

STUDENT PROJECT FINAL REPORT
TO THE UNIVERSITY OF HAWAII
MARINE OPTIONS PROGRAM

FEASIBILITY STUDY OF RAINBOW TROUT
AQUACULTURE IN HAWAIIAN WATERS

DURATION:

NOVEMBER 1, TO MAY 15, 1982

PROJECT MEMBERS:

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PROPOSAL DATE

JANUARY 1, 1982

FINAL REPORT DEADLINE

MAY 1984



INTRODUCTION

Our data of the growth rate of a cohort of Salmo gairdneri, raised in Kaumana Hawaii, should be of great value to existing data on the temperature limits of this species of trout. Previous studies indicate waters above 60°F (15.5°C) stunts the growth of rainbow trout (Salmo gairdneri).¹ The study conducted measurements of growth of the trout in both length and weight. Length was measured in (cm) from tip to tail. Weight was determined by weighing a sample of 50 fish and finding the mean weight, by dividing total weight (gm) by the number of fish. We also took temperature readings (°C), salinity measurements (‰), and dissolved oxygen readings (‰). Unfortunately we were unable to obtain equipment to monitor Nitrates and pH.

The question of whether or not the trout grown in these warm subtropical fresh water ponds mature into viable adults, has not yet been answered, due to the fact that these trout are only ten months old, and trout mature in three to five years under normal conditions, although the gonads of several trout which have been harvested show slight abnormalities of gonadal development.

As for the marketability of the fish, the answer seems to be a hesitant yes or an optimistic maybe. Pioneers Richard and Elaine Dollnig of Hilo Trout Farms still feel that there is great potential for the aquaculture of rainbow trout (Salmo gairdneri), on the Big Island (Hawaii). But conclude that cutting overhead costs is a must. Feed proved to be the number one cost in raising trout in fresh and/or brackish water ponds. Unfortunately we ran into

problems in monitoring the brackish water pond in Keaukaha, so most of our data is of the trout grown at Akolea Aquatics in Kaumana Hawaii, although personal contacts reveal that growth of the two cohorts are nearly identical.

The marketability is a question pondered by Carl Ramsey, a manager at Safeway grocery store. Saying that any "new" product is expected to have successes and set backs throughout its advertisement campaign.² Bill Salvedor, owner of Reed's Bay Restaurant, seems pleased with the trout he serves, which happen to have been grown at Akolea Aquatics by Howard and Eric Takata. Reed's Bay sells approximately 80 fish per week according to the seller's estimates.³ The fish are sold live from holding tanks located under the restaurant, then cooked how you like it, and served piping hot, a delicious entree.

And as for the possibility of rearing trout in brackish ponds, the answer is a solid yes. Although the week to week monitoring of the brackish water ponds was not possible, the data obtained from the Dollnig's on the growth of the cohort in the brackish water is nearly identical to the data we have gathered from the Kaumana trout. This answer can be further substantiated by Aquaculture Digest.⁴ Rainbow trout have also been acclimated to a habitat of sea water (34⁰/00 Sal.).⁵ But mainland production is so advanced, Hawaii trout farmers will have trouble competing with mainland prices, no matter how low they trim their overhead.

METHODS AND MATERIALS

The trout eggs were flown in from an Idaho trout farm. The eggs were eyed, meaning they were fertile. The eyes are easily seen as two black dots on the eggs. The eggs were incubated in 45° to 50°F water. (An old soda bottle cooler was used as the incubator tank). The eggs were placed in screened floating trays, this allowed water movement among the eggs. Daily care is needed to remove dead eggs that could spoil the water quality. The eggs hatched in 2 to 3 weeks. The egg shells must be removed constantly, because they build up quickly. Five gallons of water or more was changed every day as a safety precaution. We found gravity flow to be the best method. When all of the eggs hatched, there were approximately 28,000 sac-fry, which look like tadpoles. We did not weigh the sac-fry, in fear of damaging them. The sac-fry lost their bellies in 1 to 2 weeks. They matured into fingerlings and went straight to the surface for food. Feedings were done in the morning and at night. This was the only time possible because of work. More feedings may have been better?. Howard Takata took approximately 7,000 up to his farm in Kaumana Hawaii.

Howard held his fingerlings in the cooler for 3 weeks before setting them out in the pond. The water temperature must be gradually changed. This is to keep the fish from becoming ill. A fast water temperature change shocks the fish. The fish were kept in screened cages. The pond water is much warmer than the incubator tank. The pond water varied from 17° to 21°C. (graph.) staying at a mean of 19°C. The fingerlings were kept in the pond,

in the screened box's for 3 weeks. They were fed 2 to 3 times a day, about 1 pound a day. The feed has to be very small in diameter, almost like large grains of sand. The fish were kept on this diet until they were big enough to eat large pellets, about 2 months. The weighing of the fish took place when the fish went into the screen box. We weighed 100 fish at a time with a counter weight (O'haus scale). This was very easy, because the fish were so small. The feeding rate remained constant, 2 to 3 times a day just the pound of food given per day increased to 3 pounds. As the trout became larger, we cut the sample down to 50 fish. This made weighing them easier. We needed to use two counter weights on the scale.

The trout were drugged with an anesthetic, tricaine. The drug was administered in the water of a five gallon bucket. We put five fish at a time in the solution. The drug slowed the trouts metabolism to where they seemed to appear dead at the bottom of the bucket. This is when we took them out of the solution and placed them into a plastic container for weighing. The drug helped very much when it came to weighing, it really reduced the trouts activity. When weighing was completed the trout were returned to the pond. They recovered within one minute and showed no signs of ill effects. The same drug was used in all the weighings. The trout looked very healthy and responded to feedings well. The pond maintained a good oxygen level due to good ariation and circulation. There was a problem with a native bird (the Auku). This bird would prey on the trout in the late hours of the day when the trout are near the surface of the water, feeding on insects that fly over the water.

We monitored the trout growth from eggs to market size. In ten months they are market size in Hilo.

DISCUSSION:

This implies that Hawaii is a suitable sight for the Aquaculture of Salmo gairdneri, rainbow trout. Steimying otherwise rumors stating that Hawaiian waters are too warm for the culture of these rainbow trout and other mainland species as well.

Thanks to those who experimented with Salmo gairdneri, at their own expense, in these "warm tropical ponds" we can now substantiate the rumors of fishermen on Kauai and Hawaii who say "Sure I've caught a few trout from the Waimea river and Kahua Ranch" respectively. The trout aquaculture business has many other proven possibilities here in the islands. In the 1950's and 60's there were several fishermen who brought in trout eggs from the mainland. Different marketing approaches were taken. One of which was raising the trout to market size (7-12 inches), and then stocking a fishing pond. Those who caught fish paid for it by the inch (.10 cents an inch in 1955). Young and old alike would come and fish for rainbows out of the pond, being practically gauranteed a catch every time. A former farmer revealed the trout he raised, showed the same approximate rate of growth for the trout he cultured, saying "the trout grew an inch per month on the average".

There are also reports of the trout on Kauai, indicating similar growth rates for Salmo gairdneri, but also stating the

reproductive capabilities of the trout have been severely retarded.⁶

The temperature of the Akolea Aquatic's pond ranged from 17° - 21°C, averaging 19°C. Temperatures of this extreme, were often thought to be the upper limit of the trout's tolerance level. Prolonged periods of time at this temperature was even thought fatal at one time.

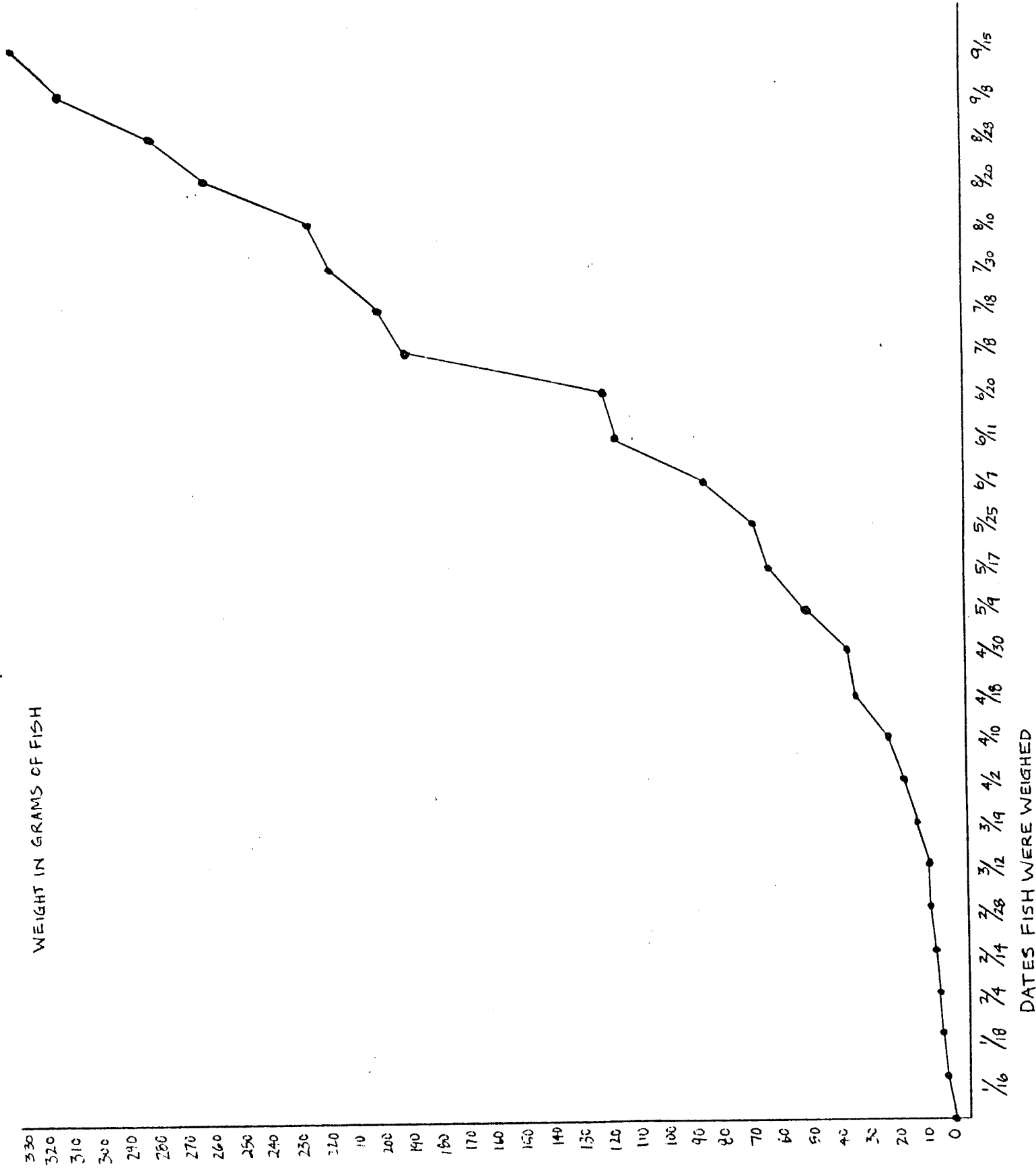
This information opens many new options for the aquaculture world. A Variety of new species once thought impossible to rear in Hawaiian waters may now be tried and experimented with. The knowledge aquired may be applied toward brackish and salt water culture. This also opens many oppertunities for the cool, nutrient rich deep waters lying off the coast of Hawaii, at a depth of 200+ meters. Maybe this water could be more productive for the culture of Salmo gairdneri.

SOURCES CITED

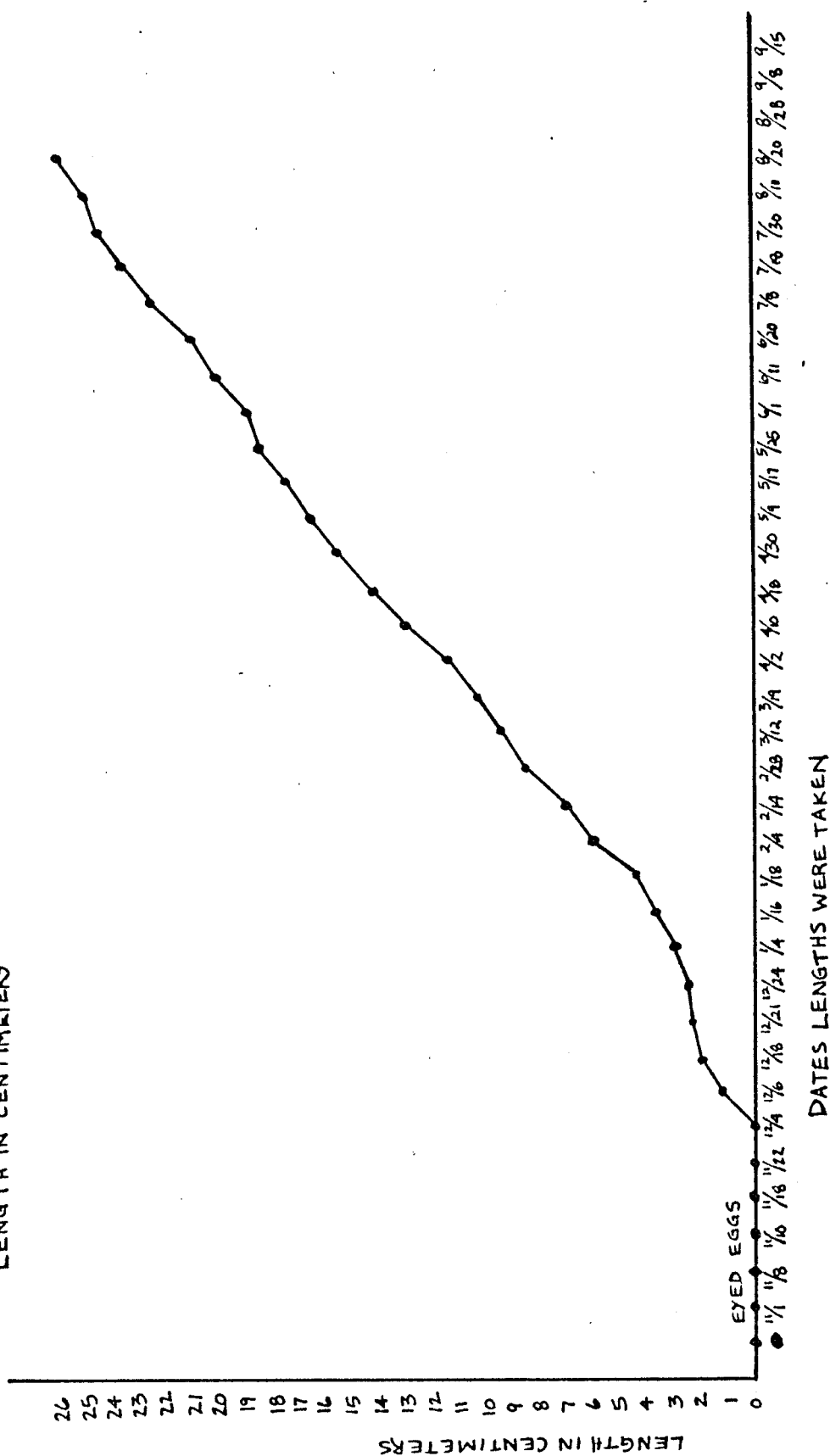
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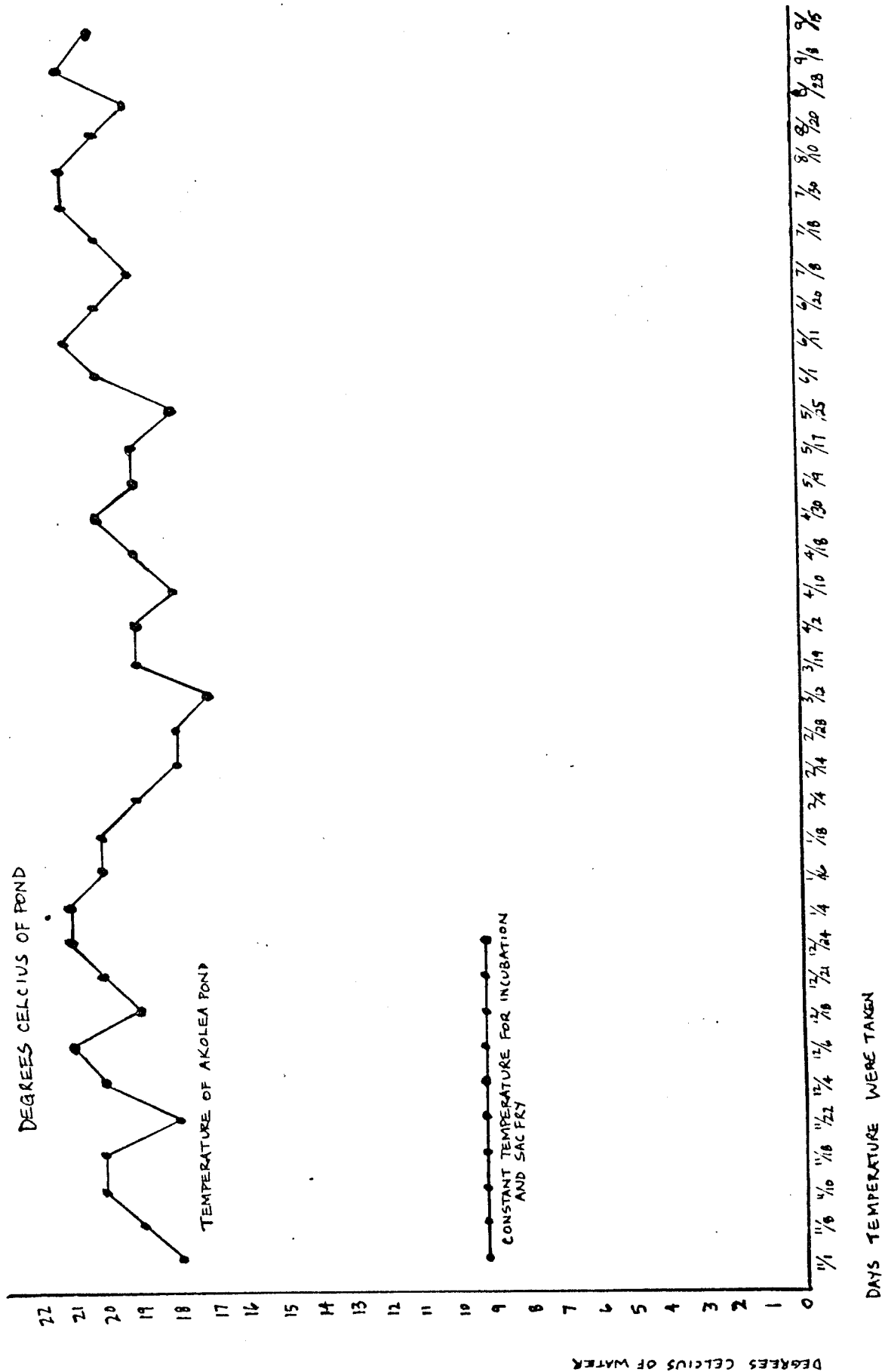
WEIGHT IN GRAMS OF FISH



LENGTH IN CENTIMETERS

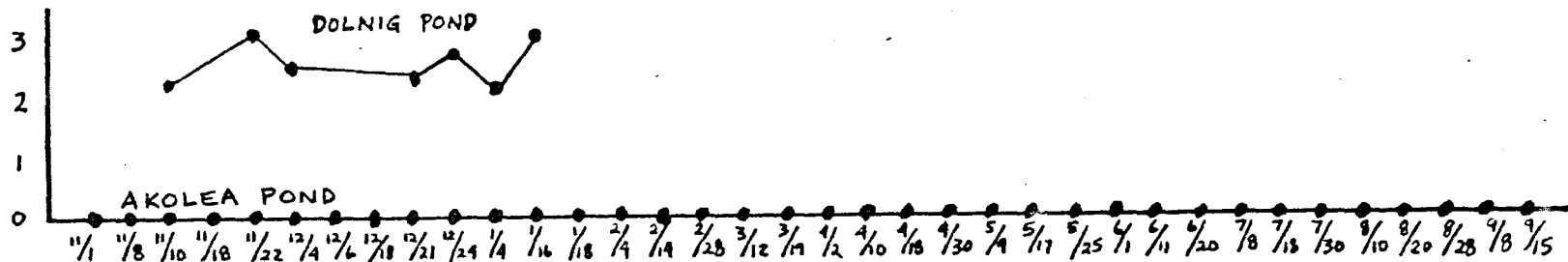


DATES LENGTHS WERE TAKEN



PPM SALINITY

SALINITY PPM



On February 4, 1982, we (John Ahchong and Mike Rock), were awarded a grant by the University of Hawaii at Hilo Marine Option Program. The dates were set in conjunction with the school year. However, allowing for the fact that the trout eggs didn't arrive until the end of November 1981, they are not quite large enough to be sold to market. We feel by admitting our results now, evaluators would draw inconclusive evidence.

The trout at Howard Takata's farm in Kaumana have shown remarkable growth rates in the past two months. As of late, the rate of growth seems to be accelerating and the mortality rate is controlled solely by the bird. We have monitored the growth rates for only six months and would like to measure and weigh the fish periodically, (once a week), until the trout reach market size, 10-12 oz. dressed out. According to Takata's observations of his and Dollnig's last crop the trout should reach market size by the end of August 1982.

The data gained would then cover the trout's full life cycle to market. Providing complete data on growth rate, pest and disease problems, and water quality results.

Therefore, we would appreciate an extension on our proposal to include the months of June, July and August. This should be time enough for the trout to grow to market size fish. With your financial assistance a complete study shall be compiled of the Rainbow Trout being grown at Akolea Aquatics in Kaumana, Hawaii.

Mahalo,

Mike Rock
John Ahchong