Apr 21st, 9:00 AM - Apr 22nd, 4:45 PM

SEA CUCUMBER (Apostichopus californicus) CULTURE AND ENHANCEMENT OPPORTUNITIES.

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Pacific Shellfish Institute

2020 Salish Sea Ecosystem Conference

ABSTRACT

- Demand for giant red sea cucumbers (*Apostichopus californicus*) continues in Asian markets while wild harvest has declined on the west coast of North America. Multiple trials are in place in Washington state to culture this species on upland and floating structures that support other species (figure 1). Co-culture of sea cucumbers has proved to be effective with mussels, black cod, sea weed and oysters as the sea cucumbers feed on the detritus of these species. In addition, there are current food resources from aquaculture that the wild population currently exploits but conceivably could utilize more efficiently. Efforts to further this utilization are in progress as well.

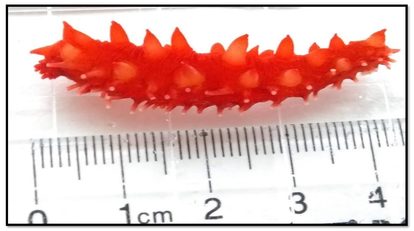


Figure 1: Sea cucumbers juvenile

BACKGROUND

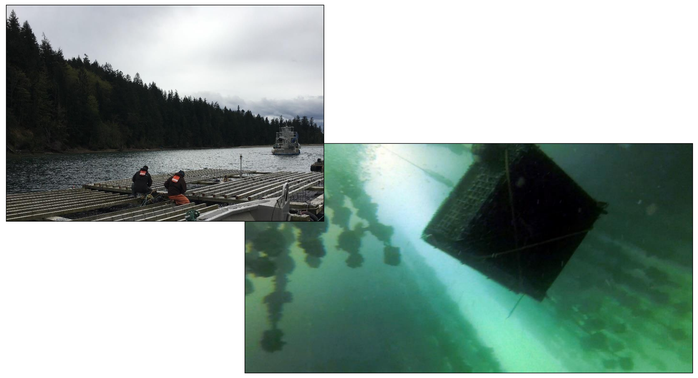
- The giant red sea cucumber (*Apostichopus californicus)* is an emerging aquaculture species with substantial economic and ecological value in California, Oregon, Washington State, British Columbia and Alaska. It is the largest sea cucumber species on the U.S. West Coast and the predominant species commercially harvested in the region. Declining wild stocks and high commercial value make *A. californicus* an excellent candidate for aquaculture and enhancement.

- Upland culture using aquaculture byproducts and waste and enhancing habitat near aquaculture sites for wild stocks of *A. californicus*, could considerably increase U.S. seafood exports and domestic consumption while generating revenue for coastal communities. In both scenarios sea cucumbers intake nutrients coming from aquaculture systems, directly feeding on waste components of currently cultured species.

- **The Pacific Shellfish Institute with the Puget Sound Restoration Fund, NOAA, SOLSEA, Suquamish Tribe, University of Washington and Jamestown Seafood** have developed technology and gained knowledge to successfully raise sea cucumbers in upland and marine environments through Saltonstall Kennedy and Pacific States Marine Fisheries Commission grants.

MARINE CO-CULTURE

- Trials co-culturing sea cucumbers with black cod and mussels have produced harvest size sea cucumbers (figures 2 and 3).
- Labor and scalability may deter commercial applications of these growing methods.
- Wild sea cucumbers have been documented in mussel farm footprints in areas with structured habitat (figure 4).
- Many North American farms and nurseries are located and proposed at sites with low sea cucumber abundance. These include fish farms, delayed release fish netpens, shellfish nurseries and shellfish rafts.
- Adding structure below these farms to increase habitat and food utilization may boost wild stocks and aquacultured animals if tagging technology is perfected.



Figures 2 and 3: Sea cucumbers deployed between raft sections in cages below the mussel lines.

Figure 4: Sea cucumbers utilizing food resources in a mussel farm footprint

UPLAND CO-CULTURE

- Trials co-culturing sea cucumbers with the seaweed dulse (*Palmaria palmate)* , have produced harvest size sea cucumbers (figure 5).
- Labor may be low in co-culturing with seaweed in upland tanks as fouling is minimized and predators are already excluded.
- Other seaweeds have shown positive growth in juvenile sea cucumbers and are used in the production of other sea cucumber species (figure 6).

Figures 5 and 6: Dulse (*Palmaria palmate)* grown during co-culture trials and sea cucumber nursery trials comparing mussel waste to seaweed as food sources.

CONCLUSION

- There are many underutilized food sources for sea cucumber aquaculture and enhancement.
- Aquaculture can be successful in upland or marine environments with upland co-culture presenting as the most economically feasible.
- Enhancing marine aquaculture (shellfish and finfish farms and nurseries) by adding structure and/or seeding with sea cucumbers in farm footprints can be a way to boost wild stocks while feeding on farm detritus.

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