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Understanding non-industrialized workers' approaches to safety: How do commercial fishermen "stay safe"?

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Abstract

Background: Commercial fishing is carried out worldwide, often in non-industrialized forms, and is associated with high rates of fatal and non-fatal occupational injury. *Problem:* Fishermen who work independently in non-industrialized settings do not have access to union or industry sponsored safety services and must make their own decisions about safety practices. Learning the meaning of safety for them and the safety measures they employ is important before developing interventions. *Methods:* Two fieldworkers conducted in-depth ethnographic interviews with 31 commercial fishermen in North Carolina. Interviews and fieldnotes were analyzed using QSR N5. *Results:* Fishermen primarily related staying safe to work practices and attitudes. They identified specific safety measures, appropriate gear and boat maintenance, weather decisions, and working cooperatively when ocean fishing. *Discussion:* The ethnographic research process can produce information about a group's norms of preventive behavior and safety concerns. Knowledge of workers' concepts and practices will inform researchers' inquiries.

Keywords: Safety; Commercial fishing; Non-industrialized workers; Qualitative methods; Ethnography

1. Background

Fishing is one of the most dangerous occupations. Despite modernization, fishing is still carried out under changeable, often adverse, environmental conditions and is associated with high rates of fatal and non-fatal occupational injury worldwide (Conway et al., 2001; Grainger, 1993; Jin, Kite-Powell, & Talley, 2001; Roberts, 2004; Thomas, Lincoln, Husberg, & Conway, 2001; U.S. Coast Guard, 1999; U.S. Department of Health and Human Services, 1997). Those who work independently in non-industrialized settings are not served by union or industry sponsored safety efforts and must develop their own safety practices. Learning workers' views of the occupational risks and what safety measures they employ to address those risks is vital before developing interventions to reduce risks, prevent injuries, and inform further injury prevention research (Goldman et al., 2003; Holt & McClure, 2006; Linnan et al., 2005; Moir, Paquet, Punnett, Buchholz, & Wegman, 2003; Nyswander, 1956).

Workers served by trained safety professionals in industrialized settings are familiar with the concept of "safety." They hear messages to "work safely" and often receive health and safety training. Since their industrialized work environments are typically predictable and repetitious, safety regulations and practices are generally standardized, such as: wear protective gear; stay alert; clean up spills promptly; and lock down machinery before servicing. It is still up to the worker to comply with safety regulations, but the safety rules are institutionalized. The work environment for small-scale independent commercial fishermen is entirely different.

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They work either alone or in groups of two or three; are not unionized or formally organized; receive no formal safety training; and their work environments change seasonally by what they fish and daily (or hourly) due to the weather. Because of these variable work conditions and their independent organization, commercial fishermen do not have unified employee or union-shaped safety practices. Therefore we were interested in exploring what small-scale commercial fishermen considered hazardous and their existing safety practices. Research has suggested that it is critical to know the beliefs and practices of the target group before developing interventions (DeJoseph, Norbeck, Smith, & Miller, 1996; Goldman et al., 2003; Israel et al., 1995; Krumeich, Weijts, Reddy, & Meijer-Weitz, 2001; Quandt, Arcury, Austin, & Cabrera, 2001; Scrimshaw, Carballo, Ramos, & Blair, 1991). We wanted to know: What does "safety" mean for these small-scale independent fishermen? What safety practices do they currently use? How do they decide what risks to take? Without this knowledge injury prevention interventions may neither be adopted nor effective.

The majority of research on commercial fishing has focused on the deep-sea fishing fleets of Alaska, Scandinavia, Canada, and Britain (Jensen, 1996; Jin et al., 2001; Petursdottir, Hannibalsson, & Turner, 2001; U.S. Department of Health and Human Services, 1997). These fishermen typically work on large boats that are part of industrial-scale fishing operations, are often employees of a company, stay out for five days or more, and fish in the open ocean using heavy equipment. Small-scale commercial fishermen generally work under very different conditions. They are independent, often own their own boats, go out and return the same day, and fish close to the coast in relatively protected waters. In addition to differences in their work environment, their occupational risks differ as well (Bay of Bengal News, 2005; Griffith, 1999; Lipscomb et al., 2004; Marshall, Kucera, Loomis, McDonald, & Lipscomb, 2004; Warner, 1976). Many small-scale commercial fishermen begin fishing as teenagers and continue into their seventies. Thus they are exposed throughout their lifetimes to a wide range of musculoskeletal stress as well as acute injuries and chemicals involved in boat and gear maintenance (Kirrane, Loomis, Egeghy, & Nylander-French, 2007; Marshall et al., 2004).

Perhaps the most significant reason that small-scale fishermen have not been studied in the United States is that there are few records for researchers to use beyond state maintained lists of commercial fishing licenses. Small-scale commercial fishermen are not organized in groups, there is no mandatory injury reporting, and there is limited access to the population since they work independently. Lacking the types of records that occupational health and safety researchers generally use, small-scale independent commercial fishermen have seldom been studied.

Only within the last 10 years have a few researchers investigated occupational hazards for these fishermen and the area remains under-researched. Fulmer and Buchholz (2002) examined the musculoskeletal hazards of independent fishermen in Massachusetts and suggested modifications to boats and gear which could reduce ergonomic strain. Mirka, Shin, Kucera, and Loomis (2005) used video to assess the biomechanical stress for crab fishermen and found ergonomic stress varied between and within crew members. Internationally, the 2005 IFISH 3 Conference held in India specifically addressed issues for the small-scale fisherman (Bay of Bengal News, 2005). Because of this lack of existing research on the occupational safety of small-scale commercial fishermen, our research is formative and exploratory.

We used qualitative research methods to learn what these fishermen thought about safety. This methodology enabled us to "study things in their natural setting, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them" (Denzin & Lincoln, 1994). Qualitative research methods enabled us to learn the emic or insiders' perspective (Creswell, 1998; Fetterman, 1998; Hammersley & Atkinson, 1995). Occupational health and safety researchers have used qualitative methods to address a wide range of occupational health issues from construction safety practices to MSD risk exposure for hospital workers to pesticide exposure in migrant farm workers (Arcury, Quandt, Cravey, Elmore, & Russell, 2001; Arcury, Quandt, & Russell, 2002; Baer & Penzell, 1993; Elmore & Arcury, 2001; Gillen, Kools, Sum, McCall, & Moulden, 2004; Goldenhar, Hecker, Moir, & Rosecrance, 2003; Gordon et al., 2006; Hugentobler, Israel, & Schurman, 1992; Mergler, 1999; Murray & Dolomount, 1995; Quandt et al., 2001; Strunin & Boden, 2000). Some occupational health researchers have used qualitative methods to address safety issues of large industrial boats (Binkley, 1995; Murray & Dolomount, 1995).

2. Methods

This research was part of a larger epidemiological study that sought to examine the occurrence and determinants of occupational injuries among small-scale non-industrial commercial fishermen (Lipscomb et al., 2004; Marshall et al., 2004). Two fieldworkers conducted in-depth ethnographic interviews with 31 commercial fishermen, generally meeting in the fishermen's homes or at a fish house where fishermen docked their boats and sold their catch. Interviews lasted from one to three hours, were audio taped, transcribed verbatim and reviewed by the interviewer for accuracy. Fieldworkers used a wide ranging topic guide that covered safety practices, navigation and safety gear, risk taking, maintenance activities, the fishing process, fishing careers, accident history, and other topics. Fieldworkers asked participants questions such as, "How do you stay safe when you are working?" and "Do you do anything differently from other fishermen you know?" They asked what the fishermen did to make their boats safe, as well as a hypothetical question: "If someone gave you $500 or $1,000 to make your boat safer what would you spend it on?" The interviews were

unstructured and open-ended. Fieldworkers went on fishing trips, observed boat and gear maintenance, unloading and packing the catch, and business transactions at fish houses. To document these activities they wrote fieldnotes, which are detailed accounts of their observations, used a still camera, and videotaped the fishing process (Bernard, 1998; Emerson, Fretz, & Shaw, 1995; Schensul, LeCompte, Nastasi, & Borgatti, 1999).

3. Sample

The fishermen in our study worked primarily in the sounds, rivers, and inlets of the North Carolina coast, which are protected by barrier islands known as the Outer Banks. This coastal area is rich in wetlands and has supported a small-scale fishing industry for many generations. The area is sparsely populated and the communities are tightly knit (Griffith, 1999; Mansfield, 2001). Fishermen who work in the ocean pass through inlets in the Outer Banks and seldom travel further than 50 miles off shore. We located fishermen using a variety of methods. Fieldworkers met some fishermen at the docks and fish houses, a local crab pot maker gave us names, and at interviews fieldworkers asked for suggestions of other fishermen to talk with. Known as snowball sampling, this method is commonly used in ethnographic fieldwork (Fetterman, 1998; Hammersley & Atkinson, 1995; Patton, 2002). We also used principles of purposive sampling since we wanted to interview fishermen with a range of ages and experience and include different sized fishing operations. We concentrated on the two most common types of fishing: crabbing with crab pots and fishing with gill nets in the sounds and the ocean. Interviewing continued until we reached "data saturation," meaning that little new information or contradictory or disconfirming data emerged from interviews (Morse, 1994; Patton, 2002; Safman & Sobal, 2004).

4. Analysis

We used a code and retrieve text analysis process described in Miles and Huberman's (1994) classic work on qualitative analysis. Based on the discussion guide and on themes that emerged from interviews and fieldnotes we constructed a schema for coding data (Denzin & Lincoln, 1994; Miles & Huberman, 1994; Seale, 1999). Codes included type of fishing gear used; safety practices; activities considered to be dangerous by the fishermen; and regulation and policy comments. We used QSR N5, a text analysis program that allows for complex and multiple coding of text that can then be sorted and manipulated (QSR International Pty Ltd., 2003). A statement can be assigned multiple codes and new codes can be created as themes or issues emerge. The project ethnographer and a doctoral student went through the interviews and fieldnotes and assigned one or more codes to passages and defined codes so they would remain stable throughout the analysis process. They met regularly to resolve coding disparities and to clarify code definitions. This basic code and retrieve approach is used by many qualitative researchers (Miles & Huberman, 1994; Patton, 2002; Richards & Richards, 1994). After all interviews and fieldnotes had been coded, the project ethnographer reviewed the text at each code and, if coded incorrectly, moved it to an appropriate code. We examined the text at each code to assess the range, amount, and congruity of information on a topic and to identify information that was inconsistent or contradictory. Reviewing and coding data allowed us to see emerging connections, patterns, and categories. We grouped our findings by the major themes that fishermen identified as contributing to fishing safety: attitudes and work habits; maintenance of boat and gear; and decisions about the weather and cooperation among fishermen.

5. Results

Twenty-nine commercial fishermen we interviewed worked alone or with up to three crew members. They described themselves as captains and owned their boats and equipment. Two fishermen were long-term crew members and worked for a boat owner. All 31 fishermen interviewed fished primarily in the rivers, estuaries, and the Pamlico and Albemarle Sounds inside the Outer Banks of North Carolina. Eight also used gill nets in the Atlantic ocean, generally during the winter. Twenty-eight of the fishermen discussed in this paper are white men, two are African American men; and one is a white female. When interviewed they ranged in age from 18 to 80. We selected representative quotations to illustrate the fishermen's strategies and approaches (within text and in Table 1).

6. Attitudes and work habits

When asked how they stayed safe, most fishermen responded by citing the importance of a general attitude of work safety and that regard for safety was the norm among fishermen. One fisherman told us, "most everybody is pretty cautious around here." Fishermen told us that paying attention, staying alert, and using good judgment were attitudes they thought essential for safety. Often this general attitude was described as "common sense." One long time fisherman explained: "We all got our individual ways of doing things. Try not to do something you KNOW is gonna kill you."

According to many fishermen, safe work habits resulted from experience, know-how, and caution. They explained specific work habits that made fishing safer (Table 1). Trips and falls are a significant hazard on boats. An experienced crabber explained how she guards against this hazard: "When the floor in our boat starts to get a little slippery we stop and put [burlap] bags down." Others used rubber mats for added traction. An 80 year old fisherman told us he always faced the water to avoid being thrown overboard by a movement of the boat.

Table 1
Representative quotations selected from interviews with 31 small-scale North Carolina commercial fishermen

Concept	Quotation
Attitude Work Habits	It's basically just knowing the do's and the don'ts, what you can and can't do. I don't know if we really worry about it, it's just something that's there and you're conscious about it and you just do in your every day work, and that helps. You get into a pattern. But you just learn to be on the lookout for them [hazards] and go on. But a lot of things are just a lot of common sense, being aware, taking precautions. Most of it's just common sense, I mean. Most people I've seen get hurt it was carelessness and not using good common sense about things.
Specific safety measures	I got a piece of rope, nylon rope with a bracket in it where I can put my feet in. If I was to happen to fall overboard, I could climb right up with that rope, but I never fall overboard. A lot of people leave the boat in gear [when pulling crab pots]. Because it does wear easier. But that crab pot rope falls on the floor, and you're going to your next crab pot, and if you're not taking [it] out of gear, and that rope catch around your leg, drag you overboard, and that boat's going to keep right on. And it's not only that, it can sink you right under and chop you right up in a heartbeat. As I got older, I was trying to mechanize everything and take all the physical labor out of the work that I could.
Gear and Boat Maintenance	You pay attention. I pay attention to how the mechanical part of my gear is working, it's something you learn to do. I can tell if something were to go wrong with that engine, I can tell it immediately. I try to keep my boat clean. I keep my gear in good shape. Well we always tried to take care of our equipment and we try to make that understandable when we start fishing. There's been some people that were drowned and hurt and people killed on boats, but I've never had anybody hurt on my boat. I say everybody around pretty much, when they got the money, tries to keep their stuff up. Today I went down there and worked on my rig. I changed the oil and looked at different things. I try to. Some things creep up on you. Because if you don't keep your stuff up, you get out there working and something happens or whatever. But I try to each week, check everything out and make sure the equipment is right.
Safety gear wish list	I pretty [much] got all, everything safe as I could make it, I try to keep it like that. I've got the thousand dollars and I try to be as safe as I can.
Decisions about the Weather	Gale warnings. I work every day. I can always find the lee shore. I've got pots set on both sides of the river so there's always a calm side that you can, when you work in a river like this, that you can work. You more or less look at it, and if it sounds real bad you don't go. If we're doing real good, I'll force myself harder. If we're not catching many fish, not making — if I know I'm not going to go out there and make much money today, enough to survive, I don't push it too hard. But, if you're careful, you can work in a bad time. I mean, you need to get on and ride a boat with me to understand what you can work into. A lot of people won't go when we will, but it depends on what's out there waiting for us, how hard we push on going, too. Even though it's crabs out there and the price is good, you can't always make it because of bad weather, breakdowns.
Cooperation and working together	But that's one reason there's not as many people drowned in our ocean is we stick together. We try to take our time and look out for each other when we're working. It's not working by yourself. You look out for the other one and they look out for you too.

Fishing involves lifting and moving heavy boxes of bait and catch, so there is the risk of pulled muscles, sprains, back problems, and general musculoskeletal stress. Two fishermen over age 70 employed special measures to protect themselves from musculoskeletal stress. One of them said: "I've got everything so mechanized on my big boat there. I've got hydraulic winches and hydraulic steering and I've got cables going everywhere and the only time I need somebody to help me is to get the stuff off the boat." Mechanization of heavy physical tasks enabled both men to keep fishing and reduce their exposure to musculoskeletal stress. Other younger fishermen used hydraulic steering and motorized pot and net pullers, but fieldworkers did not observe them using any lifting or moving aids.

Crab fishermen saw one piece of equipment as particularly dangerous. They use a hydraulic winder called a "puller" to haul their crab pots up to the side of the boat (at waist level) to be emptied. The fisherman hooks a buoy that marks his crab pot and then puts the line connected to the crab pot into the reel of the pot puller, which then pulls the crab pot out of the water and to the edge of the boat. The pot puller is usually turned on and off with a switch, large button, or a floor pedal. Our interviews indicated that pot pullers were responsible for many accidents resulting in bruised or crushed fingers, falls, head injuries, and even being thrown overboard. To address this hazard all the fishermen we spoke with customized their pot puller set ups. Many installed a floor pedal to control the pot puller, others installed "dead man" switches that allowed the puller to operate only when the switch was depressed. This way the puller would not keep running if the fisherman moved away from the puller, lost his footing or fell overboard.

7. Boat and fishing gear maintenance

There was consensus among fishermen that, to be safe, it was important to keep the gear and boat clean and well maintained and to replace equipment before it broke (Table 1). Some kept their boats clean as a matter of pride. One fisherman explained: "I don't want nothing on my boat that's going to rust, alright? My boat looks good, and all [the gear is] stainless." Fishermen told us that keeping the boat

clean and neat contributes to safety. Several fishermen routinely stopped while out on the water to wash down the decks, this removed bits of bait and fish scales, which could make the deck slippery.

Fishermen spoke of the problems of breaking down while out on the water or while attempting to navigate the shallow inlets that separate the sounds from the ocean. The threat of breakdowns, and fishermen's personal experiences with them, were powerful incentives to keep boats well maintained. One of the most active crabbers told us "anytime you see something that might look like it's going to break or something we go ahead and change it." Most fishermen practiced such preventive maintenance.

Boats had standard safety equipment such as life jackets, life preservers, and radios, but boats used to fish in the ocean more than three miles off-shore must also be equipped with life rafts, survival suits, and emergency signaling devices, all of which must meet Coast Guard standards. These safety requirements are mandatory and enforced by the Coast Guard. Since this equipment is required, fishermen do not decide whether or not they will purchase it (U.S. Coast Guard, 2003). The eight fishermen we spoke with who fished in the ocean had this equipment and considered it necessary. "You need good life preservers, survival suits we have. I would get them anyway, but we're required to have them," one fisherman told us.

We asked fishermen how they would make their boat safer if they were given $500 or $1,000. Only one fisherman had an item on his wish list: rubber mats for the bottom of his boat to reduce slip and fall hazards and the stress on his joints. Other fishermen had their boats equipped to their satisfaction and felt they did not need additional safety gear (Table 1).

8. Decisions about the weather

All fishermen balance the desire to stay safe with the need to make a living (Table 1). For the fishermen in our study, most of whom spend the majority of their time in protected waters, there was less of a trade off between safety and earnings. The sounds are considered to be much less dangerous than the ocean, and many long-time fishermen asserted that they had never felt unsafe while on the sounds. A crabber and ocean gill netter told us "Most of the time in the summertime I go about any day I want to, crabbing in the Sound. I mean we might get about one, two real bad days, if it ain't blowing more than 20 or 25 [knots] we work crabbing." This view of the weather was shared by most crab fishermen we interviewed: in the protected sounds weather is not seen as a significant hazard.

Fishermen viewed staying safe while fishing in the ocean to be more complicated. One man who has fished commercially for 30 years explained a typical approach to ocean fishing in the winter: "How much money you're making depends on how rough it is, too. Like, if you're making a bunch of money, it's going to have to be mighty rough to NOT go." Another long time fisherman said of working in the ocean: "But, when it's your livelihood, when you've got to do it to feed your family, a lot of times you take chances." Fishermen make decisions concerning staying safe by balancing weather conditions, value of the catch, and concerns about risk. If the conditions for making money are there–the fish are available or the crabs are going in the pots and the prices are good–the weather is seen as an occupational hazard to be worked around (Table 1).

9. Cooperation among fishermen

These fishermen consider fishing in the ocean during the winter to be dangerous. The cold water, rough seas, distance from land, difficult inlets and changeable weather all contribute to their awareness of risk. The fishermen who fished in the ocean relied on the "buddy system" to stay safe. A group of three or more boats would leave the dock at the same time and the fishermen would stay in touch while on the water. One ocean gill netter explained "Everybody knows what everybody's doing, because they're all talking on the radio." Most fishermen in these groups have known each other and fished together their entire lives, and the groups are generally stable over time. The fishermen cooperate within the group, sharing information on the location of fish, letting other group members take nets full of fish if a boat is at capacity, and generally looking out for each other. One longtime fisherman explained how this process worked: "if somebody looks like they're going to have too many fish, they get on the radio and say 'I'm going to need some help, ' and then somebody else that hasn't got many fish, they'll come on [and take the net]." Fishermen told us that they worked this way for safety; if anything went wrong there would be help from fleet members.

10. Discussion

A qualitative approach allowed us to understand fishermen's thoughts about safety. These small-scale commercial fishermen primarily related "staying safe" to using common sense and practicing safe work habits. They used the term "common sense" to include all of what they viewed as basic knowledge about working on boats, seamanship, and fishing. The fishermen's recognition of the importance of everyday work habits reveals that they have a broad concept of safety. Rather than relating safety only to preventing boat sinkings or other disasters, these fishermen recognized safety as an integral part of the day-to-day fishing process.

The independent commercial fishermen's approach to safety is in contrast to the reported approach of commercial fishermen who work on large steel hull boats in the ocean. Binkley (1991) and Pollnac, Poggie, and VanDusen (1995) found that Nova Scotian and New England fishermen tended to deny and trivialize the dangers of ocean fishing. They suggest that this is a cultural adaptation fishermen make as a

way to cope with their high risk occupation, and they found that this attitude of denial of danger hampered safety training efforts. However, later research by Eklof and Torner (2002) with Swedish fishermen found different relationships between risk perception and participation in safety training, so this area requires further investigation.

Pollnac et al. (1995) also found a relationship between time spent at sea and a fisherman's realistic assessment of risk. Fishermen who spent fewer days at sea per trip were less likely to deny and trivialize dangers of fishing. Since most small-scale independent North Carolina fishermen return to the dock each day, this may contribute to their awareness of the importance of safety, supporting Pollnac's idea. The difference in attitude may also be due to the different employment situations: independent self-employment versus working for a company. The independent fishermen may possess additional motivation to be cautious since they will bear the cost of any loss. This is in contrast to fishermen employed on large boats owned by companies or by individuals who do not work on them. Such fishermen are employees, rather than autonomous workers or small employers in charge of their own boat and crew.

Fishermen thought that keeping the boat and gear clean and in good repair contributed to safety. Most fishermen practiced preventative maintenance in order not to break down while out on the water and equipped their boats with standard safety devices and also sophisticated communication and navigation equipment. Only one fisherman named an item he would purchase if given extra funds for additional safety equipment, which indicates that cost is not a significant barrier in equipping boats to be safe among this group of fishermen. The substantial investment in navigation and communication equipment that the majority of fishermen made–beyond what is necessary for the job of catching fish or crabs–demonstrates that they value safety and will invest in equipment that they believe helps them stay safe.

Bad weather is a primary danger for fishermen. Yet, when working in the protected estuaries, rivers and sounds, fishermen were not concerned with rough weather. They do consider weather a risk when working in the Atlantic Ocean. They gathered weather information and made decisions about staying on the water; treating the weather as another occupational hazard. Fishermen reduced their risks when fishing in the ocean by forming fleets of three or more boats so that they could look out for each other. They use cooperation and team work as a means of increasing safety in a dangerous environment (Levinson, 2002).

Using ethnographic interview methods and participant observation documented with fieldnotes allowed researchers to learn what practices fishermen used to stay safe and what activities they considered to be risky. Ethnographic methods are valuable because researchers can discover the approach and assumptions of a group, especially when researching workers who work independently and are not part of an established institutionalized safety program. Ethnographic interviewing and participant observation have been used with other occupational groups who work independently in non – industrialized settings. For example, there are studies of migrant farm workers' beliefs and practices concerning occupational safety (Arcury et al., 2002; Elmore & Arcury, 2001; Quandt et al., 2001). Ethnographic methods could also be used with other groups of independent workers such as loggers or non-union construction workers.

This research was part of a larger epidemiological study that sought to examine the occurrence and determinants of occupational injuries among small-scale non-industrial commercial fishermen (Lipscomb et al., 2004; Marshall et al., 2004) A cohort of 219 independent commercial fishermen was followed for up to two years using weekly telephone interviews and periodic medical examinations. Work practices and exposures to occupational hazards were assessed by questionnaire. Combining quantitative with qualitative methods enabled the quantitative researchers on this study to deepen their understanding of the occupational lives of the fishermen and informed the interpretation of the quantitative results. For example, Marshall et al. (2004) used the qualitative data to illustrate some of the common types of injuries fishermen suffer and to provide examples of the injuries for which fishermen receive medical care. The ethnographic interviews revealed common barriers to receiving care: most fishermen did not have health insurance and would have to pay out of pocket. Lipscomb et al. (2004) used descriptions from the ethnographic interviews, still photographs and video of fishing activities both on and off the water to identify potential ergonomic stressors and sources of variability in exposures that could contribute to the musculoskeletal symptoms that commercial fishermen report. The ethnographic data enabled her to identify areas where ergonomic stress could be reduced with mechanical modifications.

11. Strengths and Limitations

To check the soundness of qualitative data, researchers examine data from different sources to see if it is consistent; this is known as triangulation (Altheide & Johnson, 1994; LeCompte & Schensul, 1999; Marshall & Rossman, 1989; Patton, 2002). We were not able to compare our data to statewide injury records to compare the anecdotal reports gathered in interviews because independent commercial fishermen in North Carolina are not required to report their own work injuries to any record keeping authority. The lack of records made it impossible to calculate reported injury rates. We did have data on injuries collected by phone questionnaire as part of the epidemiological study. These injuries were comparable to the types of injuries we heard about during interviews, which supports the reliability of the qualitative data (Lipscomb et al., 2004; Marshall et al., 2004).

Denzin (1978) proposed four types of triangulation: data, investigator, theory and methodology: of these we used three. Data triangulation involves using diverse sources of

data collected at different times, settings, and areas in order to produce richer, more complete descriptions. We conducted fieldwork over the course of two years in all seasons and weather and in a wide range of settings (homes, fish houses and boats ranging from 18 to 36 feet). We accompanied fishermen in a range of areas, from estuaries, rivers, and sounds to the open ocean. Investigator triangulation involves using different investigators who discuss their findings throughout the research process, which Denzin proposes can reduce personal bias. The two fieldworkers had different experience, backgrounds, and personal characteristics. One was a white male, in his twenties from Hawaii with limited fieldwork experience. The other was a white female in her forties from the South with extensive fieldwork experience. They communicated closely throughout data collection. Denzin defines methodological triangulation as using different methods to collect data. We used recorded interviews and participant observation supplemented with still photos and video recordings to achieve methodological triangulation (Denzin, 1978; Seale, 1999).

This research was limited in that it was formative and exploratory and did not include the development and implementation of an intervention, so we are not able to demonstrate the efficacy of our findings for intervention development. Although we used different methods and social networks for locating fishermen to interview, the majority of participants were committed and established fishermen. We were not able to interview marginal fishermen who might work only during one season or who were not part of the social networks we tapped. These marginal fishermen may have a very different approach to staying safe. We interviewed only two fishermen who self-identified as crew members, so our findings may have limited generalizability beyond independent small-scale North Carolina fishermen who are the captains of their own boats.

Since the goal of this qualitative research project was to document fishermen's existing safety practices, exposure to hazards, and fishing methods, we selected participants based on their experience, how informative they were and their willingness to spend time with us. Unlike research based on statistical methods, random selection of participants is not a tenant of qualitative research, since results do not propose to statistically represent the population (Creswell, 1998; Patton, 2002; Safman & Sobal, 2004).

12. Implications and Impact on Industry

This exploratory research produced information about the safety practices, risk perceptions, work lives, and work processes of the independent commercial fishermen of North Carolina, a little studied occupational group. When researchers understand more of the work world and the safety beliefs and practices of the occupational group under study, their inquiries may be better understood by the workers and be more appropriate to specific work concepts as they exist in the field. The process may also reveal hazards and exposures not previously documented. Quantitative researchers can gain a deeper understanding of the group under study through access to complementary research involving participant observation, interviews, and analysis of ethnographic material.

Petursdottir et al. (2001) reported that commercial fishermen who work on large industrial steel hull boats are reluctant to attend voluntary safety courses; we know of no research on the desire of small-scale commercial fishermen to attend safety courses. However, in order to effectively communicate safety information to any group it is vital to know how that group conceptualizes safety and the safety practices they have already integrated into their work lives. The commercial fishermen we worked with believed that they knew how to stay safe and had all of the equipment they needed; this belief might make them less likely to attend safety courses since additional information is not perceived as a need. Yet, interventions and safety training can build on and be congruent with the existing safety practices of workers. For example, disseminating design modifications for the pot puller could acknowledge the fishermen's safety concerns about this potentially hazardous machine. Using common terminology can make interventions more appealing and accessible to a group of workers. This qualitative data can also be used to develop instruments for quantitative measurements for future research. This qualitative and ethnographic approach can be used to collect "best practices" in the occupational community and incorporate an awareness of safety and injury prevention. Since these best practices are already being used by workers, there is a greater likelihood that they are practical and appropriate and would be adopted by other workers if promulgated in a safety program. Understanding how a group of workers stays safe creates opportunities for more accurate quantitative measurement, the development of more appropriate safety interventions, and knowledge that is useful for disseminating interventions and safety information.

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