

BCF BEGINS MARICULTURE TRAINING PROGRAM FOR NORTHWEST INDIANS

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The Indians of the Pacific Northwest traditionally have lived near salt water, an important part of their rich heritage. At one time, the region's supply of marine products--halibut, salmon, crabs, and oysters--far exceeded the demand; the prosperity of the tribes was attributable directly to these resources. The artwork of the Indians expresses the importance of these resources to the vigor of the tribal community.

The impact of non-Indian populations exploiting these same resources has been felt for about 200 years--most seriously in the past 50 to 75. Now, Indian and non-Indian alike use modern methods to harvest fish and shellfish, almost all destined for commercial sale. As demand frequently exceeds supply, it has become important to investigate every potential method for increasing the harvests of fishery products.

Lummi Indians

The Lummi Indian Reservation lies less than 15 miles from the Canadian border, in the northwest corner of Washington. Some 100 of about 1,600 members of the tribal community live there. About 90 percent of Lummi families have incomes of less than \$10,000 per year, mainly from salmon fishing on the reservation and on traditional fishing grounds nearby. In recent years, the total annual income from salmon fishing has ranged from \$100,000 to \$200,000 per year. The income from other fishery resources has been much less.

The traditional dependence of the Lummi on marine resources cannot be maintained without increasing the quantity of commercially important fish and shell fish. As natural fishery resources outside the reservation are open to exploitation by Indian and non-Indian, one recourse is to increase resources within the reservation. This must be accomplished through mariculture (fine aquaculture).

Mariculture Has Merits

The reservation is a large tract of flat land bordering the Strait of Georgia. Many of its 10,000 acres are suitable for housing or commercial development; for the latter, the prime acreage is 5,000 acres of tidelands.

The Lummi Tribal Council is considering an imaginative project for developing the aquacultural potential of these tidelands. Primary emphasis will be on the culture of fish and shellfish of high economic value in a series of diked enclosures on the tidal flats.

BCF Provides Training

To support the Lummi tribe, the BCF Seattle (Wash.) Biological Laboratory is providing personnel and facilities to train Lummi youth. Guidelines are limited, and BCF scientists were given the responsibility for planning the training program.

We embarked on a program of maximum effort in practical training and experience, coupled with extensive assistance in continuing the formal education of locally accredited schools. Academic training would be given by BCF scientists whenever such training could be related directly to the trainees' possible future responsibilities. At every opportunity, they would participate in fishery research projects of BCF and the University of Washington to broaden their background and skills.

The Training Program

The experimental program began with four trainees. They were quartered on board the 115-foot BROWN BEAR, formerly an oceanographic research vessel, now converted into

a floating maricultural laboratory. The vessel is moored in fresh water near the University of Washington's Fisheries Center and within walking distance of BCF's Seattle Biological Laboratory.

The trainees were started immediately on practices of fish culture with eggs of fall chinook salmon. The adult salmon reach the Seattle Biological Laboratory via a short, interconnecting waterway that discharges into Puget Sound. The trainees spawned the fish and transferred the fertilized eggs to incubators on board the BROWN BEAR. The approximately one-quarter-million eggs taken enabled the trainees to arrange a variety of experimental conditions during the incubation period. These experiments were demonstrably effective in stressing the importance of environmental conditions to the health, vigor, and survival of the developing embryos.



Fig. 1 - Lummi trainees check their newly hatched chinook salmon eggs. Temperature-controlled supplies of fresh or salt water can be pumped into all the laboratories of the BROWN BEAR.

Standard salmon cultural practices were used (fig. 1). Since formal education completed by the trainees averaged 10 years, considerable effort was put into on-the-job academic training that would apply directly to maricultural problems. The trainees were

taught the International (Metric) System and its application to laboratory instruments. They were instructed in the rudiments of statistics and statistical applications, the use and significance of elementary graphs for plotting data, manipulation of analytical balances, vernier and other calipers, and other measuring devices, desk calculators, and the slide rule.

The trainees were taught to use anesthetic and prophylactic compounds for handling and treating fish. This training required instruction in proportionality and its application to weight, volume dilutions, and to practical experience in preparing anesthetic solutions and salt baths.



Fig. 2 - Trainee measures dissolved oxygen in floating laboratory water supply. The training emphasizes learning to measure--and to understand importance of--the properties of water that are vital to the mariculturist.

They were instructed in water chemistry. Emphasis was on characteristics of water quality important to mariculture, such as dissolved oxygen, pH, ammonia nitrogen, phosphates, nitrates, turbidity, salinity, and alkalinity. Thorough experience was given in using analytical instruments and "cook-book" techniques (fig. 2) for spotting trouble with the quality of the water used in maricultural systems.

The phases of training in fresh-water salmon culture are now almost complete, and the BROWN BEAR will soon be moved to salt water. There, the trainees will get experiential

the salt-water acclimation of rainbow trout and salmon--and the culture of these highly desirable fish in salt-water pens and cages.

Training in shellfish culture was begun in the fall 1968. The trainees collected bay samples in Puget Sound, Wash., at regular intervals and processed the samples. They are being taught how to measure and weigh shellfish to interpret growth patterns, and how to look for in gonad development. They are also being taught to collect plankton samples, to determine when bivalve larvae appear, and how to prepare artificial cultch material for collecting spat. BCF scientists are preparing to begin training in the culture of algae for feeding bivalves and bivalve larvae.

When the BROWN BEAR is moved to salt water, the trainees will learn to condition commercially important bivalves for spawning, the care and feeding of larvae, and the collection of spat on artificial cultch.

Other Work Experiences

The Lummi trainees have benefited from work experiences other than those given on the BROWN BEAR. One trainee spent 2½ weeks on the BCF research vessel MILLER EEMAN off California assisting in the collection of plankton, learning how to operate the plankton nets, and to prepare plankton samples. More recently, two of the trainees have been working at the University of Washington with Professor Lauren Donaldson, a well-known authority on rainbow trout and salmon culture. Prof. Donaldson has been teaching them techniques for spawning trout, the care and incubation of trout eggs, preparing and handling eggs for shipment, "cold-storing" of salmon fingerlings, and good cultural practices.

When their training with Prof. Donaldson is completed, they will spend several days at the BCF Biometrics Institute, in Seattle, where they will be introduced to data processing. Although they will not be expected to acquire any specialized skills, they will be made aware of the labor-saving aspects of automatic data processing by working with punch cards. They will start with simple card-punching.

Some Problems But Progress Evident

Within 2 months after training began, it became evident that the trainees were not adequately prepared for the technical instruction. The scientists were not able to divert sufficient time from their regular duties to provide the guidance necessary to improve the trainees' comprehension. The number of trainees, therefore, was reduced to two. This reduced the training load for the scientists and increased personal contact, a factor that proved extremely important.

The Lummi Tribal Council reassigned one trainee to Peninsula Community College in Port Angeles, Wash., where he was enrolled in the Fisheries Technician program. The effectiveness of our training program was noted by one instructor there. He said that of five Lummi students enrolled, the one who had undergone 2 months' training with BCF was relatively advanced in technical competence and skills.

The cooperation of local school authorities in the training program has been outstanding. One trainee attends a local high school each morning, where he takes academic subjects required for graduation. The school authorities have arranged to give him elective credits for the work experience and academic instruction provided in the BCF training (called "Elements of Marine Science"). These credits will be applied toward his certification for graduation.

The training program is still highly experimental; it will be modified as the needs of the Lummi Aquaculture Project become evident. Plans are being made to include the training of Lummi women; it is expected that their involvement will encourage family participation and increase the stability of the project.



U.S. Fishery Jurisdiction

U.S. territorial waters are 3 miles--but fishery jurisdiction extends an additional 9 miles.