Salt Water Culture of Red Hybrid Tilapia in Jamaica

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ABSTRACT

Four stocking densities of red hybrid tilapia in salt water were assessed at 25, 50, 75, and 100 fish/m^3 during three scheduled ten-week trials. All male fingerlings were stocked in 1.76 m^3 tanks and fed a pelletized 30% protein floating feed formulation at 3% estimated body weight/day. Average weights were significantly different at different densities. Specific growth rates, feed conversion ratios and survival showed density related effects.

KEY WORDS: red tilapia, cage.

INTRODUCTION

Since about 1977 there has been a great deal of interest in the expansion of freshwater aquaculture in Jamaica. The demand for fish products in Jamaica is high and with an initially small and now declining offshore fishery, supply is often met by importation. Inland aquaculture has proven to be an alternative to importation, saving and possibly earning foreign exchange.

At present most suitable sites, mainly on the south coast, have been utilized, and the focus of further expansion is being directed toward saltwater culture. Methods of saltwater culture show the potential for growth of the industry with minimal impact on limited freshwater resources and land space and higher production of high quality fish per unit area, with less expenditure.

Cage culture may provide alternative employment for fishermen, reducing pressure on the island's marine fishery. Research in Jamaica has been aimed at developing a feasible production system in saline water. Hall (1989a) investigated the salinity tolerances of local strains of red hybrid, as well as *Oreochromis niloticus* through assessment of the effects of varied acclimation schedules. Hall (1989b) also did preliminary studies into the cage culture of these hybrids. Presently, objectives include the assessment of the effects of stocking density on growth and survival in tanks.

MATERIALS AND METHODS

Tank culture trials were conducted at the Port Royal Marine Lab between January 1990 and May 1991. All male Jamaican red hybrid tilapia were stocked in 1.76 m^3 aerated tanks at rates of 25, 50, 75, and 100 fish/m^3 during three scheduled ten-week growth trials. Fish were fed a 30% protein floating feed formulation at 3% of their estimated body weight per day. Average flow rates were 0.5 litres/kg/minute, dissolved oxygen ranged from 4.6-7.2 mg/litre, salinity from 31-35%, and temperatures from 29-30°C. Sampling of fish length and weight was done bi-weekly. Dissolved oxygen, temperature, and salinity values were measured weekly.

RESULTS

Multifactor ANOVA showed a negative relationship between density and average weight over time (P<.05) for the three trials (Figure 1 and Table 1). Pooled survival rates over experiments were also negatively correlated to density (P<.005 Chi Squared value 304.787; Spearman ranked correlation coefficient = -1.00 & p<.005 (Figure 2 and Table 2). Specific growth rates (G = 100 x $\{\ln W_f - \ln W_i\}/t$) where W_f = final weight, W_i = initial weight and t=time in days, though not statistically significant for all trials, showed a general trend towards decreasing growth with increased density (Figure 3). Feed conversion ratios (total feed wt/wet weight gain}) tended to increase with density (range 1.3-3.6). Condition factors (K = {W/l3 }x 100 where W=weight in grams and l=length in centimetres, (range 3.49-4.69) did not differ significantly between densities or over time for the trials (Figure 4).

Table 1. Multifactor ANOVA of Weight vs Density by Week. F- Ratios and P values.

TRIAL	F - RATIO	P
1A	6.331	< 0.005
1B	2.428	<0.05
1C	1.907	<0.05

Table 2. Pooled Survival Rates vs Density. Chi-Square and Spearman Rank Correlation.

Chi-Square	D. F.	P
304.787	3	< 0.005

Spearman Rank Coeff	P
-1.00	<0.005

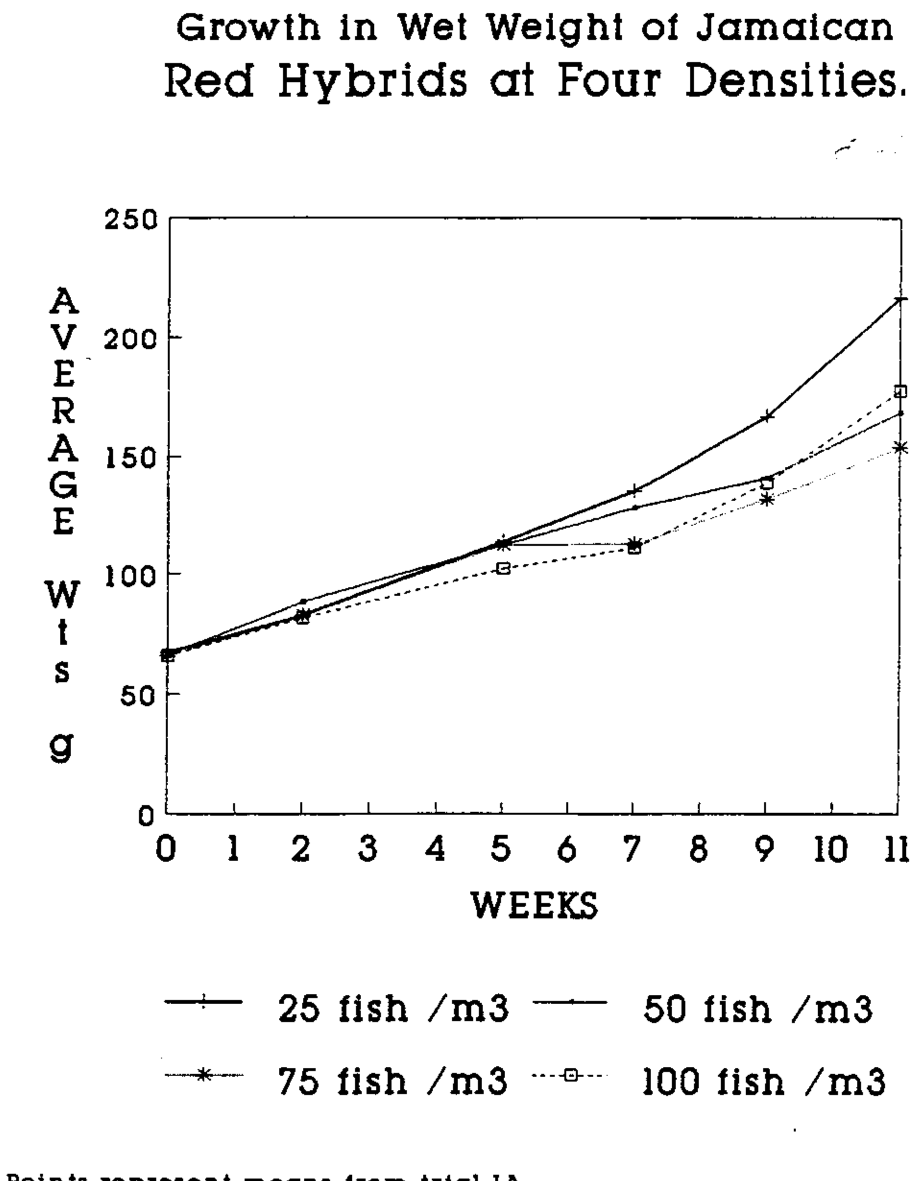

Figure 1. Growth of Jamaican Red Hybrids at Four Densities over an eleven week Growth Trial.

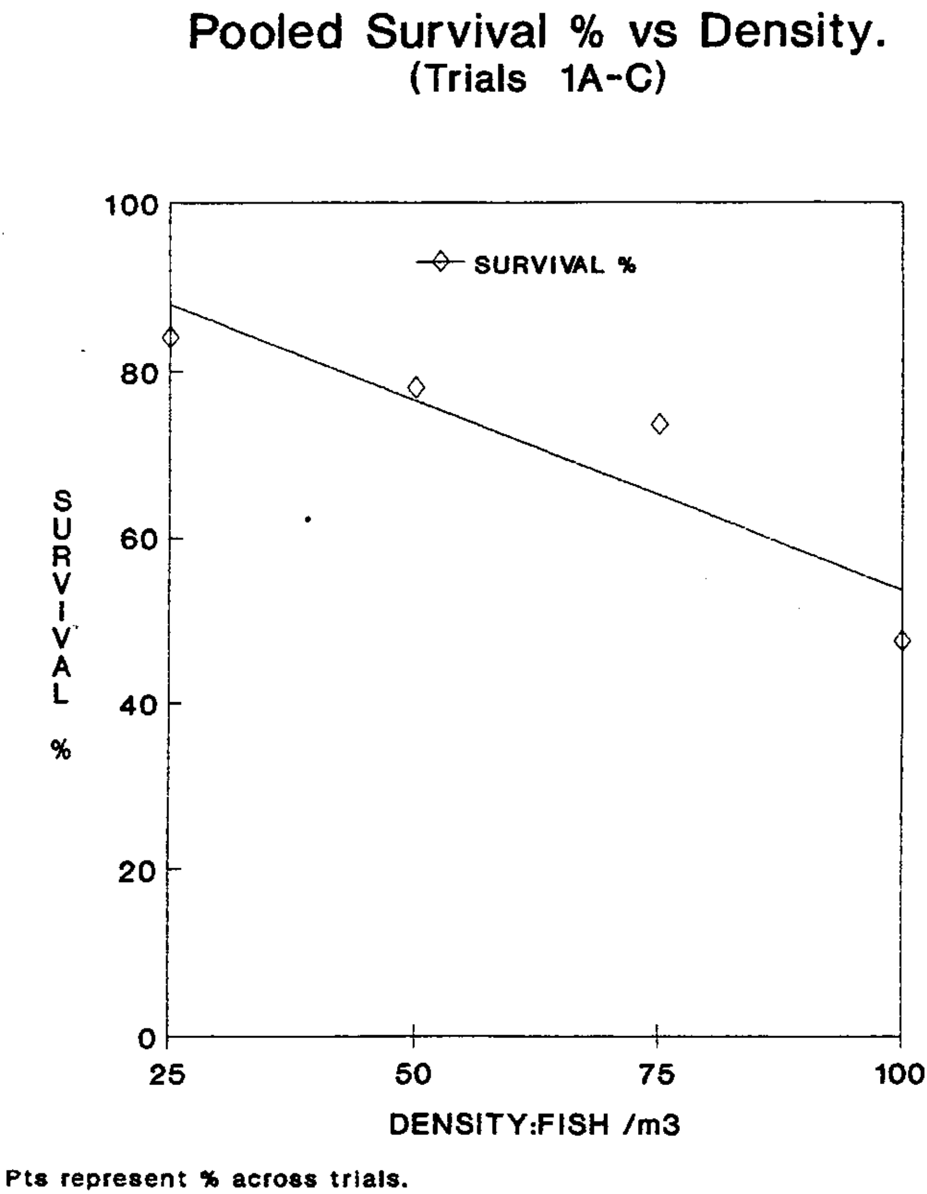

Figure 2. Pooled Survival (%) vs Density.(Trials 1A-1C).

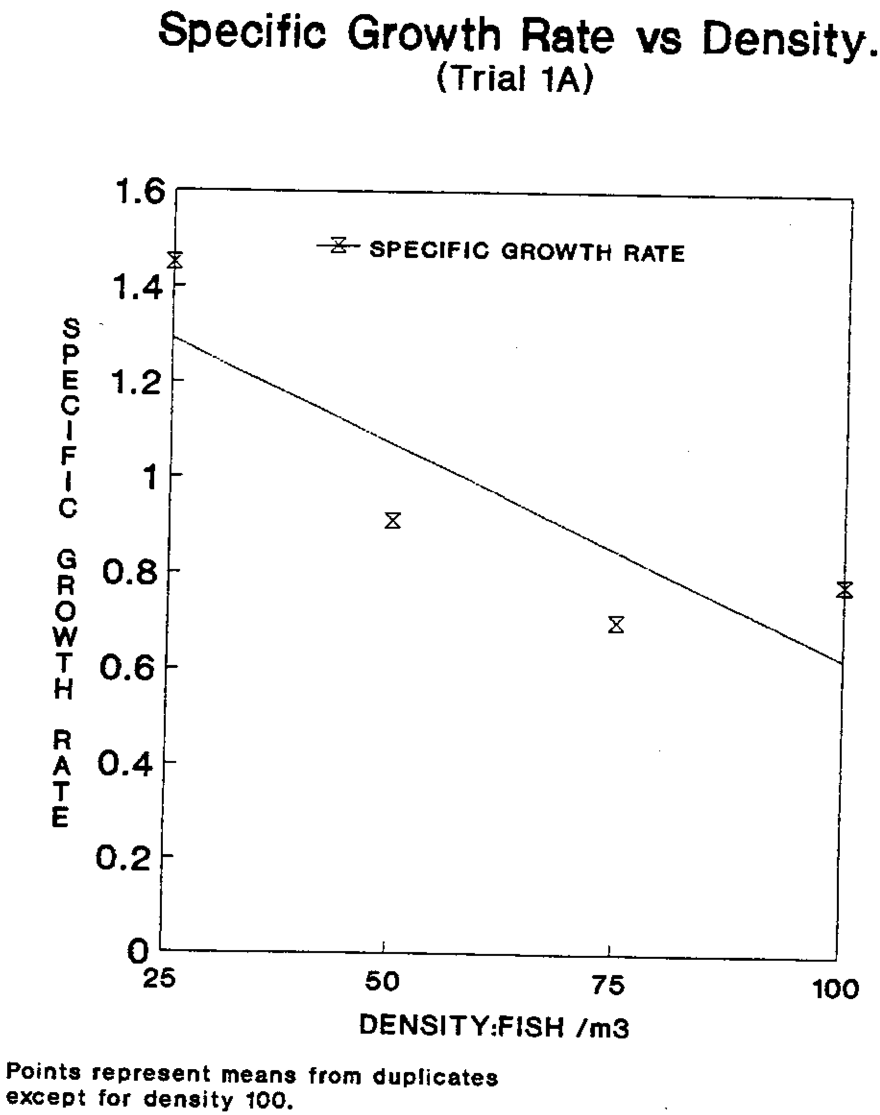

Figure 3. Specific Growth Rate vs Density. (Trial 1A).

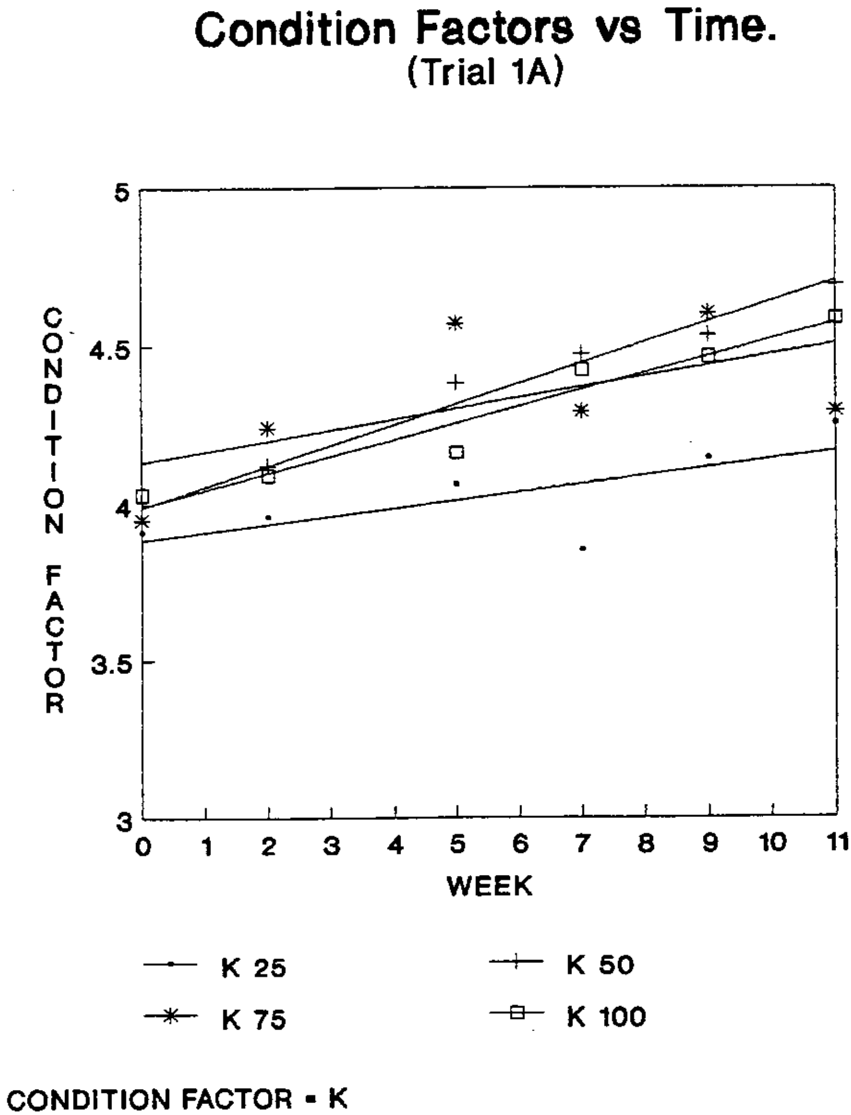

Figure 4. Condition Factors vs Time (Trial 1A). Condition Factors for each density over eleven week experimental period.

DISCUSSION

Local pond stocking densities for the production phase (fingerling = 20-30 g to adult = 180-260 g) are generally at rates of 1.5 fish/m^2 (Cooke and Moo-Young, 1982; Popma *et al.*, 1984; Hanley, 1990). Survival rates seldom exceed 90% and generally are between 60-80% for a ten to fifteen week production cycle. Total production of marketable fish ranges between 1800-2900 kg/ha.(Popma *et al.*, 1984). Feed conversion ratios from 1- 1.5 are ideal, though 2-2.5 are more likely (Hanley, 1990). A few farms practice intensive culture, utilizing aeration and 30% water exchange/d, achieving densities of 2.5-8 fish/m^2 (Hanley, 1990).

Tank trials indicate better performance at rates between 25 and 50 fish/m^3, with generally better growth, survival, and feed conversion ratios than at higher densities. These densities are 2.5-5 times higher than local intensive rates and survival and feed conversion ratios fall well within reported values. Watanabe *et al.* (1988a) found survival for Florida red hybrids in saline water to be better than in freshwater. Hall (1989a) also reported similar results for Jamaican strains. Improved growth in saline water was attributed to non-osmoregulatory and behavioral influences (Watanabe, 1988a-b). Fish in increased salinities were less aggressive, suffering fewer agonistic encounters. Fewer fish were observed with damage to tail and fins at higher salinities. Survival rates at higher salinities, as a result, were found to be higher.

Intra-specific aggression restricts consumption in subordinate fish even when food is not limited (Brett, 1979, cited by Watanabe, 1988b). Improved growth was attributed to increased food consumption and lowered food conversion ratios with increasing salinity (Watanabe *et al.*, 1988a). Techniques which limit aggressive behavior in intensive systems should improve production by reducing energy expenditure (Fishelson, 1983 cited by Watanabe, 1988b).

It is proposed that increased salinity will allow higher stocking rates than are presently achievable in freshwater systems. Higher levels of water exchange in tanks and cages may also facilitate increased production.

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