Egyptian Journal of Aquatic Research xxx (2017) xxx–xxx

HOSTED BY

Contents lists available at ScienceDirect

Egyptian Journal of Aquatic Research

journal homepage: www.sciencedirect.com/locate/ejar

Full length article

Effect of hybridisation on fecundity of *Oreochromis karongae* (Trewavas 1941)

Elysee Nzohabonayo [a,b], Daud Kassam [a,*], Jeremiah Kang'ombe [a]

[a] Lilongwe University of Agriculture and Natural Resources, Bunda Campus, Africa Centre of Excellence in Aquaculture and Fisheries Science (AquaFish), P.O. Box 219, Lilongwe, Malawi
[b] University of Burundi, P.O. Box 2940, Bujumbura, Burundi

ARTICLE INFO

Article history:
Received 16 March 2017
Revised 11 July 2017
Accepted 16 July 2017
Available online xxxx

Keywords:
Fecundity
Oreochromis karongae
Oreochromis shiranus
Egg diameter
Spawning

ABSTRACT

Effect of hybridisation of female *Oreochromis karongae* and male *O. shiranus* on fecundity of *O. karongae*, was investigated at Bunda, Lilongwe, Malawi. Number of eggs, weight (mg) and diameter of individual egg (mm) and relative fecundity were assessed. The results revealed that hybridisation exhibited a significantly higher number of eggs (288.94 ± 15.8) per female compared to pure *O. karongae* (144.00 ± 7.23). There was no significant difference, in terms of number of eggs, between the hybrid and pure *O. shiranus* (298.60 ± 7.27). There was no significant difference between hybrid eggs size (27.8 ± 0.77 mg; 3.28 ± 0.12 mm, respectively for egg weight and diameter) and pure egg size of *O. karongae* (27.7 ± 0.03 mg; 3.00 ± 0.26 mm, respectively for egg weight and diameter). Therefore, hybridisation of female *O. karongae* and male *O. shiranus* may be used by farmers for increased production after further studies especially on hatchability and survival of eggs and fry, respectively.

Introduction

In Lake Malawi there is one endemic tilapiine species, *Oreochromis karongae*, famously known as "Chambo", which is moderately cultured. Tilapiine group is commonly cultured because of its several qualities that make it attractive in fish farming such as high tolerance to poor water quality, good growth performance, diseases resistance and white mild flavoured flesh (Nguyen, 2008). The fish farmers in Malawi currently farm the following three tilapia species; *O. shiranus*, *O. karongae*, *Tilapia rendalli*, and the African catfish, *Clarias gariepinus* (GOM, 1998). Fish farmers prefer *O. karongae* and *C. gariepinus*, because of their size, which is a trait directly linked with the selling price (Andrew et al., 2003). *Oreochromis karongae* performs better than the other two mentioned tilapia species in terms of growth when grown in ponds (Brooks and Maluwa, 1997). Studies have shown that *O. karongae* grew from 54 to 104 g in 16 weeks, while *O. shiranus* grew from 39 g to 55 g on average (Maluwa and Dickson, 1996). Furthermore, *O. karongae* is most preferred tilapia species by consumers because of its shiny skin, good flavor and relatively big size (Kaunda et al., 2005) (see Fig. 1).

In spite of the above, the unavailability of fingerlings in quantity and quality due to low fecundity and hatchability (Msiska and Costa-Pierce, 1997) restrict the use of *O. karongae* in aquaculture. Fry production has been successful in the slow-growing but relatively high fecund *O. shiranus*, however it has remained a challenge in *O. karongae*, as noticed by very low hatchability of the only few eggs available (Valeta et al., 2013) (see Fig. 2).

Studies on fecundity of fishes are important for fishery management and policies. It is one of the important constituents of fishery biology as it has direct implication on fish production, stock recruitment and stock management (Pitman et al., 2013). Fecundity is also important for acquiring information related to different races, as different races have distinctive fecundities and egg diameter, which in turn is helpful in identifying the population (Shaheena, 2012).

Hybridisation of fish for practical purpose has confirmed its efficiency. For instance, the hybrids of Nile tilapia x blue tilapia (*O. niloticus* x *O. aureus*) are fertile with increased cold and salinity tolerance (Lahav and Lahav, 1990). Kassam and Sangazi (2016) reported that hybrids from female *O. karongae* and male *O. shiranus* has shown high growth performance as compared to parental lines. This breeding technique is used in aquaculture to produce offspring with specific desirable traits or enhance performance. Hybridisation of tilapia have been considered as a tool to increase tilapia production. Hence the aim of this research was to investigate if hybridisation may enhance fecundity of *O. karongae*, which

Peer review under responsibility of National Institute of Oceanography and Fisheries.
* Corresponding author.
E-mail address: dkassam@bunda.luanar.mw (D. Kassam).

http://dx.doi.org/10.1016/j.ejar.2017.07.002
1687-4285/

Please cite this article in press as: Nzohabonayo, E., et al. Effect of hybridisation on fecundity of *Oreochromis karongae* (Trewavas 1941). Egyptian Journal of Aquatic Research (2017), http://dx.doi.org/10.1016/j.ejar.2017.07.002

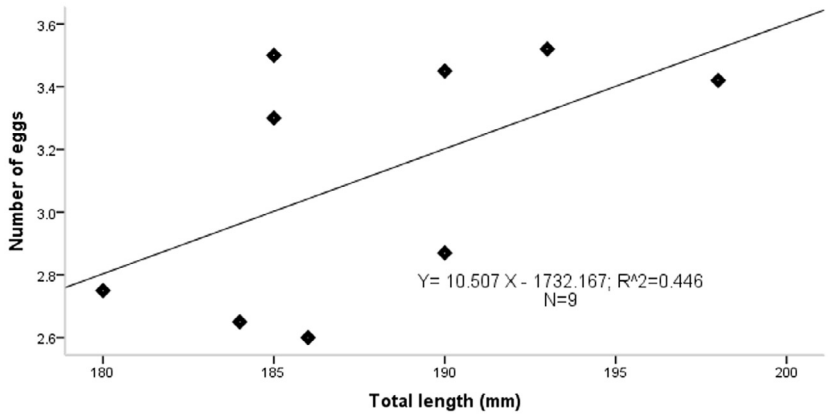

Fig. 1. Relationship between number of eggs and total length of *O. karongae*Y: Number of eggs; X: Total lenth (mm); R^2: coefficient of determination; N: Sample number.

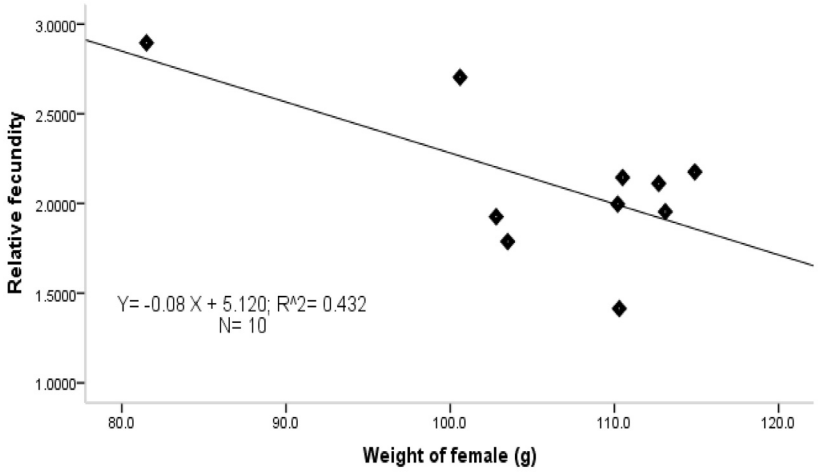

Fig. 2. Relationship between relative fecundity and weight of female of *O. karongae*. Y: Relative fecundity; X: Weight of female (g); R^2: coefficient of determination; N: Sample number.

may increase availability of fry. Such results will contribute to the knowledge of the reproductive biology of *O. karongae* and be useful for tilapia production in Malawi.

Materials and methods

Experiment setup

The experiment was conducted at Bunda Fish Farm in Lilongwe (Latitude 14° 35′S and longitude 33°50′E) for a period of 56 days. Broodstock of *O. karongae* and *O. shiranus* from Bunda Fish Farm were acclimatised for 7 days during which fish were observed for signs of diseases and parasites. After acclimatisation, broodstock were randomly allocated to experimental hapas ($2 \times 1 \times 0.9$ m each, 9 in total) installed in 700 m^2 pond. Fish were stocked at a ratio of 1:2 (male and female), with 2 males to 4 females stocked in each hapa. The feed were formulated at Bunda Fish Farm at 30% CP using maize bran, fishmeal and soybean (Table 1). Fish were fed two times daily (9 am and 3 pm) with 30% crude protein diet at 3% body weight.

The selected broodstock of *O. shiranus* (male) were crossed with *O. karongae* (female) (Treatment 1). The control were crosses of *O. karongae* versus *O. karongae* (Treatment 2) and *O. shiranus* versus *O. shiranus* (Treatment 3). Three treatments replicated thrice were used in this study with average size for broodstock of 100.48 ± 1.10 g; 100.52 ± 1.23 g and 98.62 ± 0.35 g respectively).

Table 1
Formulation and analytical composition of the experimental diets.

Ingredients	Diet (30% CP)
Soybean meal (%)	24.5
Fish meal (%)	24.5
Maize bran (%)	48
Vitamin and Minerals premix** (%)	1.5
Salt (%)	0.5
Cassava (%)	1
Proximate composition (Mean ± SD)	
Moisture (%)	15.65 ± 1.41
Protein (%)	30.02 ± 0.20
Lipid (%)	8.28 ± 0.14
Fiber (%)	7.1 ± 0.070
Ash	8.56 ± 0.04

** Vitamin and mineral premix for Broiler starter feed contained (1 kg) Vitamin A, 12,000,000 IU; Vitamin D_3, 2,000,000 IU; Vitamin E, 30,000MG; Vitamin B_{12}, 0.030G; Vitamin H, 0.100G; Vitamin K_3, 3000G; Thiamine, 3000G; Riboflavin, 2000G; Pyridoxine, 3000G; Endox, 0.020G; Folic acid, 1000G; salcostat, 5000G; Iodine, 1000G; Chlorine, 350,000MG; cobalt, 0.600G; copper, 6000G; Iron, 20,000G; Manganese, 70,000G; Selenium, 0.150G; Zinc, 40,000G.

Water quality parameters like temperature (°C), pH and dissolved oxygen (mgL^{-1}) were recorded daily using water probe