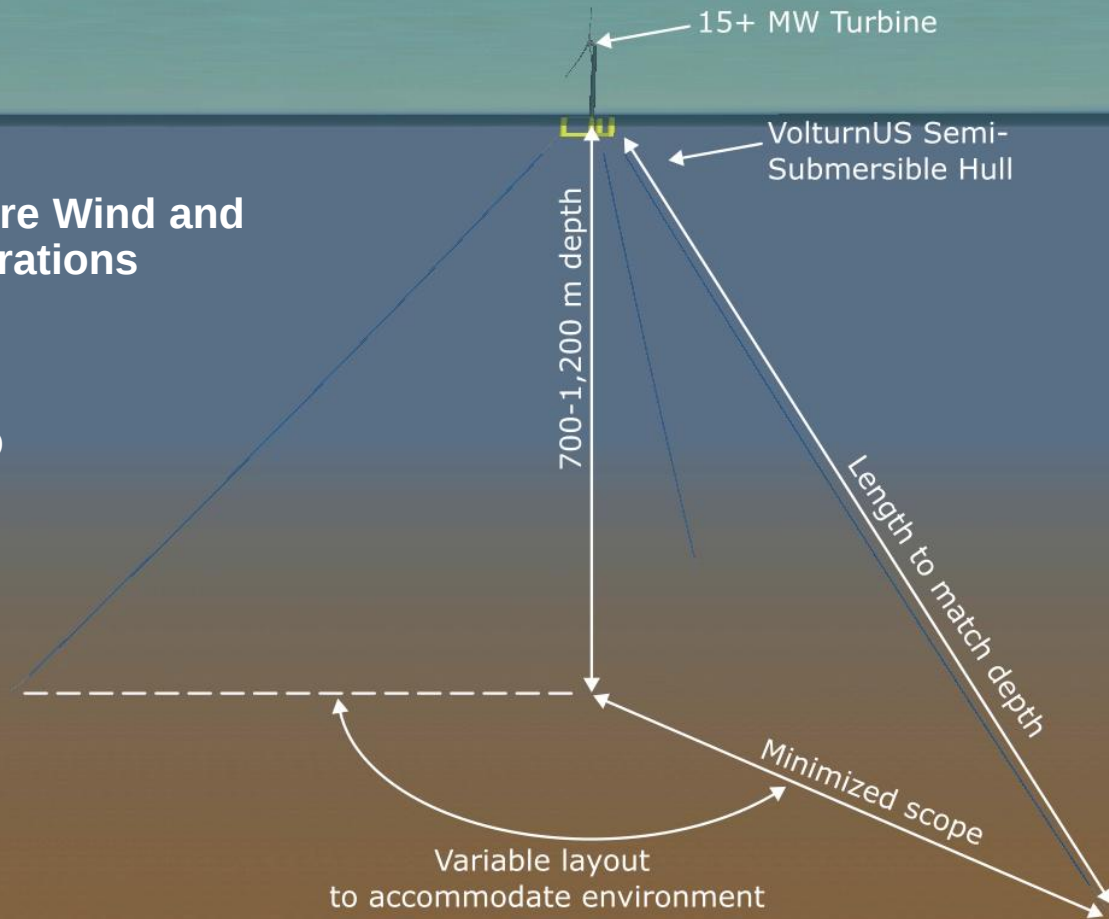


State of the Art for Floating Offshore Wind and West Coast Mooring Considerations

Spencer Hallowell, PhD
Habib Dagher, PE, PhD
Anthony Viselli, PE, PhD

May 28th, 2025



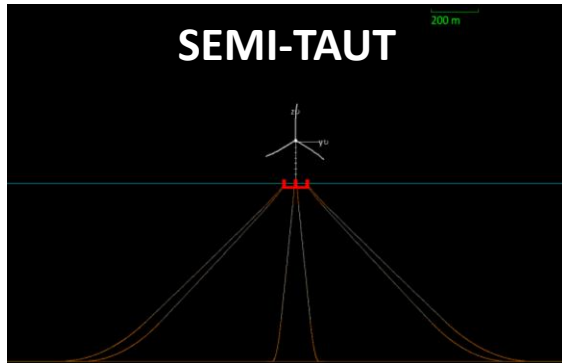
Market and supply chain specific

Three hull topologies, three mooring topologies

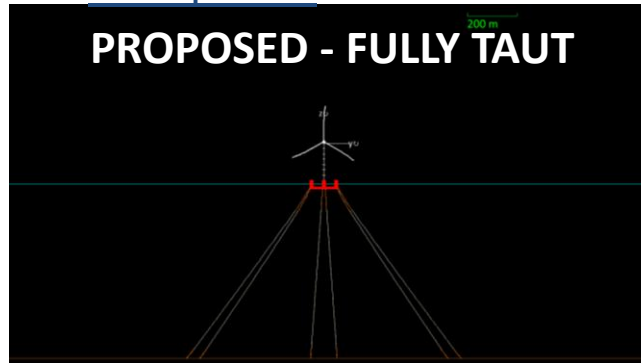


Site specific

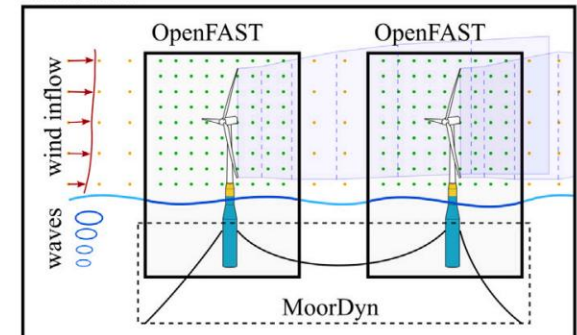
SEMI-TAUT



PROPOSED - FULLY TAUT



FAST.Farm



Lozon, E. and Hall, M., 2023. Coupled loads analysis of a novel shared-mooring floating wind farm. *Applied Energy*, 332, p.120513.

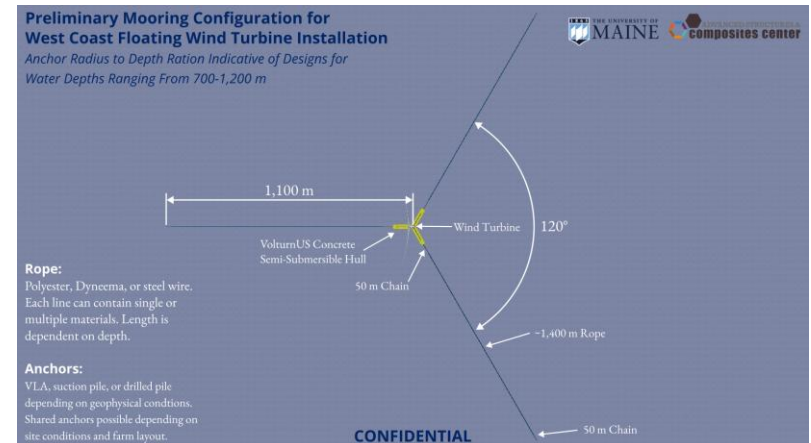
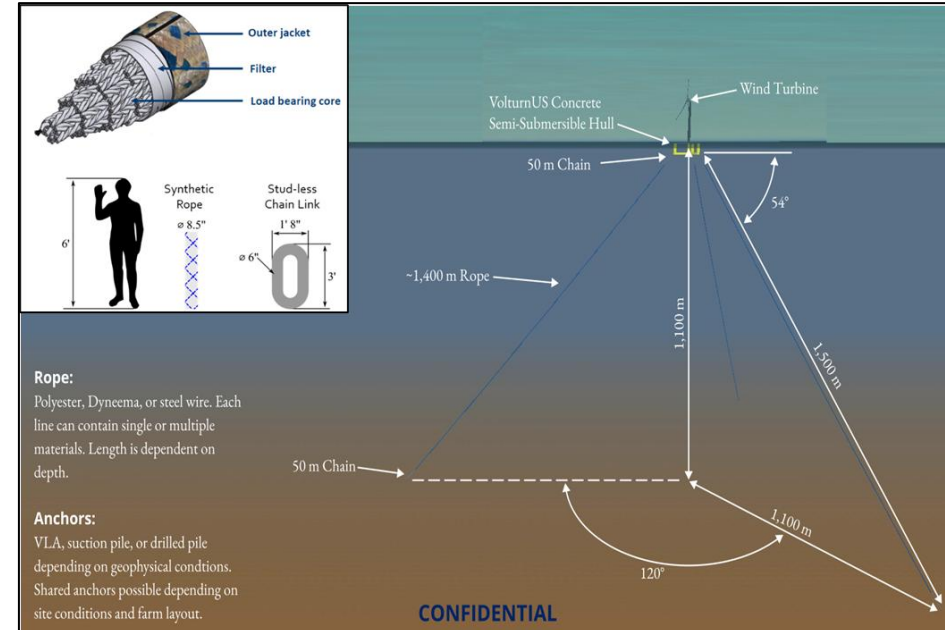
VoltturnUS 4-column concrete semi-sub
1:8 Scale deployment (2013),
Catenary chain mooring



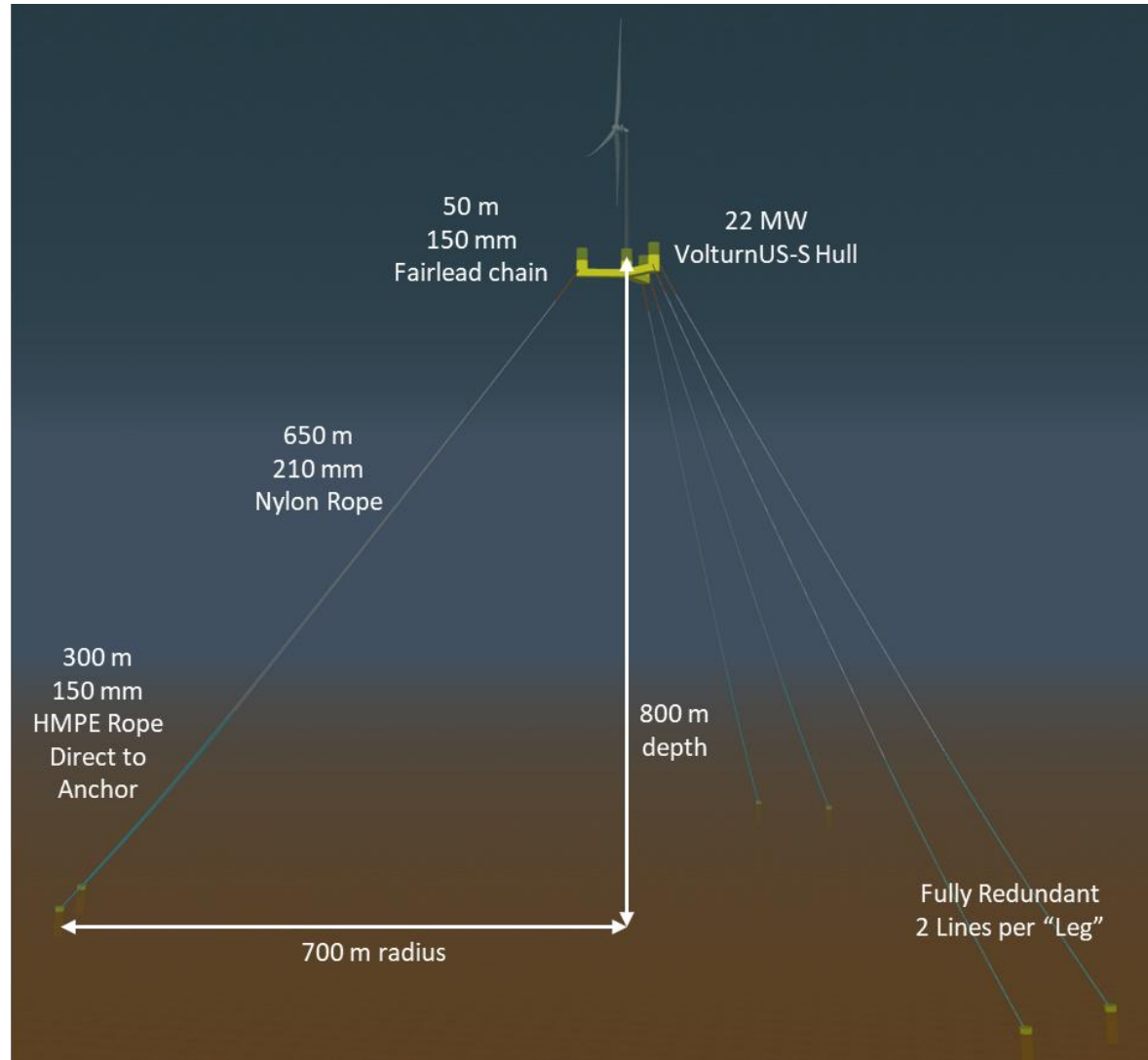
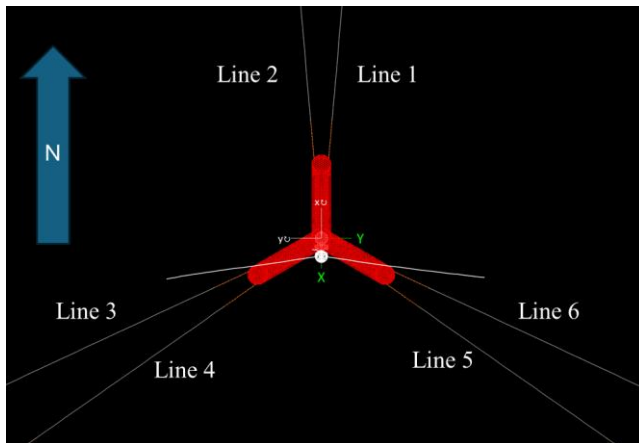
VoltturnUS+ cruciform barge with passive damper
1:4 Scale deployment (2025)
Nylon semi-taut mooring



- 5 GW of floating offshore wind requires 1,000 km of mooring lines
- Current world production capacity can't keep pace with mooring needs, but synthetic ropes have the quickest ability to scale up for full FOWT deployment
- Develop a taut-synthetic mooring system to 50% FEED level and verify performance in basin test
- Emphasize minimizing jewelry and connections, and increasing ease of installation
- Minimize environmental impact to the ocean resource
- Achieve approval in principle from ABS to mature technology to TRL of 4 or better

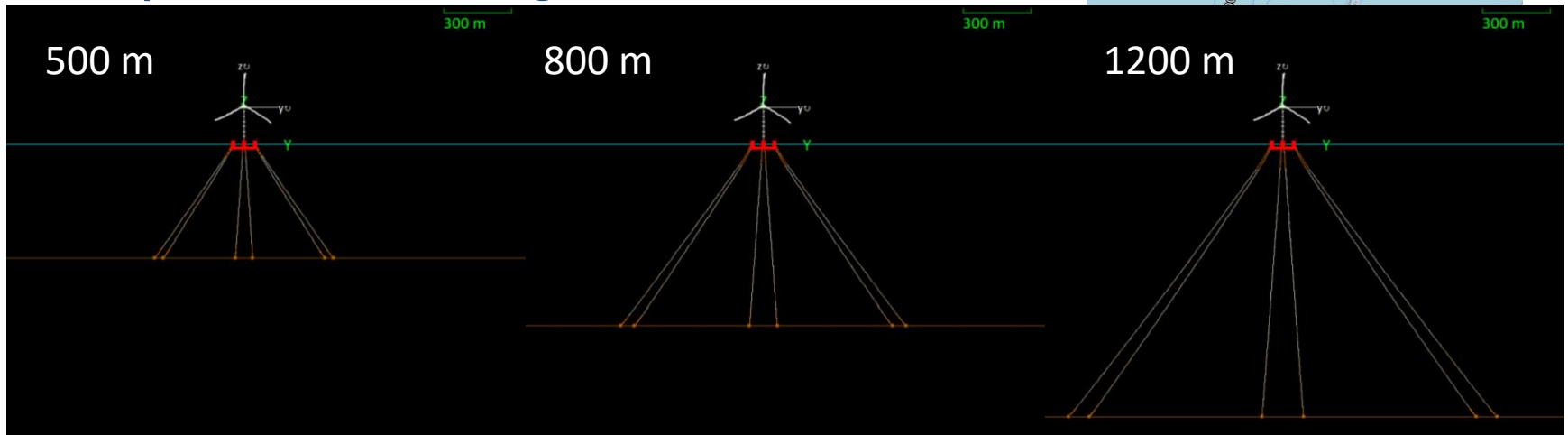
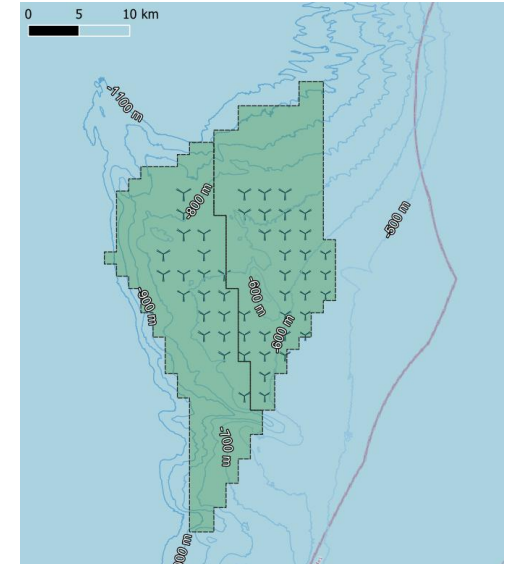


- 6-line redundant taut system
- Hybrid HMPE nylon synthetic design
- Tailorable to various water depths while maintaining consistent pretension and declination angle



Humboldt Lease Areas

- Array layout likely to be optimized for AEP
 - Moorings and dynamic cables may be oriented to provide vessel corridors
- Constant declination angle and pretension possible
 - Greater confidence in mooring locations
- Deeper water = larger radii

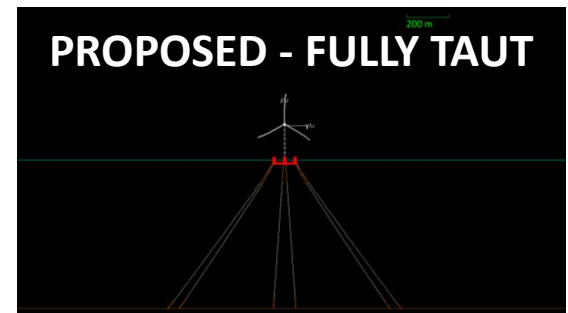
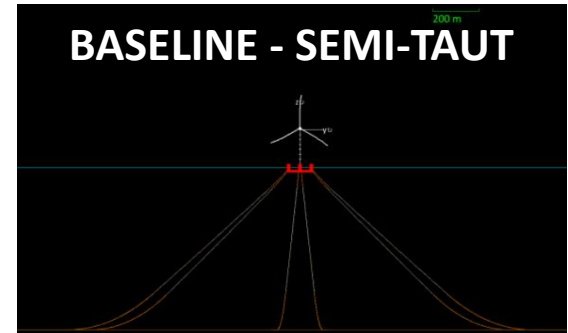
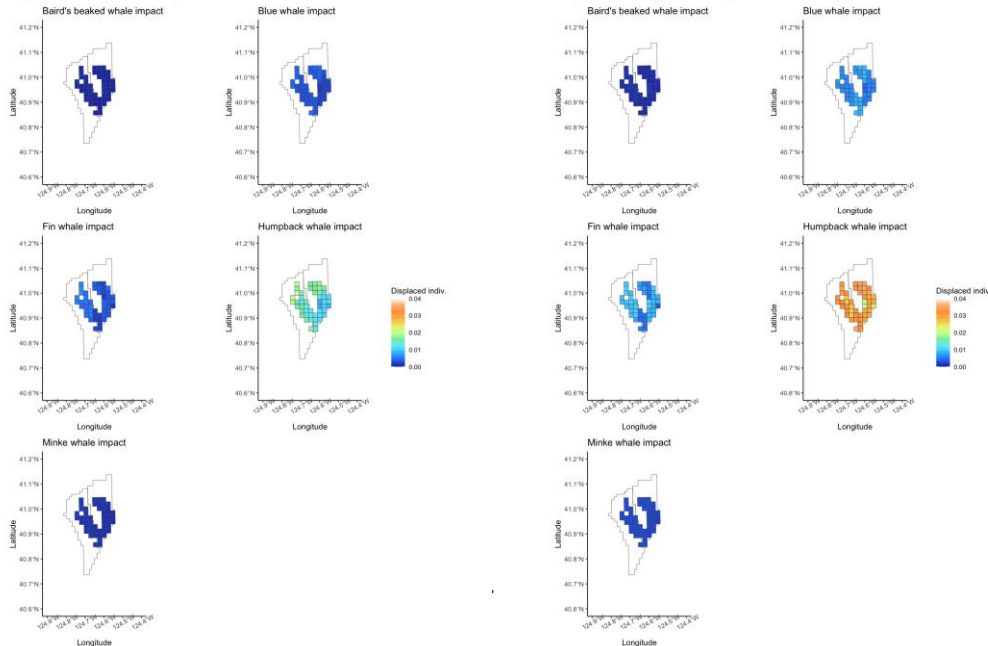


- Moving from a semi-taut (Baseline) to a fully taut (Proposed) system at the turbine locations examined changes:
 - Seabed impact (- 20.20 % sediment disturbed)
 - Fishery value impact (- 74.08 %)
 - Fishery volume (- 74.11 %)
 - Cetacean impact (- 76.96 %)

Large whale impacts

Fully taut, predicted large whale displacement

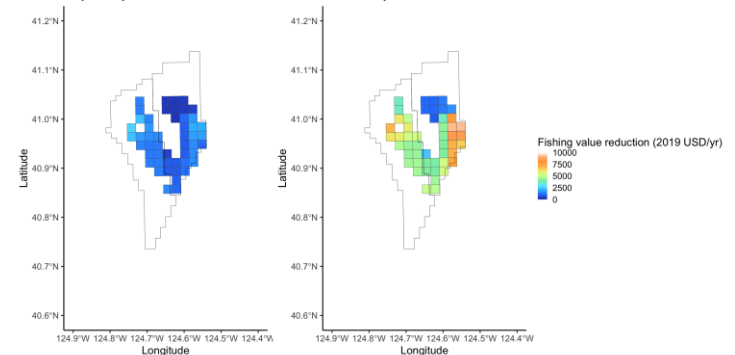
Semi-taut, predicted large whale displacement



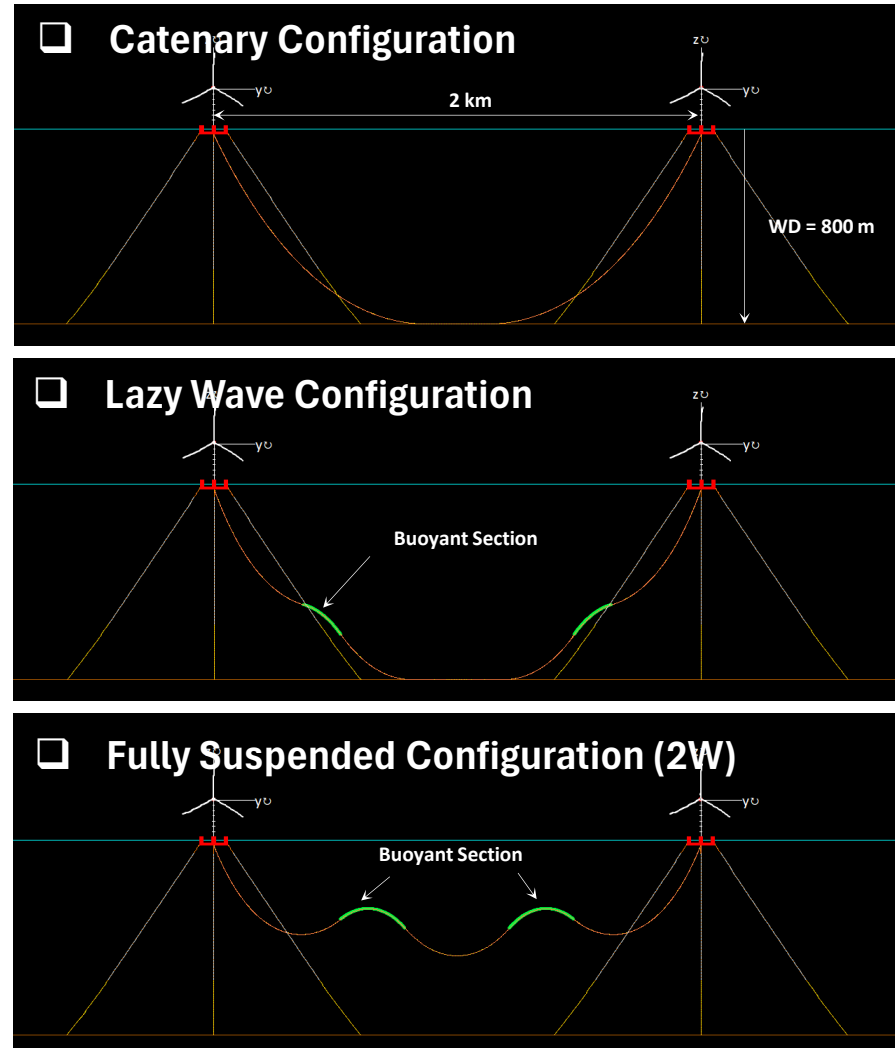
Ground fishing impacts

Modeled reduction in commercial groundfish value
Fully Taut System

Semi-Taut System



- Three different typical configurations
- Catenary
- Lazy wave
- Fully suspended



- VolturnUS+ passively damped barge floater
- Nylon semi-taut mooring system
- Same mooring installation method as proposed in this project
- Grid connected 220 kW turbine



