Innovation for Sustainable, Scaleable and Efficient Seaweed Cultivation: Marine Cable From Recycled Carbon Fiber

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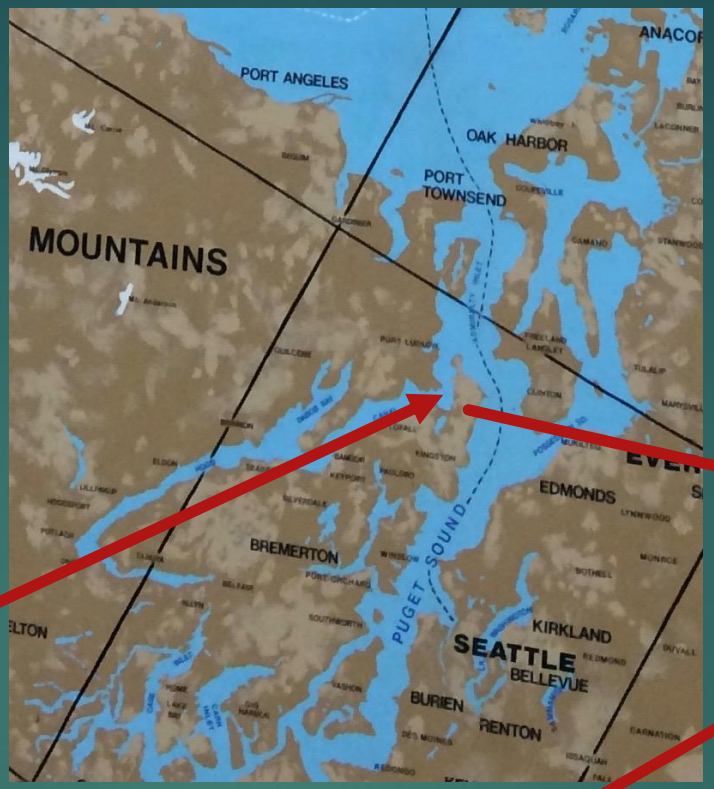
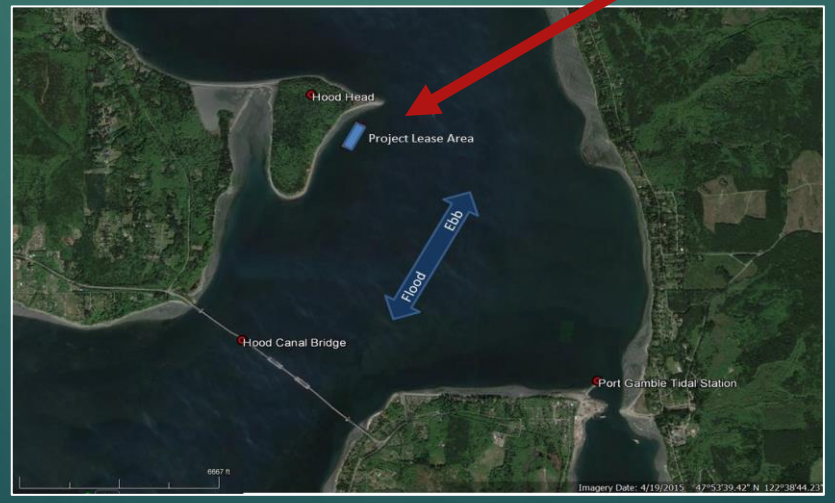




Combined shellfish and seaweed farm on five-acre deep water site

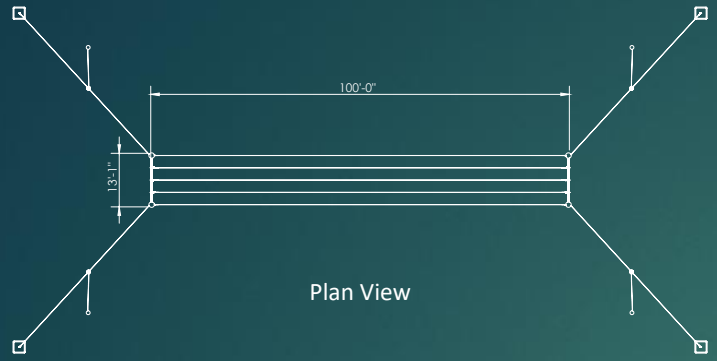
Hosted a major study in 2015-16 on whether growing kelp can mitigate acidity for shellfish aquaculture

rCF Project Partner: Composites Recycling Technology Center

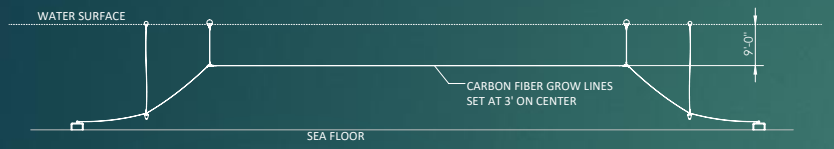
- Not for profit in Port Angeles, WA
- Keep scrap carbon fiber out of landfill
- Develop unique products that solve issues
- Create jobs

CRTC
COMPOSITE RECYCLING TECHNOLOGY CENTER

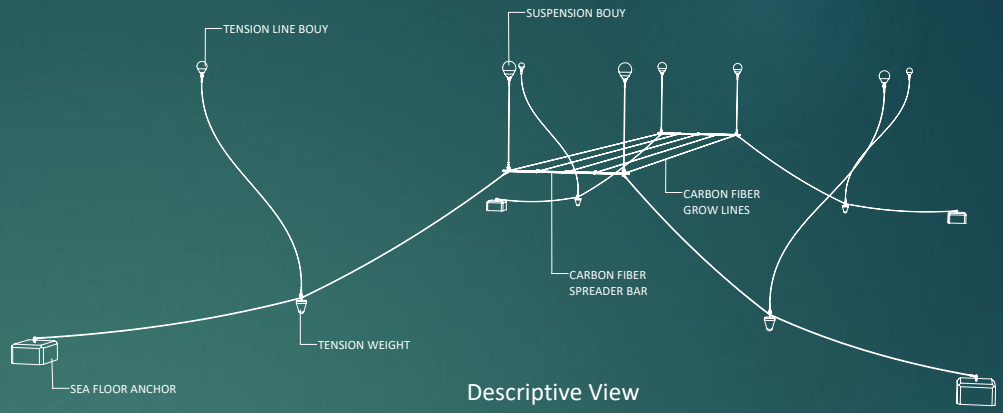
- The CRTC has worked with partners to repurpose windmill blades and aerospace material that comprise a huge waste stream
- They found this material could be transformed into a marine cable
- It does not shed micro plastics
- It is too stiff to entangle marine life
- If it breaks free it sinks



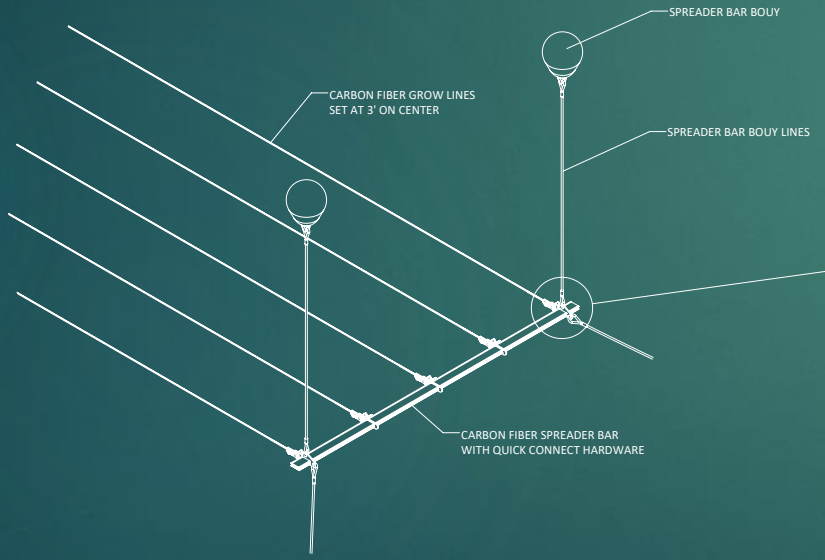
Plan View



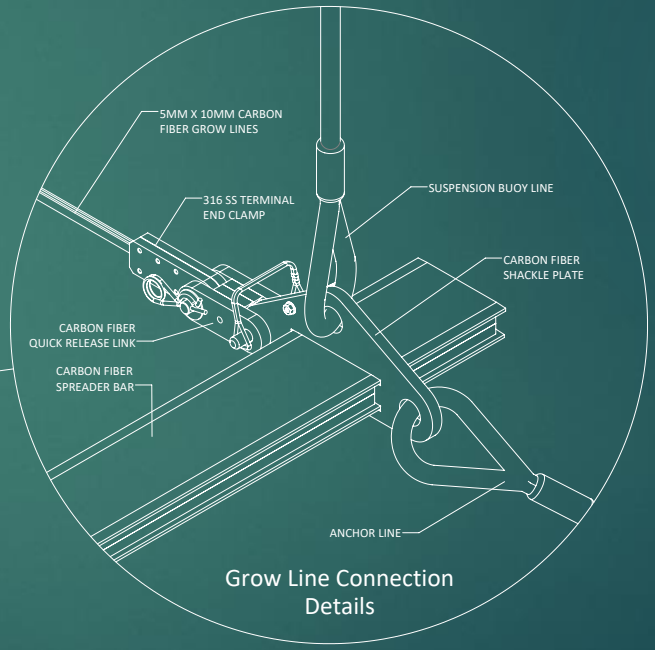
Side Elevation



Descriptive View



Spreader Bar Details



Grow Line Connection Details

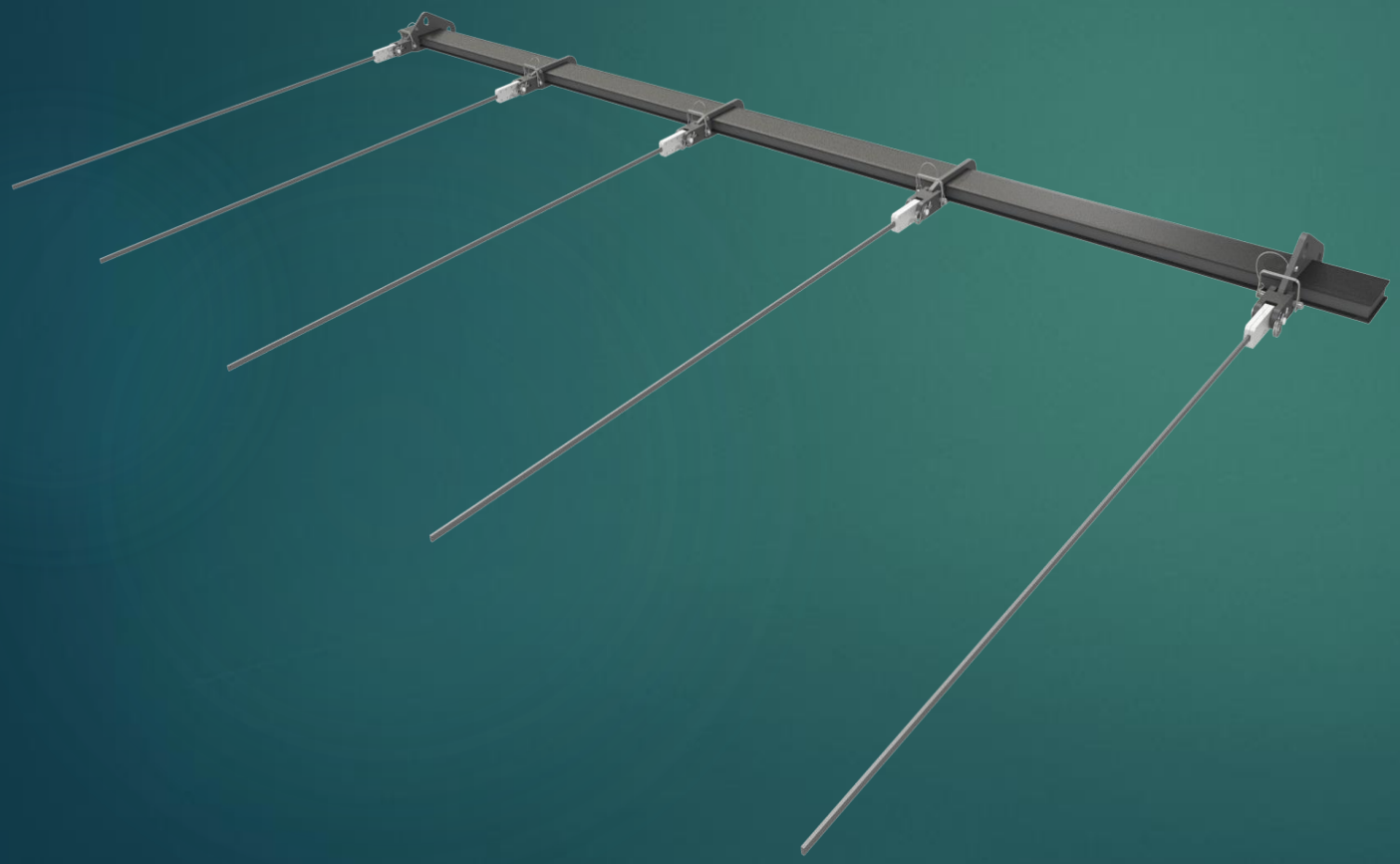
The prototype system was composed of five 100’ grow lines set at 3’on center and tensioned between two carbon fiber spreader bars. The system was suspended at 9’ below the surface

Prototype Carbon Fiber Grow Line System | 100’ – 5 Line Lattice

Prototype Spreader Bar

The anchor, suspension and grow lines are connected to the spreader bar with carbon fiber shackle plates.

Grow lines spaced at 3’ on center.

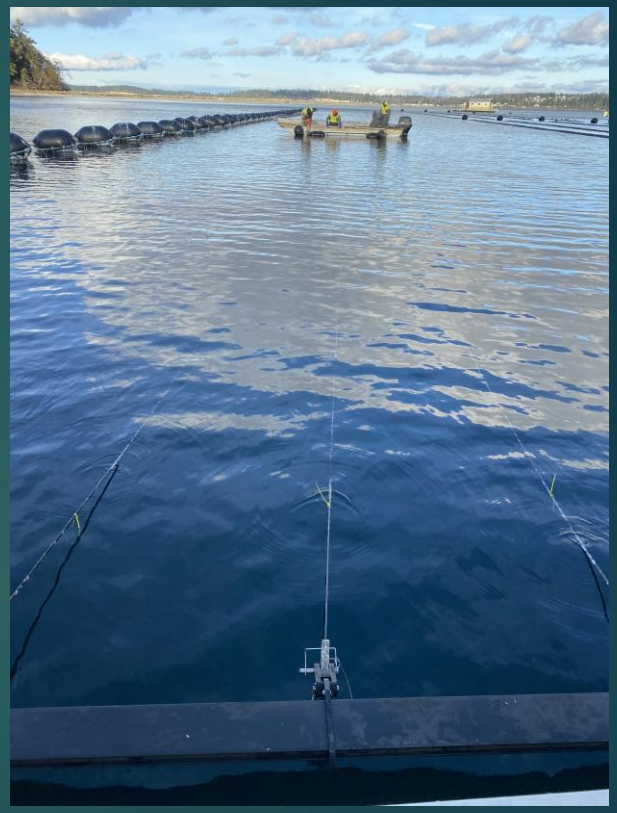


Prototype Spreader Bar on Raft Floats

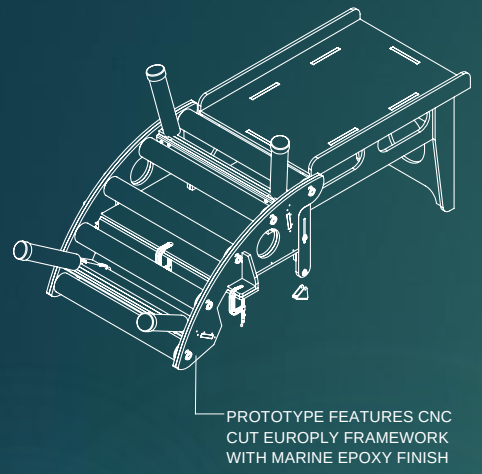
Prototype Deployment

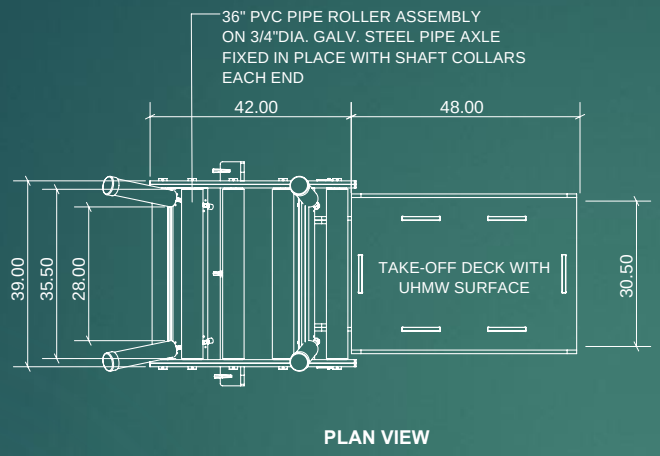
Securing spreader bars on service rafts

Servicing grow lines

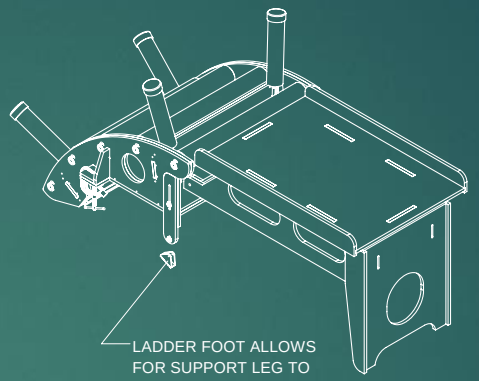


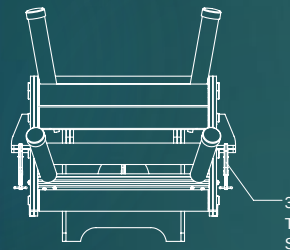
Prototype Bow Mount Harvesting Fixture



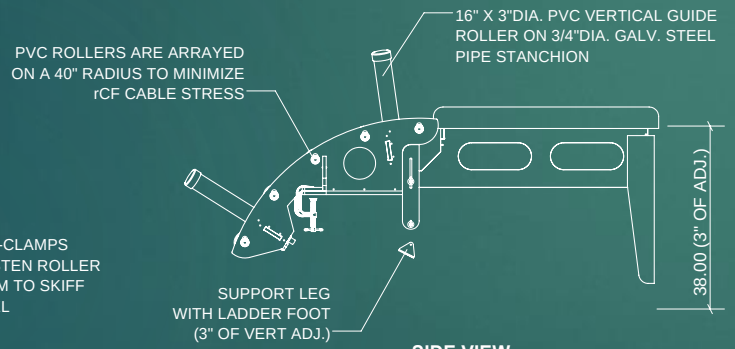


PLAN VIEW

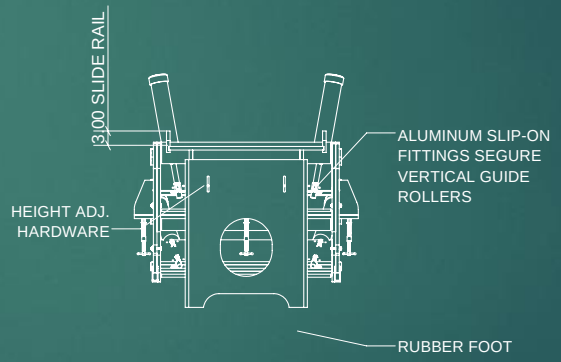




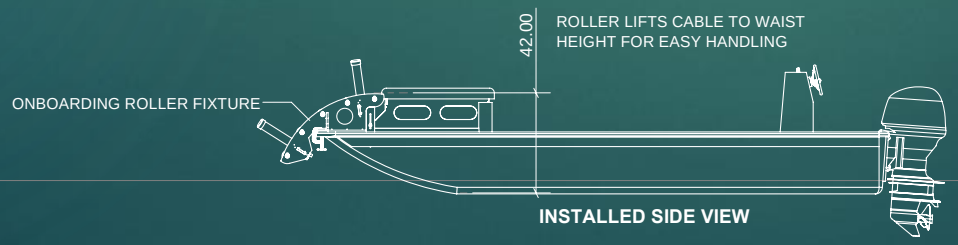
FRONT VIEW



SIDE VIEW

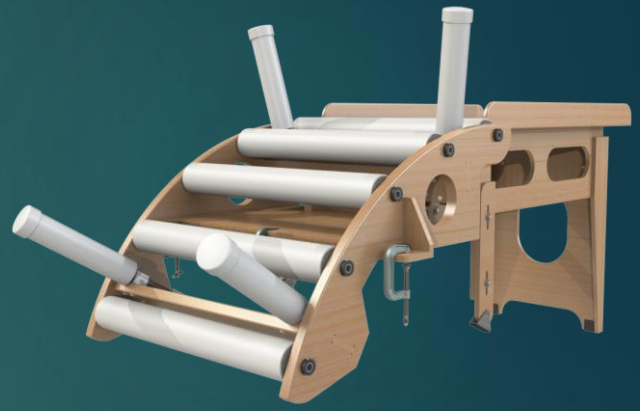


REAR VIEW



INSTALLED SIDE VIEW

The prototype harvesting fixture is designed to ease the grow lines over the bow and provide a stable work deck.



Prototype Harvesting Fixture

Harvest

Harvesting Sugar Kelp – the carbon fiber grow line simply feeds off the stern of the skiff

SUMMARY OF RESULTS FROM EVALUATION OF PROTOTYPE

- The system worked great
- Biofouling came off easily
- As we harvested, we were able to reseed
- The cable stayed in the water
- We compared the carbon fiber system to poly lines and…

RESULTS-

- We could space our lines 3’ apart vs 20’ apart with rope
- Rope spacing due movement with current and waves risking crop damage and affecting operations
- Rigidity of recycled carbon fiber cable demonstrated little to no crop damage
- The kelp bonded well to the marine cable - low knock off

Benefits of rCF cable:

- No shedding of micro plastics and associated social license risk
- No marine mammal entanglement (ditto)
- Very durable - will last many years before replacement
- Easy to clean in the water
- Can re-seed directly after harvesting for multi-cropping
- Yield improvement compared to poly as a function of spacing

Subsequent Development Work Through September 2025

- Larger scale system, with improvements for easier deployment, deployed and planted in Fall 2023 for harvest and assessment in Q2 2024; 2023 harvest showed equivalent benefits to previously seen
- Bull kelp testing in Alaska-JIP With Sea Quester Farms
- Next generation system to be deployed and seeded Fall 2024, including complementary devices for more efficient harvesting and cleaning
- Next stage economic analysis, market research and commercialization plan

- THANKS!

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