

Characterisation of wild and cultured *Oreochromis shiranus* in Malawi

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Abstract

Oreochromis shiranus is a Malawi indigenous tilapia fish species. The aim of the study is to characterise the species phenotypically and genotypically within and between wild strains, unimproved and improved cultured strains. Phenotypic characterisation studies will be carried out using whole fish specimens while genotypic variation analysis will be done through DNA extraction, PCR and electrophoresis processes using fin-clips/body tissue preserved in absolute alcohol with the help of gene markers. It is hoped that the results will be incorporated in a breeding programme to improve stunted and slow growth presently reported in many culture practices of *O. shiranus* in Malawi.

Key words: DNA, fish phenotypic characterisation, Malawi, PCR

Résumé

L'*Oreochromis shiranus* est une espèce indigène de poisson tilapia au Malawi. Le but de cette étude est de caractériser l'espèce phénotypiquement et génotypiquement à l'intérieur et entre les souches sauvages, les souches cultivées améliorées et non-améliorées. Des études de caractérisation phénotypique seront effectuées en utilisant des échantillons de poisson entiers alors que l'analyse de variation génotypique se fera par extraction de l'ADN, la PCR et les procédés d'électrophorèse utilisant des tissus fin-clips/body conservés dans l'alcool pur à l'aide de marqueurs génétiques. Il est à espérer que les résultats seront intégrés dans un programme d'élevage pour améliorer une lente et ralentissante croissance actuellement signalée dans la plupart des pratiques de la culture de *O. shiranus* au Malawi.

Mots clés: ADN, caractérisation phénotypique des poissons, Malawi, PCR

Background

The World trends in capture fisheries depict decline in yield per capture effort (FAO, 2006). In the last fifty years, world aquaculture grew tremendously from a production of less than

a million tonnes in the early 1950s to 59.4 million tonnes with a value of US\$70.3 billion. China led in production, contributing 41.3 million tonnes which is 69.6% of the world aquaculture production (FAO, 2006). The fisheries sector is a major source of livelihood for many communities around the lakes and the coastal regions of many countries. Malawi has four (4) fresh-water lakes namely Malawi (Nyasa), Malombe, Chiuta, and Chilwa which are the major sources of capture fisheries. Aquaculture contribution to Malawi fisheries catch statistics is less than 1% annually while fish consumption is 5.7 kg/capita/yr.(FAO, 2006). The country lags behind in fish consumption compared to her neighbours, Tanzania (10kg/yr), Zambia (7.7kg/yr), Namibia (10kg/yr) and Congo Republic (FAO, 2006).

Literature Summary

Tilapias (family: cichlidae) are among the most important fish species farmed in tropical Africa and sub-tropical regions (Msiska, 1998). The cichlids were introduced for aquaculture in Malawi in the 1940s (Betam *et al.*, 1942) and still remain the major species of choice for culture practices in the country. Africa is the source of wild tilapias genetic material but with little emphasis in genetic research for the species (Pullin, 1988). *Oreochromis shiranus* is an important food fish in Malawi farmed by nearly 90% of the fish farmers either in monoculture or polyculture. Its ability to grow and reproduce in shallow ponds with minimum inputs makes it very useful for small-scale aquaculture (National Aquaculture Centre, 2004). In 1996 a National tilapia-breeding programme was introduced in Malawi for *O. shiranus* genetic improvement due to its ease to reproduce in ponds relative to other tilapias and it was the fish raised by most farmers, over 90%, in ponds (National Aquaculture Centre, 1996). The formation of a base population for a breeding programme in aquaculture fish species requires starting with a broad genetic base. Many studies in mass selection for improved growth rate in experimental populations of carp and tilapia, may have failed because of the narrow genetic variation in the base population (Moav and Wohlfarth, 1973, 1976; Hulata *et al.*, 1986; Teichert-Coddington and Smitterman, 1988; Huang and Liao, 1990). If a population under selection is large and the build up of inbreeding is kept low by using many brood stock, at least 50 pairs per generation (Bensten and Olesen, 2002), selection can continue for many generations without any reduction in genetic gain. Despite the existence of cultured strains, wild populations still remain the best contributors to a synthetic population because the genetic difference between wild and cultured stocks may be moderate (Bensten and Gjerde, 1994).

Study Description

The research study will be conducted in Malawi. The fish specimens will be collected from 11 locations spread across the country's water bodies and culture systems, 40-50 specimens per location. Whole fish specimens and fin-clips/body tissue would be preserved in 90-95% absolute alcohol. Determination of fish age, using otolith, and phenotypic characterisation will be done at Bunda College of Agriculture laboratories in Malawi. DNA extraction from fin-clips/body tissue specimens, polymerase chain reaction (PCR) and electrophoresis processes will be done at Biosciences for Eastern and Central Africa laboratories (BECA) at ILRI, Kenya.

Research Application

The implementation of a comprehensive quantitative genetic diversity evaluation within and between populations of *O. shiranus* from the wild and culture systems, will provide a genetic component to the development of aquaculture strains which are fast growing. This will cause a desire to conserve the wild strains in their natural environment.

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