Problem Statement

Within the Gulf of Mexico, there is an inherent need for the mechanization of an oyster drying system that is used to control biofouling during the growing season. Oyster drying is the process of exposing growing oysters to ambient air for a time period of 24 hours per week in order to minimize biofouling. Biofouling is the growth of biotic matter that inhibits the growth of the oyster by a parasitic relationship between barnacles and biotic matter in an ocean environment. This project aspires to mechanize the current, manual drying process into a control system that will improve quality and quantity of the oyster yield. In addition, the design aims to reduce the overall cost of oyster production through reduction of manual labor hours performed by Murder Point Oyster Company. The design of a mechanized lifting system for the suspended oyster cages along a 100 yard cable line into the Gulf of Mexico will comply with recognized constraints such as existing equipment and a 5 foot ocean depth with minimal tidal movement.

Objectives

I. Provide a design to mechanize the drying of oysters that accommodates severe storm events within the Gulf of Mexico
II. Design will adhere to the client’s budget of $1000
III. Design will include a parts list and will operate from the boat in order to reduce time and labor costs

Site Location

Client: Lane Zirlott
Location: Coden, Alabama
Company: Murder Point Oysters

The oyster farm is located approximately 100 yards off shore in a saline environment. Travel time from dock to the farm site is approximately half an hour. Within the farm, there are two acres of available space. The site possesses a potential for expansion.

Operation Procedures

In order to reduce the number of manual labor hours required to accomplish adequate drying in the adjustable long line oyster system, an electric-powered crane system will be installed on Murder Point Oyster Company's vessel. This system will include a Vestil WTJ-4-G Crane, Badlands Electric Winch, and the manufacturing of a stainless steel mechanism that can reach the oyster lines from the boat. When assembled, the electric winch will be mounted to the crane, and the crane will lift and drop the grab hook mechanism in order to secure four oyster lines simultaneously. Each line will then be guided into existing clips by a crew member in the ocean. This system will be powered by an existing generator located on the roof of the vessel’s cabin.

When not in use, the generator is to be powered off. The winch is to be left in the neutral position, and the grab hook mechanism should be stored on the boat. The crane should be left in a position so the arm does not reach over the side of the vessel. This protocol is to be taken into account to maintain a safe environment for operation, as the designed system introduces operation hazards to the crew of the vessel if caution is not exercised.

Analysis

The simulated crane was designed to emulate a lap joint design with the bolt group acquired from the specifications of the selected crane. Finite Element Analysis was conducted in order to simulate prying force and axial loading on the bolts utilized within the lap joint. A 1¼” extra heavy duty locking helical washer, hex flange screw and hex flange nut were utilized for the bolt simulation. Moments were applied at the end of the simulated crane as well as parallel axis loading placed along the length of the extension of the crane. The mounting was determined to be adequate and well within design specifications for the boat.

Cost Estimate

<table>
<thead>
<tr>
<th>Design Components</th>
<th>Number of Units</th>
<th>Price per Unit</th>
<th>Shipping per Unit</th>
<th>Total Cost per Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vestil Crane Model WTJ-4-G</td>
<td>1</td>
<td>$346.86</td>
<td>$0.00</td>
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<td>120v Badlands Electric Winch</td>
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</table>

Total Design Cost: $899.86

**assumes all installation and installation supplies will be supplied by client

Conclusion

The mechanization of oyster drying in the Gulf of Mexico will save time, money, and labor involved with the current manual process. Economic analysis shows this system will be feasible for the client, Lane Zirlott, and profitable over the design life cycle of ten years. Murder Point Oyster Company will see a payback by reduction of labor hours up to ¼ in as little as a year. If the safety recommendations are followed, no harm will come to the crew or the surrounding habitat as a result of the implementation of the design.

Acknowledgements

Dr. Mark Dougherty – Associate Professor, Biosystems Engineering
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Lane Zirlott – Client, Murder Point Oyster Company