Reproductive Efficiency of Nile Tilapia *(Oreochromis niloticus)* and "Red" Tilapia *(Oreochromis spp.)* and Comparative Growth and Efficacy of Sex Reversal of Nile Tilapia and "Red" Tilapia

Interim Work Plan, Africa Study 6

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Introduction

Tilapia are cultivated in Africa, southern Asia and Central and South America. The "red" tilapia *(Oreochromis spp.)* has greater acceptance among some consumers, but "normal" colored fish showed superior growth compared to red colored fish. This research compares Nile tilapia and "Red" tilapia as relates to the reproductive efficiency of adults and growth, survival, and response to sex reversal of fry.

Sex reversal involves feeding a feed that has been treated with a male hormone to fry before the primal gonadal cells of females have differentiated into ovarian tissue. The hormone-treated feed used for sex reversal is generally stored under refrigeration. Incorporated in this research is an analysis of the shelf life at ambient tropical temperatures of the hormone-treated feed used for sex reversal. The following is a preliminary report summarizing methods and results without statistical analysis. All research was conducted at "El Carao" Aquaculture Station in Comayagua, Honduras.

Materials and Methods

"Red" tilapia brood fish were compared to *O. niloticus*, ("Black") in their ability to produce fry for sex reversal. Four reproductive trials of were conducted for each species. *O. niloticus* or "red" tilapia broodfish were stocked at a rate of 230 females and 115 males into 0.05 ha ponds (882-1,554 kg/ha). Ponds had been filled with reservoir water 2 to 3 days prior to stocking. Two ponds were stocked with red broodfish and two ponds with Black broodfish. The mouth of each female was checked for eggs or fry at stocking. Fish were fed once daily at a rate of 1% body weight per day. Maximum and minimum water temperature, and morning dissolved oxygen (D.O.) were recorded daily and secchi disk visibility weekly. Ponds were drained and fry collected 215 to 230 degree days after stocking (13-19 days) as suggested by Green and Teichert-Coddington (1993). Fry were collected by draining ponds to a concrete harvest sump. All fry were then graded through 3.2 mm vexar screen (Hiott and Phelps 1993) and were counted as two separate groups: those retained by the grader (>14 mm) and those passed through the grader (<14 mm). Subsamples of 25 to 50 fry were measured to the nearest millimeter at the beginning, middle and end of counting. All fry were counted by visual comparison. All broodfish were separated by sex, counted, and weighed. They were placed in 20m^3 concrete tanks and fed at 1.5% body weight per day for 7 to 10 days prior to restocking. Each pond was then thoroughly dried and prepared for refilling. The above procedure was replicated four times. Fry from these trials were used for sex reversal studies.

Fry of Nile and "Red" tilapia < 14 mm were stocked in hapas suspended from a wooden pier in a 0.1-ha pond with a maximum depth of 1.2 m and a minimum depth of 0.7 m. The hapas measured 1.0 x 1.0 x 0.7 m (length x width x height) and contained 0.5 m^3 of water. Fry were counted by visual comparison and stocked at 4,000 m^3.

Fry were fed four times daily for 28 days. The feeding rate was adjusted weekly by measuring 25 fish to the nearest millimeter and estimating weight as described by Shelton et al. (1978). Daily feeding rates were 15%, 12%, 8%, and 4 % BW during weeks 1, 2, 3, and 4, respectively. Daily feed quantities were weighed and placed in sealed plastic jars until delivery. A feed containing 60 mg/kg of 17-α methyltestosterone was prepared by following the method described by Zeigler Inc. (personal communication) and the protocol presented in INAD #.

The hormone feed was prepared by dissolving three g of the steroid in 1,000 ml of 95% ethyl alcohol to make a stock solution with 3 mg MT/ml. Twenty milliliters of the stock solution were mixed with 210 ml of 90% ethyl alcohol and sprayed on one kg of the feed as it was mixed for 20 min in a covered industrial mixer. The feed was then spread out for 12 hours to evaporate the solvent. The next day the feed was sealed in plastic zip-lock bags and placed in a freezer at -2°C.

Preliminary Results

Preliminary results are summarized in tables 1 and 2.

Table 1. Summary of reproductive efficacy trials with "Red" and Nile Tilapia.
Each entry is the average of two replicates.

Trial	Total No. of Fry	Total No. of Sex-reversible fry <= 14 mm	Tot. No. of Large Fry > 14 mm	Degree Days to Harvest	Avg. Temp °C	No.Females	No. Males	No. Fry/kg Female
Trial 1 Blacks	37329	36388	316	218.0	25.3	220.0	108	1440
Trial 1 Reds	35329	33388	816	221.3	25.3	213.0	103	1230
Trial 2 Blacks	60500	57250	750	228.0	29.9	221.0	104	2427
Trial 2 Reds	58700	54500	750	225.0	29.9	228.0	107	2362
Trial 3 Reds	96050	92000	2500	231.5	29.5	224.0	114	3506
Trial 3 Blacks	76000	74750	1150	230.5	29.5	227.0	114	3048
Trial 4 Reds	114250	110750	1500	226.3	31.2	0.0	0	3732
Trial 4 Blacks	118750	116750	500	226.3	31.2	230.0	115	3688
Avg. Blacks	72695	70597	679	225.0	29.0	226.3	111	2635
Avg. Reds	76532	73347	1392	226.8	29.0	164.5	80	2724

Table 2. Comparative growth and efficacy of sex reversal of Nile tilapia (Bk) and "Red" tilapia (Rd. Treatment refers to number of days treated with 60 mg/kg MT for "Red" tilapia or "Black" *O. niloticus*.

Treatment	Final Length (mm)	Growth (mm/d)	Wt. Harvested (g)	Avg. Weight (g)	% Survival	FCR
14-d Rd	20.0	0.7	335.7	0.18	95.6	0.6
14-d Bk	22.1	0.9	363.1	0.22	83.9	0.5
21-d Rd	27.0	0.8	537.9	0.34	79.3	0.8
21-d Bk	27.1	0.8	591.4	0.38	78.1	0.7
28-d Rd	31.6	0.8	784.6	0.56	70.1	0.8
28-d Bk	32.4	0.8	952.9	0.64	74.7	0.9
Cont. Rd	32.6	0.8	877.4	0.64	68.5	0.9
Cont. Bk	33.0	0.8	1044.8	0.65	80.5	0.8