuries, whereas only 68% of fatalities were classified as contact. The overall incidence rate of nonfatal injuries was 1188 per 100,000 full-time equivalents (FTEs) per year. The rate varied considerably by year, from a low of 286 per 100,000 FTEs in 2001 and 2007 to 3806 per 100,000 FTEs in 2003. The overall occupational fatality rate over the period 2001–2007 was 164 per 100,000 FTEs per year. These results can

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This work was supported by the National Institute for Occupational Health and Safety's Fatality Assessment and Control Evaluation (FACE) Program, grant U60 OH0345-01; and Drexel University's School of Public Health. The authors would like to acknowledge Jerry Fagliano, Jennifer Lincoln, Devin Lucas, and David Valiante for their contributions to this paper.

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aid in targeting the commercial fishing industry for injury prevention strategies and interventions, especially for falls, crushing injuries, and drownings.

KEYWORDS. Commercial fishing, denominator data, occupational health injury rates, work-related fatal injuries

INTRODUCTION

Commercial fishing is notorious for the harsh conditions, strenuous physical work and unusual hours, as well as its high morbidity and mortality rates. The calculated fatality rate among commercial fishermen in the United States for 2000–2006 was 115 deaths per 100,000 fishermen per year.[1] The average annual occupational fatality rate among all US workers is four deaths per 100,000 workers per year. Based on fatality rate comparison, the Centers for Disease Control and Prevention (CDC) named commercial fishing as one of the most dangerous occupations in the United States.[1] Thus, commercial fisheries demand the attention of this country's public health workforce to improve occupational health and safety.

More detailed information about fishing hazards has been collected in specific regions. According to the National Institute for Occupational Safety and Health (NIOSH), the commercial fishing industry employed a total of 23% of all people working in Alaska, but accounted for more than 47% of Alaska's occupational fatalities from 1980 to 1988.[2] For the period 1991–1992, the fatality rate for Alaska's commercial fishing industry was 200 deaths per 100,000 workers per year.[1] During the 1990s, the fatality rate among Alaska fishermen decreased by 42%, due largely to new United States Coast Guard (USCG) safety requirements and several National Institute for Occupational Safety and Health (NIOSH)-implemented interventions, including improving personal flotation devices, a deck safety project, and improved access to vessel stability data.

Given somewhat similar conditions, the New England and Mid-Atlantic fishing industries also have a dangerous and demanding commercial fishing industry. However, safety data are sparse on the East Coast commercial fishing industry; particularly in New Jersey.[3] Although there is potential for the interventions implemented in Alaska to be used effectively in New Jersey, it is necessary to recognize the distinct characteristics of New Jersey's commercial fishing industry. In contrast to larger vessels in Alaska, commercial fishers in New Jersey operate small- and medium-sized vessels with typical crew sizes ranging from only one to three people.[4] For the years 2001–2006, the largest fishing catches in New Jersey, measured in pounds, were surf clams, mackerel, and herring.[5] For the years 2001–2006, the largest fishing industries in New Jersey, measured in dollars, were sea scallops and surf clams.[5] The Cape May–Wildwood Port in New Jersey is among the 10 largest commercial fishing ports in the nation.[6] Over the past 5 years the New Jersey fishing industries have seen rapid increases in both metric tons caught and dollars generated. With growth comes the potential for increases in occupational injuries and fatalities.

This paper examines rates of nonfatal and fatal injuries within New Jersey's commercial fishing industry. These incidence rates can be used to provide information on the types of risk factors prevalent among commercial fishermen that lead to injury, in order to inform development of the most appropriate interventions.

RESEARCH DESIGN AND METHODS

Population

The population for the project was New Jersey commercial fishery workers. The estimated number of New Jersey commercial fishery full-time equivalents (FTEs) was taken from a 1999 estimate by the state of New Jersey Department of Agriculture (Agency Communication, 2008). The estimate was derived primarily from

National Marine Fisheries Service (NMFS) data on current vessel counts in combination with industry assumptions, such as crew size, extent of aquaculture, and percent part-time employment. There was no estimate provided for the total number of individuals employed as vessel crew members, and this estimate does not include self-employed fisherman.

Case Definitions

Numerator data for occupational injury and mortality came from two sources: (1) the US Coast Guard (USCG) Marine Safety and Pollution Database; and (2) the New Jersey Department of Health and Senior Services Fatality Assessment Control and Evaluation (FACE) surveillance system, which is a health and safety program funded by NIOSH. Cases include fishermen who suffered unintentional traumatic nonfatal and/or fatal work-related injuries that occurred within the USCG-defined coastal latitude and longitude for New Jersey. (The latitude and longitude boundaries for New Jersey are south of 40°50′ North latitude, north of 38°03′ North latitude, west of 74° West longitude, and east of 67° West longitude.) The case definition for an occupational injury is based on well-established NIOSH guidelines for what constitutes injury at work.[1] Excluded from the case definition are fishermen whose injuries were not occupationally linked and fishermen who suffered an intentional injury or one resulting from a previous medical condition. The FACE database only includes those fatalities that meet the NIOSH guidelines of work-relatedness, and USCG data were filtered upon receipt using the same criteria.

The USCG Marine Safety and Pollution Database was the source of work-related commercial fishery nonfatal and fatal injuries for New Jersey. This database includes reported injuries and fatalities to the USCG and injuries that required USCG assistance. The New Jersey data were extracted by the latitude and longitude locations of the injuries. Incidents may also have included vessels from New Jersey or other states with non-New Jersey residents as crew members.

The New Jersey Department of Health and Senior Services' (NJDHSS) NIOSH-funded FACE Program was another source of work-related commercial fishery fatalities used for this study. The FACE Program has developed and maintained a surveillance system for identifying work-related fatal injuries in New Jersey, which includes a registry of all workplace fatalities. The database was populated by using multiple source notifications, which includes death certificates, medical examiner reports, newspaper articles, and Occupational Safety and Health Administration (OSHA) reports. Potential cases that did not match the sample definition were injuries and/or fatalities that were a result of homicide, preexisting medical conditions, or overexertion, and would be excluded prior to inclusion in the FACE database. Relevant work-related fatalities were extracted from the FACE database for the years 1992–2007.

Data Analysis

Annual incidence rates and exact 95% confidence intervals based on the USCG data were calculated and expressed as counts per 100,000 FTEs, for consistency with existing occupational health literature and to agree with the FTE denominator provided by the NJ Department of Agriculture. The distribution of injuries among 13 standard categories was also examined for both the USCG and the NJDHSS FACE data. Data were analyzed using SAS version 9.1 (Cary, NC).

RESULTS

In total there were 316 occupational injuries and/or fatalities recorded by the USCG for the years 2001–2007 in New Jersey, of which 256 occupational injuries met the inclusion criteria. Of these, 31 were fatal injuries and 225 were nonfatal. Table 1 shows the distribution of nonfatal injuries by injury category, and Table 2 shows the distribution of fatal injuries.

Among nonfatal injuries, the most frequent category was fall onto surface; other categories included crushed between objects, struck by moving object, line handling/caught in lines, collision with fixed objects, fall into water, and a variety of infrequent noncontact injuries.

TABLE 1. Distribution of Nonfatal Occupational Injuries[a] by Injury Category

Injuries	Frequency	Percent
Contact injuries		
Fall onto surface	123	54.7
Crushed between objects	27	12
Struck by moving object	21	9.3
Line handling/caught in lines	19	8.4
Collision with fixed object	17	7.6
Fall into water	7	3.1
Other	1	0.4
Subtotal	215	95.5
Noncontact injuries		
Diving	3	1.3
Burn	2	1
Exposure	2	1
Asphyxiation	1	0.4
Dangerous atmosphere	1	0.4
Other	1	0.4
Subtotal	10	4.5
Total injuries	225	100

[a]Injuries occurring in New Jersey waters during 2001–2007, recorded by USCG.

TABLE 2. Distribution of Fatal Occupational Injuries by Injury Category

Fatality	Frequency	Percent
Contact fatality		
Crushed between objects	12	38.7
Fall into water	5	16.2
Collision with fixed object	1	3.2
Fall onto surface	1	3.2
Line handling/caught in lines	1	3.2
Struck by moving object	1	3.2
Subtotal	21	67.7
Noncontact fatality		
Asphyxiation	4	12.9
Diving	3	9.7
Exposure	3	9.7
Subtotal	10	32.3
Total fatalities	31	100

Data source: USCG and NJDHSS FACE Program.

Fatal injuries showed a different distribution by category, with crushed between objects being the most frequent. Fall into water and several noncontact injuries (asphyxiation, diving, and exposure) accounted for most of the other fatalities. Most nonfatal injuries (96%) were contact injuries, whereas 68% of fatalities were contact injuries.

The second data source used to analyze occupational fatalities among New Jersey commercial fishery workers was the NJDHSS FACE database. A total of 30 fatal injuries among commercial fishermen were recorded in the FACE database, of which 25 met the case definition. Among these fatality data, 52% of fatalities were a result of contact injuries, the remaining 48% were a result of noncontact injuries. All the fatality cases recorded in the FACE database were in concordance with those reported by the USCG.

Table 3 shows the calculated incidence rates of nonfatal occupational injury among New Jersey commercial fishermen. Based on a constant denominator estimate of 2706 FTEs in each year and a total of 18,942 FTEs over the 7-year period, the overall incidence rate of nonfatal injuries was 1188 per 100,000 FTEs per year. The rates vary considerably by year, ranging from a low of 286 per 100,000 FTEs in 2001 and 2007 to 3806 per 100,000 FTEs in 2003. No explanation was apparent for the major swings in the total number of nonfatal and fatal cases over the study period. However, some possibilities may include the occurrence of especially dangerous weather in certain years, changes in the intensity of fishing because of availability or regulatory requirements, and changes in ship technology over time.

Table 4 shows the calculated incidence rates of occupational fatalities. Using the same

TABLE 3. Nonfatal Occupational Injury Incidence Rates

Year	FTEs*	Cases	Incidence rate**	95% confidence interval
2001	2706	8	296	128,583
2002	2706	32	1183	809,1669
2003	2706	103	3806	3107,4616
2004	2706	30	1109	748,1583
2005	2706	21	776	480,1186
2006	2706	23	850	539,1275
2007	2706	8	296	128,583
Total cases	18,942	225	1188	1038,1354

*FTEs = full-time equivalents.
**Rates calculated per 100,000 FTEs.

TABLE 4. Fatal Occupational Fatality Incidence Rates

Year	FTEs*	Cases	Incidence rate**	95% confidence interval
2001	2706	3	111	23,324
2002	2706	2	74	9,267
2003	2706	13	480	256,822
2004	2706	5	185	60,431
2005	2706	3	111	23,324
2006	2706	0	0	0,136
2007	2706	5	185	60,431
Total cases	18,942	31	164	111,232

*FTEs = full-time equivalents.
**Rates calculated per 100,000 FTEs.

constant denominator estimates, the overall occupational fatality rate over the period 2001–2007 was 164 per 100,000 FTEs per year. The rate was also variable from year to year, with a peak of 480 per 100,000 FTEs in 2003.

DISCUSSION

The calculated fatality rate among commercial fishermen in New Jersey was 164 per 100,000 FTEs in the years 2001–2007. This rate is higher than the CDC's US estimate for 2000 to 2006 of 115 deaths per 100,000 fishermen per year.[1] These numbers are considerably higher than the overall annual occupational fatality rate among US workers of four deaths per 100,000 workers per year, indicating the relative danger of work in the commercial fishing industry. The current study also examined nonfatal occupational injury rates, to better understand the burden of injury among commercial fishers. The average annual rate of nonfatal occupational injury in New Jersey, 1188 per 100,000 FTEs, further demonstrates the risks to these workers. There were major differences between fatal and nonfatal injuries in the proportion of contact injuries recorded. This could be due to differences in actual occurrence, or that noncontact injuries that did not result in death may be less likely to be reported to USCG than contact injuries.

The injury types among New Jersey commercial fisher workers are both consistent and different from the findings developed by NIOSH in a report of the breakdown of fatalities among commercial fishermen in Alaska. The highest occurring injury type for deaths among commercial fishermen in Alaska was due to vessel loss, followed by falling overboard.[2] Approximately one-third of the fatalities reported by the USCG data for New Jersey were a result of falls into water and asphyxiation. These deaths may or may not have been a result of vessel loss. However, the highest percentage of deaths among New Jersey commercial fishermen (38%) resulted from being crushed between objects.

Given these reported proportions, intervention programs for New Jersey commercial fishermen should account for hazards related to drowning risk as well as on-board traumatic injuries. In particular, FACE reports indicate there might be opportunities to intervene via improved equipment or changes in vessel practices. For example, two states (Massachusetts and Alaska) report fatal injuries as a result of clothing becoming entangled in equipment such as propulsion shafts and winches. FACE report recommendations included the following: disengage the transmission before attempting to work on or near a propulsion shaft and coupling; guard moving machine parts including propulsion shafts; do not work so close to winch-driven lines or rotating winch heads; ensure that winches have a foot pedal-operated "deadman's switch"; and confine loose clothing, as far as is practicable.[7]

One limitation of the project was the potential for bias in the collection of numerator data. The available nonfatal work-related injuries from the USCG Marine Safety and Pollution Database are based on self-reporting of injuries by the commercial fishing vessels, or injuries that require USCG assistance. These data are likely an underrepresentation of less severe injuries, since minor injuries are less likely to require USCG assistance, particularly for noncontact injuries. However, the comparison between the USCG data and the NJDHSS FACE data set supports the reliability of these data, at least for severe injuries that result in death.

Another limitation of the numerator data was that although the New Jersey injury data were

extracted from the USCG database by the latitude and longitude locations of the injuries, these data have no record of the vessel home port. Consequently, it is impossible to tell whether the fishermen aboard the vessels recording injuries in New Jersey waters were native to New Jersey.

There are also limitations with the denominator data used in this study. The denominator data used was an estimate for 1999 derived by the New Jersey Department of Agriculture for the total number of commercial fishermen in New Jersey. The injury and fatality incidence rates in this project were calculated using a constant denominator which provides no detail on changes over time in the number of fishers and the hours worked per year. Other possible denominator data, typically used for computing occupational fatality and injury rates for other industries, were not workable. Bureau of Labor Statistics (BLS) counts of fishing workers are very low, perhaps because it relies on a voluntary survey from fishermen who may be at sea for many periods during the year.[8] NJ Department of Labor data undercounts fishing workers, at least partially because only fishery workers who pay into unemployment tax system are included; therefore the self-employed fishermen population is not counted. [9,10]

Additional injury risk factors not examined here but that are significant may include fisheries management regimes, the viability of the fishery as it relates to funding vessel maintenance, repair and replacement, weather issues, and crew training and certification. Further exploration into these and other risk factors are needed.

CONCLUSIONS

As elsewhere, work in the commercial fishing industry in New Jersey is dangerous, and these workers warrant the attention necessary to improve occupational health and safety. Based on the information presented in this study, targeted interventions can be inferred by the number of injuries from each injury type, for both contact and noncontact injuries. Specifically, the distribution of fatal injuries differed by category, with the most frequent cause as crushed between objects. Fall into water and several noncontact injuries accounted for most of the other fatalities. A more detailed assessment of fatal and nonfatal crushing injuries and nonfatal falls might identify opportunities for prevention. Furthermore, intervention programs for New Jersey commercial fishermen should account for hazards related to drowning risk as well as on-board traumatic injuries.

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