DEPARTMENT OF MECHANICAL ENGINEERING

Motivation, Goal, Impact

- Oyster shucking requires skilled, time intensive labor causing workforce shortages and production restrictions
- Design an automated system with the capability to shuck and detach oyster meat from the shell without compromising quality
- Automate the process to increase production time of skilled workers



Requirements

- 1. Confine the oyster



Example of manual oyster shucking operations at Harris Seafood.

Design Calculations & Decisions Adductor Measurements Press Force Testing



Performed directly on the hinge of 10 oysters. The results provided the average force to crack an oyster is 876 lbf with a max of 1,386 lbf. The press cracking the oyster is designed to meet max force specifications.





Displacement analysis using the max strength of 1320 lbf on carbon steel. Max displacement was negligible at 0.001502 inches, with little stress.



ENME - D4 - Mother Shuckers Automated Oyster Shucking Machine

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2. Crack the oyster shell open 3. Release the adductor muscle from the oyster shell 4. Maintain quality of meat 5. Shuck oysters ranging from three to six inches in size

Example of split oyster shell anatomy.





-----> Adductor Diamete -----> Horizontal Distance Vertical Distance

Measured 70 Chesapeake Bay oysters based on the diagram to the left. These measurements were used for jig design, programming, and drill bit selection.



• Vertical distance increases by 0.16 inches per 0.25 inch increase in oyster size. Adductor has a max diameter of 1 inch • Horizontal distance has an average of 0.385 inches with a standard deviation of 0.133 inches





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Final Design

Jig designed to confine the oyster for drilling and cracking.



Electronic wiring diagram to control linear actuators and drill. Actuators are ran by DC power and drill is ran by AC power.

Complete machine design with oyster press, drill, jig, and framing.

Prototype & Test Results

Prototype

Assembled oyster shucking machine prototype.



Electronics system prototype compatible with Arduino coding system.

Test Results

- Jig confines and holds various sizes of oysters between three and six inches
- Press cracks oysters at the hinge without crushing the shell
- Drills accurately sized holes through oyster shells and oyster meat without resistance
- Occasional inaccuracies in adductor muscle locations; multiple jigs will be manufactured per 0.25 inch size difference
- Framing will need a higher degree of manufacturing





