Understanding Marine Energy's Potential to Power Aquaculture

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Background

Figure 1. Depiction of aquaculture and marine energy co-location (Illustration by Molly Grear).

Pacific Northwest National Laboratory is exploring the potential for co-location of marine energy and aquaculture.

These efforts are part of the Powering the Blue Economy (PBE) initiative which seeks to understand the power needs of existing and emerging maritime markets and advance technologies that could integrate marine energy to relieve power constraints and enable sustainable growth.

Figure 2. Co-located aquaculture and renewable energy deployments or research projects around the world (figure adapted from Freeman et al. 2022).

Three projects are exploring offshore, community-scale, and nearshore opportunities for co-location though a combination of energy needs assessments, marine energy resource characterization, and outreach and engagement with local communities.

Offshore Aquaculture in Puerto Rico

Goal: Investigate the feasibility of and opportunities for co-locating offshore aquaculture and wave energy in Puerto Rico.

Spatial Analysis

- Identify key parameters for offshore aquaculture and wave energy.
- Conduct a spatial analysis to find suitable areas for co-location.

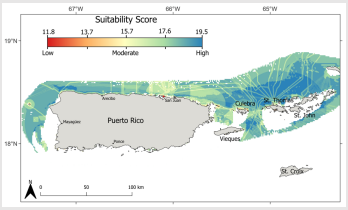

Figure 3. Suitability map of potentially suitable locations for co-location of wave energy and offshore aquaculture.

Environmental Monitoring

- Conduct fieldwork to develop monitoring methods for co-location, gather local data, and inform future efforts.

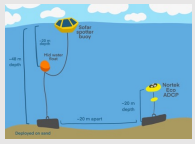

Figure 4. Fieldwork equipment to measure environmental conditions: currents, waves, wind, etc. (Illustration by Molly Grear).

Outreach & Engagement

- Engage stakeholders to receive feedback and incorporate local perspectives and opinions, needs, and knowledge.

Figure 5. Workshop held in Puerto Rico in February 2023.

Community-Scale Aquaculture in the Salish Sea

Goal: Assess the potential for wave or tidal energy to power community-scale aquaculture in the Salish Sea.

Energy Assessment

Figure 6. Sablefish net pet at JST aquaculture facility (Photo by Hannah Hudson).

- Assess the energy needs of the Jamestown S'Klallam Tribe's (JST) aquaculture operations.

Spatial Analysis

- Identify key parameters for aquaculture and marine energy in the Salish Sea.
- Assess if marine energy resources align with current JST facilities and for future co-location opportunities.

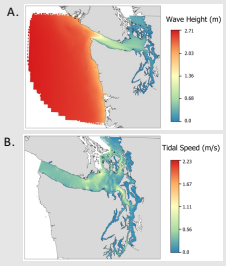

Figure 7. Wave height (A) and tidal speed (B) in the study area.

Outreach & Engagement

- Collaborate with JST to develop educational material and engage with the aquaculture community regarding the use of marine energy for aquaculture.

Nearshore Aquaculture Across the U.S.

Goal: Investigate the feasibility for a low-velocity marine energy technology to power aquaculture operations at nearshore kelp and oyster farms.

Energy Assessment

- Understand power needs through literature review, discussion with partner farms, and electricity bills.

Figure 8. Floating upweller system at Hog Island Oyster Co. (Photo by Ruth Branch).

Characterize Nearshore Farms

- Measure current speeds using acoustic doppler current profiler (ADCP) to identify viable tidal resource.

Figure 9. Nortek ADCP used to measure currents.

Evaluate Low-Velocity Technology

- Test VIVACE (vortex induced vibration) low-velocity technology to evaluate its potential to support power needs.

Outreach & Engagement

- Develop elementary age workbooks for education on marine energy and aquaculture.
- Create simulated kelp growth experiment for the classroom.

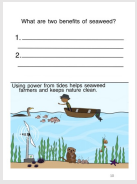

Figure 10. Children's workbook on marine energy and aquaculture.

Impact

Together these projects are:

- Developing a diverse set of pathways for marine energy use with aquaculture.
- Working to foster economic, social, and environmental goals by leveraging the immense power of the oceans.
- Supporting communities and marine life while exploring the potential to sustainably power the blue economy through research, collaboration, and outreach and engagement.

PAMEC Energy Association

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