Seaweed cultivation projects in CA and related regulatory framework

R. Lovell, State Aquaculture Coordinator, CDFW

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USC - Wrigley Inst event

Wild Harvests vs Cultivation (Aquaculture)

Wild Harvests - Commercial or Non-commercial (personal)

CDFW webpage: https://www.wildlife.ca.gov/Conservation/Marine/Kelp/Commercial-Harvest
see Info Digest: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=84550&inline

Non-commercial: < 10 lbs/day (personal use = not sold) under sport fishing license
Commercial harvest: annual license (calendar year, not pro-rated) + royalty on harvests paid monthly
specify type: Kelp (macrocystis & nereocystis), Edible seaweed, Agar-bearers
(separate forms & royalty rates)

87 Administrative Kelp Beds - entire CA coast subdivided
categorized: Open (33), Leasable (5 of 33), Lease Only (3), Closed (18)

MarineBIOS (mapping site) - includes layer for Admin. Kelp Beds.
https://apps.wildlife.ca.gov/marine/

Aquaculture of seaweed

One lease issued so far by state (Fish & Game Commission) specific to seaweed
PharmerSea, Goleta CA @ Ellwood Pier (25 ac)
annual rent + royalties paid monthly under terms of State Water Bottom Lease
Pilot project Sunken Seaweed at San Diego (Port District business incubator)
Land-based systems: Moss Landing (M. Graham), The Cultured Abalone (Goleta CA)
issued by CDFW Marine Region - NO Commercial Sales of production
Federal waters project (Catalina Sea Ranch)

Other agencies involved in permitting
see: Permit Guide to Aquaculture in CA
https://permits.aquaculturematters.ca.gov/Permit-Guide

Coastal Commission (structures in water = "development" => CDP)
US Army Corps of Engineers (incl: NOAA PRD review + Water Board sec 401 certif)
US Coast Guard: Private Aids to Navigation (PAToN)

Aquaculture Permit Counter - coordinating tool for early planning and interagency coordination
https://permits.aquaculturematters.ca.gov/
Informational Digest to the Regulations Governing the Harvest of Kelp and other Marine Algae in California

(Cover only)

Revised regulations
Effective date April 1, 2014
Saline Drainage Water in CA
Putting CA Aquaculture to work – turning waste into resource
Randy Lovell, Aquaculture Coordinator, CA Dept Fish & Wildlife

Irrigators in the western San Joaquin Valley suffer from geology that both restricts natural drainage, and exposes perched water to marine deposits that increase salinity in the groundwater and soil. In order to keep these lands agriculturally productive, sub-surface drainage tiles were installed to channel perched water away using networks of canals and pipelines. The proposed destination for this drainage water into the San Luis Drain, leading to discharge into the San Joaquin River, was halted in the early 1980’s when high levels of selenium carried by this water through the Kesterson Wildlife Area were found to cause toxicity problems in wildlife, including deformities of infant waterfowl exposed to selenium biomagnification through the food chain.

Selenium levels in CA soils vary by region, but the issue of salt accumulation in irrigated soils is a much more widespread problem, and the drainage water that carries these salts away from the soils continues to be a vexing issue. Utilizing drainage water with salinities that are too high for conventional terrestrial crops may, in fact, be ideal for many aquacultured species with wide-ranging salinity tolerances, and this idea was tested successfully in the late 1970’s and early 80’s, with encouraging results (Monaco, et al. 1981).

Unfortunately, these results were overshadowed by the tragic revelations at Kesterson, and a wave of attention, research funding, and recommendations ensued on how to deal with the selenium problem, with the predominant solutions being the reduced use of irrigation water, and the removal of land from production. The remaining drainage water still generated is sent to be evaporated, often in ponds. In a surprise observation of some of these evaporation ponds, it was discovered that as the water evaporated and the mineral salts remained and concentrated, the selenium concentration did not raise in step with that of the salinity. Further study showed that microbially-rich blooms in the ponds (eg: algae) helped facilitate the volatization of selenium to the atmosphere (“phytoremediation”).

Work done by university and other researchers on Red Rock Ranch has explored the use of such algal-bloom drainage water to raise aquatic invertebrates like brine shrimp, which can thrive in the highly saline water. Brine shrimp are an important food for fish and birds, but tight control over their proximate makeup is best accomplished in a managed aquaculture approach. Possible uses of this protein-rich biomass includes delivery of selenium nutritional supplements to livestock raised where forages may be deficient in this vital trace nutrient.
In a broader approach to the saline drainage water, if viewed as a resource, one can incorporate aquaculture methods to pre-treat the water before use in the culture of a long list of brackish or marine finfish or shrimp species.

By balancing the source waters (perhaps blending drainage with other brackish waters), microbial blooms, and other factors, a system can be envisioned where selenium is volatized in high-rate algae production processes, and the leftover saline water further utilized in aquaculture.

High-Rate Algae Ponds

Many marine species of fish & shrimp actually thrive in salinities far below normal seawater strength, providing the grower with many options to tailor output to market demands.

Commercial aquaculture provides economic incentives to both treat a potential source water (through phytoremediation) and capitalize on a regionally-specific toxicity problem. At the same time, it demonstrates a solution to soil salinity problems that exist throughout the world, using California-based ingenuity.