

Design and Develop of a Mechanism to Minimize Musculoskeletal Stress on Crawfish Farmers

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Abstract

The purpose of this project was to invent a tool to be mounted to the crawfish boat that will raise the trap out of the water for the farmers eliminating strain on the farmers' bodies. In turn, lowering their musculoskeletal symptoms will also lower risks of injuries while harvesting crawfish for young and older farmers. Also, by minimizing musculoskeletal symptoms with the use of this mechanism the impact on the farmers' psychological health will be reduced. The social and economic health of the farmers will benefit as well.

Introduction

Many residents in Louisiana choose the occupation of farming crawfish. The harvesting process is strenuous. The repetitive motions of leaning over to grab the trap, picking up the trap, dumping the trap, baiting the trap, and setting the trap back in the water all happen in less than thirty seconds²¹. To produce enough crawfish to go to market, a farmer may perform this sequence of tasks over and over for up to twelve hours a day on three to four days a week¹⁵. Over time this stress on the farmers' bodies leads to pain in their backs, arms, and shoulders. These ailments are considered musculoskeletal symptoms, MSS²⁶. Devices have been designed to make the crawfish harvesting process more efficient and less strenuous on the farmers. Some of these devices that do not require traps or bait show great potential but are not economical and have technical problems that need to be addressed²⁴. There are several patents for crawfish harvesting systems, but none of them incorporate the current equipment being used^{3,4,7,10,11,20}. The development of a device that is an accessory to the farmers' current equipment that is easy to install and operate would be more economical than purchasing a whole new harvesting system.

Methods

Research and design were conducted on the following to incorporate a design that melds with the existing tools and processes. The design had to be easy to operate minimizing the learning curve so

farmers could quickly use the mechanism efficiently. The farmers would need to see a quick return on their investments like a reduction in soreness that is currently felt daily. The assembly to their boats needed to be simple so they do not have to modify their existing equipment too much. Simple mechanical parts with no hydraulic, pneumatic, or electronic components minimized break down issues of the mechanism. The material required for the mechanism had to be light weight not to add too much extra weight in the boat which could cause unnecessary wear and tear on the boats' motors and to the ponds. Extra weight in the boat would cause deeper ruts in the ponds and in turn cost the farmer more money after the season to rework his pond⁶. The material also could not cause damage to the traps. The mechanism needed to mount and operate in a way that would not be intrusive to the farmers' work of emptying the trap, rebaiting it, and replacing it into the water. The design process included research, interviews, analyzing concepts to determine the best design, building and testing the prototype, and analyzing data collected.



Figure 1. Trap Lifter on Boat

Design Testing and Data Analyses

To narrow down to the best design concept, the researcher used the Pugh Chart Method. The researcher also analyzed the usefulness of the design by referring to MSS injuries resulting in lost workdays in Louisiana in the years from 2003 – 2017¹⁴. Annual reports of crawfish acreage and number of farmers in Louisiana published by Louisiana State University Agriculture Center show that most farmers can harvest their acreage alone with the right equipment⁵.

Summary and Conclusions

The completion of this design with the use of the Pugh Chart, robust design experiment, and the advice from Mr. Hipp proved that a torsion spring was not needed due to the light loads being raised nor will a new universal cap for the traps need to be designed and manufactured¹². The best location for the mechanism is closest to the harvester attached to the gunnel of the boat. It is intended to act as an extension of the farmers' arms and hands. The final prototype design meets and exceeds the design criteria laid out at the commencement of this project while reducing MSS in crawfish farmers by eliminating the pull-back felt by their arms and backs when grabbing the traps by hand. Using this mechanism lowers the risk for MSS injuries that could lead to lost workdays and in turn lost dollars. The potential minimum lost dollars are twice the cost of the mechanism which is only \$650.00 with maximum potential lost dollars reaching over \$19,000 in 2017. The researcher has developed a mechanism that will minimize musculoskeletal stress on crawfish farmers.

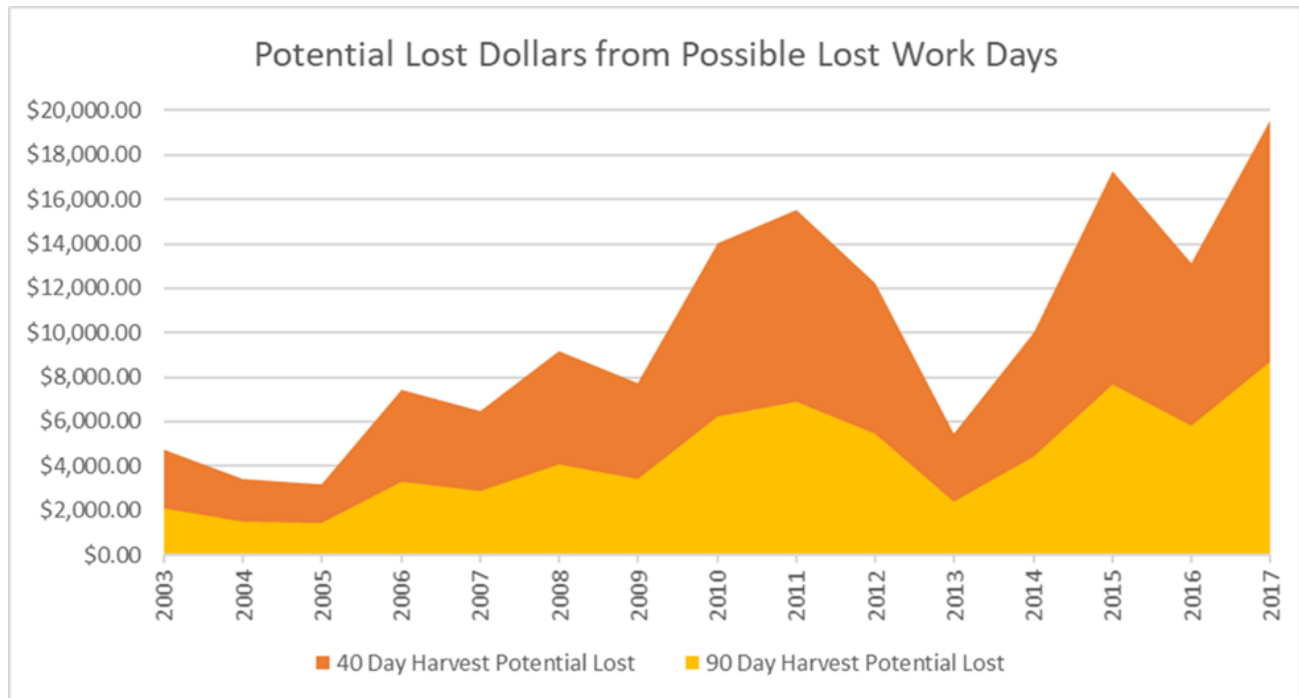


Figure 2. Illustration of Potential Lost Dollars

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