

Cultivating Edible Seaweed in Hawaii

New technique helps local farmers

By Mari N. Jensen



Seaweed cages in lagoon.



This edible red seaweed, called "long ogo" by the Japanese, is eaten by people in Hawaii, Asia and the Pacific.

Although a yearning to surf was what first drove native Tucsonan Edward Glenn to Hawaii, what keeps him going back is his life-long interest in marine agronomy. Now, instead of hanging out in the waves, Glenn spends his time on the leeward side of the island of Molokai, working with the local community on sustainable aquaculture projects for the ancient fishponds that dot the island's south coast.

Rather than growing fish, Glenn and his colleagues are focusing on the edible red seaweed *Gracilaria parvispora*. The alga, known as "long ogo" by the Japanese, is eaten by people in Hawaii, Asia and the Pacific and is also a source of agar, a common thickening agent in Japanese cooking.

"Long ogo" was once the most important edible seaweed on Hawaii's reefs. In the past, people would go out to the reef and yank the seaweed off the rocks or even take the whole rock, Glenn says. Ultimately, the reef populations of seaweed declined. People started to grow another species of seaweed in tanks on land, but the replacement just wasn't as good.

"This particular seaweed is the one that people desire the most, and it has become overharvested on the reefs of Hawaii," says Glenn, a professor of soil, water and environmental science in the University of Arizona's College of Agriculture and Life Sciences (CALs). "Our scientific challenge was to find a way to put the seaweed into a practical aquaculture system. People have been trying for years to grow this particular species, and they haven't been able to do it."

However, Glenn and his colleagues *have* done it. The group, which includes researchers from the Department of Soil, Water and Environmental Science's Environmental Research Laboratory (ERL) and others in Hawaii, has developed a way to grow the complete life cycle of "long ogo" without needing to harvest starter plants from the ocean. Glenn says the sustainable system for growing fresh "long ogo" is unique in the United States.

In 1990, Glenn was in Hawaii helping his former graduate advisor, Maxwell Doty, find places in the Hawaiian islands suitable for cultivating seaweed. Molokai stood out as the best spot for such a project: the ancient fishponds still existed, some islanders had begun a fishpond revival movement and the local community wanted the kinds of enterprises that would mesh with their rural lifestyle.

Molokai is a relatively undeveloped island, without the coastline-oriented tourist industry prevalent on Hawaiian islands such as Oahu and Hawaii. Many Molokai residents cherish their rural lifestyle and want to continue traditional Hawaiian ways of life, rather than converting the island's economy to one dependent on tourism, Glenn says. However, Molokai also has limited opportunities for employment. An aquaculture project focused on growing "long ogo" in the ancient fishponds would satisfy a lot of different needs.

So Glenn applied for some funding from the National Coastal Resources Institute, a branch of the National Oceanic and Atmospheric Administration and has been working on

the project for over a decade. In 1998 he teamed up with Stephen Nelson, former director of the University of Guam's marine biology lab, who had retired to Tucson. Currently a senior research scientist at ERL, Nelson's primary research focus is the Molokai project.

Now the "long ogo" project is a \$300,000 enterprise that, by supplying seaweed to markets in Honolulu, provides additional income for about 40 farmers. The project has also developed several seaweed-based specialty foods, such as Molokai Limu Salsa, thereby enlarging the market for the farmers' harvest. Having a small aquaculture business is a significant source of additional income for many of the farmers.

A key part of the project is the hatchery, run by Ke Kua'aina Hanauna Hou (KKHH), a nonprofit organization that develops aquaculture enterprises for coastal residents. In KKHH's hatchery tanks, algal spores are allowed to settle onto rocks or coral chips and start growing. Then those rocks or chunks of coral are given away to the farmers so they can start their own plot of "long ogo." Farmers can have a load of seaweed-covered rocks delivered by pickup. The starter plants can be grown in a variety of places: an ancient fishpond in the ocean, as part of a land-locked fishpond, or even in the effluent runoff ditch from a shrimp-farming operation.

If the plants are grown in the ocean, once the mass of seaweed gets big enough, the farmer harvests it and sells the harvest back to KKHH, which then sells the fresh seaweed to markets in Honolulu. Once a plot is established, it provides a continual source of "long ogo," because the base of the seaweed remains in place and keeps growing anew. The little plots of "long ogo" that are grown in the ocean also release spores periodically, thereby replenishing the natural population.

"This is actually repopulating the reef," says Nelson.

Growing the plants in the unappetizing waters of fishponds or shrimp-farming effluent provides the seaweed with a ready source of the nutrient nitrogen, but plants from those environments cannot be marketed as is. So KKHH will buy back the fertilized plants and place them in a cage in a clean-water

lagoon. Once there, the lagoon's waters cleanse the plants. The plants bulk up, doubling or tripling in weight as they use their stored nitrogen. At that point, KKHH sells them.

What does "long ogo" taste like? Glenn says it is eaten fresh and often combined with other foods. "It's crunchy and slightly salty, like a pickle without the vinegar taste." One of his favorite long ogo dishes is ahi poke, a Hawaiian dish like sushi that combines cubes of fresh, raw tuna, pine nuts, chopped ogo and sesame oil with some soy sauce.

The team is working on a way to combine "long ogo" production with fish farming in the ancient fishponds. Although the ponds were used by the ancient Hawaiians for fish aquaculture, the walls have not been maintained and the ponds no longer hold fish securely. However, fish could be stocked in the ponds within net pens. If the pens were large enough, basket cages of seaweed could be placed inside the pens, allowing the plants to take up the nitrogen from the fishes' waste products. The researchers are still working out the details. Nelson says such combination aquaculture would help smooth out the income stream for fish farmers.

"For fish, you have to wait several months to sell them, but the seaweed could be sold every couple weeks and make the operation financially stable."

The project has been so successful that Glenn and his colleagues are looking for new markets for the specialty seaweed. Last year, the team received a \$49,000 grant from the U.S. Department of Agriculture's Cooperative State Research, Education and Extension Service that will let Glenn, Nelson and KKHH develop additional Hawaiian ogo products, such as sports gels, gourmet recipes and healthcare products.

Processing the seaweed could be done as small family businesses, Nelson says. Some large-scale seaweed-processing plants use harsh chemicals to extract the agar, but Nelson sees an opportunity to extract Molokai agar in gentler ways so it can be marketed as an organic product. "We can say this was grown in the pristine waters of Hawaii." ■

The Environmental Research Laboratory

The Environmental Research Laboratory (ERL) is a specialized off-campus component of the Department of Soil, Water and Environmental Science in the College of Agriculture and Life Sciences. It fulfills a unique function within the University of Arizona by conducting innovative, applied environmental research and education programs relevant to desert ecosystems. Areas of ERL research include:

- Water quality and human health protection
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The facility is located on an 8.6 acre facility 10 miles south of Tucson.



S. Nelson

Fish tank on Molokai, Hawaii.

For more information contact Ed Glenn at (520) 626-2664 or eglenn@ag.arizona.edu. Ke Kua'aina Hanauna Hou (KKHH) website: www.pukoo.org/.