Safety Training and Oceanic Fishing

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Introduction

This paper reports on the cultural adaptation of Atlantic commercial fishermen to the danger of their occupation and efforts to ameliorate that danger through safety training programs. The research is directed towards measuring fishermen's patterns of subjective perceived danger and assessing the impact of safety training on these patterns of thinking. Safety training for commercial fishermen has unique problems owing to a culture that relies heavily on the trivialization or denial of the dangers associated with the work (Binkley, 1995; Poggie et al., 1995, 1996; Pollnac et al., 1995). Hence, understanding the efficacy of various approaches to safety training is important in promoting greater safety at sea, for this understanding will help create the most effective programs.

Commercial fishermen participate in a demonstrably dangerous occupation. Their death rate is seven times the national average for all industrial groups (Macdonald and Powers, 1990:245). This well-documented danger is widely recognized by agencies and institutions concerned with safety policy and insurance (Appave, 1990; Carter, 1990; MacDonald and Powers, 1990; Canadian Coast Guard, 1987; National Research Council, 1985).

One of the problems noted by those concerned with fishing safety in the northeastern United States and eastern Canada is the tendency of many fishermen to trivialize or totally deny the dangers associated with their occupation (Poggie and Pollnac, 1988; Poggie et al., 1995, 1996; Pollnac et al., 1995; Binkley, 1991, 1995; McCay et al.[1]). When they admit it, fishermen have a tendency to claim that danger affects other fishermen, but not them, because they are careful. Some actually are careful, equipping their boats to the extent that they exceed Coast Guard safety standards. Many fishermen, however, simply do not allow themselves to think about the danger of their occupation, while others trivialize it.

These patterns of denial and trivialization have become part of the occupational subculture of fishermen and are reflected in patterned verbal comments we and other researchers have encountered in participant observation fieldwork among them. For example, a number of fishermen have made statements to the effect that they have worked for years with no severe accidents and never expect to have one. Others state that fishing is no more dangerous than other occupations despite overwhelming evidence to the contrary (personal observation).

The strategy of denial and trivialization may be psychologically adaptive, but it can result in fishermen who are poorly informed about the nature of the real dangers of their work. They are poorly informed because they refuse to search out, or even take seriously, information concerning the dangers of their occupation. Consequently, their behavior may be inconsistent with the actual dangers of their occupation. Evidence of this is provided by the fact that many fishermen carried little or no safety equipment before it became mandated by law.

Although fishermen comply with the new safety regulations by acquiring the required safety equipment, there is evidence that, in many cases, the compliance is grudging and superficial at best. They frequently fail to take enough interest to learn how to properly deploy the equipment or fail to maintain it adequately. For example, Emergency Position Indicating Radio Beacons (EPIRB's) are required on all fishing vessels operating more than 3 miles from shore. Fishermen purchase them because they are required to, but they fail to maintain or deploy them properly. Some fishermen reportedly keep their EPIRB's in a drawer in the cabin to protect them from theft but forget to place them back in the bracket when at sea; hence, if the vessel sinks, the EPIRB will sink with it and fail to operate as a locating beacon. One fisherman sadly told us that his brother lies dead under 30 fathoms of water with two EPIRB's stored in the cabin. Finally, EPIRB's require periodic testing and maintenance which some fishermen never perform.

Similar types of improper use and deployment are associated with other required safety equipment (e.g. survival suits, survival craft, distress signals like flares and smoke signals, fire fighting equipment, etc.). Fishermen appear to trivialize the importance or deny the significance of safety equipment; hence, they do not search out information to learn to use and maintain it properly.

It is very important to understand the subjective patterns of fishermen's per-

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[1] McCay, B. J., W. G. Gordon, E. B. Levine, J. B. Gatewood, B. Thompson, and C. Creed. 1989. From the waterfront: interviews with New Jersey fishermen about marine safety and training. Project Report for New Jersey Marine Sciences Consortium, NJMSC-SK-89-1, 74 p. Unpublished manuscripts available from the authors c/o Dep. Sociol.-Anthrop., Univ. of Rhode Island, Kingston, R.I. 02881.

ceptions of danger so that policy makers, safety trainers, and fishermen themselves may deal with this problem more realistically and thus increase the level of safety within the industry. Present increased efforts at educating fishermen about these dangers may be helpful if they actually change the way fishermen think about and behave in response to danger.

Perceptions of Danger

This study sets out to develop a method to measure and compare subjective perceptions of danger between fishermen who have completed a safety training course with those who have not had such a course. The study uses a post-test-only design. The "experimental" group was composed of a sample of 35 northeastern U.S. fishermen who recently completed a 2-day vessel safety course at Ocean City, Md., given by vessel safety experts from the University of Rhode Island. The control group, a sample of 44 fishermen from New Bedford, Mass., did not take the course.[2]

First, individuals in both groups were interviewed in terms of their subjective ranking, on a scale of 1 to 10, of the danger involved in fifteen fishing incidents that vary in frequency of occurrence and severity of outcome. The context (season, weather, and seas) of the fifteen situations posed was that they were fishing at their normal distance from shore in mid-February, with sustained winds of 25 knots and 6- to 10-foot seas. This contextual information was provided to standardize the hypothetical conditions under which each respondent evaluated the relative dangers of the fifteen incidents. The list of incidents (Table 1) was derived from Coast Guard reports and key informants from the region.

The next step in the research is based on the assumption that covariance in the perception of relative danger of specific fishing incidents can be used to define sets of incidents which engender similar patterns-of-worry responses. These sets of incidents can then be treated as a single variable—a scale composed of the weighted sum of responses to the incidents. Principal component factor analysis with varimax rotation of factors was used to determine patterns in variability in responses to the 15 incident types. The scree-test, which limits factors derived on the basis of a leveling-out of eigenvalues, was used to define a number of factors. The results of this analysis are also shown in Table 1.

Table 1.—Principal component analysis of incident evaluations. Boldface type indicates highest loadings on each factor.

	WORRY FACTOR		
Incident Type	1	2	3
Lose all electronics.	**.86**	.02	.02
Engine failure.	**.83**	.20	.21
Lose ability to steer the boat.	**.79**	.14	.04
Fog, visibility less than 50 feet.	**.68**	−.34	.37
Pull a bomb-like object in gear.	**.63**	.19	.21
Flood (pumps unable to keep up).	**.58**	.41	.25
Flood (pumps able to keep up).	**.53**	.37	.34
Fire in the engine room.	**.51**	.47	.44
Explosion in the engine room.	−.12	**.81**	.23
Fall overboard.	.24	**.69**	−.18
Struck amidship by another boat.	.25	**.62**	.32
Several inches of ice in rigging.	.12	−.07	**.80**
Gear hung-up on the bottom.	.06	.17	**.67**
Fire in the galley.	.34	.39	**.61**
Fall and break a bone in arm or leg.	.40	.12	**.46**
Cumulative percent of variance	28	44	60

The three factors derived from the principal component analysis are referred to as WORRY1, WORRY2, and WORRY3. The analysis appears to have grouped the incidents in terms of potential severity. Those with high loadings on WORRY2 are the most severe types of incidents (e.g. explosion in engine room, falling overboard, collision at sea). WORRY1 and 3 are composed of incidents of less severity, with those on WORRY3 (e.g. ice in the rigging, fire in the galley) having potentially more immediate consequences than incidents loading highest on WORRY1 (e.g. loss of electronics or engine failure). The incidents in Table 1 for which the factor loadings are in bold print indicate the ones with the highest loadings on each factor. That does not mean, however, that a given incident does not also have a relatively high loading on another factor. Fire in the engine room has relatively high loadings on all three factors, indicating that it could be quite dangerous with immediate impact (WORRY2 and WORRY3), yet in some cases could be handled easily (WORRY1). Flooding with pumps unable to keep up, has high loading on WORRY2 as well as on WORRY1, on which it loads highest. The relative sizes of these loadings are reflected in the standardized factor

[2] Power analysis was conducted to estimate ideal sample size for the New Bedford research (text footnote 3). Power refers to the probability of finding a statistically significant relationship in a sample when there is in fact a significant difference in the population. It is always possible that although there is a significant difference in the population, a specific sample will not result in a statistically significant finding. Since we want to increase the probability that the research design is strong enough to find a statistically significant difference, if in fact one does exist, it is important to consider the concept "power" in determining sample size (Cohen, 1988). The power analysis suggested a sample size of 44 for New Bedford. Power analysis was conducted to determine the minimum sample size for the experimental group (the fishing vessel safety trainees) with the following assumptions: 1) a difference of at least 0.75 separates relevant groups on the dependent variable measures (three-fourths of a standardized factor score; 2) the standard deviation for each group is estimated to be 1.0; 3) the alpha is set at 0.05, two-tail; 4) the desired power is 0.90. Analysis indicates that with a sample of 44 in the control group, the sample size must be at least 34 in the experimental group in order for the power of the statistical design to be at least 0.90. In other words, with the indicated sample sizes, the probability that any given sample would have differences which are statistically significant is .90 when in fact there is a significant difference in the population. Conversely, it means that there is one chance in ten that the test on the sample will not be statistically significant, when in fact there is a significant difference in the population. Since questionnaires were handed out to all trainees, and 35 usable forms were returned, the experimental group is slightly greater than the planned sample size. This, of course, increases the power of the research design.

Ideally, the experimental and control groups should be matched on all important variables except participation in the training session. Since the trainees were a self-selected group, this was not possible, but it is possible to compare the two groups with respect to three variables that may influence perceptions of relative risk (fishing type, vessel size, and distance from shore of fishing activity). These data are presented to enable readers to evaluate potential threats to validity as well as to structure needed future research on this topic. Fishing type varied between the two groups, with the control group (New Bedford) being characterized by a preponderance of scallopers and draggers and the trainees mostly longliners and sea clammers with some draggers. Vessel length also distinguished the two groups, with the controls having longer vessels (mean 92.9 ft, s.d. 18.2) compared to the trainees (mean 68.7 ft, s.d. 25.0), a difference which is statistically significant ($t = 5.33$, $P < 0.001$). However, we found no statistically significant correlations between vessel length and any of the three Worry Factors. Distance normally fished from shore and maximum distance fished from shore do not distinguish the controls from the trainees (mean 182.6 mi, s.d. 153.5 versus 118.7 mi, s.d. 284.5, $t = 1.31$, $P > 0.05$ and 281.7 mi, s.d. 203.3 versus 218.7 mi, s.d. 451.1, $t = 0.81$, $P > 0.05$, respectively).

scores calculated for the scales developed from the three factors. Hence, a fisherman with a high factor score for WORRY1 manifested a higher degree of concern with incidents loading highly on factor 1 than fishermen with lower factor scores.

Safety Training and Perceptions of Danger

The profiles provided by the factor loadings and the factor scores give us a picture of how danger is perceived by the overall sample, as well as a measure of individual variability in concern. The individual-level independent variable of interest in the design of this study is whether a fisherman has completed or not completed the safety training course conducted by personnel from the University of Rhode Island. We wish to determine if there is a relationship between having taken the safety training course and differences in concerns as to dangers of the occupation as measured in this analysis.

Analysis of the relationship between the control and experimental groups and the three worry factors are presented in Table 2. As indicated by higher mean factor scores, individuals in the experimental group are more concerned with the dangers in WORRY3. There are no significant differences in the patterns on WORRY1 and WORRY2.

Discussion

Based on the evidence in hand, we may conclude that the safety training course has heightened the concern among fishermen in our experimental group regarding Worry Factor 3. The items that define this factor are: ice in the rigging, gear hung-up on ocean bottom, fire in the galley, and fall and break a bone in arm or leg. These items are judged to be intermediate in their dangerousness (compared to the highest loading items in WORRY1 and 2) and can be dealt with, given proper sensitization, preparation, and response. We turn to a description of the course which appears to have brought about this change in perception.

Table 2.—Relationship of control-experimental to worry factors.

Item	WORRY1	WORRY2	WORRY3	*n*
	Mean Factor Scores			
Control	.18	–.02	–.35	44
Experimental	–.22	.03	.44	35
t-value	1.79	–0.22	–3.79	79
Probability	>.05	>.05	<.001	

The safety training taken by the experimental group was a 2-day course that began with an effort to sensitize fishermen to the dangers of their occupation. Films of three actual events of capsizing, colliding, and being swamped by a big wave were shown to fishermen at the beginning of the first day of the class. The consequences of the three events shown in the film were catastrophic in that they clearly involved the loss of life and property. Two of the events, the big wave and the capsizing, were both related to stability of the vessels and could have been prevented with proper preparation and response. The mistake involved in the collision was due to the improper use of radar. Because of this mistake, the two fishing boats involved collided even though they were both in full reverse. When the colliding vessel's bow backed out of the middle of the second vessel, it left a gaping hole; which resulted in the second vessel sinking within two minutes—insufficient time for crew members to use immersion suits or deploy life rafts.

The rationale for showing fishermen these real events of loss at sea was to illustrate to them the considerable dangers involved in their work and to motivate them to take the course material seriously. Based on the growing knowledge of fishermen's adaptation to the dangers of their work, we would argue that this aspect of the safety training course helps to overcome the tendency to trivialize and deny danger that is a common feature of the subculture of commercial oceanic fishing in the Atlantic region (Binkley, 1991, 1995; Pollnac et al., 1995; Poggie et al., 1996).

The course proceeded with a general overview of safety issues. It continued with more specific information on safety equipment and procedures such as emergency communications, flares, and distress signals; personal flotation; damage control and minimizing flooding; and fire prevention and control. The course continued with actual practice at firefighting, raft launching, flood control, donning an immersion suit, etc. The course concluded with training on how to conduct a drill and involved actual drill practice in a range of distress situations. Following the drill practice, a debriefing took place. The research questionnaire was administered at the conclusion of the debriefing.

Overall, this analysis indicates that the training course resulted in trainees manifesting more caution with respect to only one of the three Worry Factors. The fact that only one factor was significantly related to training should not be construed as indicating that the training is marginally effective. As reported in an earlier analysis of these items (Pollnac et al.[3]), all fishermen are equally cautious with respect to items in WORRY2, and items in WORRY1 are frequently dealt with by competent captains and crew. The items in WORRY3 are serious, but were probably not perceived in all their seriousness until the training sessions heightened awareness. This finding would be useful in designing future training sessions for other fishermen. The training session examined in this analysis can be related to changing perceptions which may help save lives in the future of the fishermen who completed the course.

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