

The Northeast Center for Occupational Health and Safety: Agriculture, Forestry and Fishing

Summary Annual Report
Fiscal Year 2015

NIOSH Center Grant
2 U54 OH007542-12

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September 2015

Section I

Center Summary

The Northeast Center (NEC) is a NIOSH funded extramural Agriculture, Forestry and Fishing (AFF) Research Center, which is affiliated with the Bassett Healthcare Network in Cooperstown, NY. The mission of the NEC is to enhance the health of AFF workers by identifying priority health and safety issues and working with AFF communities and stakeholders to identify prevention solutions. The Center provides these services to an eleven state region that extends from Maine to West Virginia. Over the course of the past twelve months, Center researchers have worked diligently to complete research projects and intervention evaluations, as well as to publish the results of these efforts in peer-reviewed journals. The Center's evaluation team has continued to monitor and track the progress of individual projects and was also central in efforts to conduct a cost-analysis of the impact of the NY OSHA Local Emphasis Program, which is described in the Outreach and Evaluation sections of the Center Annual Report. Project investigators have also dedicated considerable energy to working with the NEC Promotions Coordinator to disseminate research results and information on AFF health and safety best practices to the AFF communities throughout the NEC region. The Center's major projects are evenly divided between Research, Intervention/Prevention and Education/Translation. These projects and Principal Investigators represent considerable expertise in engineering, occupational medicine, public health, social science, evaluation and education. Several NEC mini-grants were funded in 2014/2015 to address a number of local AFF priorities. One of these mini-grants, has led to the submission of an expanded NIH study application that was submitted in July 2015. NEC research, outreach and prevention activities continue to leverage local, long-established partnerships with agencies and health research institutions throughout the Northeast, such as Harvard University, Pennsylvania State University, the University of Massachusetts: Lowell, the University of Vermont, Farm Bureau, State Departments of Agriculture, Labor and Health, Fishing Partnership Support Services, the National Oceanic and Atmospheric Administration, the U.S. Coast Guard and the MIT Sea Grant Program.

In addition to NIOSH Center funding, the NEC has been awarded a U01to expand an evidence-based ROPS retrofitting intervention model to high-risk states and to lay the groundwork for a National ROPS Rebate Program. The NEC also supplements NIOSH research activities and dissemination efforts by utilizing funding from other agencies in excess of \$1.2M.

Center Aims and Priorities:

Priorities	Maximize Center Resources		Research to Practice	Emphasize Impact	
Aims	#1-Improve Surveillance to identify priorities	#2-Focus on Vulnerable and High-Risk Workers	#3-Move proven prevention strategies into workplaces	#4-Reduce traumatic injuries in Ag, Forestry, Fishing	#5-Reduce traumatic deaths in Ag, Forestry, Fishing

Relevance

AFF workers have a significantly higher risk of occupational death and injury than workers in other U.S. industries. However, addressing these issues in the Northeast is particularly challenging due to the considerable diversity in AFF work environments and populations. As a result, NEC activities have largely focused on identifying and monitoring risk factors, in order to develop multiple strategies for addressing them. In the area of farm and forestry safety and health, a surveillance system is being developed to capture both injury and fatality data from multiple sources. This information is being used to prioritize intervention and outreach activities and to strategically develop partnerships within the communities we serve. The identification and amelioration of emerging occupational hazards and health issues are an additional Center priority and our researchers continue to look for opportunities to track these issues in Northeastern AFF communities. The NEC also collaborates closely with the NIOSH Commercial Fishing Safety Research and Design Program, which conducts surveillance of commercial fishing injuries and fatalities through the U.S..

In addition to surveillance, NEC activities have focused on different facets of the injury process, from education on risks, to interventions that mitigate risks (i.e. increasing access to safety products, working with manufacturers to improve safety designs and equipment, developing standards for safer working conditions, conducting on-farm safety audits, promoting the use of safety products, etc...), to strategies for improving outcomes should injuries or illnesses occur (i.e. first-aid training, case-management and treatment, provider occupational health training). Similar activities are also being conducted in the area of fishing and forestry safety, with the aim of reducing injuries and illnesses and improving outcomes for those injuries and illnesses that do occur.

Key Personnel

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Section II

PROGRAM HIGHLIGHTS

Center-Wide Activities

During the reporting period September 2014 to September 2015, the NEC has made significant progress in fulfilling the aims of the various Center proposals, as well as the overarching aims of the Center's core objectives. In October, the NEC Fishing Advisory Panel met in New Bedford, MA to discuss emerging and ongoing commercial fishing concerns in the coastal communities of MA, ME and RI. In November, the NEC Scientific Advisory Panel met in Washington DC to review NEC research projects and to identify NEC priorities for the upcoming funding cycle. In May, the Center organized a retreat and workshop for partners and researchers, which provided a thorough grounding in conducting Cost Effectiveness and Cost Benefit Analyses. The course was designed to encourage Northeast AFF researchers and partners to consider the relative costs and benefits of potential AFF interventions and to look at these options from an economic, as well as public health, perspective. All of these meetings have provided Center administrators and researchers with valuable feedback and opportunities for mid-course project corrections. They have also ensured that NEC projects remain responsive to the needs of AFF workers.

Presentations and Publications

Over the past year, six presentations have been made (or accepted for presentation in 2015) at national epidemiology, safety and health conferences. There have been three manuscripts published or accepted for publication in the peer-reviewed literature and six manuscripts in progress. See Table 1. "Scientific Project Outputs and Intermediate Outcomes" and Table 2. "Dissemination of NEC Project Results" at the end of this report for a detailed listing of publications and presentations.

Outreach

Outreach is an important component of NEC injury prevention activities and includes safety training and education, health screenings and promoting the use of personal protective equipment (PPE) for AFF workers. A group of NEC "regional trainers" are employed to provide safety expertise and support to farmers in a number of northeastern states. Safety trainings consist of on-farm consultations with farm managers, on-farm worker safety trainings, and off-farm educational presentations to youth, farm owners, and farm service organizations. New approaches to training include working with a refugee center and presenting ergonomic topics for preventing muscle injuries. Targeted populations for these trainings include Dairy farm managers, Spanish speaking workers on dairy farms, migrant seasonal workers, Anabaptist communities, and small farm, fishing and logging operators.

This year there were 39 on-farm consultations reaching 104 farm managers, 130 safety trainings in English for 1446 workers, 258 safety trainings in Spanish for 2,631 workers, 41 educational sessions reaching 746 youth workers, and 40 presentations to agricultural service providers reaching 770 professionals. Topics included tractor safety, animal handling, machinery safety, first aid, basic CPR, confined space hazards, orchard safety, chemical hazard communication, fire extinguisher use, electrical safety, roadway safety and many other topics.

Logging safety classes were also offered to farmers and land owners who have varying levels of logging expertise. This year 21 'Game of Logging' classes were offered on the following topics: chainsaw handling, use of proper protective equipment, and safer felling practices. One hundred and sixty-three individuals participated in these trainings with 145 on waiting lists for future offerings. Trainings were evaluated using pre- and post-training tests, as well as direct observation. Trainees were also scored on their chainsaw handling performance and felling practices. Evaluation results were used to fine tune subsequent trainings. The NEC also sponsored three Commercial Fisherman Safety and Survival / Drill Conductor training courses, which were held in New York, Rhode Island, and Maine (90 trained).

Outreach activities have also encompassed attendance at trade shows, provision of technical assistance, as well as promotional activities which include print publications, radio spots and internet/social media updates. NEC staff wrote 29 articles for publication with 17 being printed in farming publications covering topics of seasonal and current interest. Trade shows are a major avenue for making farmers aware of the NEC services that are available to them. These services include the ROPS Rebate Program, on-farm services such as trainings and safety and audits, and the Farmer's Occupational Health Clinic. There were 51 outreach events that were attended by NEC staff in the past year.

A mobile trailer outfitted for health screenings, is also featured at various trade shows and farmer attended events. This year the following services were offered: skin cancer screenings (4), blood pressure (2), vision (2), and hearing (3). Strategies for increasing the use of PPE on farms included: providing high quality PPE (which is provided at cost or with a slight mark-up to cover distribution costs) at trade shows and on farms and opportunities for ordering supplies through a catalog. This \$27,000 worth of PPE was purchased by 210 customers. Farms are also able to request respirator fit-testing for their workers by attending an outreach event or having it done on their farm. In 2014/15, 40 employees at eight farms were fit-tested for respiratory protection. Some of these activities were directly supported with NEC outreach funds and some leveraged with other funding sources.

The OSHA Local Emphasis Program for Dairy Farms in New York took place from July 1, 2014 to present and was a catalyst for major safety awareness in the dairy industry. The NEC conducted a survey to assess the financial impact of this inspection program on dairy farms. Results of the survey illustrated the amount of time spent on documentation, training costs, costly physical changes, and changes in attitudes about the importance of safety and health of workers. Detailed information about expenditures and time was recorded for sixteen farms that needed to prepare for a possible random inspection. The investments were significant for many of these farms. However, there were examples of quick returns on these investments (higher milk production after electrical upgrades). These investments were also a small fraction of the overall production costs for these larger farms. The results are to be published as a case-study in a peer reviewed journal. A revised manuscript is currently under review by AJIM.

Research Core

The New Surveillance Strategy for Farming and Forestry Injury Project

Continued exploration of these data sources has allowed for detailed understanding of the utility of each data source, separate and together. Data from Maine and New Hampshire have been coded using the Occupational Injury and Illness Classification System (OIICS). These cases are considered the 'gold standard' by which faster, electronic methods of identification and classification will be made. The continued use of multiple data sources is warranted, as no single data system currently captures the vast majority of agricultural and logging related injury.

The developments of easy to use info graphics are underway for both Maine and New Hampshire. These resources will then be distributed to stakeholders in each state, and to the broader agricultural and forestry workforce through social media and the NEC website.

Time-trend and seasonal variation analyses are ongoing, and cumulative incidence has been calculated using Census of Agriculture/American Community Survey population estimates as denominators. Future plans include use of the developed surveillance system to evaluate intervention programs, identify emerging issues in agriculture and forestry occupational health, and to incorporate expanded E-Codes in the ICD10 transition into surveillance efforts.

Beyond Maine and New Hampshire, data acquisition has varied from state to state, and the process of securing additional data continues. Recently, Connecticut data was made available to researchers. A manuscript summarizing the injury data from New Hampshire was published in the *Journal of Occupational and Environmental Medicine* (title: Developing surveillance methodology for agricultural and logging injury in New Hampshire). Other outcomes achieved or expected during the course of this project are the improved granularity in definition and description of events (through narrative fields on ambulance reports), a finalized keyword search algorithm, the ability to detect dispersion/trends in events through the use of control charts and the ability to summarize episodes of care, as well as distribution of payer information.



States in the Northeast that are participating in the multi-state surveillance effort are shaded in gray.

Musculoskeletal Disorder Rates in Northeast Lobster Fishermen

This surveillance research project is designed to improve the national surveillance of commercial fishing morbidity and mortality by seeking to understand a regionally important fishing industry, lobstering. NIOSH developed the surveillance program, in part, by using newly available total occupational exposure data mandated by the National Marine Fisheries Service within the National Oceanographic and Atmospheric Administration (NOAA). The lobster fishery, while economically important in the Northeast, is mainly regulated by states, rather than by the federal government. Consequently, the total occupational exposure of the lobster fishery was not available for computing comparable rates. Through this project, the NEC is fulfilling a national need for estimating injury and fatality rates of the lobster fishery which is unique to the Northeast region.

This four year prospective study will quantify work exposure (Full Time Equivalents; FTE) by specifically estimating the denominator population in man-hours, of the lobster-harvesting sector. In addition, the Nordic questionnaire is being used to measure the prevalence of musculoskeletal injuries and the body segment injured. Data are being collected by phone every three months from a cohort of 274 lobster boat captains. These phone surveys have allowed lobstermen to report any acute injuries over the previous months. Data have also been collected in face to face interviews, from captains and crew members, on an annual basis. Two hundred and seventy-one of the active subjects in the cohort have been interviewed face-to-face, as well as an additional 124 sternmen. In these interviews, researchers sought to quantify aches and pains that may be indicative of non-acute injuries and chronic musculoskeletal disorders. The face-to-face interviews were halted during the third year because of budget limitations.

Preliminary results support the hypothesis that the lobstering sector has a comparably low fatality rate, with specific body segments (wrist, hand, shoulder and back injuries) being associated with increased risk for injury. Data from the first two years indicate that the fatality rate was 49.6 fatalities/100,000 FTE. During this time, one fatality occurred in the Maine fleet in 2012. The overall incidence density rate for all reported injuries in the first two years was 49.7 per 100 FTE. The density drops to 15.0 per 100 FTE for those receiving treatment. While 13 of the 30 low-back injuries affected work, only two individuals received treatment. For wrist/hand injuries, 20 of 53 events affected work and 16 of these individuals did receive treatment.

Qualitative data has already offered a valuable glimpse into important health issues and community concerns. These are namely the lack of ergonomic advice or guidance in the health care system. These outcomes will inform future work in reducing outcomes of injury and illness for lobster fishermen. Preliminary study results have been disseminated at the Maine Fisherman's Forum in 2015, and two papers have been submitted for publication. Intervention ideas are already being developed. One is the subject of a current feasibility study, i.e. evaluation of the ergonomics of a foot operated lobster banding tool that is designed to reduce wrist and hand stress. Data have been collected on the changes in muscle activity and posture angles as a result of this tool and is currently being analyzed.

Intervention/Prevention Core

Farm Tractor Stability Systems

According to the NIOSH website, (<http://www.cdc.gov/niosh/topics/aginjury/>), the leading cause of occupational fatalities is tractor overturns. While rollover protective structures (ROPs) are extremely useful in preventing or reducing injury when a farm tractor rolls over, the project researchers are investigating the human factors and engineering issues associated with preventing farm tractor rear and side overturns in the first place.

To accomplish the project goals, the research team built a farm tractor simulator with a 6-axis motion base, a 360 degree visual display, and an 8000 series John Deere tractor cab. The motion system of the simulator has been enhanced with a mechanism which adds a seventh axis of motion. The simulator can now tilt the 1-ton tractor cabin to angles above 25 degrees in roll, an improvement over the 15-degree limit of the original system. This is a unique setup for vehicle driving simulators and key to studying rollover scenarios.

This simulator will be used to safely evaluate tractor operator behavior and perceptions when confronted with dangerous overturn or near-overturn scenarios. Furthermore, the researchers are developing a stability display system (tractor operator interface), for side overturn alert and prevention. The interface will be evaluated in the farm tractor simulator under large tilt and roll angles to determine the optimal type of information to give operators who are in danger of rolling their tractors, and the optimal placement and type of warning alerts. This interface will be developed to overcome human factor limitations, therefore visual, auditory, and haptic alerts will all be tested. The experiment will establish which system (or combination thereof: visual, haptic, auditory) are most effective for promoting safe tractor operation, as well as the best configuration for alert thresholds. Also, as part of this project, the researchers have evaluated tractor operator visual scan patterns in a natural setting to determine the best location to mount the interface. Finally, as a separate but related goal, the researchers will develop an active intervention system (i.e. power cutoff) to prevent rear overturn.

With the enhanced motion system, an experimental protocol was developed to test the operators' ability to perceive tractor tilt. Data collected during pilot-testing showed that subjects find it more difficult to estimate roll angles, compared to pitch, and that perceptual errors at large tilt angles can typically reach 4 degrees. These results have been presented at the SHWA Ragusa conference in September 2015. Based on this, a larger study will be conducted with 60 tractor operators in the fall of 2015.

A second experiment is currently under development for implementation in 2016. A virtual field environment is being constructed, along with dynamic models of tractor behavior, in order to have operators drive through various low- and high-risk rollover scenarios in a realistic simulation. This will be used to test the alert system developed at Penn State, which includes three components: one, a display showing current and past tilt angles of the tractor, with green/yellow/red indicators depending on rollover risk; two, a haptic alert through vibration of the steering wheel; three, an auditory warning. Data collection will begin during the fall of 2016. A state of the art manuscript review is also in progress.

Industry partnerships have also been pursued. John Deere has contributed to the project by donating a new tractor cab, which is in use on the simulator, and Volvo has invested \$100,000 in this research.

Social Marketing of Machinery Safety Shields

Machinery entanglement incidents are unfortunately a relatively common cause of farm fatalities and serious injury in the Northeast. Detailed fatality data for New York and Pennsylvania (representing 66% of the Northeast farm population) indicate that machinery entanglement fatalities are among the top three causes of death. Fortunately, the installation of power-take off (PTO) shielding can considerably reduce, if not eliminate, the risk of injury or death from PTO entanglements.

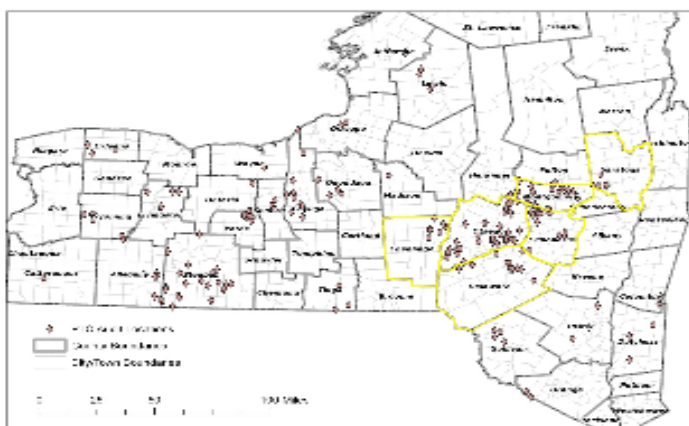
Using an intervention framework that has proven successful for increasing the installation of ROPS on unprotected tractors, project researchers have laid the groundwork for launching a PTO social-marketing campaign in New York. A telephone survey conducted during the first year of the project suggested that 90.2% of PTO drivelines in New York are adequately shielded. To assess the accuracy of this survey and confirm the proportion of adequately shielded PTO drivelines, a series of 211 on-farm audits were completed. Audits began at the end of year one, and were completed at the beginning of year two. In total, 1,470 implements were examined during these audits; only 57% of the PTO drivelines were adequately shielded.

In addition to on-farm audits, focus groups were conducted with New York farmers to identify favorable messages to be used in the social-marketing campaign. The three finalized messages are shown below. The six-month PTO shielding campaign ran from January 2015 through June 2015. This involved disseminating messages through two popular agricultural journals (*Country Folks* and *Farming*), Cooperative Extension offices, county Farm Bureaus, local dealerships, and mail and email blasts to farmers in the six-county intervention region (see below). Currently, the research team is working to reevaluate the 211 farms from which a baseline assessment was conducted.

Over the next year, follow-up and data analysis will be completed to determine the impact of the social marketing campaign on the target population. A manuscript detailing the outcomes of this intervention will be completed, as well.



Finalized Social Marketing messages for machinery safety shields (PTO).



Target area of New York State for dissemination of PTO social marketing messages outlined in yellow.

Education/Translation Core

On-Line Tool for Designing Ventilation Systems to Reduce Manure Pit Entry Risk

The appropriate design and installation of pit ventilation systems greatly reduces worker exposures to toxic and asphyxiating gases when entering manure pits. The on-line tool version 1.0 was launched on September 23, 2014 at <http://www.engr.psu.edu/ventilationdesign>. From 2014-2015, project staff worked on modifications and improvements to this online design tool. The tool now has modules for stand-alone manure pits, manure pits beneath tunnel-ventilated barns, manure pits beneath cross-ventilated barns, and manure pits beneath naturally ventilated barns. A seven session, six hour educational workshop, "Online Tool for Designing Ventilation Systems to Reduce manure Pit Entry Risk", was developed for potential

online tool users. The workshop was first presented on July 26, 2015 as a pre-meeting continuing education session at the American Society of Agricultural Engineers Annual International Meeting in New Orleans, LA. A technical presentation, “Enhanced Online CFD Tool Features for Ventilating Manure Pits”, was presented at the same International meeting. The authors of the workshop and technical presentation were: Harvey B. Manbeck (presenter), Daniel W. Hofstetter, Dennis J. Murphy, and Virendra M. Puri.

Future plans include recording the developed workshop and placing the sessions onto the website as an online-university course, as well as conducting webinar and additional live presentations of the developed workshop. Publicizing and marketing the online tool, with assistance from the Center, will also be a focus for year 5. In addition, a journal article on the online-tool features will be prepared during year 5.

Northeast Fisheries Winch Safety Improvement Project

The objectives of this study are to design a mechanical device to enhance safety and disseminate training on the use of this device to the fishing community. This study will employ social marketing protocols to share practical administrative controls/practice currently used in the fleet.

As previously reported, in order to describe common winch configurations utilized in the Northeast fishing industry, 45 captains were surveyed in the ports of Gloucester and New Bedford in Massachusetts, and Point Judith in Rhode Island. One hundred percent of those surveyed, had winches that were hydraulically powered. Of the 89% of survey respondents who reported having a PTO (shut-off switch) on board, 39% reported that these shut-off switches were more than one arm’s length away from the winch operator, thus prohibiting immediate winch shut-down in the event of an accident. The survey data showed that the hazardous manual level wind technique, found on 39% of the boats, is only used on those boats with a main-deck winch placement, not a pilot-house, deck placement. Because 90% of the captains reported that they do not employ hydraulic level winders (HLW) on their vessels, there seemed to be no clear need for a newly designed HLW.

After presenting schematic diagrams of hydraulic level winders and an emergency “crashbar” to two focus groups of trawler captains in early 2014, we hosted two more focus groups, one in Gloucester (Dec. 2014) and one in Point Judith (Nov 2014) to get additional feedback on these schematics and to test the level of interest in the devices. Trawler captains debated the pros and cons of the likelihood that they would install hydraulic level winders to replace manual winding operations or just make level winding more efficient. Even though the cost of one winder was estimated at \$2600-3200, several captains thought the cost-benefit ratio would not be favorable. However, on vessels currently employing a crew member to guide wire manually, the cost could be offset because a hydraulic level winder would free-up one crew member for other tasks, increase productivity and reduce the risk of entanglement. On the other hand, while the hydraulic level winder concept was not readily embraced in the initial survey, captains did note that an emergency shut off would likely be cost effective and easy to retrofit on boats with various deck configurations. Captains did see substantial benefit to having a shut-off device within an arm’s reach of the winch, which is how the pressure-sensitive crashbar would operate. In 2015, project staff contracted with a marine fabricator to design and build a full-scale prototype of the crashbar device, which will undergo a sea trial on a Point Judith trawler early in the fall of 2015.

Considerable effort was also dedicated to identifying three trawler captains in Gloucester and Point Judith who would agree to filming fishing trawler operations with and without a hydraulic level winder and finally with the installed, newly-designed emergency crashbar device. The contracts for filming these operations required that captains have additional liability insurance and life raft capability, immersion suits for all and included cost negotiation for fuel and crew expenses. A videographer has also been identified who has now produced two videos from the two completed fishing trips. A manuscript discussing the results of the survey of 45 captains from Gloucester, New Bedford, and Point Judith has been submitted to the SJPH. Project researchers attended and presented at the NEC retreat in Saratoga Springs in Sept 2014 and are also planning to exhibit the videos and the emergency crashbar device at the ComarExpo in New Bedford in 2016. A website has also been developed and can be found at <http://www.hsph.harvard.edu/northeastern-winch-safety-improvement-project/>.

Evaluation Core

Most noteworthy accomplishments for the Evaluation Core in 2014 - 15 include:

- 1) Economic analyses planning, such as the cost-analysis of the impact of the NY OSHA Local Emphasis Program, described in the Outreach section of this report.
- 2) Collaborating on the development of proposals for the next funding cycle.
- 3) Maintaining clear logic models for the NEC and individual R01 projects and tracking the progress of all Center projects (outputs, impacts, and progress relative to project timelines).
- 4) Evaluation of the Center's Annual Meeting of scientific and feasibility project investigators.
- 5) Measuring collaboration and relationships between and among center staff/administration and extramural partners via social network analysis (SNA).
- 6) Collaborating with the ECO groups from other AFF Centers on databases, research and evaluation methods and evaluation outputs.
- 7) Use of a risk/cost/impact/innovation rubric to profile NEC scientific projects and demonstrate their salience.
- 8) Structuring evaluation methods for all NEC Outreach efforts and programs.
- 9) Providing updates to scientific project PI's, the NEC administration and the Scientific Advisory Panel on all evaluation results and providing relevant recommendations for keeping projects and efforts on track.
- 10) Reaching out to Center project investigators to track and encourage the reporting of success stories (see **Table 2**).

In 2014, the NEC annual meeting was held on September 24-25, in Saratoga Springs, NY. Researchers from each of the six funded scientific projects and six of the feasibility projects were in attendance. Attendees presented their projects at a poster session on the evening of 9/24/14, and as brief oral presentations on 9/25/14. The oral presentation format was limited to five slides which served to summarize project activities, publications, outputs, outcomes and next steps for translating AFF research into practice (R2P). The R2P topic stimulated considerable discussion after each presentation and was very helpful for exploring R2P challenges.

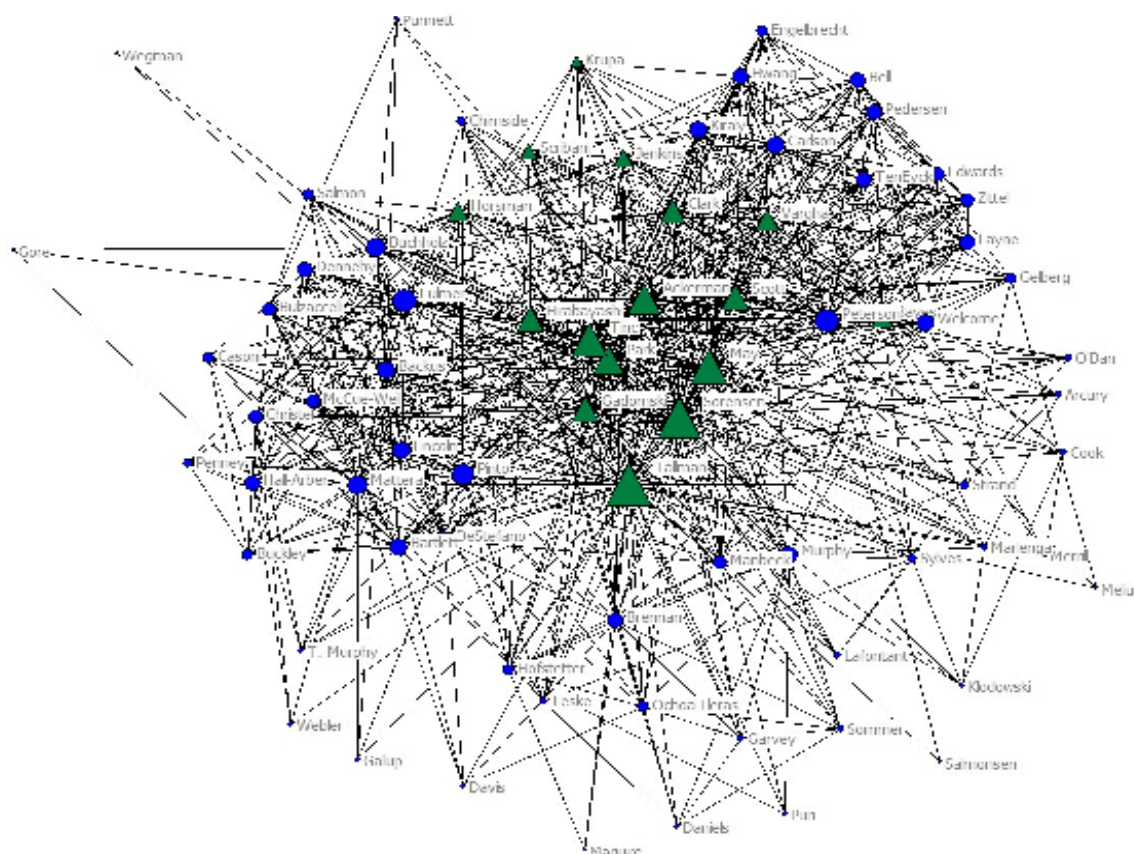
The evaluation team made the following recommendations following the Annual Meeting:

- NEC should continue to promote engineering solutions that account for human factors.
- NEC expertise in social marketing should continue to be used to increase adoption and implementation of injury prevention interventions.
- Establishing industry partnerships should continue to be a priority to also speed adoption and implementation of injury prevention interventions.
- NEC should continue to link surveillance results with the development of injury prevention interventions.
- Poster presentations are a helpful adjunct to annual meetings as they promote discussion and networking among the investigators.

- NEC's future emphasis on fishing and logging is well supported by the injury data as well as participants at this meeting.
- NEC should encourage collaboration between agriculture and fishing safety researchers to translate lessons learned from the agricultural sector to the fishing sector if possible. Examples include mitigation of toxic gas exposure in confined spaces and tractor / vessel stability.

For the 2015 Center SNA survey, an 85.7% response rate was achieved (66/77 subjects responded). Expansion of the roster included several advisors from the commercial fishing community. Compared to 2014, the 2015 sociogram depicting “any contact” (pictured below in **Figure 1**) has expanded further and has become more integrated. There were a total of 1,194 ties for any contact in 2015 as compared to 1,039 ties in 2014. An increase in the size of several nodes was observed, most notably among the fishing sector contacts, indicating a higher level of degree centrality for those nodes. This would suggest that contacts in the fishing sector are becoming more integrated within the network and are forming additional relationships over time. The network is moving towards the desired “wheel” or “circle” shape, as demonstrated in the map below. Compared to 2014, there appears to be a slight re-centralization of NEC nodes (green triangles) in 2015, perhaps a function of the preparation for the AFF funding renewal application. Continued expansion of the network may also necessitate more direct leadership by NEC until independent relationships are formed between extramural partners.

Figure 1. Social Network Map, NEC 2015.



In addition to annual SNA surveys, the following rubric (see **Table 1**), was developed by the evaluation core, which focuses on intermediate outcomes and has been updated to reflect developments in the past fiscal year.

Table 1. Risk/Cost/Impact/Innovation Rubric

	RISK	COST	IMPACT	INNOVATION
On-line Tool	Exposure to hydrogen sulfide*, CO ₂ , ammonia, explosive gases, and decreased O ₂ *(d/t increased use of gypsum). Risk posed to farmer as well as rescuer.	Multiple fatalities in one incident because rescuer succumbs. Prior software was expensive. Tool allows user to avoid site license fee. Cost associated with maintaining website.	Prior work published in 6 papers. ANSI/ABAE standard now moving online for manure pit ventilation. Website launched 9/23/14.	Hazard mitigation via pit ventilation. Allows end-user to access software at no cost. User friendly and adapted to work for just about any configuration. Could be adapted to fishing holds.
Lobstermen	Lobster line entanglement. Repetitive use injury of hand/wrist (carpal tunnel), back, shoulder and knee.	Wrist/hand, shoulder, back and knee MS injury are being documented.	Lobstermen are state licensed and not included in federal data.	Lobstermen not studied before. Work exposure is being measured. Validated Nordic MS Qu is used to measure injury.
Shields	Machinery entanglements d/t unshielded PTO can lead to amputations, and fatality - One of the top three causes of death on a farm	Amputations and fatality lead to lost farms and productivity. BareCo can offer shield at lower price.	Increase # of shielded PTO and decrease risk of injury. Pre and post shield installation photos. Several papers published, one on the reliability of shield-use self-reporting.	Use social marketing to encourage PTO shield use. Partner with local dealerships to provide information and make improved shields more widely available. Partner with shield manufacturers to address concerns raised by farmers about PTO shields.
Winch	Amputations, entanglements and fatality. Vessel instability or sinking. Large turnover of crew, large variety of boat designs. Winch location affects vessel stability.	Majority of boats do not have shut-off within arm's length. Paddle bar on top of winch drum to shut it off costs about \$2K. Cost analysis would be helpful.	Develop prototype for emergency stop that would reduce winch entanglement.	Multi-component prevention strategy (education, outreach, multiple shut off options, paddle bar) is needed and is being developed.
Surveillance	Data needed to assess risk and injury trends. E coding of external cause of injury or location codes or free text captures risk and injury data.	Using existing data is less costly than repeated surveys and can identify trends over time.	NIOSH interest. Outpatient data in ME added 17 cases to injury identification technique. Trending underway using existing data.	PCR data being used for injury surveillance. No changes required of data for process. Use for other types of injury: NH included. Translating this model for NIOSH State based OCC Health Surveillance.
Tractor Stability	300,000 tractors in use. 100 deaths/year. 3x shorter life for each hour of tractor use. Rear and side overturn.	\$2.5 million estimate per death. \$100 per tractor tilt detector. OEM buy in will lead to large cost savings. Industry investment (Volvo) made in 2014.	Driver alerting system for side overturn. Rear overturn prevention by mechanical intervention.	Tractor driving simulator –tilt cab. Use existing eye and face tracking technology on tractors.

Table 2. NEC Success Stories and Impact

Shields	The NEC identified a new type of PTO guard and has been working with manufacturers to broaden distribution to farmers in the NE. In addition, the research team has developed several message concepts that have been tested with local farmers. The research group has been able to identify the barriers and motivators to PTO shield use, as well as the [lack of] differences in shielding behaviors between commodity and demographic groups. The research team is preparing to submit a grant to strengthen and enhance this study.
Winch	The characterization of operations involving drum winches provides a new, systematic approach to drum winch and wire handling hazards. This approach incorporates data about drum winch placement, types of hydraulic control valves, availability and access to emergency shutoffs and methods for ensuring a level wind on the drum winch.
Surveillance	New Hampshire plans to use NEC surveillance methods for piloting ways to ID occupational injury in their PCR data. Data summaries are being developed for different states that can be distributed to workers, stakeholders and other researchers. In this way, data can drive AFF safety and health efforts to priority occupational health and safety issues.
Tractor Stability	Photo and video of simulator has been developed (see photo below). Researchers expect to start subject testing very soon and should be able to get useful photos and video for the next report.
On-line Tool	Agricultural engineers, manure facilities planners, ag safety specialists, and safety regulators now have simple and cost effective access to an on-line simulation tool that helps them assess the effectiveness of manure pit ventilation strategies to remove toxic and asphyxiating gases from confined space manure storages prior to entry. The on-line tool also allows users to evaluate the impact of manure pit ventilation upon air quality in the animal housing space above slotted floor covered manure pits during pit ventilation.
Lobstermen	Preliminary results have indicated that the overall lobstering effort in the Northeast would rank high among all US fisheries, and the coincidental mortality rate would rank low. These results can help inform NIOSH and interested occupational health researchers about comparable outcome rates in general, and about the likely relative impact of potential fishery specific interventions.



Feasibility Studies

Four one-year feasibility studies were awarded in September 2014. One of the awardees from Virginia Tech has developed a free application for smart phones to be utilized as a tool to record and practice safety drills. The app continues to be improved and promotion is planned through various channels across the country (AMSEA, Maine Fisherman's Forum, etc) <https://itunes.apple.com/us/app/fvdrills/id597745204?mt=8>. Future plans include translation of the app into several languages, including Vietnamese. A second awardee, from Fishing Partnership Support Services, based in Burlington MA, conducted in-depth interviews with owners of fishing vessels in the Northeast. These interviews assessed the owners' attitudes surrounding a newly developed hatch monitoring system, and helped to determine the level of interest and feasibility in installing such systems on NE fishing vessels. Researchers also assessed the owners' interest in adopting a worksite safety and health program for their crew. Analysis of the interview data is complete, and FPSS's Director of Evaluation is finalizing a report of the findings, anticipating that it will be ready for review by September 30. The third study is focused on the development and testing of a new lobster-claw, banding tool to be used in the Northeast lobster fishery. Several prototypes of devices are being tested using electromyography to assess muscle labor load with the new tools compared to the traditional lobster banding tool. In addition, qualitative data on comfort and preference of the tools will be assessed. The final project focused on the development and sustainment of a national network of partners (the National Tractor Safety Coalition, or NTSC) to facilitate the establishment of a national ROPS program. This project utilized task force groups, a steering committee, web-tools, newsletters, and media channels to promote continued collaboration of safety partners in support of the national initiative.

One feasibility study was also awarded in March of 2015. This funding will support a Fishing Partnership Support Services Future Search meeting, which will gather approximately 80 leaders in healthcare, government, public relations, non-profit advocacy, and the fishing industry in October 2015. The purpose of this 3-day meeting is to create a shared vision, commitment, and action plan to improve the overall health of commercial fishing communities': physical, psychological, behavioral, and financial. The event will generate a strategic plan for launching a multi-year intervention program aimed at improving health in these four domains. The interventions will be evaluated for impact and effectiveness in collaboration with the NEC.

Other NEC-Related Activities

Though not supported as part of the 2011-2016 NEC funding, two additional NIOSH funded projects are functioning as part of the overall NEC initiative and should be mentioned to provide an expansive view of NEC efforts.

Use of personal flotation devices by Northeast Fishermen

NEC, in partnership with Fishing Partnership Support Services, conducted a study in 2015/2015 to explore perspectives of Northeast commercial lobstermen regarding the use of personal flotation devices (PFDs) (98% participation rate). Researchers sought to identify factors contributing to low PFD-use, and motivators that could lead to increased use of PFDs. The results showed substantial barriers to PFD use. Fishermen described themselves as being proactive about safety whenever possible, but described a longstanding tradition of not wearing PFDs. Key factors integrally linked with the lack of PFD use were: workability, identity/social stigma and risk diffusion. Future safety interventions will need to address significant barriers to PFD use that include issues of comfort and ease of use, as well as social acceptability of PFDs and reorientation of risk perceptions related to falls overboard.

National ROPS Rebate Program (U01)

In September of 2015, the NEC was awarded a U01 to build on the National Tractor Safety Coalition (NTSC) efforts to launch a National ROPS Rebate Program. NTSC stakeholders will be working on different task force groups to identify funding for a national program, address manufacturing concerns related to retrofitting tractors, and further develop the structure of the program. Several fundraising and education documents have been developed and coalition members have presented and networked at numerous

conferences and meetings. Media reports have also been disseminated highlighting the key components of the program and these have generated interest in both the farm and stakeholder community. In addition to these NTSC member activities, the NEC will implement ROPS Rebate Programs in high-risk states and will set the stage for national expansion. One paper was published during this time (Tinc et al., “Creating a national coalition to address tractor overturn fatalities”) and another was provisionally accepted (Tinc et al., “Implementing a national tractor safety program: using ‘whole system in a room’ to mobilize partners and implement solutions”).

Table 3. Scientific Project Outputs and Intermediate Outcomes

Project	Outputs	Outcomes
On-line Tool	Demonstration of on-line simulator tool; User inputs any manure pit configuration on windows-based platform. Alpha and beta testing completed. Trainer's manual available. User's manual is on website. Presented at the 2014 ASABE conference.	Online tool launched 9/23/14. Papers published: Murphy, D.J, Manbeck HB. Confined Space Manure Storage and Facilities Safety Assessment. <i>Journal of Agricultural Safety and Health</i> .
Lobstermen	Most important are the estimates of exposure, i.e. FTEs. Have learned that FTE in ME is 2180 compared to 1502 in MA. Also MS injury. Wrist and hand injuries were the most frequently reported among the cohort, with cuts compromising the majority of these injuries.	<i>Short term:</i> Estimate total occupational exposure and occupationally-related musculo-skeletal morbidity for lobstering. Produce fatality rates for on-shore lobstermen in ME/MA <i>Long term:</i> Knowledge of injury and fatality rates in lobster population; potential for prevention. The relationship between work and injury outcome will be clarified. Begin to explore specific intervention ideas based on likely impact and likely success, e.g. foot operated lobster-banding tool. Re-examine process of hauling in lobster.
Shields	Worked with professional advisory board; established inaccuracy of telephone survey to determine shielding rates; conducted farm audits (n=211) in NYS only to look at 1,500 implements in order to identify shielding rate (57% PTO shielded by audit vs. 95% shielded by phone survey). Identified barriers to shielding, identified the “ideal shield” through BareCo. Identified appropriate social marketing messages via focus group discussions. Campaign launches in six county region of NYS. Follow-up audits planned.	BareCo PTO shield testing - \$60 each Three papers completed: Chapel et.al. “Validation of self-reported power take-off shielding and comparisons of shielding for various farm implements using on-site farm audits.” Weil et.al “It's tough to tie your shoes while you're walking.” A qualitative analysis of power take-off driveline shields: Barriers and motivators for shield use for New York State farmers”. Tinc et al “Concept Identification for a Power Take-Off Shielding Campaign” 2014 ISASH and SHARPS presentations. Social marketing messages finalized (three messages) for dissemination.
Winch	Completed qualitative study of 54 captains which is a baseline survey to identify barriers to intervention (cost, placement and diversity of winch equipment). Majority of all boats had PTO switches. A winch on top of pilot house is a stability hazard. Manual level wind technique is used when winch is located on mid deck.	Article published in Commercial Fisheries News. Backus, A. Winch safety study identifies crew hazards. January 2014 and Winch safety study identifies emergency shutdowns.
Tractor Stability	Study of roll and pitch perception and risky behavior using a tractor-driving simulator. Use alert system for side-overturn prevention. Use power cutoff to prevent rear overturn.	IEEE, ASABE 2014 abstract. Open source software. 360 degree tractor driving simulator. \$100 tilt detector. Open access to share development idea led to industry partnership with Volvo research and development.
Surveillance	Data received from ME, NH, NY, NJ (death data). Active requests in VT, MD, NJ (EMS/hospital). Case matching complete in ME and NH between EMS and hospital data. Sensitivity/specificity/ positive predictive power of farm location check-box, identification of common cases between various data sources.	First paper published in Agromedicine. One accepted provisionally Agromedicine. Presented study design and preliminary results at APHA meeting Nov 2013. Established collaborative relationships with various state agencies. Sharing surveillance methodology with other agencies. Developed multiplier to correct observed inj. rates.

Table 4. Cumulative Dissemination of NEC Project Results

Category	Details
Published Papers	<u>Shields Project:</u> Tinc PJ, Madden E, Park S, Weil R, and Sorensen JA. Concept identification for a power take-off shielding campaign. <i>J Agromed</i> 2015; 20: 55-63. Chapel D, Sorensen JA, Tinc PJ, Fiske T, Wyckoff S, Mellors PW, and Jenkins PL. Validation of self-reported power take-off shielding using on-site farm audits. <i>J Agric Safety and Health</i> 2015; 21(2): 95-104. <u>Surveillance Project:</u> Scott, E. E., Hirabayashi, L., Krupa, N. L., Sorensen, J. A., & Jenkins, P. L. (2015). Developing Surveillance Methodology for Agricultural and Logging Injury in New Hampshire Using Electronic Administrative Data Sets. <i>J Occup Environ Med</i>, 57(8), 866-872. Scott, E. E., Krupa, N. L., Horsman, M., & Jenkins, P. L. (2015). Estimation of agricultural and logging injury incidence in Maine using electronic administrative data sets. <i>J Agromedicine</i>, 20(2), 195-204. <u>National ROPS Effort Project:</u> Tinc PJ, Ayers PD, May JJ, Purschwitz MA, and Sorensen JA. Creating a national coalition to address tractor overturn fatalities. <i>J Agric Safety and Health</i> 2015; 21(2): 105-112. <u>Multi-state ROPS:</u> Hard, D., McKenzie, E. A., Cantis, D., May, J., Sorensen, J., Wyckoff, S., . . . Maass, J. (2015). A Demonstration Project in New York and Virginia: Retrofitting Cost-Effective Roll-over Protective Structures (CROPS) on Tractors. <i>J Agric Safety and Health</i>, 21(3): 173-185. <u>Other:</u> Earle-Richardson, G., Scribani, M., Scott, E., May, J., & Jenkins, P. (2014). A Comparison of Health, Health Behavior, and Access Between Farm and Nonfarm Populations in Rural New York State. <i>J Rural Health</i>. 1-8.
Articles	<u>Fishing Safety</u> Backus A. Mar. 2015. A float plan and other documents to aid in event of search and rescue. <i>Commercial Fisheries News</i>. 42(7):28 Backus A. Mar. 2015. Think about ice before you head out. <i>Landings</i>, 23(3):15 Backus A. Jan. 2015 Reducing Risk: Icing by the numbers. <i>Commercial Fisheries News</i>. 42(5):19.
Papers in Progress	<u>Fishing</u> Fulmer, S., Buchholz, B., Scribani, M.B., Jenkins, P. Musculoskeletal Disorders in Northeast Lobstermen. <i>Am J Ind Med</i>. In process. Fulmer S, Buchholz B, Jenkins P and Scribani M. Work-time Exposure and Acute Injuries in Northeast Lobstermen. <i>J. Agromedicine</i>. In process. <u>LEP</u> Gadomski, A., Vargha, M., Tallman, N., Scribani, M.B., Kelsey, The Impact of preparing for OSHA Local Emphasis Program inspections of New York dairy farms: case studies and financial cost analysis. <i>Accepted. Am J Ind Med</i>. In process. <u>PFD</u> Weil, R., Pinto, K., Lincoln, J., Hall-Arber, M., Sorensen, J. The Use of Personal Flotation Devices in the Northeast Lobster Fishing Industry: An Examination of the Decision-Making Process. <i>Accepted. Am J Ind Med</i>. (n process). <u>National ROPS Initiative:</u> Tinc PJ, Ayers PD, May JJ, Purschwitz MA, Park S, Bayes B, Sorensen JA. Implementing a national tractor safety program: using "whole system in a room" to mobilize partners and implement solutions. Provisionally accepted, revised. <i>J Agromedicine</i> 2015. <u>Tractor Stability Project:</u> State of art review in progress. 2014.
Projected Publications and Deliverables	<u>Online Tool Project:</u> On-Line Simulation Package for Designing Ventilation Systems for Confined-Space Manure Pits 2014. http://www.engr.psu.edu/ventilationdesign Standards: Revision of ANSI/ASABE 607, Ventilating Manure Pits to Reduce Entry Risk (2015-2016). Extension Publications: Users Manual for Designing Manure Pit Ventilation System using SWFS (Q2, 2014). Extension Fact Sheets (Q4, 2014).
Presentations	<u>Evaluation Core:</u> Scribani M, Gadomski A, Tallman N, May J. Measuring collaboration: A social network analysis. American Evaluation Association Annual meeting, in Washington, D.C. 10/18/13.

	<u>Online Tool Project:</u> Manbeck HB et al. Online Tool for Designing Ventilation Systems to Reduce manure Pit Entry Risk. Presented at the ASAE Conference. New Orleans, LA, 7/26/15. Manbeck HB et al. Enhanced Online CFD Tool Features for Ventilating Manure Pits. Presented at the ASAE Conference, New Orleans, LA. 7/26/15. <u>OSHA Farm Inspection</u> Vargha, MB . Farm Inspection Preparation. ISASH, Normal, IL. 6/24/15. <u>Surveillance Project:</u> Scott E. Establishing a Surveillance System for Traumatic Agricultural and Forestry Injury in the Northeast US. SHARP. Saskatoon, Canada. 10/14. Scott E. New Surveillance Strategies for Farming and Forestry Injury. Columbia University. 4/ 15. Scott E. Alternative Sources of Injury Data..Occupational Health Surveillance Meeting. Chester, CT. 5/15. Scott E. Comparing Computer Coding of OIICS against a Visual "Gold Standard" for Farming and Forestry Injury. CSTE. Boston 6/15. <u>Shields Project (planned presentation):</u> Tinc PJ. Social Marketing of Power Take-Off Shields. 2014 International Society for Agricultural Safety and Health (ISASH) Conference. 6/22-26/2014, Omaha, Nebraska. Sorensen JA. "It's Tough to Tie Your Shoes While You're Walking" A Qualitative Analysis of Power Take-Off Driveline Shields: Barriers and Motivators to Shield Use for NY Farmers. 2014 Safety and Health in Rural Populations (SHARP) Conference. 10/14, Saskatoon, Canada. <u>National ROPS Initiative:</u> Tinc PJ, Hirabayashi L. Poster presentation abstract accepted for the American Public Health Association Annual Conference, 10/31/2015-11/4/2015, Chicago, Illinois. Sorensen, JA. Whole System in a Room: A Dynamic, Multi-Stakeholder, Collaboration Process to Develop a National Tractor Safety Initiative. Agrisafe Webinar. September, 2014. Sorensen, JA. Whole Translating Research into Practice, ROPS Programs: A Translational Research Case Study. Bassett Grand Rounds. Cooperstown, NY. September 2014. <u>Injury and Health</u> Sorensen, JA. ROPS Programs: A Campaign to Address the Most Frequent Cause of Farm Death. (Part of a one day R2P Symposium). NIOSH Total Worker Health Conference. Bethesda, MD. October, 2014. Sorensen, JA. Qualitative Approaches in Injury Research. Columbia University Injury Course Lecture. New York, NY. April, 2015. Sorensen, JA. r2p in the Agricultural Sector. r2p in Construction Conference: Science, Strategies & Partnerships to Advance Safety & Health. Silver Springs, MD. June, 2015. <u>Tractor Stability:</u> Daniels J, Garvey P, Murphy DJ, Sommer HJ, Brennan S, Ochoa Lleras N, Brown AA. GoPro Filming of Driver Behavior While Operating Farm Tractors. 2014 ASABE Annual International Meeting. Ochoa Lleras N, Brown AA, Brennan S, Garvey P, Sommer HJ, Murphy DJ. Development of an open-source Immersive Tractor Driving Simulator. 2014 ASABE Annual International Meeting. Swanson KS, Brown AA, Brennan S, LaJambe C. Extending Driving Simulator Capabilities Toward Hardware-in-the-Loop Testbeds and Remote Vehicle Interfaces. 2013 IEEE Intelligent Vehicles Symposium Workshops. Swanson KS, Brown AA, Brennan S, LaJambe C. Extending Driving Simulator Capabilities Toward Hardware-In-The-Loop Testbeds and Remote Vehicle Interfaces. IEEE IV 2013 Environment Perception and Navigation for Intelligent Vehicles, 6/23/13, Gold Coast, Australia. <u>Lobstermen Project:</u> Fulmer S. Preliminary analysis presented at the bi-annual UMass-UConn OCC Health Symposium in May, 2013. Fulmer S. Ergonomic hazards in lobster fishing. ME Fishermen's Forum. March 2015.
Media Coverage	<u>Online Tool:</u> Telephone interviews and one live interview with media outlets including newspapers and NPR.