Pacific Northwest
NATIONAL LABORATORY

Using marine energy in oyster farming operations: an assessment of opportunities

C. Briggs and M. Grear

umerc
University Marine Energy Research Community

+ METS
MARINE ENERGY TECHNOLOGY SYMPOSIUM

U.S. DEPARTMENT OF ENERGY BATTELLE
PNNL is operated by Battelle for the U.S. Department of Energy

Background

- Oysters are keystone species
  - Play these same important roles when farmed as well [1]
- Farmed oysters are run through a machine called a ‘tumbler’
  - Tumbler cleans and shapes the oyster
  - Often diesel powered

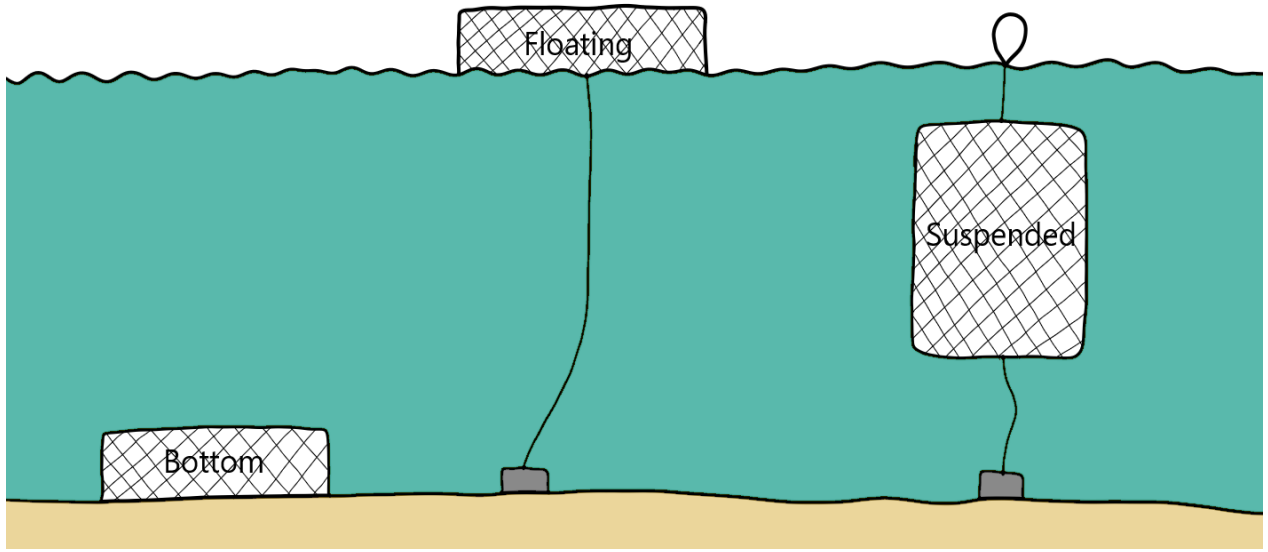

https://i.ytimg.com/vi/qDwti69d0s0/maxresdefault.jpg


https://hamahamaoysters.com/blogs/oyster-blog/how-we-farm-tumbled-oysters

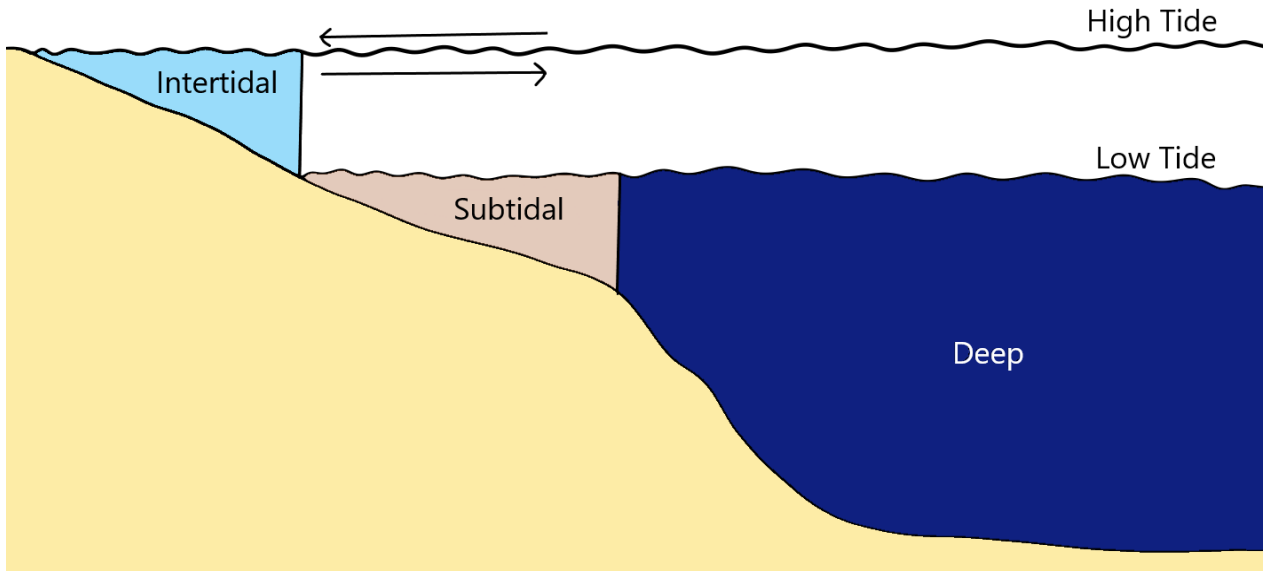

https://cboysterco.com/farm-photos/f/oyster-tumbling

Oyster Farming Equipment Types and Zones

Equipment Types



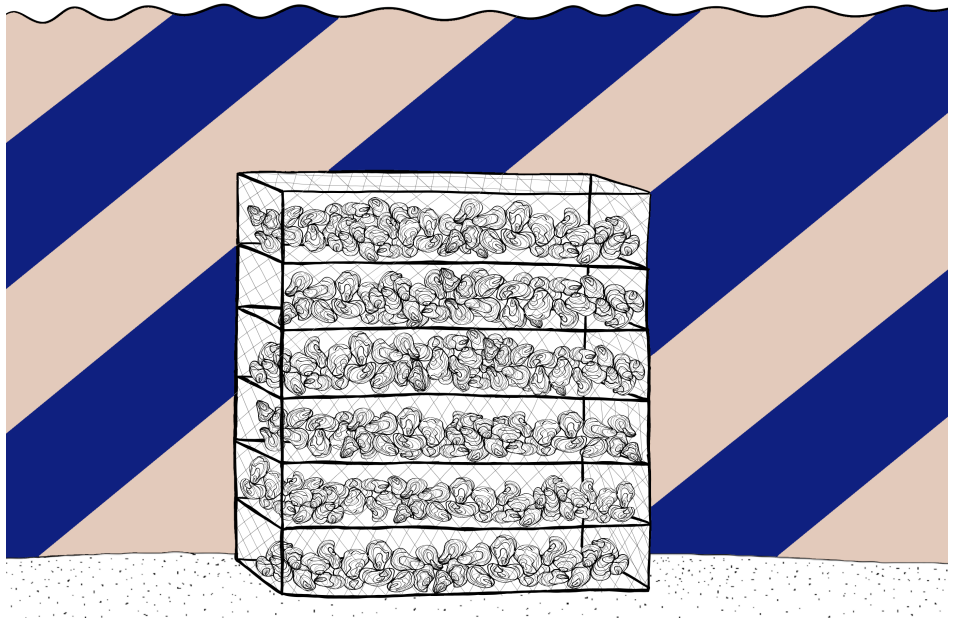
Water Zones



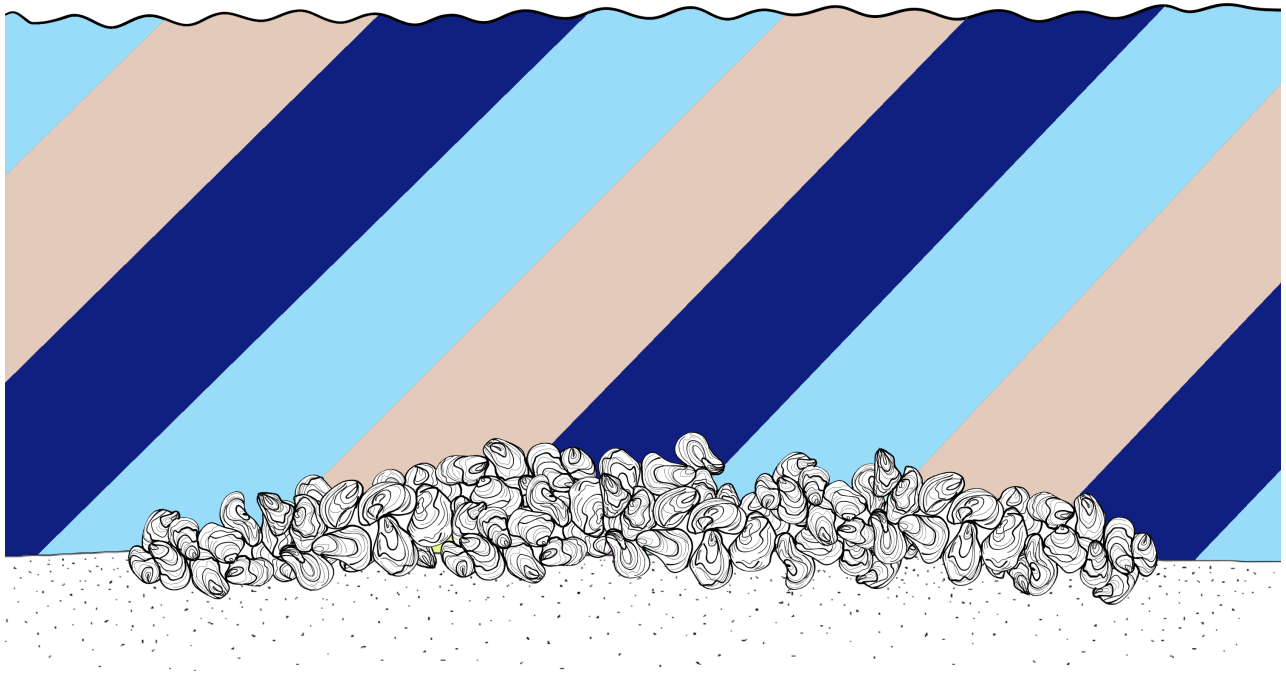
Standard Techniques

Intertidal
Subtidal
Deep

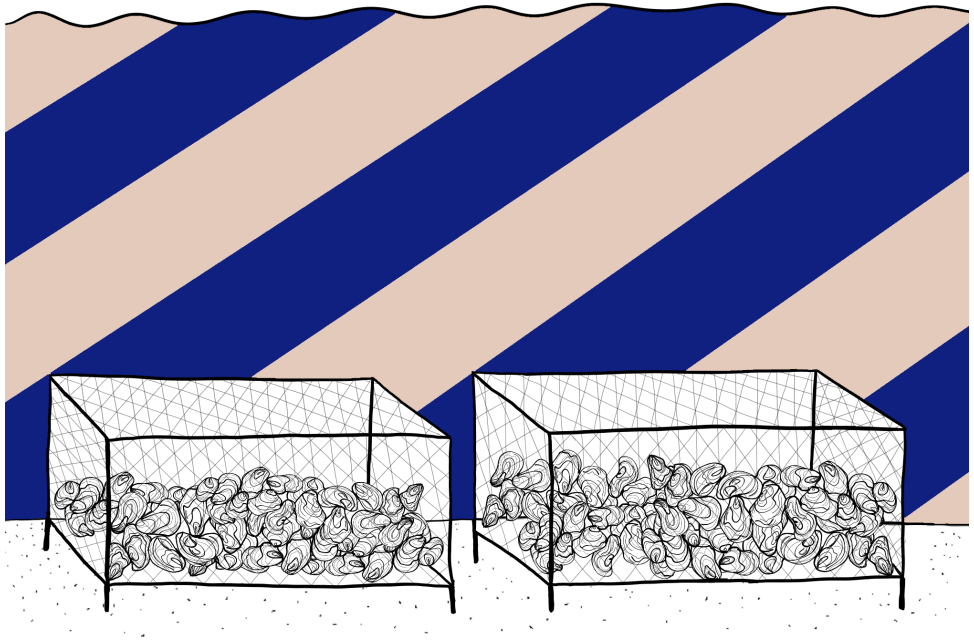
Tray Cultures



On Bottom/Bed



Bottom Cages



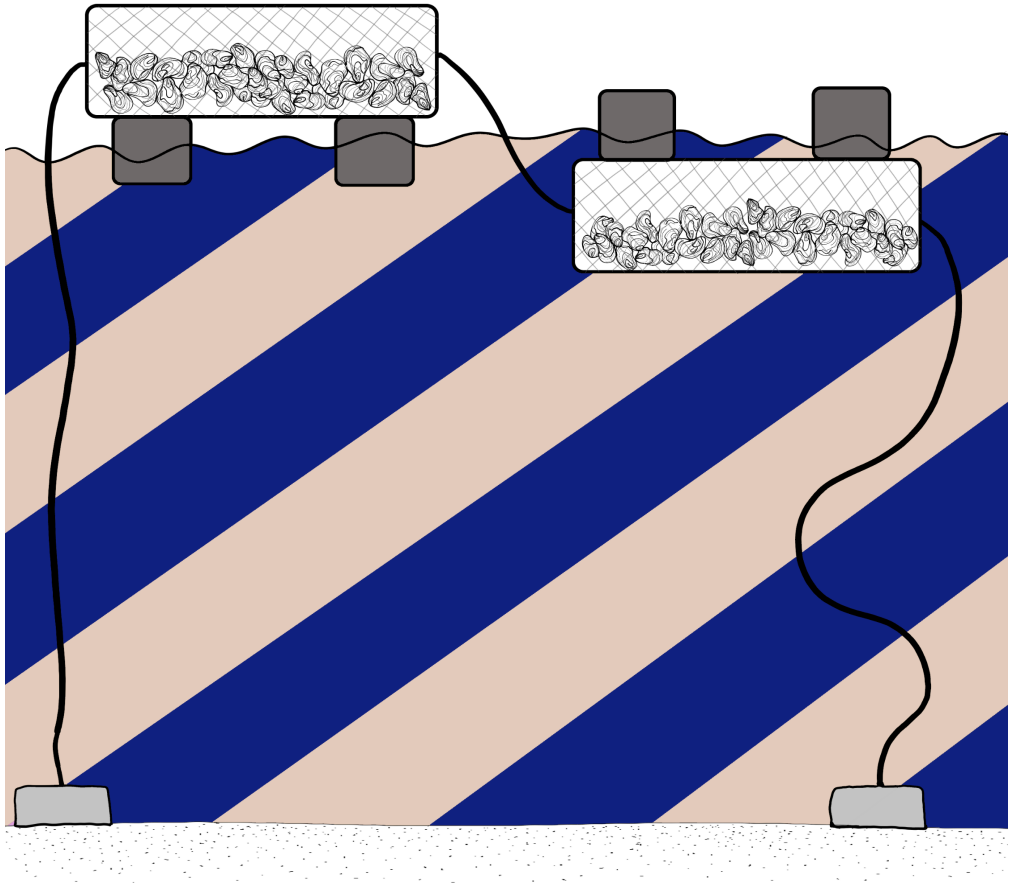
Intertidal

Subtidal

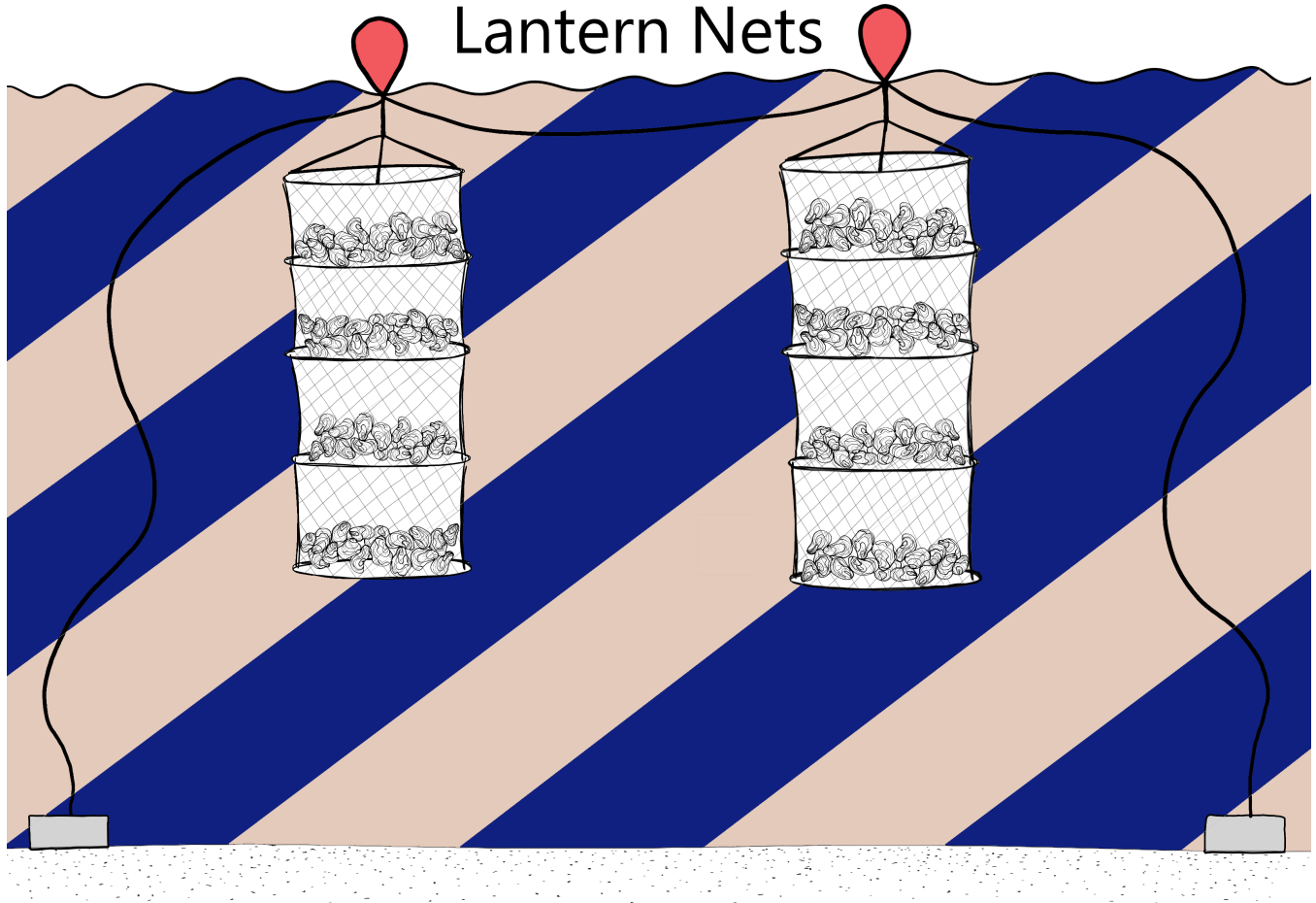
Deep

Standard Techniques

Floating Cages



Lantern Nets



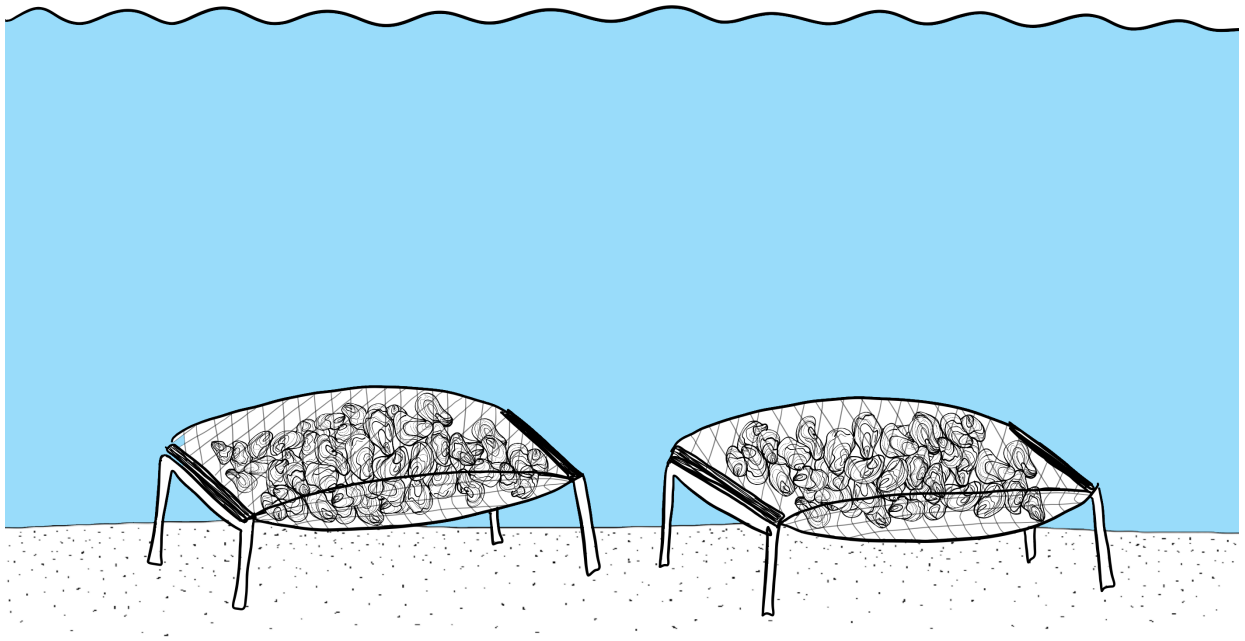
Intertidal

Subtidal

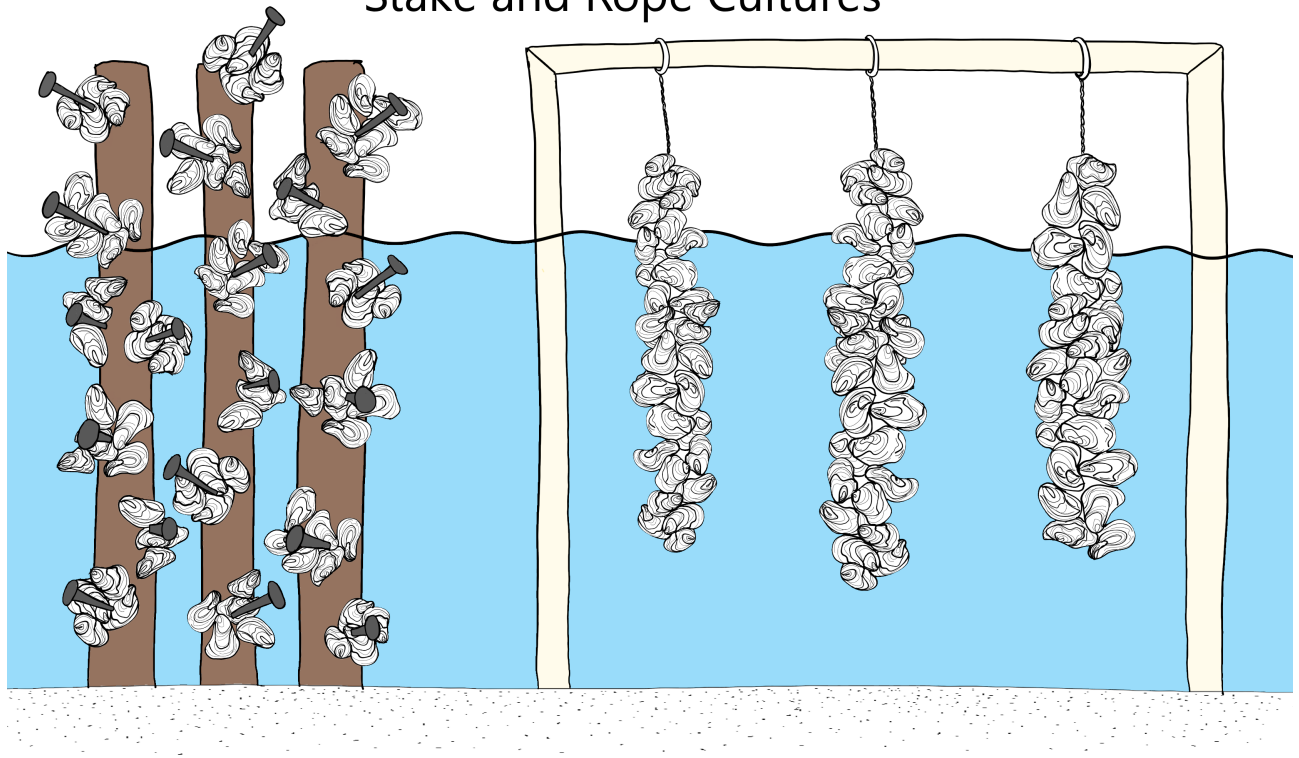
Deep

Standard Techniques

Rack and Bag



Stake and Rope Cultures



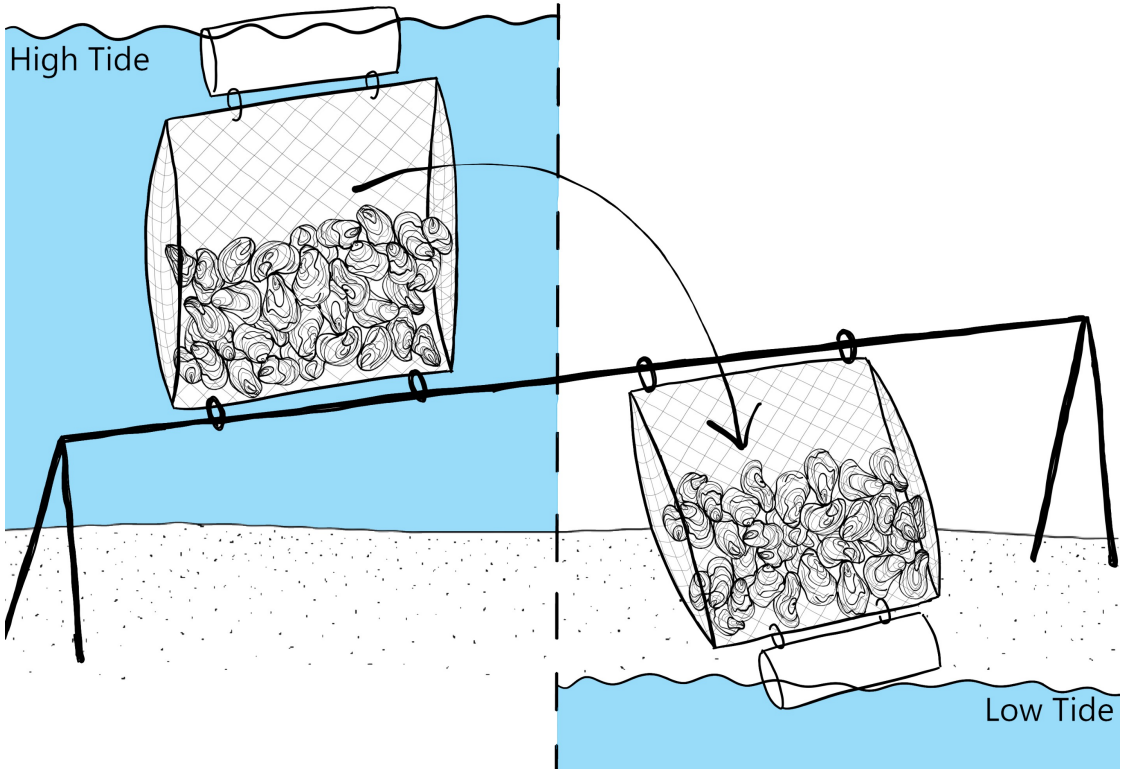
Ocean Powered Techniques

Intertidal

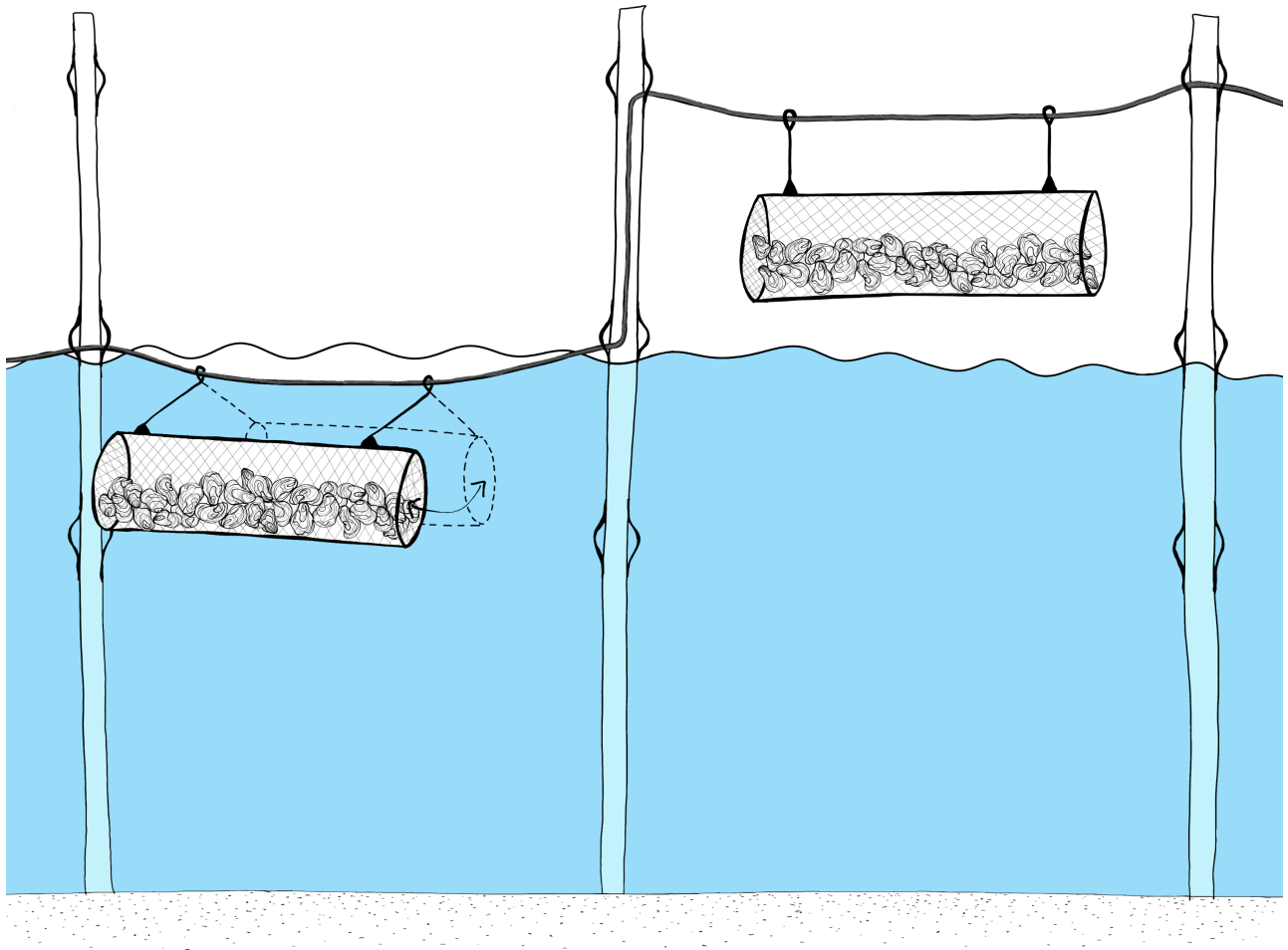
Subtidal

Deep

Flip Bags



Longline



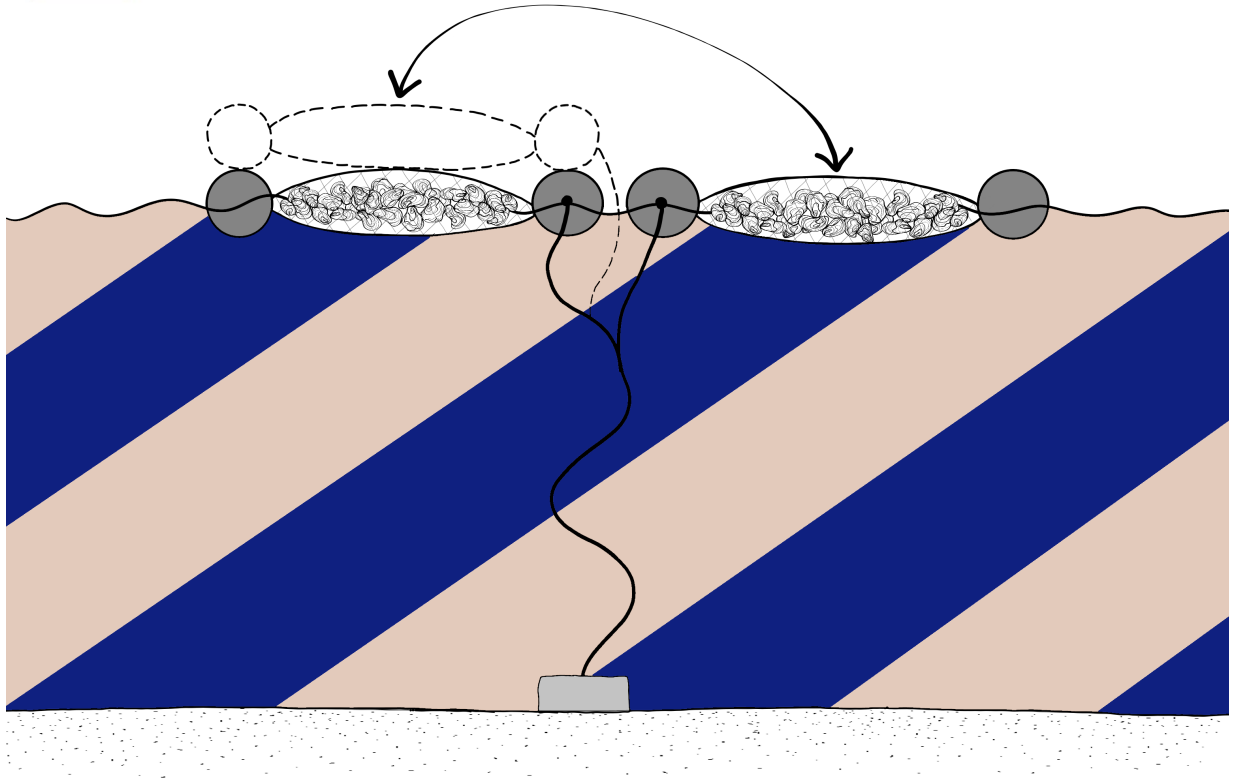
Ocean Powered Techniques

Intertidal

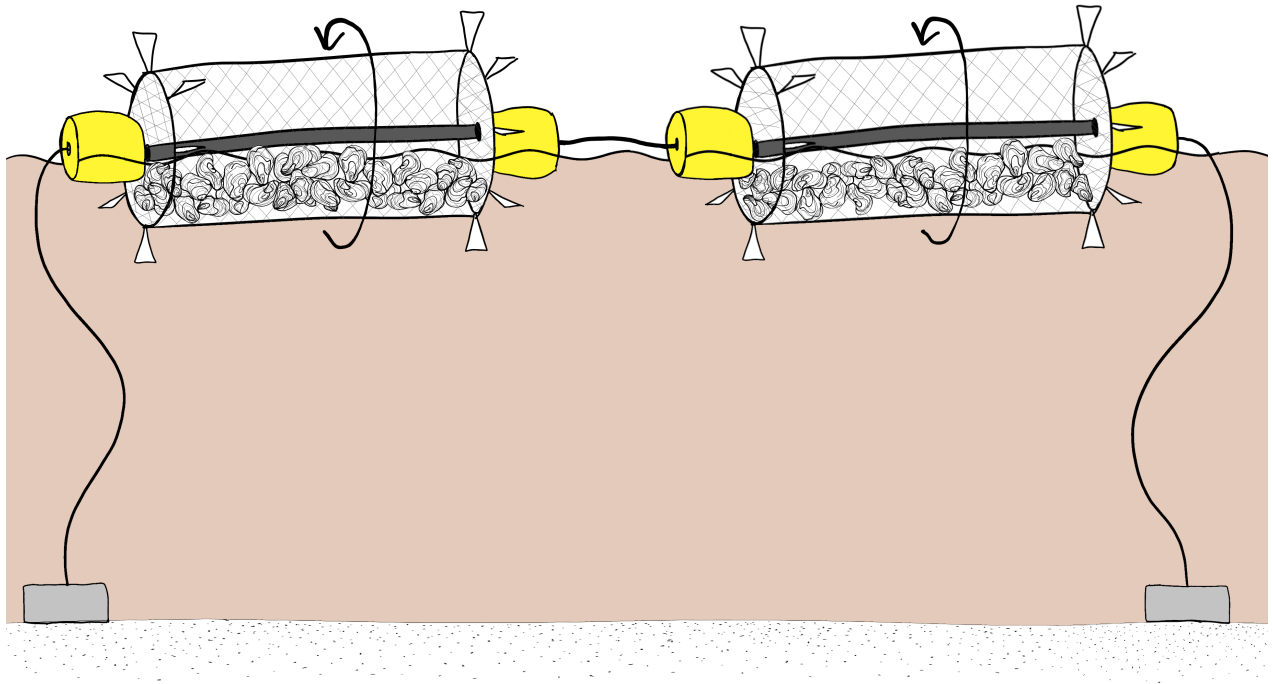
Subtidal

Deep

Floating Bags



Barrel Cages [2]



Comparison

Ratings from Alaska Oyster Growers Manual, 4th Edition [3][4]

	Standard Techniques	Ocean Powered
Cost	Mixed - expensive	Inexpensive
Labor	- Easy deployment - Mixed labor for working crop - Mixed ease of defouling	- Mixed ease of deployment - Easy to work crop - Easy to defoul
Survival and Growth Rates	- Fast growth - Mixed - high survival rates	- Fast Growth (1st year especially) - High survival rates
Storage of Equipment	Mixed ease of storage	Difficult to store

Scalability Factors

Diesel Powered

- Waters conducive to oyster growth
- <100 m depth, logistically

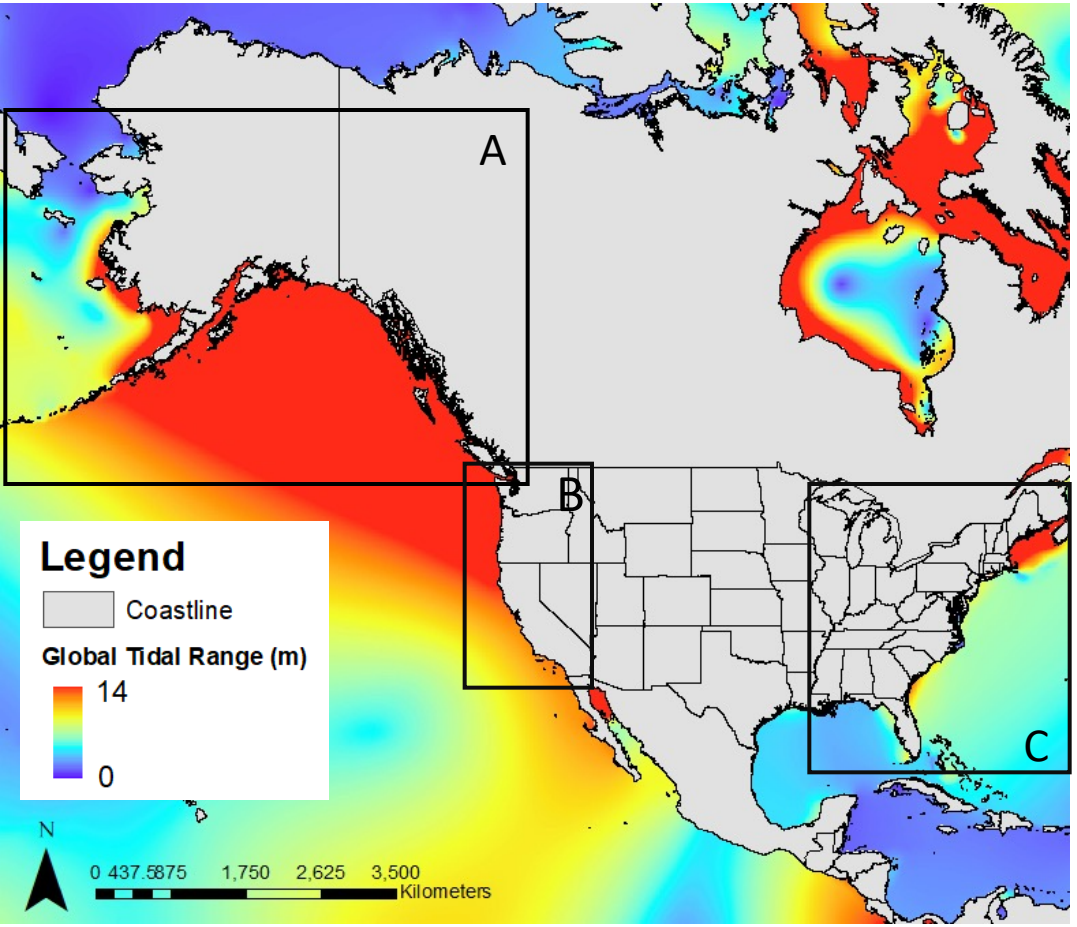
Ocean Powered

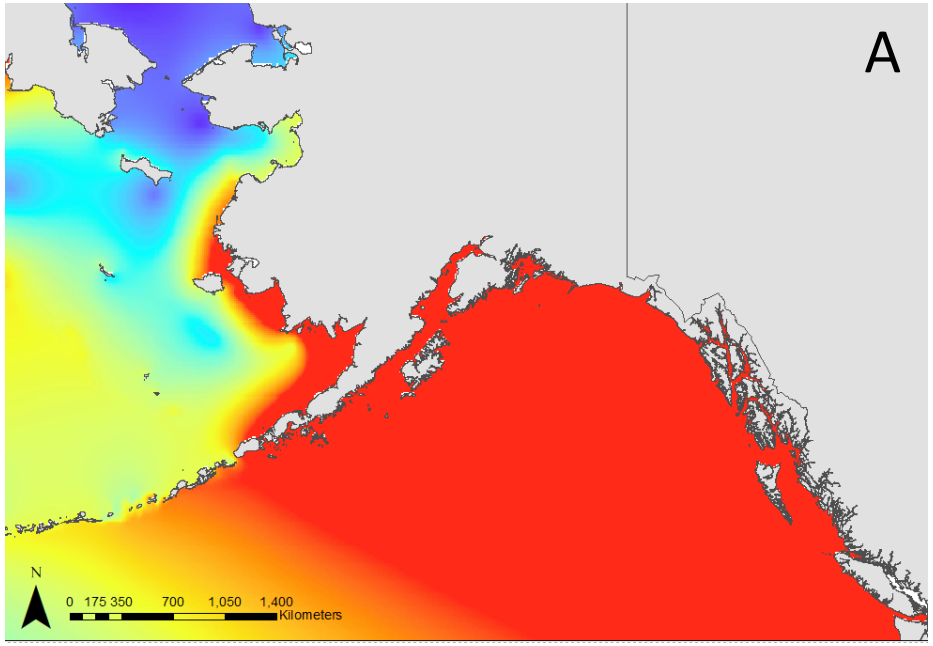
- Waters conducive to oyster growth
- <100 m depth, logistically
- Tidal Requirement
  - Range of tide: 2.5ft or 0.76m (based on most common gear dimensions)

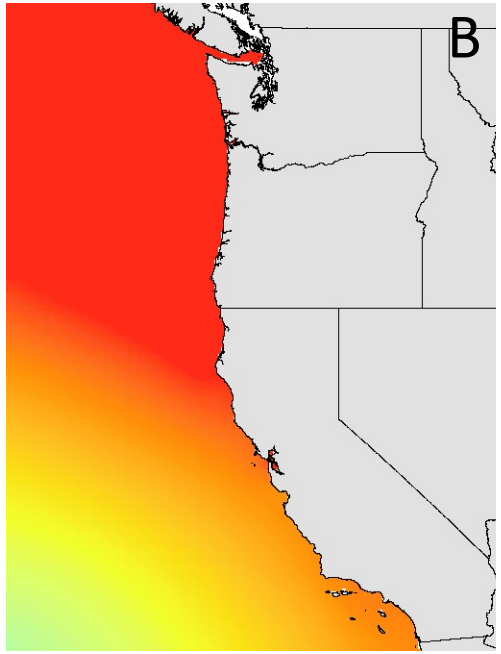
Scalability

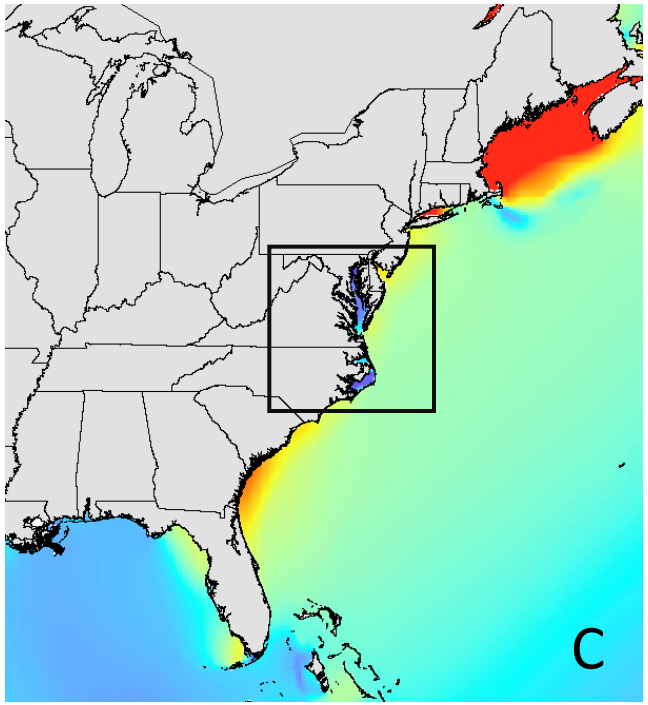
Global Tidal Range

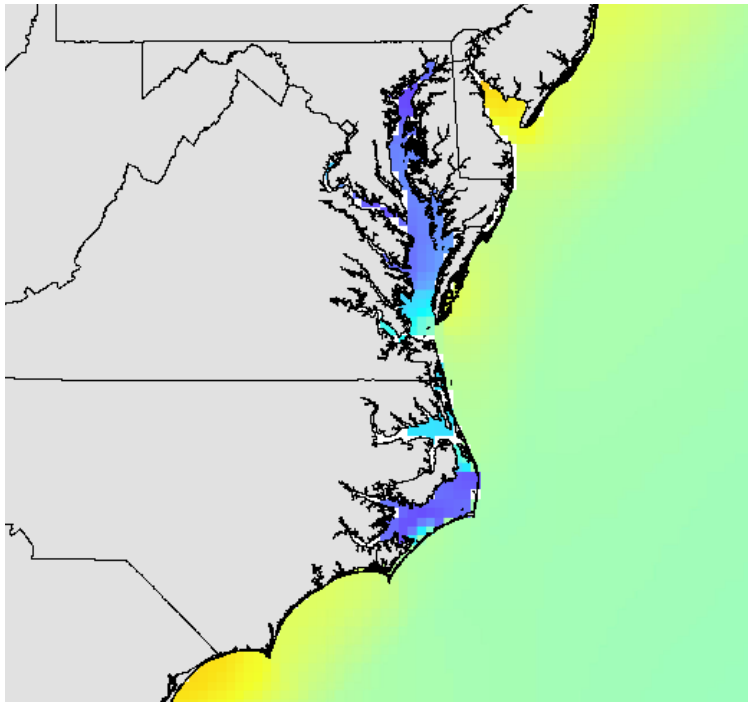
Range of tide requirement: 0.76m











Source: ESRI Global Tide Range in meters, computed using the FES2014 model data obtained from AVISO. [5]
Resolution: 1/16°

Conclusion

- There are a variety of reasons ocean powered oyster farming gear might be a more favorable option for oyster farmers
  - In terms of cost, labor and oyster growth rates
- Sufficient tidal range exists along much of the US coast to power all four ocean powered tumbling techniques
- A paper is underway planning to incorporate analysis of oyster growth parameters into suitability
  - A case study is planned to assess how much diesel usage would be offset by converting a standard farm to ocean powered equipment

Acknowledgements

This work is supported by The Department of Energy, Water Power Technologies Office.

Pacific Northwest NATIONAL LABORATORY

umerc University Marine Energy Research Community

+ METS MARINE ENERGY TECHNOLOGY SYMPOSIUM

References

[1] Powell, D., Subramanian, S., Suwansa-ard, S., Zhao, M., O'Connor, W., Raftos, D., & Elizur, A. (2018). The genome of the oyster Saccostrea offers insight into the environmental resilience of bivalves. DNA Research, 25(6), 655–665. https://doi.org/10.1093/dnares/dsy032

[2] Kramer, J. (2017). Using tidal energy to clean and tumble oysters. Sustainable Agriculture Research and Education.

[3] Alaska Oyster Growers Manual 4th Edition. (2012).

[4] Walton, B., Davis, J., Chaplin, G., Scott Rikard, F., LaDon Swann, D., & Hanson, T. Off Bottom Oyster Culture Gear Types.

[5] Environmental Systems Research Institute, Inc. (2020). Global Tidal Range in meters. Computed using the FES2014 model data obtained from AVISO.

Questions?

For more information, please feel free to contact:

candace.briggs@pnnl.gov

molly.grear@pnnl.gov