Development of Sea Cucumber Aquaculture

Ecological Aquaculture
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Little attention has been paid to the aquaculture opportunities of sea cucumbers for US producers in this multi-billion-dollar market (Reynolds, 2022). Hatchery trials have been conducted throughout the world but have been successful in only a few countries. Sea cucumbers in growout cages have shown good growth and high survival in Hawai'i with minimal labor required (D. Anderson, Kauai Sea Farm).

Expansion of sea cucumber aquaculture in IMTA systems in temperate and tropical areas would give an opportunity to grow a low trophic, high-value species as well as add restorative aquaculture goods and services to marine ecosystems.

The EAF is working with research colleagues in both tropical and temperate regions to develop sea cucumber aquaculture systems and markets. In the temperate zone, Costa-Pierce has joined Nord University (Bodø, Norway) to continue research cooperation and training in the Nordic Masters Programme with Sweden and Iceland. In the tropics, EAF is supporting work by the native Hawaiian-owned Kauai Sea Farm LLC (KSF, Kalaheo, Kauai) who have developed a solar-powered hatchery for the high-value, native *Holothuria whitmaei* sea cucumber. This is the only known hatchery in the US and Pacific Islands. Further assistance to investigate to improve settlement methods and optimization of larval rearing is needed. Aquaculture of the even higher value native Hawaiian sea cucumber *Stichopus horrens* is a priority. KSF is the principal investigator on an ongoing National Oceanic and Atmospheric Administration (NOAA) Saltonstall-Kennedy project to investigate production of three native Hawaiian sea cucumbers utilizing integrated IMTA fishponds throughout Hawai'i.

EAF is working with partners to develop global knowledge sharing among applied sea cucumber researchers and developers who work with both tropical and temperate species. The model organism worldwide is the successfully farmed tropical species *Holothuria scabra* (“sandfish”, “beche-de-mer”). In the temperate zone, Möreforsk, Norway have established the EU Holosustain sea cucumber network. Many experts also work in tropical sea cucumber aquaculture in Madagascar, Panama, Thailand, and Saudi Arabia. An experimental hatchery exists at the Kristineberg Marine Research Centre of the University of Gothenburg, Sweden. In the temperate zone, growth is slower, and markets different. Red sea cucumbers (*Parastichopus* spp.) are a prime target being the highest high value species.

The most widely fished sea cucumber in the North Atlantic is *Cucumaria frondosa.* Anecdotal reports from fishermen suggest that sea cucumber abundance is declining in the Gulf of Maine. New funding will help establish the first hatchery production for this species in the Northeast USA as a beginning stage to develop aquaculture as an alternative to unsustainable fisheries. The University of New Hampshire has pioneered development of the “AquaFort” and desires to investigate the sea cucumber *Cucumaria frondosa* as a promising IMTA species.

Reynolds, J. (2022). Market analysis of Hawaiian grown sea cucumbers *Stichopus horrens, Holothuria whitmaei* and *Actinopyga varians.* Graduate Program in Ocean Food Systems, University of New England, Biddeford, ME.