

Biochemical genetic markers to identify hybrids between the endemic *Oreochromis mossambicus* and the alien species, *O. niloticus* (Pisces: Cichlidae)

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Abstract

The invasion of exotic *Oreochromis niloticus* into the Limpopo River system (in the vicinity of the Vembe Nature Reserve, Northern Province, South Africa) was studied. *Oreochromis niloticus* was found in pools in the nearly dry river bed, as well as in dams alongside the river. Pure *O. mossambicus* was also found at these localities, as well as individuals that appeared hybrid-like. Starch gel-electrophoresis of muscle tissues and the resolution of protein loci using specific histochemical techniques identified the pure species as well as verifying the presence of hybrids. Various morphological characteristics were studied in order to identify hybrids. Red tilapias from the aquariums at the Rand Afrikaans University were also analysed to determine if they are hybrids or mutants. This is the first account of hybrids between the above-mentioned species in South Africa and there is no evidence that the red tilapias are hybrids.

Introduction

Skelton (1993) described the Nile tilapia (*Oreochromis niloticus*) in Southern Africa as a fodder fish, introduced from Israel before 1955 for aquaculture. He reported that this species was distributed in rivers of the Cape flats area, southwest Cape, KwaZulu-Natal and Kariba basin in Zimbabwe; the natural range includes the Nile basin, Rift Valley lakes and certain West African rivers. On 20 November 1996, three adult specimens were collected in Manxeba Pan (22°22'40"S, 31°12'40"E) situated in the Pafuri region of the Kruger National Park close to the Mozambique border and 750 m south of the Limpopo River (Van der Waal and Bills, 1997). *Oreochromis niloticus* was added to the list of exotic species in the Limpopo River and its tributaries. The alien species occurred in the lower Limpopo River, which gave dam walls a new meaning. It could resist the assault by alien tilapias and/or hybrids if foreign tilapias are not introduced in the dams. This is important since hybridisations and/or introgressions occur as a consequence of man's actions to change geographic or ecological barriers (Agnèse, 1998).

Oreochromis niloticus directly competes with our native Mozambique tilapia (*O. mossambicus*) for food and breeding place, and hybridisation has been reported elsewhere (Agnèse, 1998). Thus the indigenous Mozambique tilapia may lose its genetic purity and be replaced by hybrid wild populations throughout most of its natural range in time (Van der Waal, 1997). However, molecular markers provide a powerful means of determining the occurrence and extent of hybridisation, and these markers (unlike morphological characters) typically possess simple modes of expression and inheritance (Nason et al., 1992). Electrophoretic markers to identify the above-mentioned pure tilapia species are reported in McAndrew and Majumdar (1983) and Pouyaud and Agnèse (1995). These authors did not include hybrids in their

studies. However, hybrids exhibit character coherence (i.e. parental characteristics remain associated in hybrid progenies) (Rieseberg and Ellestrand 1993; Rieseberg, 1995), and the use of allozyme studies to identify hybrids are well documented (e.g. Van Vuuren et al., 1989; Van der Bank and Van Wyk, 1996). Hybridisation between the above-mentioned tilapia species can also produce what is known as red tilapia. Red tilapias from the aquariums at the Rand Afrikaans University (RAU) were also analysed to determine their genetic composition (i.e. to determine if they are mutants of *O. mossambicus* or hybrids). The latter specimens originated from experiments at RAU, were distributed to many parts of South Africa and interbreeds with *O. mossambicus* (Ferreira, 1998). The aims of this study were to verify the presence of *O. niloticus* upstream in the Limpopo River, in the vicinity of the Vembe Nature Reserve, to determine whether hybridisation with *O. mossambicus* had occurred and to verify the genetic integrity of the red tilapia at RAU.

Material and methods

Fourteen *O. niloticus* specimens were collected in May 1998, on the farm Den Staat, using hook and line. No *O. mossambicus* were caught. The aforementioned dam was sampled again in June 1998 using gill and seine nets. Pools within the nearly dry Limpopo River bed were also sampled in similar fashion (Fig.1). A total of 102 individuals were collected: five *O. mossambicus* individuals were collected at Loskop Dam (25°26'S, 29°21'E) and included as control samples, 23 *O. mossambicus*, 31 *O. niloticus*, 32 juveniles (of which the species-specific characteristics were not yet expressed), and 11 hybrid-appearing individuals were collected at Den Staat for electrophoretic analyses. Muscle tissue was dissected and preserved in liquid nitrogen for allozyme analysis; DNA samples were prepared from muscle tissue and stored in 70% ethanol and voucher material was stored in 10% formalin. Representatives of these fish and DNA samples will be deposited at the JLB Smith Institute of Ichthyology. Muscle tissue was also dissected from three red tilapia specimens from the RAU aquariums

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Received 14 October 1998; accepted in revised form 7 December 1999.