Reducing Risk to Life and Limb: Safety Training Steps Towards Resilience in Massachusetts' Commercial Fishing Industry

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Abstract

Vulnerability takes on a visceral meaning in the context of plying the seas in one of the most dangerous occupations in the U.S. Despite enhanced safety regulations for the fishing industry, deaths and injury abound. The loss of the F/V Northern Edge out of New Bedford with only one survivor sparked a new move towards the Northeast's commercial industry's participation in safety training courses in 2005 and 2006.

By looking at the New Bedford experience and an effort by the Massachusetts Fishermen's Partnership to build on that model, this paper explores the potential for developing a "culture of safety" in the fishing industry of the Northeast. Fishermen have long been noted as either overt risk-takers or simply fatalists, but improvements in technology have made survival in emergency situations more likely. Participation in safety training may be viewed as an optimistic choice, reflecting a community's resilience in the face of adversity.

Keywords: *commercial fishing, safety-training, risk, culture of safety*

Introduction

Commercial fishing has consistently taken the lead in grim statistics calculating the rates of injury and loss of life while working. For example, one-third of work-related deaths that took place in Alaska during 1990-2004 occurred to fishermen—a fatality rate 24 times the overall U.S. work-related fatality rate for the same period (NIOSH 2006) (see Figure 1 for comparison with other dangerous occupations). Despite

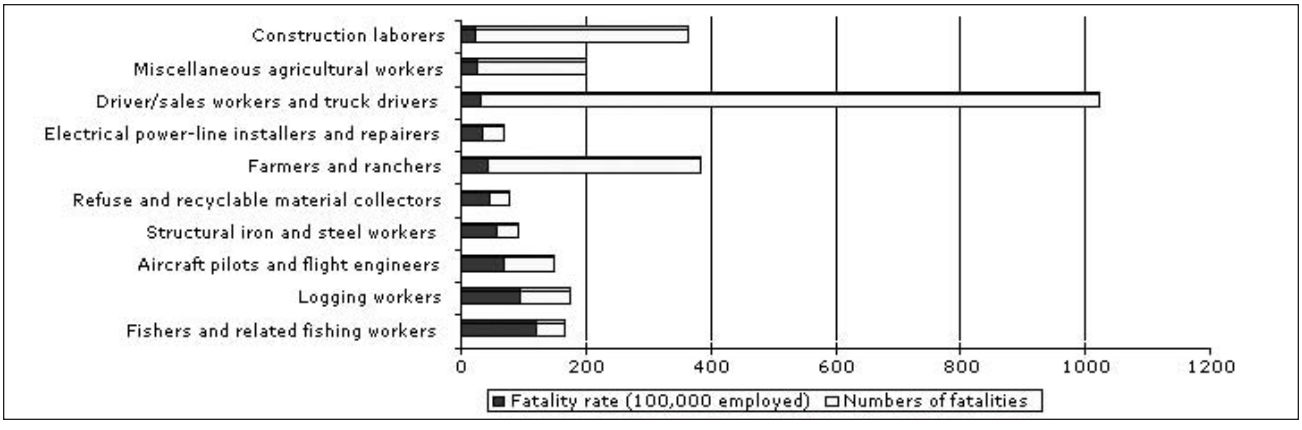

Figure 1. Occupations with High Fatalities, 2005
Rate=(Fatal work injuries/Employment) x 100,000. Employment data based on the 2005 Current Population Survey (CPS) and Department of Defense (DOD) figures.
US Department of Labor, Bureau of Labor Statistics, Current Population Survey, Census of Fatal Occupational Injuries, and US Department of Defense, 2005.

efforts to improve conditions on fishing vessels since 1880 when standards of inspection and manning requirements were first established for steam-propelled vessels, for the next century, most efforts to legislate safety on fishing vessels failed (U.S. Coast Guard 1999). The industry, the public, and legislators apparently regarded the risks associated with commercial fishing as acceptable compared to the cost of meeting higher safety standards (U.S. Coast Guard 1999).

It was primarily the dogged determination of Ambassador Robert Barry and Peggy Barry whose son was the only body recovered from the loss of the F/V Western Sea in Alaska in 1985 that eventually led to the passage of the Commercial Fishing Industry Vessel Safety Act of 1988 (P.L.100-424). This was the first safety legislation enacted in the U.S. that applied specifically to commercial fishing vessels (U.S. Coast Guard 1999). Since 1990 there has been a 76% decline in deaths of commercial fishermen in Alaska, in part due to the U.S. Coast Guard implementing the new safety requirements in the early 1990s (NIOSH 2006). These requirements focus mainly on emergency response rather than prevention of vessel loss, leaving maintenance responsibility for the "vessel's structure and watertight integrity solely with the vessel owner and operator" (Kiefer 2006, 42). In 1991 the Coast Guard restarted voluntary dockside examinations that include considerations of safety gear storage, alarms, watertight integrity, hoses, vessel stability and overloading.[3] However, active participation in the program was slow to catch on.

Fishermen are well aware of the risk inherent in their occupation, but as Pollnac et al. (1995) and others (Binkley 1995 and McCay et al. 1989) have pointed out, many choose to deny, trivialize or in some cases, even relish the risk. Years ago, when one fisherman was asked why he did not know how to swim, his fatalistic response was, "Why prolong the inevitable?" (Hall-Arber and Mrakovcich 2006). Research on humans' perceptions of risk has explored numerous variables in effort to determine what factors control the typical gulf between perceptions of risk and reality. Kates (1971) discussed the "prison of experience" explaining that peoples' past experiences influence their views of risk and hazard threat. For fishermen, the fact that most have made innumerable fishing trips and returned safely may lead to the belief that their occupation is not particularly risky. This attitude has a corollary in their tendency not to report work injuries that are non-life-threatening or, such as slipping, so prevalent that they go unnoticed (Torner and Eklof 2000, 240).

Several studies on hazards and humans' risk perception have noted typical reactions that include: denial of the hazard, fatalism (responsibility attributed to a higher power or authority over which they have no control), perception of regularity of irregular events, perception of lessened frequency of the hazard (Park 1999). In addition, when comparing risks, people do not necessarily evaluate each realistically. People routinely "discount risks that are perceived as natural, familiar, voluntary, and under their control" (Sandman 1993). For example, "We regard risks from unfamiliar or unnatural hazards (such as a new food additive) as worse than those from familiar or natural hazards" (Sprent 1988). For a fisherman, working on a wet, slippery, constantly moving deck in close proximity to heavy equipment, cables and ropes is a familiar situation. Furthermore, inclement weather and the poisonous spines of some fish are considered natural hazards.

Risk knowledge, as Rouse (2004, 9) explained, has to be interpreted and "rendered understandable." The process of "interpreting, understanding and applying knowledge is known as 'knowledge translation'." In addition, he noted, absorbing such knowledge may be dependent upon an anticipated use-value. For many years, safety was regarded as a "legislative and bureaucratic hammer to be hit with" (Loughran et al. 2002). Over the last two years, in the Northeast region of the U.S., the fishing industry has begun to reconceptualize safety preparation and training as a viable alternative to denial and trivialization.

Safety Standards

Although vessel owners in the Northeast complied with the 1988 Safety Act's regulations by purchasing the requisite rafts, ring buoys, flares, fire extinguishers, high water alarms, emergency position indicating radio beacons (EPIRBs) and survival suits, complaints about the cost reverberated around the docks (see Table 1 for typical prices). For almost 15 years after their purchase, the equipment was barely noticed. Rafts were sent out for repacking when the Coast Guard boarded a vessel and warned the owners that the repacking date was past, batteries were replaced in EPIRBs when someone happened to think about it, fire extinguishers served as hat racks and survival suits were buried in lockers under the rags, extra twine, and other paraphernalia of fishing life. Boats sank, lives were lost, bones crushed, legs entangled and arms burned, but fishermen continued to ply their trade, accepting the danger, assuming there was nothing that they could do to change it.

Table 1. Required safety equipment and costs

Equipment	Typical price
EPIRBs	$500-$1800
Immersion suits	$400-$900
Fire extinguishers	$200-$500
Life raft (4-man)	$3500-$4000
Life raft (6-man)	$4500-$5000
Flare kits	$250-$300

Source: Various Internet sites

The Report of the Fishing Vessel Casualty Task Force pointed out that standards for domestic fishing vessels are far below what is required for other domestic commercial vessels as well as below international standards for vessels including fishing boats (U.S. Coast Guard 1999). Though safety has modestly improved since 1991 when the Safety Act of 1988 was implemented, casualties (accidents) remain high. To the extent causes have been determined, the majority of losses, the Task Force concluded, were preventable (U.S. Coast Guard 1999). Casualties commonly were and remain the result of poor vessel or equipment condition, inadequate preparation for emergencies and/or lack of awareness of or ignoring vessel stability issues. According to the National Research Council (1991, 101), human factors directly or indirectly contribute to 50% of fishing vessel accidents in both the U.S. and Canada.

Furthermore, citing the 1997 U.S. Coast Guard report, *The Economic Impacts of Accidents on the Marine Industry*, the Task Force notes that costs are considerable. "Taking into account both the direct and indirect costs such as drops in stock prices, insurance premiums, deductibles, co-payments, and protection and indemnity (P&I) club payments, interruptions in operations or loss of contracts among many others, accidents cost the fishing industry over $240 million annually" (U.S. Coast Guard 1999, 4-15). This does not include loss of productivity, other indirect costs, or the cost of the Coast Guard's search and rescue operations.

Incidents in Coast Guard First District

First U.S. Coast Guard District recorded 3921 casualty (accident) cases from 1993 to 2006, including 318 sinkings (some at the dock). One hundred, forty-four fishermen died at sea in the same period. Table 2a shows that of these, sinking, man overboard, and capsizing claimed the largest numbers. Twelve divers lost their lives; 11 men had heart attacks; eight died as a result of a collision. Table 2b shows in which fisheries fatalities occurred. Trawling, lobstering, scalloping, and clamming claimed the most lives, followed by diving, tuna fishing, gillnetting, longlining, crabbing, periwinkle fishing. Table 2c lists the leading causes of injuries including illness, falls, equipment and man overboard. Table 2d lists the causes of illness, led by heart attacks.

The first district (Northeast U.S.) shows a decreasing trend in fatalities since 2003 when several multiple-fatality incidents occurred. However, in the first six months of 2007, there were already two vessels lost with six deaths (see Table 3).

Table 2a. Causes of death of commercial fishermen reported in U.S. Coast Guard's First District, 1993-2006

Sinking	38
Man overboard	32
Capsizing	21
Diving	12
Heart attacks	11
Collision	8
Wire	4
Winch	3
Drowning	2
Gear entanglement	2
Shaft entanglement	2
Net reel	1
Crushed	2
Missing	3
Suicide	1
Unknown	2
Total	144

Source: U.S. Coast Guard First District Fishing Vessel Casualty Database, 2007.

Table 2b. Death by fishery reported in U.S. Coast Guard's First District, 1993-2006

Trawler	40
Lobster	31
Scallop	25
Clam	19
Diving	12
Tuna	4
Gillnet	3
Longline	3
Crab	2
Periwinkle	1
Unknown	1
Total	141

Source: U.S. Coast Guard First District Fishing Vessel Casualty Database, 2007.

Table 2c. Causes of injuries reported in U.S. Coast Guard's First District, 1993-2004

Illness	226
Falls	85
Dredge	44
Winch	43
Wire	32
Knife	27
Net reel	21
Diver	18
Head	17
Man overboard	16
Total	529

Source: U.S. Coast Guard First District Fishing Vessel Casualty Database, 2007.

Table 2d. Causes of illness among commercial fishermen reported in U.S. Coast Guard's First District, 1994-2004

Heart attack	63
Seizure	15
Abdominal	11
Chest pains	5
Hernia	5
Intestinal	4
Stroke	4
Asthma	2
Total	109

Source: U.S. Coast Guard First District Fishing Vessel Casualty Database, 2007.

Table 3. Annual deaths for commercial fishermen reported in the U.S. Coast Guard First District (Northeast) between 1993 and 2006

1993	20
1994	15
1995	9
1996	10
1997	10
1998	10
1999	8
2000	14
2001	13
2002	1
2003	14
2004	8
2005	7
2006	5
Total	144

Source: U.S. Coast Guard First District Fishing Vessel Casualty Database, 2007.

Receptivity to Safety Training

In one article on perceptions of risk, Pollnac et al. (1995) noted that those fishing offshore from the port of New Bedford were more likely than those from Pt. Judith, who tend to fish inshore, to deny or trivialize the danger inherent in their jobs. They were also less likely to have participated in safety training, despite a requirement to conduct monthly safety training drills. "Point Judith fishermen are at lower risk than New Bedford fishermen in that they spend less time at sea per fishing trip than their counterparts from New Bedford" (Pollnac et al. 1995, 157). The researchers showed that the "greater threat" among New Bedford fishermen leads to a "greater need to deny danger as a way to cope with this greater threat" (Pollnac et al. 1995, 157).

In his study of Canadian commercial fishermen, Boshier (1999, 3) pointed out that "rituals of avoidance relieve them of the need to become informed." In fact, with his article, Boshier joined an illustrious list of researchers who have considered the role of ritual, superstition and magic in the reduction of anxiety associated with fishing, its uncertainty and risk (Malinowski 1925; Poggie and Gersuny 1972; Mullen 1978; Orbach 1977; Pollnac et al. 1995; Zulaika 1981). Boshier (1999, 3) went on to say, "Here is a case of where the 'broad experiential base' of the adult learner does not necessarily enhance his responsiveness to education."

In order to effectively address health and safety factors in commercial fishing, it is imperative to "understand and address the attitudes that impair worker's perception of their risk for disease and injury and workplace norms that limit the acceptable remedies to reduce risk" (Freeman 2001, 537). Motivation for change relies on an individual's "belief in a personal health or safety threat and belief that a specific behavior or behaviors can reduce this threat." Freeman (2001) also found that the perceived usefulness or efficacy of a safety recommendation is determined in large part by the source of that recommendation. Citing work by McGinnis and Ward 1980, Hovland and Weiss 1951 and Zanna 1973, Freeman (2001, 538) noted, "People tend to give the most weight to sources that they find expert and trustworthy, and to sources that match their ideological perspectives."

Theories of teaching and learning also emphasize social context. "Effective instruction involves . . . integration of students' prior knowledge with the new information presented" (Yamauchi and O'Donnell 2005, 4). Others have pointed out that behavioral change and learning is sometimes easier if the "natural environment" is maintained (Gallimore 2005, 208). The natural environment is considered "interactions within existing social relationships" and "settings in which those relationships are situated" (Gallimore 2005, 208). In other words, building on fishermen's knowledge of their gear, experiences of dangerous situations and safety scenarios when they are surrounded by their fellow crewmembers or fishing community members, using equipment that is typically on board a fishing boat, is apt to lead to learning and behavioral change.

Attribution of Causality

Related to their perceptions of risk, fishermen's ideas about what causes an accident at sea is likely to play a significant role in their future behavior (Acheson 2000). In fact, Acheson (2000, 228) cites DeJoy's (1994) suggestion that "the attributions personnel make regarding safety and accidents drive the decision making process more than the causes themselves." In an analysis of fishermen's attributions of what caused their own occupation-related injury or a maritime emergency incident in which they had been involved, Acheson (2000) found that participants in her study offered complex explanations and identified multiple causes. The six

causes most frequently cited were: lack of knowledge, economic pressures, weather conditions (expected), fatigue, stress, and luck or fate. As the author points out, safety training usually addresses only the techno-rational concerns, whereas there are other causes or issues that affect fishermen's safety.

Recently, fishermen have suggested that stricter regulations are the cause of increased risk in fishing. Fishermen from the Northeast U.S., Scotland and Newfoundland, independently noted that it is "harder to make a living" thus increasing stress and anxiety about money (Murray 2000; Kaplan and Kite-Powell 2000; Lawrie et al. 2000; Pollnac et al. 1995). Under the quota system of Scotland it was said that many of the boats have to spend longer times at sea to catch their whole quota (Lawrie et al. 2000). Furthermore, many fishermen said that they were forced to work in worse weather conditions due to financial pressures (Murray 2000; Kaplan and Kite-Powell 2000; Lawrie et al. 2000). An added risk is that because of the restrictions, many fishermen go to sea alone and find themselves inappropriately relying on technology, e.g., setting the autopilot while cleaning fish (Murray 2000).

A Plethora of Participants

Remarkably breaking from a long-time pattern of ignoring safety training, equipment, and requisite drills, about 700 fishermen have attended basic hands-on safety training in Massachusetts in the last two years. Five hundred, fifty-seven were trained in a program sponsored by the city of New Bedford, another 104 participated in training offered by Massachusetts Fishermen's Partnership (MFP) with funding from the Cooperative Research Partners Program of National Marine Fisheries Service Northeast Regional Office. In an effort to learn what led to this sudden shift in attitude and more importantly, level of participation, a survey was designed. Ultimately, four surveys were conducted. The preliminary survey interviewed 30 fishermen during a New Bedford training session. Although this was not ideal since the participants were interviewed while walking between stations, or waiting for the new station to begin, four interviewers were able to interview almost half the participants in that training session. Ten randomly-selected participants in New Bedford training sessions were later interviewed on the phone. Telephone interviews of 17 participants in the sessions sponsored by MFP have also been conducted. Ten trainers have participated in both sets of training sessions, seven of whom were interviewed. Participants were asked for background information about their history of fishing; then were asked to evaluate the safety training as well as to explain why they attended and what suggestions they had for attracting additional participation. Trainers were asked to evaluate the program, offer suggestions for improvements, and why they thought there was more participation than initially expected.

Tipping Point: Two Training Programs in the Northeast

When the F/V *Northern Edge*, a scallop boat out of New Bedford, sank on December 20, 2004, it served as a wake-up call to the industry. Of the crew of six, only one survived. Reports on the highly publicized tragedy explained that the sole survivor, Pedro Furtado, was the only one of the six to have participated in fishing vessel safety training, required for fishing in his native Portugal. He "said he was trained in Portugal to jump from a sinking ship and swim to a life raft. He knew how to properly open the raft, how to climb inside and that paddling furiously was a way to remain conscious while waiting for rescuers" (USMSA 2006). One other crew member jumped into the water, but was unable to reach the raft and drowned. None of the crew was able to don a survival suit since they were stored in the flooded engine room. The U.S. Coast Guard's investigation activity report for the *Northern Edge* accident revealed "a lack of licensing and crew competency credentials or certificates by all individuals on board" (U.S. Coast Guard 2004, 3). None of the crewmembers were wearing immersion suits, personal floatation devices (pdfs), or worksuits. Also, the scupper gates were closed to prevent the catch from washing overboard, thus compromising the vessel's stability by not allowing trapped water off the vessel (U.S. Coast Guard 2004).

The captain, Carlos Lopes, faced a dilemma about whether to forego catching about $18,000 worth of scallops by returning to port because of deteriorating weather or to keep fishing (The Fishermen's Call 2005). Initially, the word spread along the waterfront that the *Northern Edge*'s accident was due in part to management regulations that indirectly penalized vessels that ended their trip early due to poor weather conditions. Soon after the accident, New Bedford's Mayor Fred Kalisz visited William Hogarth, head of NOAA fisheries in Washington to discuss improving safety, in particular hoping to remove paradoxical incentives arising from management that exacerbated the already dangerous occupation. These discussions "set into motion the Safe Harbor provision, which would allow fishermen to seek refuge in a port or lee of an island during a storm without losing days or being penalized" (The Fishermen's Call 2005, 4). Hogarth also committed to providing $100,000 towards safety training in New Bedford.

The New Bedford Seafood Task Force requested Ed Dennehy, Executive Director of New Directions that admin-

isters the Job Training Partnership Act and Welfare to Work funds for New Bedford, and Rodney Avila, a well-respected fisherman and vessel owner, who also worked at New Directions to take the lead in the safety training effort. A diverse advisory panel including professional safety trainers, Coast Guard personnel, Sea Grant advisers and academics was assembled to begin implementation of a safety-training program.

When the advisory panel found that fishermen were signing up in large numbers and were showing up on the day of the training, it was surmised that the motivation for fishermen to take the safety training in New Bedford was due in part to the strong credibility of Rodney Avila who was conducting outreach as well as the belief that Furtado, the *Northern Edge*'s sole survivor, was able to survive because he had taken safety training. Researchers have postulated that fear can increase a "sense of personal susceptibility to risk and motivate change" (Freeman 2001, 538). However, they have also noted that if suggestions for "strong, practical steps for reducing risk" are not offered, recipients may discount the fear and not change their behavior. The panel believed that the fear elicited by the loss of life on the *Northern Edge* primed fishermen to make a change in their behavior. Then, the publicly acknowledged success of safety training by the survivor served notice of a concrete step that could reduce other fishermens' risk.

In contrast to expectations, responses to the preliminary survey conducted during the training in New Bedford did not cite the Northern Edge. Rather, when asked why they attended, over half of the respondents (16) noted that the captain and/or owner had made attendance either mandatory or strongly recommended. Twelve of the 30 interviewed mentioned that they were "curious," "interested," "couldn't hurt," and/or "been meaning to learn more about safety" (see Table 4a). At least two also noted that the vessel had new crewmembers and furthermore, that the workshops were a good idea as refreshers for those already familiar with safety training and necessary for the new crew.

The telephone interviews, however, offered a list of reasons from which to select, and of the 10 interviewed who took the New Bedford training, six confirmed that the F/V *Northern Edge*'s fate did attract them to the training (see Table 4a). Most (eight of the 10) also noted however that either they as owner or captain, or their owner or captain, encouraged participation. Five said that they had been "meaning to learn more about safety," one because a boat of his had sunk and another because of horror stories he had heard; two mentioned that they came because training was free. Seven of the 10 interviewed by phone mentioned that they had experienced an emergency on board their vessel, though most of the events were not life-threatening.

There were almost as many reasons offered as explanations for taking the training organized by MFP as there were participants. Only one of the 16 interviewed who took the MFP training in Gloucester, Buzzards Bay or Scituate mentioned the media attention to accidents, but five noted that they "had been meaning to take training" and five mentioned that they took the course because it was free (see Table 4a). One noted that he fishes alone and believes in "being safety-minded, keeping up with the latest techniques." Another said that he had been run-down (by a tanker) when offshore, so he's very safety conscious. Two owner/captains stressed the importance of their crew being familiar with safety procedures in case anything happened to them. One was a new crewmember and another was in training to conduct safety inspections.

Table 4a. Results of surveys asking why commercial fishermen in Massachusetts attended training in 2005 and 2006

Impetus for Training	NBa (30)	NBb (10)	MFP (17)
Capt/owner	16	6	1
Northern Edge	0	6	1
Meaning to/interested	12	5	5
Horror stories	0	1	0
Past experience	1	1	0
Hands-on	0	0	1
Free	0	2	5
Facilities/proximity	0	2	2
Well-respected	1	2	2
Media	0	0	1
Safety	0	0	4
Regulations	0	0	1
Refresher	0	0	2

NBa=New Bedford attendees (preliminary survey)
NBb=New Bedford attendees (telephone survey)
MFP=Attendees from Massachusetts Fishermen's Partnership-sponsored training in Gloucester, Scituate and Buzzards Bay (telephone survey).

Table 4b. Results of surveys asking by which means interviewees learned of the training in Massachusetts in 2005 and 2006

Impetus for Training	NBa (30)	NBb (10)	MFP (17)
Flyer (organization)	1	3	14
Newspaper	3	3	2
Captain/owner	15	2	1
Word of mouth	10	5	3
Supplier	0	1	1
Settlement house	0	3	0
Radio	1	0	0

NBa=New Bedford attendees (preliminary survey)
NBb=New Bedford attendees (telephone survey)
MFP=Attendees from Massachusetts Fishermen's Partnership-sponsored training in Gloucester, Scituate and Buzzards Bay (telephone survey).

Informal conversations with participants during training sessions indicated that some were motivated to attend after direct contact with Steve Parkes, a well-respected, former seafood buyer who conducted the outreach, though only two of the 17 interviewed by phone mentioned this. Fourteen of the 17 noted that they had seen flyers and/or received letters from their organization or from the health care plan associated with MFP (see Table 4b). Multiple levels of advertising helped spread the word. Flyers were distributed to settlement houses and other shoreside businesses, and Coast Guard personnel actively participated in encouraging owners and captains to attend and send their crewmembers. The Massachusetts Lobstermen's Association offered a 5% discount on their protection and indemnity (P & I) insurance, a benefit that some mentioned as a nice incentive but not necessarily sufficient to motivate attendance. At least one respondent said the training should be worth more to the insurance companies.[4] Several mentioned hearing about the training from friends who had participated in earlier sessions. Although not referred to by participants, proximity to the workshops may have helped draw some. New Bedford is the most active port in the region with relatively large scallop boats (typically, seven men crews) and draggers (typically with a crew of four), so holding the workshops in the area made them available to hundreds of fishermen. The workshops sponsored by MFP were held in multiple ports for the same reason, to offer easier access for the smaller boat fleet that is dispersed along the coastline.

The Trainers

The trainers attributed the success of the training to: community support; timing (specifically due to the loss of the *Northern Edge*); outreach; insurance companies focusing on drill requirements; owners requiring captains and crew to attend; accessible venue; trainers that are recognized as former fishermen and respected; translators that were made available; and the hands-on training so impressed participants that they recommended it to others. The hands-on training essentially follows a shortened version of the marine safety curriculum developed by the Alaska Marine Safety Education Association (AMSEA). All of the trainers for the New Bedford and MFP-sponsored training workshops were either from the Coast Guard or were U.S. Coast Guard accepted instructors. Many have been trained by AMSEA, a well-respected organization based in Sitka, Alaska, that has developed an extensive network of trained instructors, which they support with curricula, videos, and loans of marine safety equipment.

According to Jensen and Dzugan (2005), there is a direct relationship between recent training and survival. Every person on board a commercial fishing vessel should know how to put on an immersion suit, set an alarm, and make a mayday call. Between 1994 and 2004, on the West and Northeast coast, "survival rates more than doubled when [lifesaving] equipment was used, even though data about lifesaving equipment usage was not always available" (U.S. Coast Guard Office of Investigation and Analysis 2006).

Training Modules

What was particularly striking about the telephone interview responses was the universal acclaim for the training itself. The half-day course consists of an introduction with a short video of vessels sinking and comments from the U.S. Coast Guard safety program officer.

In one module, participants don immersion suits, jump in the water and swim/float to a raft where they climb in. Comments on this included:

"It was the best part! It was presented really well."

"I was surprised some people panicked."

"On a vessel the water is not so calm."

"Did not expect to be floating on my back."

One interviewee suggested that the experience of climbing into the raft could/should be used by designers to redesign the raft. "The situation is that the first one in the raft helped pull in next guy, but the fourth guy who ended on top of the third guy was overweight. We thought we would have to do CPR!"

Another module has the contents of a raft laid out for inspection and a trainer explains each item and its utility (includes different flares and light devices). A raft deployment demonstration using a volunteer participant clearly illustrates the length of rope incorporated into the raft's housing and the force of the deployment. Participants have the opportunity to shoot off a variety of flares and sample the rations kept in the raft.

The flares were an *"awakening!"*

"Now we see why we shouldn't shoot off a flare inside the raft!"

"We look for flares from a price standpoint but it was nice to be able to see what the difference is between large ones ($250) and the inshore kit ($50)."

The fire module includes practicing a mayday call and extinguishing fires after an explanation of the different types of fires and extinguishers. The damage control unit provided by the Coast Guard offers the fishermen a chance to attempt to stem the sudden outpouring of water mimicking actual flood-

ing conditions and a trainer also demonstrates stability issues using vessel models. "After the workshop, I used flood kit pack to plug water coming through hull."

Most of the training sessions have also included an at-sea rescue demonstration by a Coast Guard helicopter team and an opportunity to look at the helicopter and speak to the team. Because Massachusetts Fishermen's Partnership sponsors the Fishing Partnership Health Plan that offers comprehensive health care coverage to fishing families, the training sessions they provide have added a first aid module that addresses basic issues in first aid such as how to handle trauma, bleeding, infection and occupational health such as avoiding breathing fumes in enclosed spaces and particulate matter (e.g., when sanding lobster buoys).

Each of the modules offered information that is relevant and important to the fishing industry. Another indication of its on-going value is that half of the attendees interviewed have practiced since the training, primarily with putting on their immersion suit. Moreover, the sound of flares shooting off, water suddenly shooting out of holes in a vessel model, the splash when leaping into the water in an immersion suit were so dramatic and impressive that the fishermen talked excitedly about the experience to their friends and acquaintances on the docks and in coffee houses, generating more buzz and greater attendance. As one attendee commented, "Personal benefit—quick—lots of information in a short time."

Benefits Exceed Costs

Freeman (2001) suggested that for behavioral changes to take place, the benefits of the recommended measure must exceed its costs. Since vessel owners are required by law to provide safety equipment, the purchase price is no longer a barrier. Furthermore, on February 27, 2007, Sen. Susan Collins (R-Maine) and Sen. Ted Kennedy (D-Massachusetts) introduced the Commercial Fishermen Safety Act of 2007 (S. 687) that would "amend the Internal Revenue Code of 1986 to provide a business credit against income for the purchase of fishing safety equipment" (Kumar 2007).

The training courses sponsored by the city of New Bedford and MFP are free. However, there is a perceived cost associated with the potential catch foregone by not fishing the day of the training. The importance of this consideration was underscored when interviewed fishermen frequently pointed out that the workshops should be planned to accommodate the different fishing seasons and schedules. This is particularly true for fisheries, such as lobster fisheries, that are not limited by regulated "days at sea" but are constrained by season and weather.

For vessel owners who have Massachusetts Lobstermen's Association (MLA) insurance, this cost is partially compensated for by the discount on P & I as noted above. This benefit did not affect crewmembers. The owner and/or captain of the boats have the final say and there were fishermen who had signed up but were unable to participate when they had to go fishing on the day of the training. Crewmembers are unlikely to risk losing their fishing site by taking off a day of fishing unless the captain and/or owner sanction it. Consequently, New Bedford's training outreach has focused on encouraging the owners and captains to have their whole crew attend. While MFP's training outreach also encourages whole crews to attend, many of the boats are smaller with only one (or no) crewmember.

The value of experienced fishermen may also have increased in the last few years. As regulations have shortened the allowable time at sea, each trip must be undertaken with the most experienced crew possible to maximize the trip's success. Several studies have documented the "aging of the fleet" (Georgianna and Shrader 2005). As the median age now hovers in the mid-40s range, owners and captains realize that there is no longer an abundance of young, knowledgeable and able-bodied fishermen available, so the benefit of keeping the existing crews safe may now be perceived as greater than in the past. (The majority of the individuals surveyed about the training were experienced fishermen, having fished an average of 22 years with a range of five to 40 years experience.) Furthermore, the older fishermen themselves are more likely to be cognizant of their own vulnerability.

Handling Safety Equipment

The technology required by the Safety Act of 1988 greatly improved the chances that fishermen could survive accidents at sea. However, in the years since the Act's full implementation in 1993, 144 fishermen have died in U.S. Coast Guard's First District. Conversations with Coast Guard safety personnel and workshop trainers suggest that investigations of these cases indicate that all too many of these did not survive because they had not properly maintained or did not use the available safety equipment properly. The USCG has provided a voluntary exam program since 1992 (Kiefer 2006). During the examination, a list of safety discrepancies is provided to the vessel to improve the safety of the vessel and its crew. In 1995, and from 1999 through 2000, there were 1,398 lost vessels nationally listed in the Coast Guard's marine casualty database. Of those, "873 (62%) never had an examination, 261 (19%) had current fishing vessel decals, 257 (18%) had expired fishing vessel decals, and seven (1%) had an unknown exam status" (U.S. Coast Guard Office of Investigation and Analysis 2006).

When the safety training courses began, approximately

30% of the survival (immersion) suits brought to the courses by the fishermen who owned them failed. Failures included everything from malfunctioning zippers so that the fishermen could not entirely close the suit; dried up neoprene that cracked when unfolded; extraneous lights, whistles, etc. improperly tied to the suit that resulted in tears or holes; suits too large or too small for their owners; and suits so old that the seams ripped when tried on. One measure of the extended benefit of these training courses is that the trainers are seeing a much lower percentage of failures in the suits among the more recent participants.[5]

According to the preliminary New Bedford survey conducted at a workshop, 15 of the 30 interviewed had never shot off a flare, compared to 10 who had done so. Only four had climbed into a raft. Asked if they were surprised by anything that was demonstrated during the training session, several attendees mentioned improvements in the equipment since they had last noticed. One mentioned the quick attach and release mechanisms on the emergency pumps and the new gas tanks. Others mentioned the improvements in flares, and a couple of attendees said that the training was a good refresher, very worthwhile. For those who had never attended formal training, almost everything was valuable and "new." Some of the specifics learned include:

- The suit is harder to get on than thought
- Getting into the raft with the suit on can be challenging
- Having one's own suit is important
- Learning the proper techniques for extinguishing fires was important
- Seeing all the equipment packed in the life raft was surprising
- Necessity of tying-off the life raft was important
- Learning how to light flares was useful

Finally, one attendee thought the information so valuable and essential that he recommended that the workshop be mandatory. Another just said simply, "training is the best thing to do."

All of the sessions offered by the MFP training program were judged useful and clearly presented. The main suggestions were for slightly longer sessions to allow even more hands-on training, particularly for first aid and fire extinguishing. Two respondents suggested using a more realistic setting for the fire fighting simulation; one suggested a vessel and the other an enclosed space. Training for CPR was suggested for the first aid module.

Next Steps

In our two telephone surveys of participants in the safety training programs (10 from courses sponsored by New Bedford, 17 in the courses sponsored by MFP), when we asked what types of emergency situation they feared, 15 of 27 cited fire, five feared capsizing; six noted weather (including two who specified fog) and six collision, two cited going overboard and two others specified gear entanglement. "It can happen so fast, you're setting out the gear everyday, it's easy to get lax."

Asked what steps should be taken to improve safety, on a scale of 1 to 5, respondents gave training a 4.85; requiring dockside inspections received a 4.5; designing fishing regulations to take safety into account received a 4; requiring a captain's license received a 3.3; instituting stricter safety requirements such as stability requirements for all vessels received a 3.2 and higher fines received a 2.5.

Training may have received the highest rating because of the "knowledge translation" that occurred through the safety training. Fishermen could absorb the information because of its relevance to their needs and because the method of sharing the knowledge was hands-on, giving them the opportunity to "learn by doing." Coupled with the awareness of lives recently being saved due to safety training, the fishermen perceived the value of learning how to maintain and use the equipment they own.

The voluntary dockside examinations of fishing boats by the Coast Guard started in 1991. A few years ago, Ted Harrington, Coast Guard Fishing Vessel Safety Coordinator, created a database of all documented fishing vessels and all vessels that had state and federal permits. He then grouped them by size to see which ones were requesting the inspections. He found that over 65% of vessels over 60 feet had received decals by 2005. Some ports like New Bedford had rates of 85%.[6]

> *Typically [in First District] we issue about 500 decals a year and perform about 900 exams. In 2006 we issued almost 1100 decals and completed almost 2000 exams. Those decal numbers represent over 35% of all the decals issued in the nation and the exams represent about 25% of the total in the country. (They were down in all areas of the Gulf and Atlantic coasts)* (Harrington 2006).

The benefits of participating in the dockside examinations are obvious to many of the Northeast fishermen. The prevalent view among our interviewees that these should be mandatory reflects this positive impression. The total number no doubt increased in 2006 primarily because of a recent NMFS requirement that all vessels carrying observers must have a decal, but we believe that the safety-training program is also contributing to developing a culture of safety. All agreed that fishing regulations should take into account safety, however, at least one respondent pointed out that safety is also affect-

ed indirectly by regulations. Specifically, the respondent said, that the economic impacts of regulations have forced some owners to choose to pay their house mortgage and buy groceries rather than properly maintain their boat or repack their raft.

Other ideas such as a captain's license, stricter safety regulations (e.g., stability) and higher fines had lower levels of agreement. Some felt that such requirements should only be instituted for the larger vessels. Some who have undertaken the Coast Guard training for 100-ton license felt that if similar levels of memorization were required this would preclude some decent captains from being able to obtain a license. Furthermore, one interviewee did not regard this training as particularly useful for a fishing captain.

Basic stability demonstrations using boat models have been added to the training offered by MFP. As more fishermen are introduced to the primary concepts and see how they might easily be applied to their own vessels, agreement with proposals to require stability assessment might increase. Unfortunately, icy conditions are believed to have caused the loss of four fishermen's lives and the loss of F/V *Lady of Grace* out of New Bedford in February 2007. Investigation of the loss a week later of F/V *Lady Luck* out of Newburyport and her two fishermen has not revealed whether or not icing and stability problems contributed to the accident.

A 1997 Current Intelligence Bulletin issued by the National Institute for Occupational Safety and Health (NIOSH) recommended efforts to address "vessel stability and hull integrity, training and licensing of skippers and crew, management practices, human factors, avoidance of harsh sea and weather conditions, falls overboard, and unsafe diving practices." The Bulletin pointed out that vessel stability is measurable and predictable. They recommend periodic assessments of stability and minimum specifications of watertight components and bulkheads sufficient to keep vessels afloat. Training and licensing of skippers and crew should include safety training; management practices should not "exert undue pressure to fish in poor weather," weather information should be carefully heeded; all fishermen should wear personal flotation devices (PFDs) when on deck; and a training program for divers should be implemented. Our interviewees agreed to a surprising extent with several of these recommendations.

Conclusion

The tipping point for the fishermen of Massachusetts may have been the loss of the F/V *Northern Edge* and saving of Pedro Furtado, followed quickly by an offer of free training. As Gladwell (2007) explains on his website, the tipping point is a "term in epidemiology given to that moment in an epidemic when a virus reaches critical mass. It's the boiling point." The tipping point is not necessarily recognized as such by observers since it may be a relatively small event given critical importance by timing and context (Gladwell 2000). The fact that, shortly after the sinking, important institutions such as the city of New Bedford, NOAA Fisheries, and MFP (with funding from the Northeast Consortium) quickly organized hands-on training offered without cost was extremely important. In the case of these safety-training programs, community leaders also played a central role in attracting participation in both New Bedford and the small ports where MFP organized training. For changes in behavior, the safety projects found that direct communication with vessel owners and captains by someone they respect is crucial. Participation by crewmembers was frequently dependent on the captain's and/or owners' encouraging or requiring attendance. Timing is also very important since it is challenging to attract attendance during active fishing periods.

The emphasis on hands-on training provided a means to transfer knowledge in a manner sufficiently impressive to the industry participants that they talked about the training and encouraged others to attend. The workshops also seemed to develop "risk knowledge" among participants so that they began to see safety preparation and training as potentially life-saving rather than simply another bureaucratic requirement. The significant level of participation in the safety training by the Northeast fishing industry suggests some optimism among fishermen about their ability to survive accidents at sea. Now that we have made some improvements in the survivability of casualties, the next steps should focus on prevention of accidents and improvements in health care.

Endnotes

1. Author to whom correspondence should be directed: E-mail: arber@mit.edu
2. E-mail: Karina.L.Mrakovcich@uscg.mil
3. The Coast Guard "initiated a voluntary dockside uninspected vessel examination program" in 1978, but the "positions were cut in 1981 due to budget reductions" (U.S. Coast Guard 1999).
4. The cost of P&I insurance in the U.S. can be prohibitive.
5. Williams, Ted. 2007. Personal Communication.
6. Harrington, Ted. 2006. Personal Communication.

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