BACKLINE CLEANING DEVICE FOR MUSSEL FISHING IN PRINCE EDWARD ISLAND

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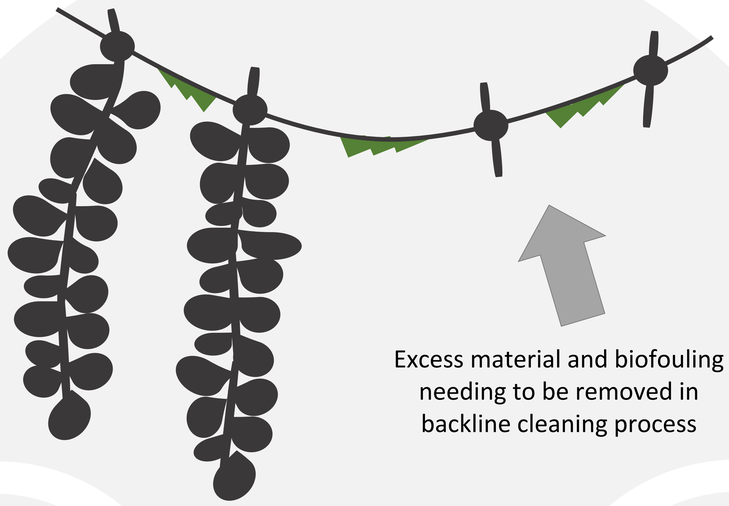
PROJECT OVERVIEW

Project Background
- Mussel harvesting is very commonly observed in bays around PEI.
- Consists of long lines of rope suspended in the water with “socks” tied on that hang vertically and contain small mussel seeds.
- Working with Atlantic Aqua Farms to develop a device that improves the efficiency of the backline cleaning process during mussel harvesting
- Currently use a bread knife to remove the excess socking material that remains after harvesting.

Problem Statement
- Tasked with designing a device that completely cleans off backline while catching all debris, maintaining its integrity and the safety of the user.

Requirements
- Safety, User-Friendly, Time, Maintenance, Cost Efficiency, Backline Protection, Ocean Protection, Weather Pliancy, Functionality, Physical Durability

Constraints
- Cost, Timeline, Adaptability



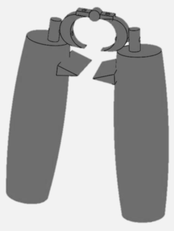
Excess material and biofouling needing to be removed in backline cleaning process

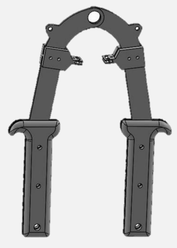
IDEATION

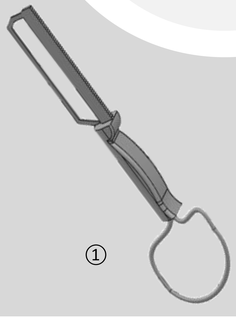
Preliminary Ideas
- Three main types of devices were explored:

1) Knife with replaceable blade and floating capabilities.
2) Forearm Squeezer that easy slips over backline and pinches together for cleaning to minimize deckhands’ efforts.
3) Push Conical Shaped Device that glides around backline with enclosed moving blades and easily expands to bypass selected areas.

Refined Idea
- Selected device was the forearm squeezer which ranked highest in decision matrix that outlined all requirements and constraints.
- Featured stainless steel blades, a metal frame, 3D printed handles and bracing components for blades. Additionally involved a tension spring and binding barrel for the point of rotation.







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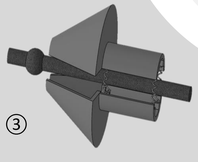

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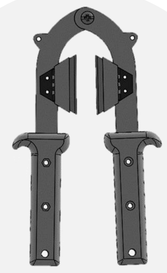
ANALYSIS

Dimensions
- Dimensions for this device were selected to accommodate for functionality and comfort for the user [1].
  - Bolt holes in the handle were positioned to ensure a secure fix to the mainframe.
  - Blade braces were dimensioned to ensure slight overlap upon closure of the device.

Cost
- Annual labour savings of around $42720.00 when cleaning process reduced to 20 minutes per line.
  - Annual material savings of around $3146.24 with an estimated annual maintenance cost of $200.00.

Human Factors [1]
- Weigh less than 5 lbs.
- Separation distance of 3 in for max power grip
- Handle height of 4.5 inches for hand comfort.

IMPLEMENTATION



Testing
- Buoyancy: Device (weighing 283 g) was suspended in a body of water with various attachments.
- Handle shape: Device was held by various individuals with and without gloves for comfort and versatility.
- Spring stiffness: experimented with various springs for optimal performance.
- Blade Placement: Angles and positioning of the blades was altered for effectiveness.

Design Modifications and Final Recommendations
- A working prototype was not fabricated, but provided the following recommendations to modify the design, it has been accepted.
  - Incorporate safety wrist strap to avoid misplacement of device but can quickly detach to prevent injury.
- Change material to aluminum and incorporate cutouts in areas of low stress to reduce weight.
- Adjust the blade placement from horizontal to vertical.

ACKNOWLEDGMENTS

- Atlantic Aqua Farms, Jeff Nelson
- Sandy Doucette, Jeff Bowser, Wayne Simmons, Aitazaz Farooque

REFERENCES

[1] Canadian Centre for Occupational Health, “(none),” *Canadian Centre for Occupational Health and Safety*, https://www.ccohs.ca/oshanswers/ergonomics/handtools/tooldesign.html. Accessed 28 March 2020.