



Investigating the feasibility of integrated multi-trophic aquaculture in Washington

Integrated Multi Trophic Aquaculture

IMTA relies on strategic use of the natural food chain to mitigate waste from open aquaculture systems. It is based on the ecosystem concept that a species always consumes waste generated by another.

Cultured mussels, for example, are filter feeders that consume plankton, detritus and decomposers from the water column. They produce feces that are consumed by sea cucumbers. Sea cucumbers have commensal fish and worms living at the end of their digestive canal that feed on sea cucumbers waste. Kelp absorbs dissolved inorganic waste produced at each trophic level. Nutrients are recycled as kelp detritus and detrital decomposers are consumed by the mussels.

Parties Involved:

- The Washington Department of Natural Resources (DNR)
- Western Washington University (WWU)
- Puget Sound Restoration Fund (PSRF)

DNR, WWU, and PSRF are working together to investigate the effectiveness of mitigating the waste from mussel rafts using a multi-trophic approach.

Stage 1: (Summer 2018) Density Analysis

Waste consumption and filtering capacity of different densities of mussels, sea cucumbers, and vegetation is measured in a controlled experiment in flow-through mesocosms.

Stage 2: (Fall-Winter 2018/2019) Small Scale Combination Experiments

Different physical arrangements of mussels, sea cucumbers, kelp and eelgrass will be tested to determine the optimum arrangement for organism growth and waste mitigation.



Floating mussel aquaculture



Giant red sea cucumber (*Parastichopus californicus*)



Sugar kelp (*Saccharina latissima*)

Stage 3: (Summer 2019) Field Experiment

Results from mesocosm experiments will inform field studies. Nutrient reduction efficiency will be measured at set distances from a field deployed a floating IMTA system.