PD/A CRSP Seventeenth Annual Technical Report

Strain Variations in Sex Ratio Inheritance

Eighth Work Plan, Kenya Research 2 (8KR2)
Final Report

Karen Veverica and Ronald Phelps
Department of Fisheries and Allied Aquacultures
Auburn University, Alabama, USA

Jim Bowman
Department of Fisheries and Wildlife
Oregon State University
Corvallis, Oregon, USA

Bethuel Omolo
Kenya Fisheries Department
Sagana Fish Farm
Sagana, Kenya

Abstract

Three distinct subspecies of *Oreochromis niloticus* have been identified in Kenya, including *O. niloticus eduardianus*, *O. niloticus baringoensis*, and *O. niloticus vulcani*. *O. niloticus vulcani* is cultured at the Sagana Fish Farm, Kenya, the PD/A CRSP prime site in Africa. During 1997 and early 1998, well over 50 individual pair spawns of tilapia from the Sagana stock of *O. niloticus vulcani* were attempted in support of a larger CRSP study designed to evaluate the sex ratios of offspring from a number of strains of *O. niloticus* from collaborating CRSP sites. Pond D3 at Sagana Fish Farm was dedicated to this activity and equipped with hapas. All fry produced in spawning hapas were transferred to rearing hapas. Although more than 100 fry were obtained from most spawns, survival to 5 cm was very low in the rearing hapas, and usually fewer than 25 fingerlings per spawn were obtained. This number was too low to complete the proposed Eighth Work Plan protocol and the fingerlings were discarded. Survival of about 80% is obtained during sex reversal in similar hapas in a similar pond. The only procedural difference is that during sex reversal fry are reared at higher densities. Only six batches of single-spawn fingerlings with adequate survival beyond a length of 5 cm were obtained. These were initially reared in hapas, followed by three weeks in the hatchery. However, these batches still contained no more than 60 fish, which was an insufficient number for this study. In mid-1998 a blower was installed in the hatchery and a complete diet became available, so the probability of success in rearing fry to 5 cm in the hatchery was greatly improved. However, information obtained in mid-1998 suggests that the population of tilapia at Sagana is not a pure strain of *O. niloticus vulcani* as originally believed, but is contaminated with *O. spirulis* and perhaps other species. If true, this greatly reduces the value of conducting further pair spawns. In consultation with the principal investigators of the parent study, it was decided not to conduct additional pair spawns. Provided funding is available, blood samples from this population and, if possible, from other Kenyan strains (e.g., *O. niloticus baringoensis*, from Lake Baringo) will be sent to Auburn University to assess the purity of these populations by electrophoretic analysis before undertaking any possible related follow-on activity.

Introduction

Although populations of *Oreochromis niloticus* give mean population sex ratios of 50:50, considerable variation in sex ratios is observed when the offspring of individual pairs are considered. The source of this variation is unknown, but may be due to autosomal influence on sex determination in the strain of *O. niloticus* used. The Reproduction Control Research study "Methods for Strain Variations in Sex Ratio Inheritance" (8RCR1A) was included in the PD/A CRSP Eighth Work Plan to address this question (PD/A CRSP, 1997). In this study, the sex ratios of offspring from pair spawns from at least five distinct strains of *O. niloticus* were to be evaluated.

In Kenya there are three distinct subspecies of *O. niloticus* that have been identified: *O. niloticus eduardianus*, *O. niloticus baringoensis*, and *O. niloticus vulcani* (Seyoum and Kornfield, 1992). *O. niloticus vulcani* is presently cultured at the Sagana Fish Farm, the PD/A CRSP prime in Africa. A minimum of 50 individual pair spawns were proposed to be carried out at Sagana for the purpose of determining the sex ratios of *O. niloticus vulcani* offspring in support of the larger study mentioned above. This document is the final report on work carried out at Sagana under this Eighth Work Plan activity.

Methods and Materials

This work was carried out at the at the Sagana Fish Farm, Sagana, Kenya. One pond and hapas for spawning and fry rearing were dedicated to the activity. Tilapia from the Sagana Fish Farm, reported to be of the *vulcani* strain of *O. niloticus*, were used for the pair spawns. Well over 50 pair spawns were attempted in hapas during 1997 and the first half of 1998. Fry produced by each pair were collected and reared as individual sets for determination of sex ratios by gonad examination after rearing to a minimum length of 5 cm.

RESULTS AND DISCUSSION

The proposed protocol stipulated that sex ratios in each pair spawn would be based on at least 100 fish. Although more than 100 fry were obtained from most spawns, survival to 5 cm was low in the rearing hapas, and usually less than 25 fingerlings per spawn were obtained. This number was too low to complete the proposed protocol and the fingerlings were discarded. To date, only six batches of single-spawn fingerlings with good survival beyond a size of 5 cm have been obtained. These fingerlings were initially reared in hapas, followed by three weeks in the hatchery. However, due to low fry survival from the spawns, these batches still contained no more than 60 fish.

The cause of low survival during rearing to 5 cm is unclear. Survival of about 80% is obtained during sex reversal in similar hapas in a similar pond. The only difference is that during sex reversal fry are reared at higher densities.

In mid-1998 a blower was installed in the hatchery and a complete diet became available, so the probability of successfully rearing fry to 5 cm in the hatchery as a follow-on activity during the next warm season was greatly improved. However, information obtained from regional tilapia experts in mid-1998 suggests that the population of tilapia at Sagana is not a pure strain of *O. niloticus vulcani* as originally believed, but rather that it is contaminated with *O. spirulis* and perhaps also with other species (Thys, pers. comm., 1998; Balarin, pers. comm., 1998). If true, this would greatly reduce the value of conducting follow-on pair spawns. In consultation with the principal investigators of the parent study, it was decided not to conduct additional pair spawns. Provided funding is available, blood samples from this population and, if possible, from other Kenyan strains (e.g., *O. niloticus baringoensis*, from Lake Baringo) will be sent to Auburn University for electrophoretic analysis to assess the purity of these populations before undertaking any possible related follow-on activity.

ANTICIPATED BENEFITS

Identification of strains of *O. niloticus* in which individual pairs consistently produce offspring with sex ratios of 50:50 would be a significant contribution towards the development of populations of YY males and reliable programs for the mass production of non-hormone-treated all-male tilapia fingerlings for stocking in rearing ponds. Production from ponds stocked only with male tilapia would be far more productive than ponds stocked with mixed-sex fish or with less than 100% males. Increased production would result in increased income for the farmers and greater supplies of food fish in the markets. These benefits would accrue to fish farmers throughout the tropics, including Africa, Southeast Asia, and Latin America.

LITERATURE CITED

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