Growth and reproductive performance of *Oreochromis* hybrids under different management regimes

My supervisory team:

Professor D. KASSAM

Professor J. KANG'OMBE

Professor J. O. MANYALA

By Elysee Nzohabonayo

Introduction

- Increasing human world's population with high demand for fish.
- capture fisheries has reached its maximum potential (FAO, 2010)
- Aquaculture is a viable alternative for increasing fish production worldwide

- Culturing species with high growth and reproductive performance may be one of the solutions

- 3*Oreochromis* species under hybridization

Research objectives

❑ To assess growth, reproductive performance of *Oreochromis* hybrids under different management regimes.

- **Specific objectives**

  ✓ To determine the effect of hybridization of *O. karongae*, *O. shiranus* and *O. mossambicus* fed 10% lipid on the fecundity.

  ✓ To estimate the rate of hatchability and survival of hybridized eggs.

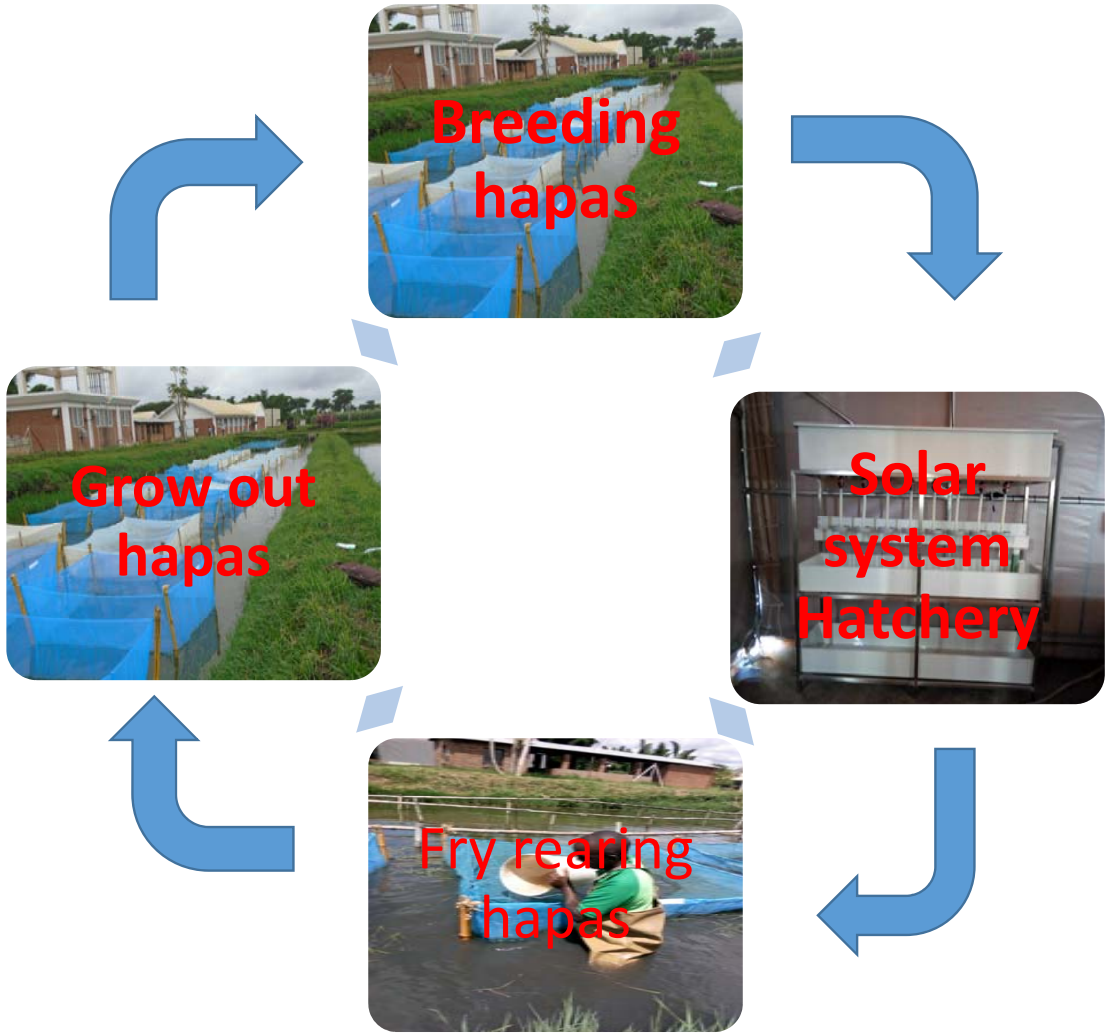
  ✓ To determine growth performance and sex ratios of *Oreochromis* hybrids fed on floating diet at different feeding rates (3%, 5% and 7%).

Materials and Methods

Set up of the experiment 1

Female	Male	Offspring
OM	OK	Hybrid
OM	OS	Hybrid
OM	**OM**	**Pure**
OS	OK	Hybrid
OS	**OS**	**Pure**
OS	OM	Hybrid
OK	**OK**	**Pure**
OK	OS	Hybrid
OK	OM	Hybrid

Diagram of our research



- Experiment 1

Experiment 1 set up and description

	Description
started Date	12th November 2018
Species	*Oreochromis karongae* (OK), *O. shiranus* (OS), *O. mossambicus* (OM)
Hapa sizes	2 X 3 X 1 m
Stocking density	2 fish/m^2
Stocking ratio	1:1 female-male
Treatments (9)	**Sex of parent stock** / Females (♀): *O. karongae* / *O. shiranus* / *O. mossambicus* Males (♂) *O. karongae* (O.K): (♂)O. K X (♀) O. K; (♂)O. K X (♀) O. S; (♂)O. K X (♀) O. M Males (♂) *O. shiranus* (O.S): (♂)O. S X (♀) O. K; (♂)O. S X (♀) O. S; (♂)O. S X(♀)O. M Males (♂) *O. mossambicus* (O.M): (♂)O. M X (♀)O. K; (♂)O. M X (♀) O. S; (♂)O. M X (♀) O. M
Replication	2
Dates sampled	11/12/2018, 24/12/2018, 08/01/2019, 21/01/2019, 07/02/2019, 20/02/2019
Incubation temperature	25±1 °C
End of first experiment	6 March 2019









heat controller duo
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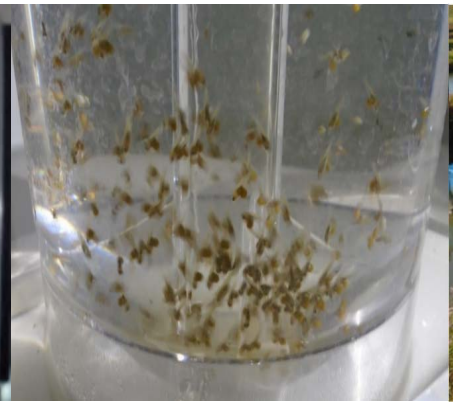

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Results

Reproductive parameters of *O.karongae, O.shiranus and O.mossambicus* in a diallel crossing for 120 days

Crosses	N	AF	RF	WoE (mg)	ED (mm)	GSI
♀ O. M x ♂ O. K	**6**	356.50±13.50^{a}	4.89±0.01^{b}	6.02±0.32^{a}	2.25±0.12^{a}	3.06±0.15^{a}
♀ O. M X ♂ O. S	10	327.67±2.67^{a}	5.29±0.19^{b}	5.81±0.04^{a}	2.36±0.15^{a}	3.05±0.08^{a}
♀O. M X ♂ O. M	11	350.69±11.49^{a}	5.17±0.08^{b}	6.38±0.40^{a}	2.25±0.01^{a}	3.11±0.21^{a}
♀ O. S X ♂ O. K	**4**	315.00±39.00^{a}	5.05±0.45^{b}	5.95±0.45^{a}	2.30±0.05^{a}	2.73±0.07^{a}
♀ O. S X ♂ O. S	9	324.50±11.17^{a}	4.56±0.51^{b}	6.39±0.01^{a}	2.46±0.23^{a}	2.74±0.05^{a}
♀ O. S X ♂ O. M	8	358.50±11.50^{a}	4.99±0.01^{b}	6.04±0.24^{a}	2.41±0.01^{a}	2.77±0.04^{a}
♀ O. K X ♂ O. K	**2**	306.00±11.00^{a}	2.73±0.26a	26.40±0.10^{b}	4.13±0.00^{b}	2.25±0.17^{a}
♀ O. K X ♂ O. S	5	330.50±25.50^{a}	3.07±0.01a	26.10±0.10^{b}	3.96±0.03^{b}	2.27±0.11^{a}
♀ O. K X ♂ O. M	6	304.00±41.00^{a}	3.00±0.27a	25.83±0.73^{b}	4.09±0.09^{b}	2.36±0.08^{a}

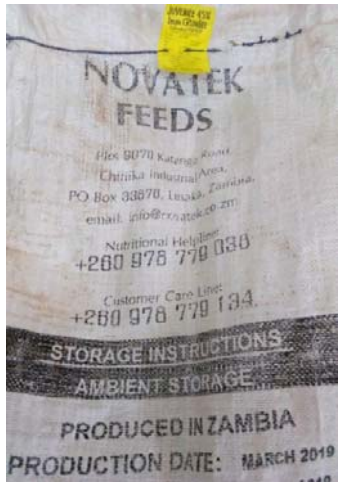
Different superscripts in the same column imply that such crosses were significantly different at 5 % level. N: Number of spawned female; AF: Absolute fecundity; RF: Relative fecundity; WoE: Weight of eggs; ED: Egg diameter; GSI: Gonado-somatic index.

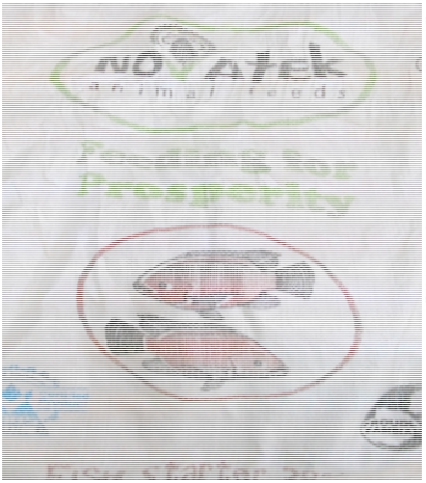
Results

Hatchability of hybrids eggs incubated in a re-circulating system

Crosses	Hatching Period	Hatchability percentage (%)	Hatchling survival percentage (%)
♀ O. M x ♂ O. K	4.00±0.00[a]	94.31±1.61[b]	99.26±0.13[b]
♀ O. M X ♂ O. S	4.00±0.00[a]	95.56±1.41[b]	99.37±0.31[b]
♀O. M X ♂ O. M	4.00±0.00[a]	96.21±1.73[b]	98.97±0.43[b]
♀ O. S X ♂ O. K	5.00±0.00[a]	96.86±0.25[b]	98.86±0.03[b]
♀ O. S X ♂ O. S	5.00±0.00[a]	96.98±2.06[b]	98.89±0.15[b]
♀ O. S X ♂ O. M	5.00±0.50[a]	96.11±0.43[b]	99.28±0.13[b]
♀ O. K X ♂ O. K	7.00±0.00[b]	78.78±0.54[a]	97.31±0.13[a]
♀ O. K X ♂ O. S	7.50±0.70[b]	79.49±0.84[a]	96.61±0.54[a]
♀ O. K X ♂ O. M	6.50±0.70[b]	83.65±0.70[a]	97.26±0.00[a]

- Experiment 2 Growth performance





Experiment 2 set up and description

	Description
started Date	10th May 2019
Species	Pure and hybrids F1 from 3 species: *Oreochromis karongae* (OK), *O. shiranus* (OS), *O. mossambicus* (OM)
Hapa sizes	2 X 2 X 1 m
Stocking density	5 fish/m^2
Stocking size	6 g ± SE
Feeding rate	3% BW, 5% BW and 7% BW
Feeding times	Twice a day (9:00 &14:00)
Treatments	♂0. K X ♀0.K; ♂0. K X ♀0. S; ♂0. K X ♀0. M; ♂0. K X ♀0.K; ♂0. K X ♀0. S; ♂0. K X ♀0. M; ♂0. K X ♀0.K; ♂0. K X ♀0. S; ♂0. K X ♀0. M ♂0. S X ♀0. K; ♂0. S X ♀0. S; ♂0. S X♀0. M; ♂0. S X ♀0. K; ♂0. S X ♀0. S; ♂0. S X♀0. M; ♂0. S X ♀0. K; ♂0. S X ♀0. S; ♂0. S X♀0. M ♂0. M X ♀0. K; ♂0. M X ♀0. S; ♂0. M X ♀0. M; ♂0. M X ♀0. K; ♂0. M X ♀0. S; ♂0. M X ♀0. M; ♂0. M X ♀0. K; ♂0. M X ♀0. S; ♂0. M X ♀0. M
Replication	2
Sampling interval	Every 2 weeks
Duration of the experiment	6 months

Preliminary result

Growth per treatment

TR	W2	W4	W6	W8	W10	W12
1 ♀ O. M x ♂ O. K 3%	2.75	3.47	4.69	5.63	6.70	7.94
2 ♀ O. M X ♂ O. S 3%	5.80	7.26	8.69	9.84	10.92	12.12
3 ♀O. M X ♂ O. M 3%	7.76	9.54	11.10	12.27	13.72	15.07
4 ♀ O. S X ♂ O. K 3%	6.72	10.10	12.26	14.95	16.59	18.61
5 ♀ O. S X ♂ O. S 3%	7.49	8.86	9.86	10.86	11.86	12.86
6 ♀ O. S X ♂ O. M 3%	7.27	8.69	9.96	11.10	12.15	13.23
7 ♀ O. K X ♂ O. K 3%	6.77	8.50	10.59	11.86	12.89	14.06
8 ♀ O. K X ♂ O. S 3%	4.97	5.99	7.38	8.85	10.99	13.94
9 ♀ O. K X ♂ O. M 3%	5.31	6.65	8.07	9.65	10.98	12.39
10 ♀ O. M x ♂ O. K 5%	**8.75**	**14.88**	**18.89**	**21.96**	**23.14**	**24.97**
11 ♀ O. M X ♂ O. S 5%	4.65	7.60	9.44	14.37	18.25	19.63
12 ♀O. M X ♂ O. M 5%	6.10	10.05	12.74	15.44	17.90	18.96
13 ♀ O. S X ♂ O. K 5%	1.88	2.27	4.37	5.10	5.81	8.88

Preliminary result

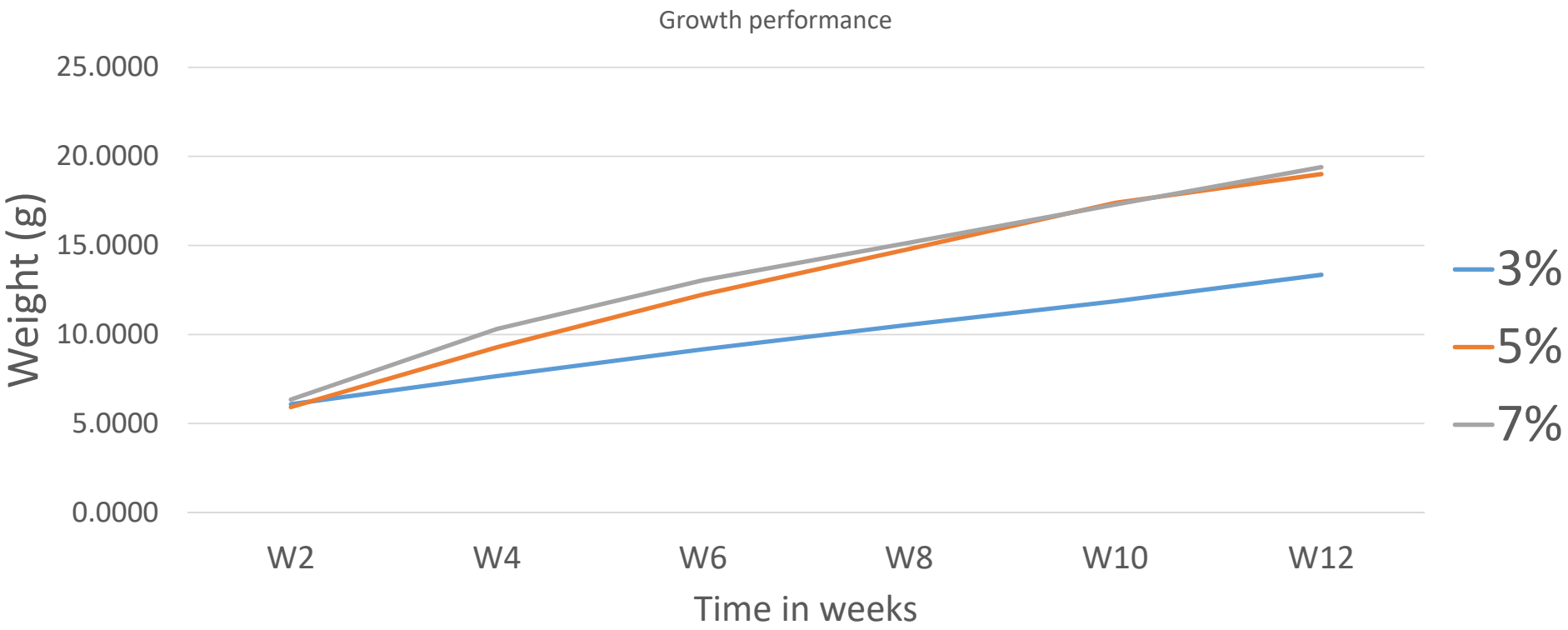
Growth per treatment

14 ♀ O. S X ♂ O. S 5%	6.38	9.33	10.06	11.39	18.47	23.20
15 ♀ O. S X ♂ O. M 5%	7.56	10.35	16.22	19.63	20.65	20.27
16 ♀ O. K X ♂ O. K 5%	4.90	8.16	10.96	12.17	11.51	12.78
17 ♀ O. K X ♂ O. S 3%	**7.09**	**11.60**	**14.32**	**17.56**	**22.66**	**23.72**
18 ♀ O. K X ♂ O. M 5%	6.04	9.37	13.28	15.63	18.21	18.66
19♀ O. M x ♂ O. K 7%	7.19	13.18	16.94	19.74	22.44	22.65
20 ♀ O. M X ♂ O. S 7%	5.95	8.90	10.74	13.17	16.55	19.19
21 ♀O. M X ♂ O. M 7%	**7.40**	**11.35**	**14.04**	**18.24**	**21.20**	**24.64**
22 ♀ O. S X ♂ O. K 7%	3.18	3.57	5.67	6.40	8.36	11.33
23 ♀ O. S X ♂ O. S 7%	4.48	10.63	11.36	12.64	14.00	19.77
24 ♀ O. S X ♂ O. M 7%	**8.86**	**12.65**	**18.02**	**20.49**	**23.44**	**24.95**
25 ♀ O. K X ♂ O. K 7%	6.20	10.18	12.26	13.47	12.20	12.97
26 ♀ O. K X ♂ O. S 7%	7.92	12.90	15.62	17.86	21.05	21.58
27 ♀ O. K X ♂ O. M 7%	6.01	9.50	12.86	14.43	16.44	17.50

Treatments 10, 24, 21, 17, 14 are performing well

Preliminary result

Growth per feeding rate



Water quality parameters

- Temperature is ranging between 18-23^{o}C
- DO is ranging between 6.28-8.91 mg/l
- pH is ranging between 7.62 - 8.86
- Ammonia is less than 0.05 mg /l

Conclusion

- The three Oreochromis species are able to hybridize and give viable offspring.
- High relative fecundity in *O. shiranus* and *O. mossambicus* and lower total number of eggs produced where *O. karongae* were males.
- Hybridization have influenced reproductive performance O. karongae as the number of spawned female increased
-
- Hybrids from female O. mossambicus and male O karongae, and from female O. shiranus and male O mossambicus has good growth performance for 5 and 7% respectively

Challenges

- High mortalities during broodstock collection
- Spawning at different times which affected the size of fingerlings
- Predators (otters) which are disturbing my hapas
- Low temperature (18^{o}C) which affect the growth of the fish


Thank you for your attention