WORK PRACTICES, ENTANGLEMENT OF LOBSTERMEN, AND ENTANGLEMENT PREVENTION DEVICES IN THE MAINE LOBSTER FISHERY: A PRELIMINARY SURVEY

A.S. Backus
Occupational Health Program, Harvard School of Public Health
Boston, Massachusetts, U.S.A.

P.J. Brochu
Occupational Health Program, Harvard School of Public Health
Boston, Massachusetts, U.S.A.

J.M. Lincoln
CDC/NIOSH Alaska Field Station
Anchorage, Alaska, U.S.A.

D. M. Bensyl
CDC/NIOSH Alaska Field Station
Anchorage, Alaska, U.S.A.

J.R. Ciampa
Visiting Scholar, Occupational Health Program Harvard School of Public Health
Boston, Massachusetts, U.S.A.

T.J. Smith
Occupational Health Program, Harvard School of Public Health
Boston, Massachusetts, U.S.A.

G.A. Conway
CDC/NIOSH Alaska Field Station
Anchorage, Alaska, U.S.A.

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BACKGROUND

Commercial fishing has been recognized as a hazardous occupation for centuries. Sir Walter Scott wrote in *The Antiquary* (1816), "It's no fish ye're buying, it's men's lives."[1] The working conditions for commercial fishermen are very hazardous and factors associated with commercial fishing deaths are complex. Gear type, fatigue, and environmental conditions contribute to the severity and frequency of these incidents.

By the mid-1980s, hazards in the commercial fishing industry captured the attention of Congress, which enacted the Commercial Fishing Industry Vessel Safety Act of 1988. During 1990-1995, the CFIVSA required fishing vessels to begin carrying specific safety and survival equipment and required certain crewmembers to have training in first aid and how to conduct emergency drills on fishing boats. However, deck safety was not addressed by these regulations.

According to data from the 1997 Census of Fatal Occupational Injuries (CFOI) published by the Bureau of Labor Statistics, the fishing industry ranked second to the logging industry for the highest occupational fatality rate. That year, timber cutters sustained 128.7 fatalities per 100,000 full time workers; the fishing industry sustained 123.4 fatalities per 100,000 full time fishermen.[2] With the 1997 United States national average for all industries at 4.8 fatalities per 100,000 full time workers[3] the fishing industry is on the order of 25 times more hazardous than all occupations combined.

In Maine, from 1993-1997, the average number of lobster licenses of all classes issued annually by the Department of Marine Resources was 5681.[4] The occupational fatality rate for lobstermen was 14 per 100,000 licensed lobstermen,[5] more than 2.5 times the national average for all industries (4.8 per 100,000) (Note the comparison is between licensed lobstermen both full and part time and full time workers. The figures for lobstermen are not normalized to full time lobstermen. Therefore, the actual rates would likely be higher.) From 1993-1999, seven lobstermen drowned after falling overboard.[6] Conditions on the boats suggested that trap rope entanglement was a likely cause.[7] Anecdotal reports indicate that the prevalence of the entanglement of lobstermen in trap rope is high. When they become entangled in trap rope, they can be pulled into the water and often are not able to free themselves from the rope.

Lobsters are fished by placing a baited, rectangular mesh trap (size: 0.5 m by 0.5 m by 1.0 m, and weighing 2-4 kg) on the sea bottom (5-20 meters deep) connected to a surface buoy by a rope, "trap rope". One to ten traps may be connected to the same rope. Traps are periodically (every one to three days) pulled up into a boat using a winch (pot hauler), the trapped lobsters are removed, and the trap is cleaned of debris and re-baited.

There are four basic activities associated with lobstering:

Buoy pick-up - the buoy is gaffed, and the trap rope is placed in the pot-hauler (winch);
Freeing snarls - gear caught on another set of traps is untangled;
Setting gear - lobster traps are baited and thrown overboard; and,
Shifting gear - a large number of lobster traps are hauled-up and transported to another fishing ground.

This study was undertaken to gather data on the prevalence of personal entanglement in trap rope, to understand the work practices associated with entanglement, and to learn from fishermen what work practices and engineering controls would 1) reduce the risk of entanglement, 2) help lobstermen escape from an entanglement, and 3) facilitate re-boarding in the event that a lobsterman was pulled overboard from an entanglement.

METHODS

An interview guide for this cross-sectional study was developed and piloted with lobstermen. The guide consisted of eight sections: background information, description of lobstering practice, description of vessel, entanglement likelihood and circumstances, interventions, other devices, personal entanglement accident history, and communications.

Five people were trained to use the interview guide and 103 lobstermen were interviewed at the wharves, in coffee shops, lobster co-ops, storage cabins, and hardware stores. Often this meant arriving at a coffee shop at 5:15 AM to talk with lobstermen before they headed out at daybreak. At other times, the interviews were conducted when the lobstermen were unloading at the wharves at the end of a fishing day. The interviews took place from October 1999 through September 2000. The interviewers obtained consent before proceeding with the interview; some lobstermen declined the interview but

none terminated the interview midstream in spite of having been given the option. In most cases, the lobstermen were interviewed privately. Interviewers did not collect any information that could be used to identify participants. The data were entered into spreadsheet software.

RESULTS

Of the 103 lobstermen interviewed only one was female; 93 were captains and 10 were sternmen. Fifty-two percent reported "always" fishing with a sternman, while 25% reported "sometimes" and 22% reported "never" fishing with a sternman.

Of the 103 lobstermen interviewed, 75 (73%) answered "yes" to the question, "Have you even been caught in trap rope where you lost clothing, were pulled to the stern, or pulled overboard." Forty-five (44%) of the 103 lobstermen reported a total of 90 entanglements within the last five years.

Eighty-one percent of the lobstermen interviewed said that entanglement was either "likely" or "very likely" to happen when setting gear. Sixty-eight percent said entanglement was either "likely" or "very likely" while shifting gear. Freeing snarls and picking-up the buoy were described as "not likely" to be settings for an entanglement by 67% and 94%, respectively. (See Figure 1.)

Table 1. Number of lobstermen entanglement events in the last five years.

Number of events	Number reporting	Total events
1	20	20
2	14	28
3	7	21
4 8	2	
5 5	1	
8 8	1	
TOTALS	45	90

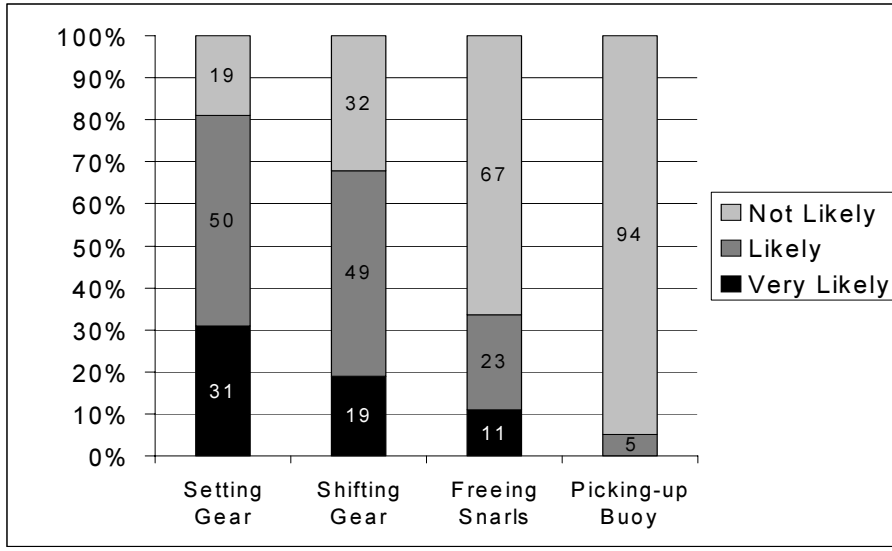

Figure 1: Likelihood of entanglement for each of the four lobstering activities.

Rope often accumulates at the feet of the lobsterman as he is setting traps. When he is ready to set the traps he pushes the first trap overboard and the remainder follow, with the rope paying out over the side or transom of the boat at considerable speed. The setting gear activity is generally more dangerous if the captain (as is the practice) has placed the boat in forward gear.

Interventions suggested by lobstermen that might reduce and presumably prevent entanglement included both work practices and engineering controls, the two categories of interventions typically found in industrial settings. Regarding their work practices, lobstermen mentioned "working slowly", paying close attention, knowing where the rope was at all times, using "common sense," keeping hands and feet away from rope as much as possible, and positioning people carefully during setting and shifting activities.

Table 2 shows the responses given when lobstermen were asked to determine whether eight engineering interventions we listed would be "not useful," "useful," or "very useful" in preventing entanglements or aiding in self-rescue from an entanglement.

Table 2. Percent of respondents specifying perceived usefulness of engineering controls to reduce entanglement risk

Intervention	Not Useful	Useful	Very Useful	Useful or Very Useful
Nonskid mats	5	53	42	95
Washrail above knee	5	38	57	95
High traction deck	15	58	27	85
Rope locker/bin	31	39	31	69
Bucket/pipe as fairlead	49	39	13	51
Temporary abrasive (salt)	61	33	6	39
Safety shut off cord for engine	65	26	9	35
Sensor mat for shutting off engine	70	27	3	30

As shown, lobstermen were clear and largely in agreement that non-skid mats, a washrail above the knee, a high-traction deck surface, and either a rope locker or a rope bin are engineering controls that would be useful in reducing the risk of entanglement.

When asked to make a choice among eight means of escaping from an entanglement, 95% of those interviewed said having a sternman would offer the best hope of escape. The second, third, and fourth choices were wearing a knife (25%), having a knife mounted in the stern (18%), and having a gag line (remote engine shut-off) (15%).

When asked to choose among four means of surviving an overboard incident and being able to re-board the boat, 98% ranked having a sternman as their top choice. Loose clothing (77%), a rope ladder or scuppers for footholds (76%), and a life jacket (60%) were ranked second, third, and fourth.

DISCUSSION

With 73% of the respondents reporting that they had experienced a serious entanglement in trap rope at some time in their fishing career, it is evident that this type of entanglement is common in the lobster fishery. When asked to explain the circumstances, lobstermen reported a variety of circumstances leading to entanglement. One lobsterman fishing alone had the trap rope wrapped around his left wrist and was pulled into the water. He was able to cut the rope, but had no flotation device and only because another lobsterman saw his aimlessly circling boat was he rescued from the water 45 minutes later. He fortunately survived without major injury. One lobsterman told of hailing a passing boat while lying prone on the deck of his boat. Others were fortunate enough to have had a sternman or a knife, or the strength to hold on to the wheel long enough to take the boat out of gear.

This study delineated four major components in the strategy to prevent entanglement and facilitate recovery from the event: 1.) control the environment including the ropes, 2.) stop the force including cutting the engine, 3.) rescue by untangling or cutting the rope, and 4.) re-enter the vessel if pulled overboard.

Rope control can be achieved through "engineering controls" such as installing an under-rail rope bin or an under-deck rope locker or by using a fairlead. Suggestions from lobstermen regarding work practices that can help reduce the risk of entanglement include "work slow," use "common sense," know where the rope is, keep hands and feet away from the rope, and choose positions on deck that reduce contact with rope. Another work practice promoted by some lobstermen was to set traps while drifting rather than while in forward gear.

More than two-thirds of the lobstermen indicated that a rope locker or rope bin would reduce the risk of entanglement. However, during this study, the interviewers only found two lobster boats with these devices. A rope locker (see Photo 1) is a water-tight compartment built under the flooring with openings under the pot-hauler and along the rail so that rope coming off the pot-hauler will drop into the compartment under where the lobsterman stands and will be completely out of his/her way. These lockers are particularly useful for lobstermen who fish ten trap trawls (ten traps on a length of rope between two lobster buoys) because these trawls involve the use of much more rope than fishing a single or double (pair of traps) per set.

Photo by Ann Backus

Photo One: Rope locker (deck platform open) shows rope collecting under the deck away from the fisherman's feet.

Nonskid mats reduce the chance of slipping into the rope pile and increase the chance of retaining or regaining balance when caught in the rope. The deck surface tends not only to become wet, but also slimy when seaweed and algae arrive on board with the rope and traps. For similar reasons, a high traction deck surface is useful. Some lobstermen improve the traction on their entire deck surface by having their decks painted with an abrasive-containing paint. Nonskid mats are often used along with high-traction deck paint.

The rope bin is a simple hinged door device that allows the rope to fall into a compartment under the washrail, but above the deck. The door, as simple as a plywood panel hinged along the deck-side edge, keeps the rope away from the feet of the lobsterman.

A fairlead in the form of a bucket or pipe, set on or mounted through the washrail, was deemed "useful" or "very useful" by 51% of those interviewed.

Illustration by Mediastream.

Figure 3. Rope bin made of plywood with a piano hinge that allows it to drop open and accept trap rope from the pot hauler.

This device controls the rope by guiding it back into the water before it has a chance to run to the stern, and thereby reduces the floor space occupied by rope to a small corner near the pot-hauler. The fairleads in use were in some cases buckets filled with water, and in others were an iron or PVC pipe, or a spaghetti-like bundle of fiberglass rods mounted through the washrail. This last invention had the benefit of being flexible in the event that a person was thrown against it during a sudden shifting of the boat or an entanglement accident.

The importance of the washrail height as a means to reduce entanglement and especially lessen the potential of being pulled over board is well-understood by lobstermen. Ninety-five percent said that a washrail (washboard) above the knee was "useful" or "very useful" in reducing the risk of entanglement. While hauling and setting, lobstermen tend to lean on the washrail. A rail that is high, i.e., above the knee and almost at mid-thigh, provides significantly more support against the loss of balance and provides a better barrier to being pulled overboard.

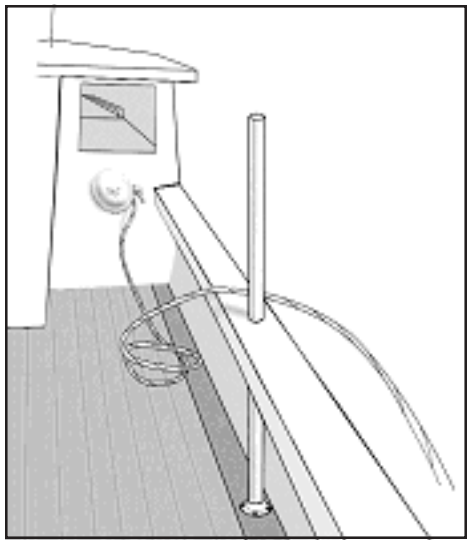

Illustration by Mediastream.

Figure 4. A fairlead made of a steel pipe or a collection of fiberglass rods mounted into the deck that "leads" rope out of the boat and minimizes the area where rope could be a hazard.

Once entangled, either a lobsterman loses a glove or boot, has to struggle to loosen the rope, or has to cut himself free. If there is a second person on board, the situation can usually be resolved quickly; if not, wearing a dive knife in an accessible location, preferably secured upside down on suspenders, is extremely important. A dive knife is made of 100% stainless steel and should have a hard molded sheath that clips the knife in for safety. Of the lobstermen interviewed, 25% answered that wearing a knife was their top choice for escaping from entanglement; 18% thought taping a knife at the stern would be their preference. In actuality, having knives both on person and taped to the transom would provide the best opportunities to escape.

Ability to cut free of the rope is dependent on the access to a very sharp knife, not one that has rusted in its holster on suspenders, or in its leather holder at the stern. Some lobstermen issue new knives after each heavy use; some have a small jack knife in their pants pocket which, even if reachable in an emergency, could not be opened with one hand if the other hand were caught in rope. The suggested placement of a knife is handle down on suspenders such that it is reachable by either hand in one stroke.

Rick Kelly

Photo 2. Wearing a dive knife in an accessible location, preferably secured upside down on suspenders, is extremely important.

Cutting the engine can be done by a competent sternman, but without the presence of a second competent person onboard, an engine gag line or kill switch is essential to get free from an entanglement.

Although only 35% of the lobstermen noted that a safety cord or gag line/kill switch that would provide remote engine shut off would be useful in reducing the risk of entanglement, a means of shutting off the engine is critical to surviving many entanglement accidents. Many lobstermen either don't think it would come to needing to shut down the engine remotely because the sternman would be available to manage the helm, or they think such a device would be a nuisance at non-critical times. For lobstermen fishing alone, it may be the only lifeline in a serious situation. A gag line run under the washrail and across the stern, reachable from two sides of the boat, would in fact be out of the way of normal operations but available to pull-on in the event the lobsterman were pulled to the deck or caught at the transom. Given that most lobstermen set their traps while in forward gear, a means to stop the engine is the only way to gain slack in the rope. The traps are fast sinking and their weight creates a force on the rope that is too great for the average lobsterman to overcome unless he can cut the rope. [8]

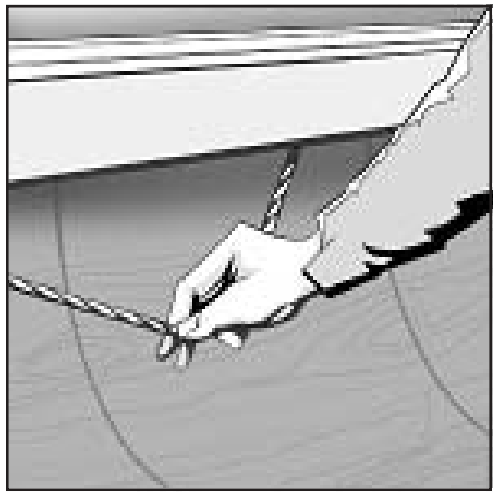

Illustration by Mediastream

Figure 5. Gag line or kill switch for remote engine shut-off.

Captains have the option of taking a sternman with them, and they do so for various reasons. Probably the most frequent reasons given are productivity and efficiency. Many captains would also cite the safety benefit of having an additional person on board. Choosing to fish with a sternman has significant positive safety implications. It reduces considerably the risk of a fatal injury because a second person is available to help. However, the risk is not negligible because some sternmen lack knowledge about the throttle and gears of a boat and could make a mistake that had a fatal outcome if he/she throttled up or didn't take the boat out of forward gear, for example. Although this survey did not contain questions regarding how well sternmen knew the boat and would be able to respond in an emergency, sternmen should be prepared to step to the helm.

In addition, the interviews associated with this study revealed that few lobstermen wear life jackets, inflatable vests, or suspenders. Thus, staying afloat in the water for a length of time is problematic. Observation of lobster boats shows clearly that few boats have fittings that would enable a lobsterman to re-board if thrown overboard. Some boats have steps, knotted ropes, or rope ladders and some have scuppers that are large enough for the toe of a boot, but generally the hand and foot holds on these boats are noticeably absent. It would be simple for lobstermen to make rope ladders to hang off

the non-working side, to install a ladder or steps, or to install scuppers that are large enough to serve as footholds and mount handles for easy re-boarding.

CONCLUSIONS

Personal entanglement in trap rope is an experience most lobstermen have had. Setting gear and shifting gear are the lobstering activities that are most likely to result in entanglement. Only a few lobstermen, however, have a planned strategy for reducing the risk of entanglement. The four components any strategy needs are to be able to 1.) control the environment, including the ropes, 2.) stop the pulling force, including cutting the engine, 3.) rescue oneself by untangling or cutting the rope, and 4.) re-enter the vessel if pulled overboard. Careful, intentional work practices, combined with a variety of engineering controls including nonskid mats, high washrails, and rope lockers or bins may reduce the risk of being caught in rope. A remote engine shut-off, strategically placed knives, personal flotation devices, and a means of re-boarding the boat are all approaches that may improve the chances for surviving an entanglement. Additionally, having two people on the boat, each with a thorough knowledge of the operations of the boat, could also improve the ability to survive an entanglement.

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FOOTNOTES

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Edited by

Jennifer M. Lincoln, M.S., C.S.P.
Diana S. Hudson, M.P.H.
George A. Conway, M.D., M.P.H.
Rachel Pescatore

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