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Ivaylo Angelov

Bulgarian Society for the Protection of Birds, BirdLife partner in Bulgaria, Haskovo 6300, P.O.Box 130, 41 Bulgaria Blvd, Bulgaria. Email: ivailo.angelov@bspb.org

Ibrahim Hashim

Sudanese Wildlife Society, P. O. Box 6041 Takamul, Khartoum, Sudan: Cola building, 2nd floor, room No 12 B.

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Pelicans transporting fish between Rift Valley Lakes

Cichlid fishes of the tilapia genus *Oreochromis* and their close relatives are widespread in Africa and occur in many lakes and in all rivers that flow into the Indian Ocean (Trewavas 1983). Widely used in aquaculture, a striking feature of the genus is how readily many species hybridise. Given the large area in which oreochromids occur, together with the lack of variation in breeding behaviours hints that evolutionary divergence resulting from isolation may have been ameliorated by periodic interchange between geographically separate gene pools.

Many oreochromids are euryhaline (Trewavas 1983) and the sea would permit such interchange between rivers flowing into the Indian Ocean at least episodically (as in floods). This might account for the similarity of *Oreochromis* species in Indian Ocean drainages, but it would not explain similarities between these rivers and the north-flowing Nile drainage. This note records

how pelicans move fish between different bodies of water, suggesting an evolutionary role in overcoming geographic isolation amongst *Oreochromis* and possibly other fishes.

Periodically after heavy rain, a cluster of small rock outcrops in the south-western quadrant of Kenya's sodic Rift Valley Lake Elementaita become islands. They form ideal nesting sites for Great White Pelicans *Pelecanus onocrotalus* (Brown *et al.* 1982). However, pelicans apparently did not use them for nesting before 1968 (Brown *et al.* 1982). The most likely reason for this was because neither Lake Elementaita nor nearby lakes (Nakuru and Bogoria) had indigenous fishes, while the *Haplochilichthys antinorii* in Lake Naivasha were too small for *P. onocrotalus*.

In 1927 however, *O. spilurus nigra* was introduced to Lake Naivasha (Anon 1928) and subsequently introductions of other species followed. Between 1945 and 1960, *Alcolapia grahami* from Lake Magadi was introduced several times to Lake Nakuru to control mosquito and chironomid larvae (van Someren *pers. comm.*). Brown *et al.* (1982) noted that Great White Pelicans had benefited from these introductions. Seemingly, it was only after fish were well established in lakes Nakuru and Naivasha that Great White Pelicans started nesting on the Elementaita islands.

On the 18 August 1991, one of us (MC) was watching the pelican nesting colony on Elementaita when an adult flew in to feed a nestling from the direction of Lake Nakuru. While doing so several small but alive fish tumbled out of the pelican's pouch and flipped their way down to the water into which they disappeared.

By 1998 *A. grahami* were sufficiently well established in Lake Elementaita for local people to be catching them commercially. The only evidence on how they had reached this lake was the observed 'arrival by pelican' because, to our knowledge, no deliberate introductions to this lake have been done. It is unlikely that the observation was a one-off incident given the constant pelican traffic between this nesting site and lakes Nakuru and Naivasha is a less likely source because being fresh water, the fishes there are not alkaline-adapted as is *Alcolapia*, and would not have survived the high pH of Elementaita.

Oreochromid tilapia are robust and, providing that their skin is damp and gill filaments are wet, can survive for hours out of water. They are mouth-brooders—females incubate eggs and larval fry in their mouths. Newly free-swimming fry stay in a shoal close to their mother's head, returning into her mouth for refuge when threatened. Only *in extremis*, as when being captured herself, does a female disgorge her fry. Thus a pelican catching such a female could result in her load of young being retained in the bird's gullet or the ejected hatchling fry sticking to the inner lining of the pelican's bill pouch. If this environment remains wet, a few might survive a flight between different bodies of water, and be washed free as soon as the bird places its bill into water.

The Elementaita observation may have involved a flight of perhaps not

more than half an hour, but it established beyond question that fishes can be carried between water bodies by pelicans and released alive. It might not be an efficient form of transport, but where gene flow is concerned, it need only happen occasionally over millennia to ameliorate the effects of divergence between otherwise isolated gene pools. In the Elementaita case however, it may have been significant enough to introduce (or at least bolster) an entirely new population of *A. grahami*.

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Miles Coverdale

P.O. Box 873, Nanyuki, Kenya †

Ian Parker

P.O. Box 52, TOLGA, Queensland 4882, Australia. Email: ipap@africaonline.co.ke

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