Seaweed Farming in Alaska

Sea Grant Alaska

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Cover photo: Checking a longline outplanting of sugar kelp at an experimental site near Coghlan Island, Alaska. Photo by Mike Stekoll

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Why seaweed farming is of interest in Alaska

Although the people of Alaska have been using seaweed as a food staple for centuries, seaweed farming is only recently attracting interest in the state. Globally, demand for seaweed has soared over the past 50 years, far outstripping wild supply, according to the United Nations Food and Agriculture Organization. Mariculture (the ocean farming of food) produces more than 96 percent of the world's supply of seaweed products, currently valued at $4-5 billion. Alaskans are starting to pay attention.

Alaska's potential for cultivation of kelp and other seaweeds is high, given its vast natural marine habitat with pristine water quality. Kelp, a large brown, cold-water seaweed, is the primary focus. Seaweed culture is a logical business addition to established shellfish farms since most utilize floating raft culture and are located on sites favorable to seaweed cultivation. Since the growth cycle of seaweed is fall to spring, it is compatible with other seasonal occupations such as summer fisheries.

Seaweeds contain important nutrients such as protein, vitamins, minerals, trace elements, and enzymes. Growing awareness of the medical benefits that seaweed provides is boosting demand for seaweed-derived snacks and other creative uses in food products for human consumption. Increasing demand for seaweeds in the food, pharmaceutical, and animal feed industries will likely expand markets in years to come.

State of the industry in Alaska

Alaska's seaweed mariculture industry is in its early stage of development, with only a few farms operating in 2017 and some permit applications in the works. Several hurdles need to be addressed before the industry can take advantage of the full potential offered by Alaska's marine environment. Maine, Connecticut, and California are further along in developing their seaweed industries and Alaskans can benefit from what they have learned.

Researchers and specialists at Alaska Sea Grant, the University of Alaska, and the OceansAlaska Marine Science Center and Shellfish Hatchery are working on the challenges through research and learning from established seaweed farmers.

The process of farming seaweed

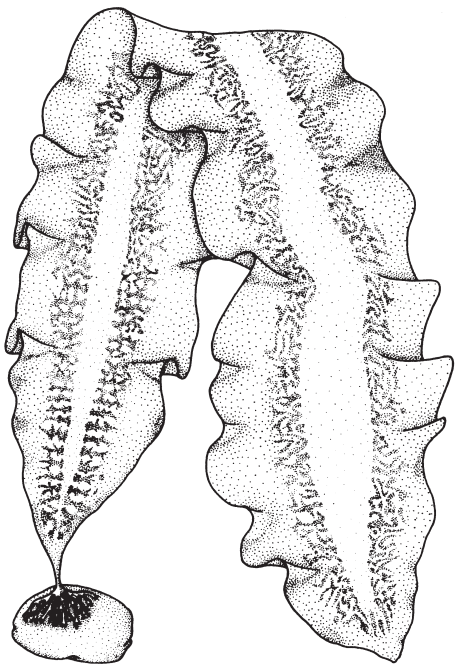
Choose a site good for growth and available for permits

Site selection for seaweed farms is one key to a successful farm. A site must have clear, nutrient-rich seawater, and appropriate marine energy (tidal, current, wave, etc.) for the species to be cultivated. In addition, the plants need adequate sunlight exposure and the necessary temperature and salinity.

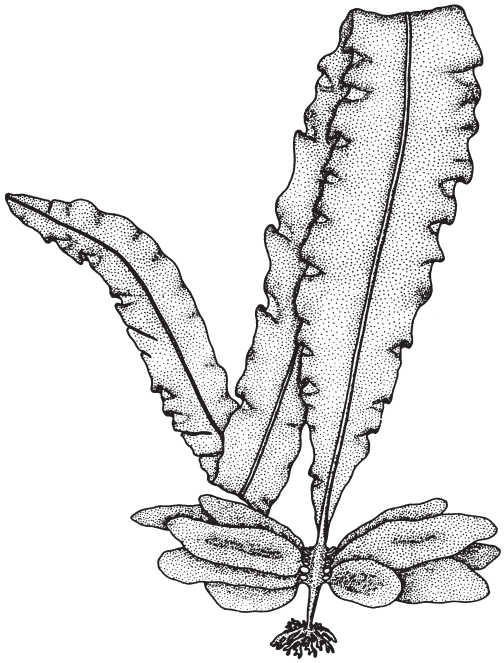
The site needs to be acceptable for permitting by the Alaska Department of Fish and Game (ADF&G), Department of Natural Resources, and land owners. The first step is to apply for an Aquatic Farm Operation Permit by completing a Joint-Agency Aquatic Farm Program application and submitting it to the Department of Natural Resources. For more information about how to apply and the fee structure, please refer to ADF&G Aquatic Farming Authorization Requirements.

Start with young seaweed plants seeded on a line

Currently, only two species of seaweed are being cultivated in Alaska—sugar kelp (*Saccharina latissima*) and ribbon kelp (*Alaria marginata*).



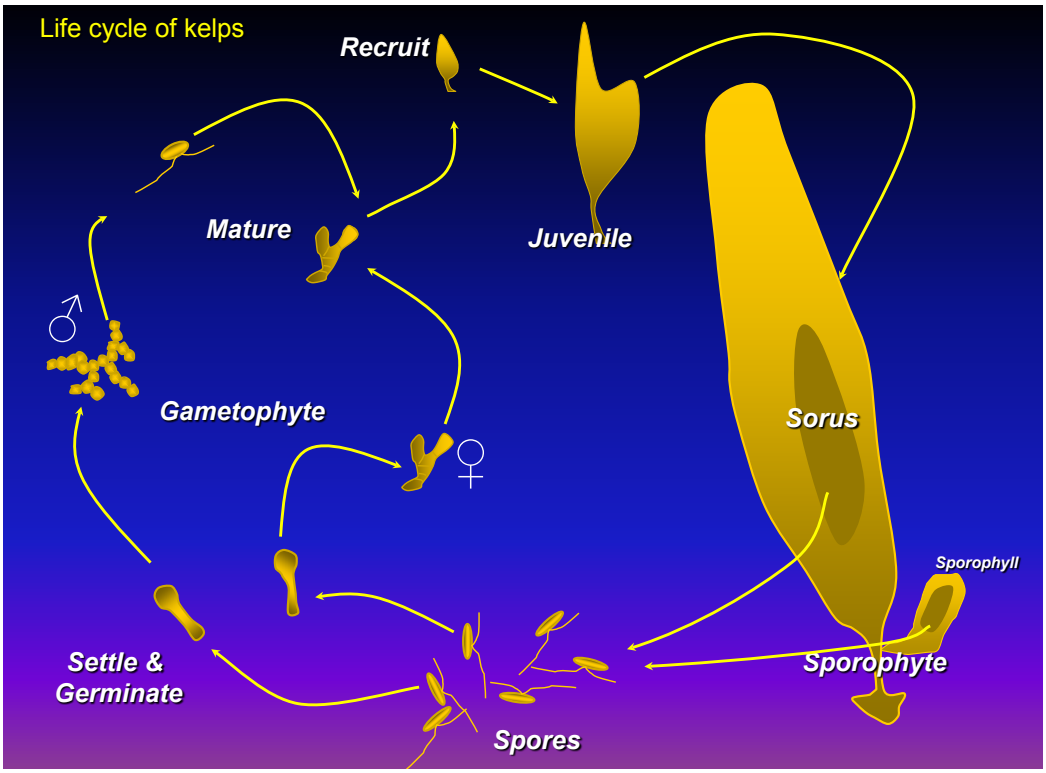
Sugar kelp. (Ernani G. Menez, illustrator)



Ribbon kelp. (Ernani G. Menez, illustrator)

Seeded string culture is used to start the initial growth of the plants. Local kelp blades are collected that have sorus tissue (flat dark structures that produce spores). Culture techniques are used to induce the sorus tissue to release spores. The spores germinate and continue the reproductive process, eventually resulting in juvenile kelp plants.

The initial stage of the mariculture operation requires a hatchery or laboratory type of environment that can control the process from spore release to the formation of juvenile plants growing on string. After a few weeks of growth under closely controlled conditions, the seeded strings are wound onto farm culture rope that can be deployed at



Courtesy of Mike Stekoll

the marine farm sites. On a small scale, this procedure is well worked out, but more work needs to be done to produce seed on a commercial scale.

Individual farmers can apply for their own hatchery permits from ADF&G to produce seeded strings, or they can get seed from a commercial hatchery. To date there are two permitted commercial hatcheries in Alaska, and only one has produced seed.

One challenge for hatchery production is the current requirement by ADF&G that parent plants used to produce the seed must be collected within 50 kilometers of the farm site. This requirement is a cautious approach to a new industry, created to protect the genetic variability of natural populations. Once research on the range of population genetics of Alaska seaweed is completed, this requirement may be relaxed.

The stipulation for local seaweed to seed the lines requires a farmer to explore nearby kelp beds for each species. However, the kelp may not be ripe (producing spores) when located. Experiments are under way at the University of Alaska to develop methods for producing seed on demand.

Many additional highly valued species are being considered for cultivation. These prospective species have complicated life cycles requiring further experimentation to perfect the culture techniques that can be used on a commercial farm.

Farm operation

Although the farm operation appears to be straightforward, many aspects of growing operations still need to be researched.

In seed-string kelp culture, the strings covered with juvenile plants are wrapped around a heavier line and suspended between buoys at the desired water depth. “Longline” is another term for the seaweed culture rope. Issues including configuration of the lines, anchors, etc., need to be adjusted for each site.

During the growing season, seaweed farmers should make sure the lines do not get tangled. Depending on the species being cultivated, it may be necessary to add more

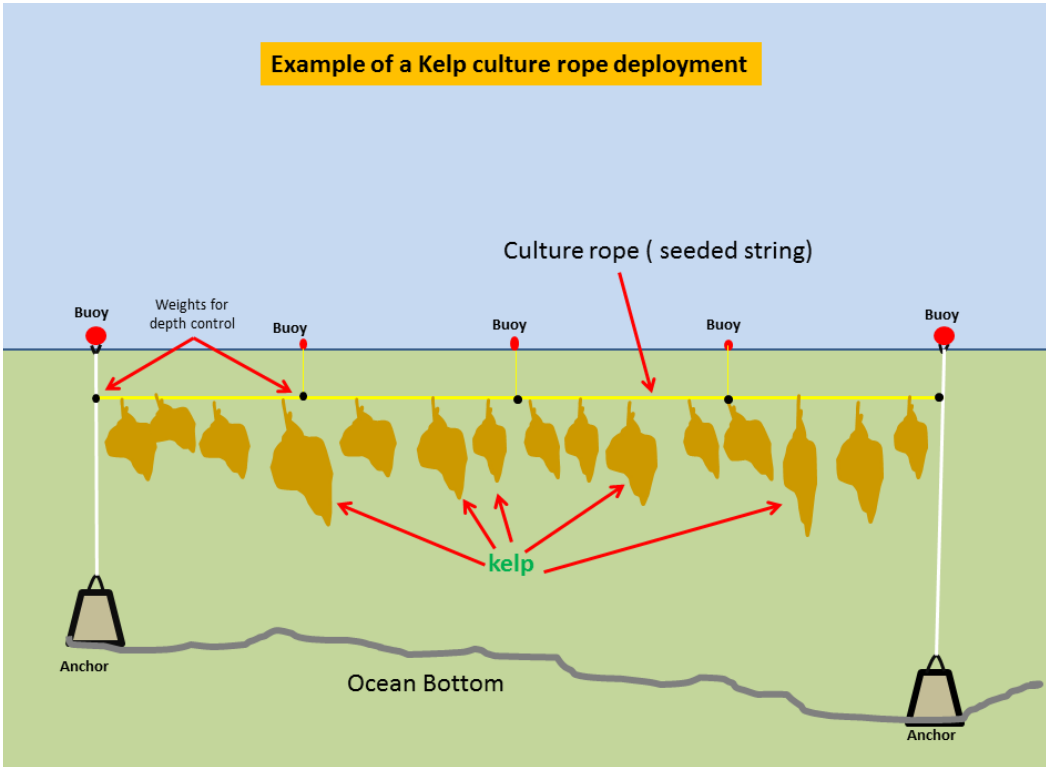
buoyancy or to add additional weights to maintain the kelp at the desired depth, since some seaweeds develop either positive or negative buoyancy as the plants grow and mature.

Farmers need to visit the site on a regular basis to determine the harvest timing and to monitor for biofouling (accumulation of living organisms), which can have an impact on the quality of the harvested product. This is especially important after storms, which can damage gear and shift positioning of the kelp lines.

Seaweed farmers should collect data and maintain records on water temperature, salinity, water clarity, and nutrient levels to help in farming decisions.

More details on farming procedures are available in free online manuals. An excellent publication is the *Kelp Farming Manual: A Guide to the Processes, Techniques, and Equipment for Farming Kelp in New England Waters*, by Katie Flavin, Nick Flavin, and Bill Flahive. It is the result of a three-year process of learning how to farm kelp in New England waters, a collaborative effort led by Ocean Approved, the University of Connecticut, and the Bridgeport Regional Aquaculture Science and Technology Education Center. The techniques in the publication are currently being used in Alaska on pilot farms.

Another good reference is a manual published by Connecticut Sea Grant: the *New England Seaweed Culture Handbook* by Sarah Redmond et al.



Harvesting, handling, storage, and processing the harvest

Best practices on how to handle freshly harvested seaweed to maintain quality and food safety are needed for Alaska. Seaweed quality begins to degrade quickly after harvest, so it is critical to carefully harvest and stabilize products for delivery and to process into marketable products. Currently there is only one commercial buyer of Alaska seaweed—markets and processing capability need to be developed before the industry can grow

Kelp drying on a clothesline. Photo by Carter Newell

much further. Alaska will benefit from collaboration with other states where work is being done on several issues.

Transporting seaweed in Alaska

Transportation of farmed seaweed to processing facilities in Alaska presents a hurdle due to large distances between farms, processing facilities, and markets. At some point, tenders for transporting harvest from the farms to processing facilities may be feasible. Harvest of kelp occurs prior to the busy salmon harvest in Alaska, and the seaweed industry might take advantage of salmon tenders and processing plant infrastructure available during the off season.

Marketing strategies

Although demand for seaweed products is growing in the United States, the market is currently predominantly in Asia and Europe. It is a challenge for Alaska to compete in the traditional markets due to the cost of labor and transportation. In the US, niche markets are promising for this new industry.

Conclusion

Alaska's seaweed farming industry has the potential to grow, with the state's clean waters and vast ocean landscape. But hurdles need to be overcome before cultivating seaweed in Alaska can fill the demand for this resource. Life histories and reproductive strategies of seaweeds are among the most complex of all marine life. Experimentation and development of best practices will be required to perfect the culture techniques that can be used on commercial farms.

In 2016, Alaska Governor Bill Walker created the Alaska Mariculture Task Force charged to develop a plan that will grow Alaska mariculture opportunities. As part of the task force, Alaska Sea Grant is providing technical assistance and supporting research in partnership with industry to develop kelp mariculture as a new industry for Alaska.

Sugar kelp cultured on longline.

Resources and more information

Alaska Department of Fish and Game, Aquatic Farm Permits: http://www.adfg.alaska.gov/index.cfm?adfg=aquaticfarming.main

Alaska Department of Natural Resources: http://dnr.alaska.gov/mlw/aquatic/

Alaska Sea Grant. Alaska aquaculture resources. http://aquaculture.seagrant.uaf.edu/ (Publications, presentations, videos, and helpful links for the aquaculture industry)

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