

Open Ocean Mariculture

Overcoming the Challenges

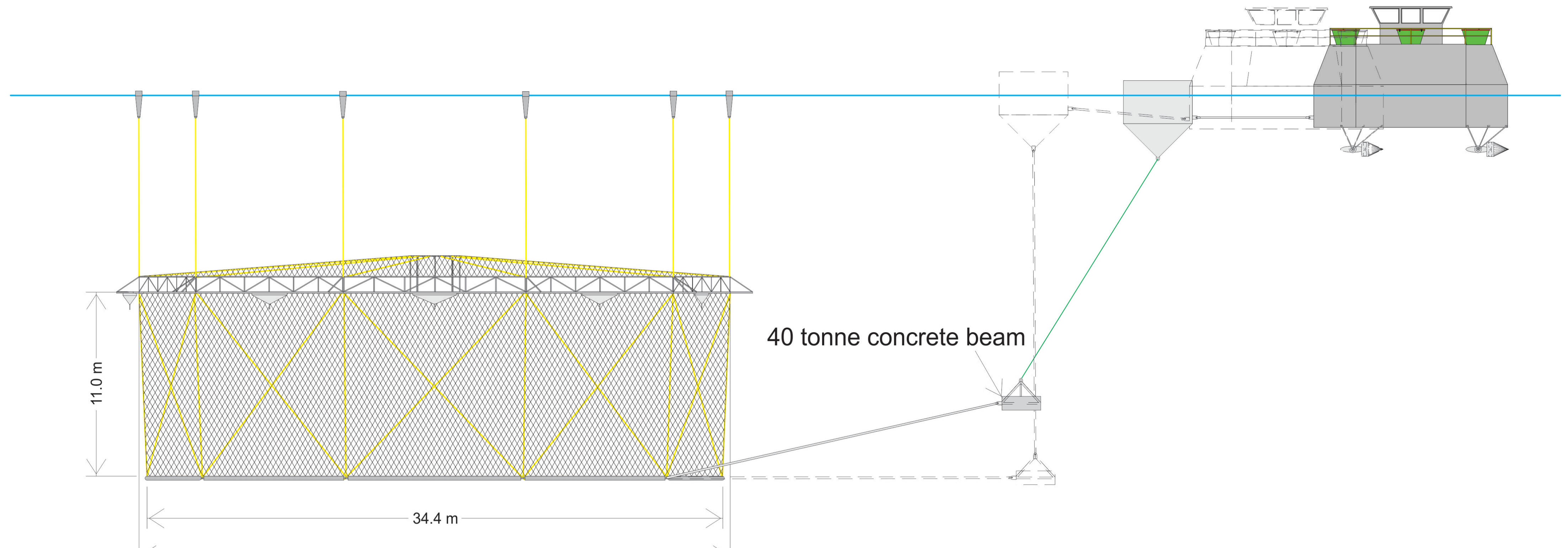
Bill Spencer, Co-Founder, Mariculture Evolution Group, July 3, 2023

About Mariculture Evolution Group (MEG)

- **Phillip Dobson** - Salmon farmer for ten years in some of the most turbulent waters in the world, the Bay of Fundy. Developed and patented the Evolution submersible cage, single point mooring system and 100 ton remote controlled feeder buoy that allowed profitability where winter waves reach six meters.
- **Bill Spencer** - developed and patented the first untethered, automated positioning fish farming platform for deep ocean high energy operation.
- At **MEG**, we combined our intellectual property to create **The Wanderer (La Vagabunda)**, a towed, free-floating system with control over direction and speed with remote command and control. The remote controlled feeder is a navigable platform that also serves as a site monitoring platform

The Wanderer - La Vagabunda

- **The Wanderer** constantly moves so the cages have the exact amount of current that produces the best results. Wandering spreads effluent over a wide area among organisms that feed on it. The farther from shore the platform wanders, oxygen levels are higher and with no fixed address, sea lice that spend their dormant phase under cages, are less of a problem.



Inshore Space Limited - Limitations de Espacio Costero

- Half of sea-bordering nations do not have enough room for nearshore mariculture leaving no choice but to go offshore. One solution is massive oil rig sized platforms, but they require huge CAPEX and long payback.



Deep Blue No. 1 - Submersible cage built in China

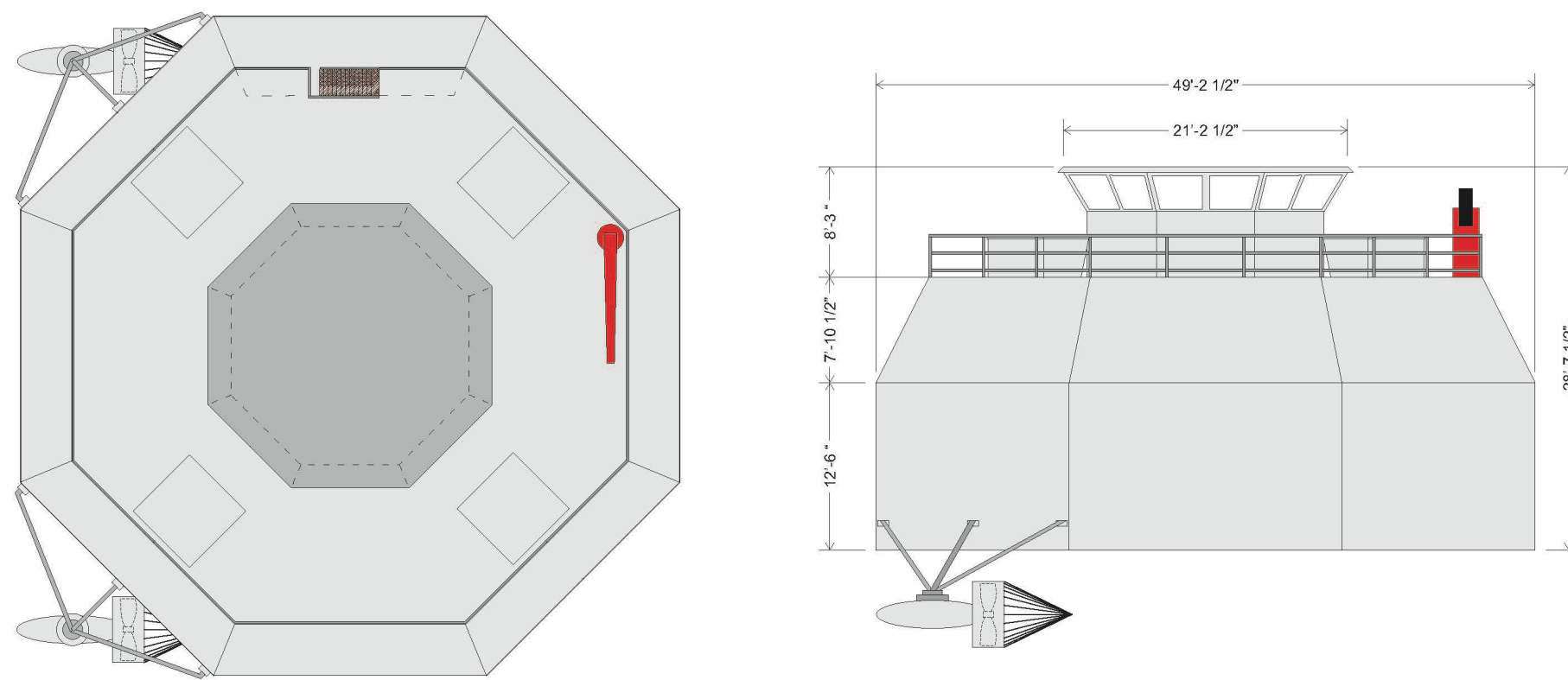
High Energy Ocean Operation - Operación Oceánica de alta Energía

- Offshore work boats will cost three times more to build and operate than typical near shore service vessels. Bad weather will stymie fish feeding, cage cleaning and other husbandry chores for weeks at a time. An integrated system with automated feeding, and foul free cage materials eliminates the problems workboats have accessing sites in bad weather.



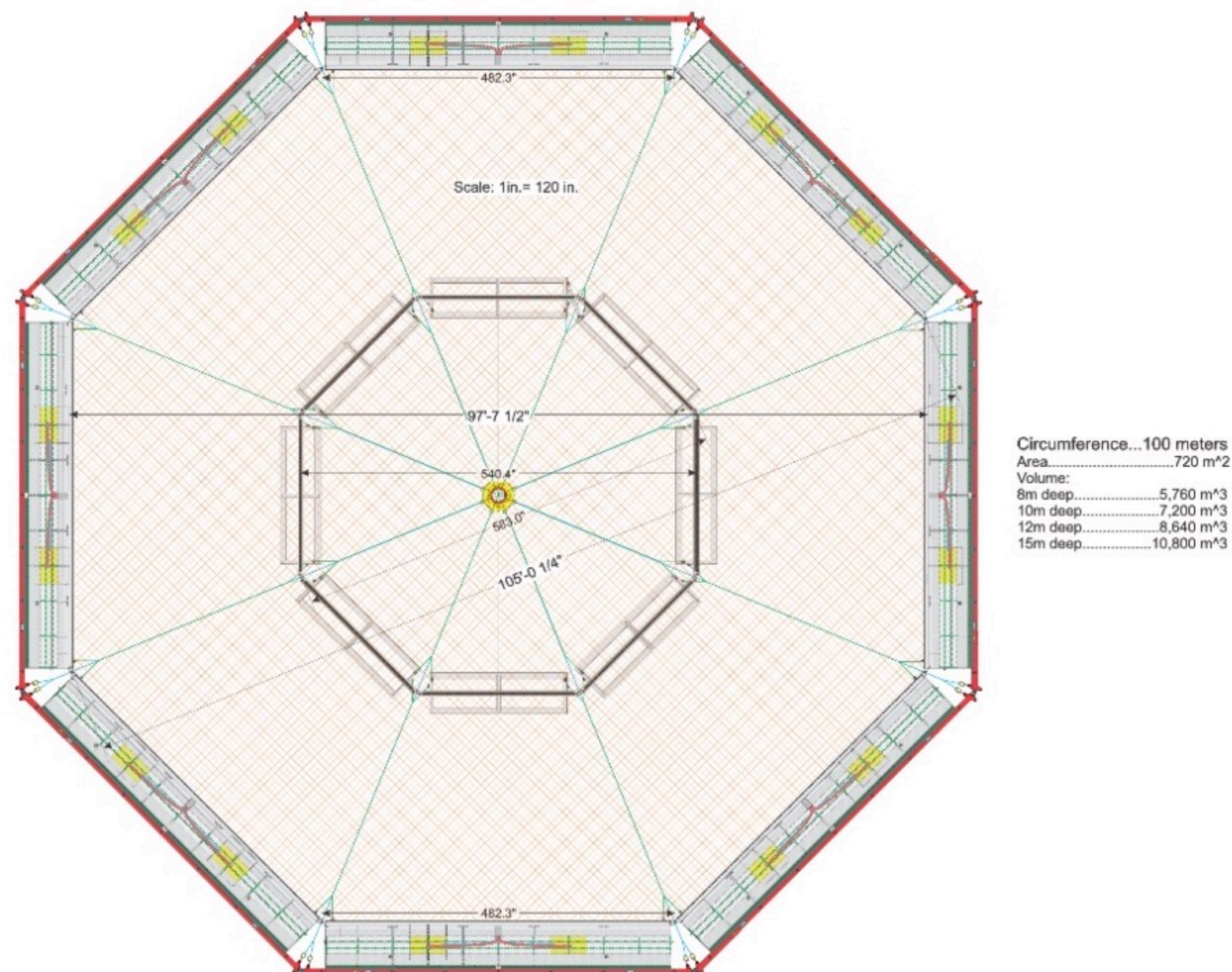
Feeding the Fish - Alimentando a los Peces

- Automated feed blowers and fleets of feed boats are impractical for high energy operation. **The Wanderer** feeder is virtually unsinkable. The feeding is done underwater to multiple cages simultaneously. The feeder is equipped with power pods that generate 10,000Kgs of thrust, enough to tow 150,000 cubic meters of cage volume at two knots.



Containment Systems - Systems de contention

- Water depth increases the cost for moored cages. Plastic surface cages fatigue from constant bending and torsion loads which restricts cage size. Submerged cages are small, expensive and inefficient to feed and maintain. Proper and timely husbandry is almost impossible, not to mention unsuitable for salmonids. Brass cage material is expensive, but the anti-fouling/predation properties repay the cost in the long run.



The Evolution Cage



Husbandry - Cria de Pece

- Cage cleaning, net changes, disease and lice control are challenges on any site. Dirty nets lower oxygen levels, restrict growth and cause poor fish health. On most inshore sites, periods of low current exacerbate the problem. The Wanderer's movement at predictable speeds and current will improve fish health, FCRs and growth rates.



Profitability - Rentabilidad

- Price is fixed by the near-shore industry. Capital and operating costs in open ocean high energy environments must be comparable or the industry won't go. Governments need to find a way to subsidize offshore operations until scale can be achieved. An offshore site should set 100,000 cubic meters as the lowest cage capacity and 4,000 tonnes as the target production for profitability.



Tank testing showed that a single line of cages was more efficient .

Regulation - Regulacion

- Governments need to relieve the industry of the cost of site selection, environmental assessment and leasing limitations. Chile has the 10th largest EEZ in the world, almost 2 million square Km, not counting neighbor islands. The government needs to conduct programmatic environmental impact assessments to soothe environmentalists and reduce costs on operators.



Now is the Time - Ahora es el Momento

Open ocean farm operators have proven that fish farmed in high energy settings have lower parasitic loads, increased growth rates and improved FCR's. The vast clean ocean water and currents ensure a healthy environment for the fish and low impact on the ocean environment.

To produce 5,000 metric tons of protein on land requires 20,000 cows, 80,000 pigs or 6 million chickens. They require 80,000 gallons of fresh water a day, and 388 square kilometers of land to grow their feed. The carbon footprint is monumental compared to the tiny footprint of a single four cage **La Vababunda** than can produce 4,000 metric tonnes of seafood.

The cost of moving the **Wanderer** through the water at low speeds is lower than fighting parasites and disease as well as traditional feed boats, maintenance and construction of moorings, diving costs and treatments for disease and parasites.

Now is the time. In order to feed a world of 10 billion people, our industry must find a way to overcome the limitations of offshore mariculture. It will not happen over night, so we must act ***muy pronto.*** **La Vagabunda** is the solution

Conclusion

We are not here to sell our innovations, but to demonstrate that with investment in infrastructure for open ocean mariculture, with a little help from the government, it is possible to overcome the challenges of farming seafood in high energy environments.

Our goal is to offer well thought out solutions to the most important problems using technology developed and manufactured locally. Some of the components of our system are commercially available and of course we would be happy to provide comprehensive technical assistance and to explore licensing.

Muchas Gracias!

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