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PRELIMINARY STUDIES OF CULTURE OF COMMERCIALY IMPORTANT
TROPICAL FISHES UTILIZING NEVADA'S GEOTHERMAL AQUIFERS TO
SIMULATE TROPICAL CONDITIONS

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ABSTRACT

A six month study to propagate tropical viviparous fishes (platies, swordtails and mollies) was commissioned by the University of Nevada, School of Veterinary Medicine. The study began in September 1986 when breeder fish were purchased and terminated at the end of March 1987. Breeder fish were stocked in growout raceways thermoregulated and oxygenated. Water temperatures were maintained at 26 degrees C and oxygen levels held at 4 - 8 PPM. Daily mortalities were recorded throughout the study. This study indicates that the culture of aquaria quality fish is viable utilizing geothermal resources. Commercial rearing techniques are presented and intensive approaches emphasized.

INTRODUCTION

Geothermal sites of Nevada, Idaho, Oregon and California, have been utilized for aquaculture research and pilot commercial demonstration for over a decade. As a result, commercial catfish farming and freshwater prawn culture are emerging as an industry in these nontraditional areas. Recognizing the success of tropical fish farm industry in Florida and Nevada's ample geothermal resources, tropical fish culture appears to be the "sleeping giant" of aquaculture and economic diversification of the region.

Pioneer efforts to culture exotic tropicals in the state of Nevada were initiated at Hobo Hot Springs in 1985 by Washoe Aquaculture Limited. Additional preliminary studies to farm exotic tropicals were initiated by Dr. Robert Taylor at Wabuska Hot Springs site near Yerington, Nevada.

This study was commissioned by the University of Nevada, Reno to investigate the feasibility of culturing tropical fishes ie, livebearers

under controlled conditions. Instead of utilizing ponds (extensive methods) as they employ in Florida and Southeast Asia and at the Wabuska site, enclosed geothermal thermoregulated and oxygenated raceways were used. The growout raceways were monitored during the culture of swordtails (*Xiphophorus helleri*), platies (*Xiphophorus maculatus*) and mollies (*Poecilia velifera*).

Tropical fish culture is labor intensive and differs with other aquaculture ie. food production as the final product is sold live. Commercial rearing techniques are generally considered proprietary and available literature is directed to hobbyist. As a result, a considerable gap exists between the hobbyist and aquaculturist. All aspects of fish culture ie., growout, capture, grading, packing and transport are equally important to the success of any future venture to propagate tropicals commercially.

This study presents data collected from September, 1986 to March of 1987 and elucidates stocking, recruitment and mortality parameters.

Geothermal Resource

The aquaculture facility is located in Douglas County, Nevada on Washoe Indian lands. The spring flows at 100 GPM and maintains a constant temperature of 45 degrees C. The spring is located in the Hobo Hot Springs area in association with other springs that discharge from a series of small faults that branch off the larger Genoa fault, which is the principal range-bounding fault on the west side of Jacks Valley. The surface displacement coincides with the gravity anomaly (Trexler and others, 1980). The thermal fluid contains 396 ppm TDS and are similar to other sodium sulfate-chloride type fluids in the region (ie. Wally's Hot Springs, Carson Hot Spring). The fluid pH is 8.9 and the water contains slightly elevated concentrations of fluoride and boron. With the exception of local recreation, this effort represents the first commercial utilization of the Hobo geothermal resource.

Breeder fish were purchased from Singapore commercial fish farmers. "Livebearers"

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swordtails, platies and mollies, were selected because of their suitability for culture in high pH water at the Hobo Hot Springs site. Genus *Xiphophorus*, the swordtails and platies, *X. helleri* and *X. maculatus* respectively represent a good portion of the tropical fish "bred and butter" trade as does *Poecilia velifera* the high sailfin mollie chosen for these trials. More specifically, the marygold wag swordtail, rainbow platy and the silver sailfin mollie were the varieties chosen for this research.

Swordtails and platies were stocked in tanks measuring 8' x 60' x 4' (approximately 10,000 gallons) and the mollies were stocked in a tank measuring 8' x 40' x 4' (approximately 6500 gallons). Stocking rates varied 2.42, 3.79 and 1.5 fish per square foot of tank bottom respectively (swordtails, platies and mollies). Raceway growout tanks were continuously thermostated at 26 degrees C and growout tanks experienced daily water exchange. Water reservoirs were aerated via a blower and micropore tubing (100 microns). Oxygen levels were maintained at a range of four to eight ppm. Fish were fed commercial salmon starter daily. Mortalities were recorded daily and fish were removed. Artificial substrates ie. dried sagebrush and materials were used to provide habitats for spawned fry to reduce cannibalism. The growout raceways were utilized for both brooder reservoirs and growout trials.

RESULTS

Table 1. summarizes stocking, mortality and recruitment data.

Table 1. Results of growout trials for platies, swordtails and Mollies

RACEWAY POPULATIONS	RAINBOW PLATY	MARYGOLD WAG SWORDTAILS	SILVER MOLLIES
Stock 9/21/86	1170	1820	480
Final Stock 3/24/87	2655	3092	*2701
Population			
Growth Rate	2.26	1.69	5.62
Recruitment 3/24/87	1485	1272	2221
Mortality 3/24/87	1076	783	1037
Rec+Mort+Stock	3731	3875	3738
Mort/Rec+Rec+Mort+Stock	28.8%	20.2%	27.7%
Rec/Rec+Mort+Stock	39.8%	32.8%	59.4%
Stock/Rec+Mort+Stock	31.3%	46.9%	12.8%

* 679/2701 = 25.1% culls or unmarketable fish

Population growth rates for rainbow platy, marygold wag swordtails and silver mollies trials were 2.26, 1.69 and 5.62 respectively (Table 1.). These results suggest that mollies were the most prolific of livebearers propagated during these trials. Recruitment represented 39.8% for platies, 32.8% for swordtails and 59.4% for mollies (recruitment/recruitment+mortality+stock) presented in Table 1. When mortality data are considered (Table 1.), mortality/recruitment+mortality+stock, mortality represented 28.8% for platies, 20.2% for swordtails and 27.7% for mollies. The initial stock of 1170 platies, 1820 swordtails and 480 mollies account for 31.3%, 46.9% and 12.8% of the total population (initial stock + recruitment + mortality (Table 1.).

Analysis of the economics of the rearing trials are presented in Table 2. Breeder Platies, swordtails and mollies were purchased for \$0.32, \$0.50 and \$0.72. However, wholesale value of the fish are \$0.25, \$0.30 and \$0.50 respectively. If the fish were to be sold at these prices the following gains would be recorded. The gain for the platies is \$299.35, \$199.60 and \$665.92. It is acknowledged that freight, operational, feed and labor expenses are not considered in these calculations.

Table 2. Analysis of economics of rearing trials of livebearers.

FISH	COST OF FISH	VALUE OF FISH STOCK
Rainbow Platy	1170 x .32 = \$374.40	2655 x .25 = \$663.75
Marygold Wag Sword	1820 x .40 = \$728.00	3092 x .30 = \$927.60
Silver Mollie	480 x .72 = \$345.60	*(74.9/2701)x.50 = \$1,011.52

*679 of 2701 mollies sampled (24.1%) proved to be culls or unmarketable fish.

CONCLUSIONS

Geothermal commercial cultivation of viviparous tropicals appears viable. However, more sophisticated methods should be implemented. In this study, researchers assumed that the growout raceways should be employed for both the breeding and growout activities. In my opinion these activities should be independent of each other. Obviously, cannibalism will be reduced. More importantly, incidental breeding of poor quality fish perpetuates the deterioration of brood pool. In other words, it is essential to maintain complete control over brooders and maintain quality of the population strain. Exotic tropicals must be cultured through genetics not farmed as a crop. As a live commodity,

handled during the growout, capture, grading, packing and transport phases, fish can experience shock stress, illness and death. The health of fish is paramount to the success of this business. All phases; growout, capture, grading, packing and transport must be achieved with the least amount of handling and fuss time. Tropical fish culture utilizing Nevada's geothermal resources appears to be viable and may evolve as a significant industry.

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