Abbassa Tilapia breeding program

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WorldFish Genetics Workshop
WorldFish Genetic Improvement program
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GIANT Strain Overview

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GIANT strain

A selective breeding program was initiated in **2001** at Abbassa—Egypt to develop and produce a genetically improved Nile tilapia which was to be referred to as “Genetically Improved Abbassa Nile Tilapia (GIANT) strain”, using the **same technology** that produced GIFT (Rezk et al., 2009).

This program was designed to suit the needs of Egyptian and African aquaculture conditions.

Its purpose was to provide a genetically diverse population based on the local strain of Nile tilapia that could be selectively improved for growth. Subsequently, the AS was established from four Egyptian populations (three wild: Kafr Elsheikh, Sharkia, and Aswan; one hatchery: Alexandria).

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GIANT strain

The GIANT strain was selected for **growth** and **high survival rates** since most tilapia farmers consider fast growth from seed to harvest size to be the most important performance trait, along with high survival rate.

On-station comparison of generation 8th and 9th of GIANT strain with commercial strain at Abbassa showed that GIANT strain performance was 28% faster than the commercial strain. Based on this result, the GIANT selection line was released to the local aqua-culture sector.

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Families per generation

Generation	Number of sires	Number of dams	Number of families
1	45	45	45
2	62	62	62
3	72	72	72
4	38	38	38
5	164	164	164
6	96	96	96
7	86	86	86
8	103	103	103
9	114	114	114
10	97	97	97
11	133	133	133
12	134	134	134
13	158	158	158
14	150	150	150
15	126	126	126

Prepared/ Trong Quoc Trinh

Families per generation

Trait	Selected	Studied	Generation	References
Harvest weight	Yes		All	
Black spot disease	Yes	No	14	https://doi.org/10.1016/j.aquaculture.2020.736039
TiLV	Yes		G16	

Prepared/ Trong Quoc Trinh

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Comparison Experiment

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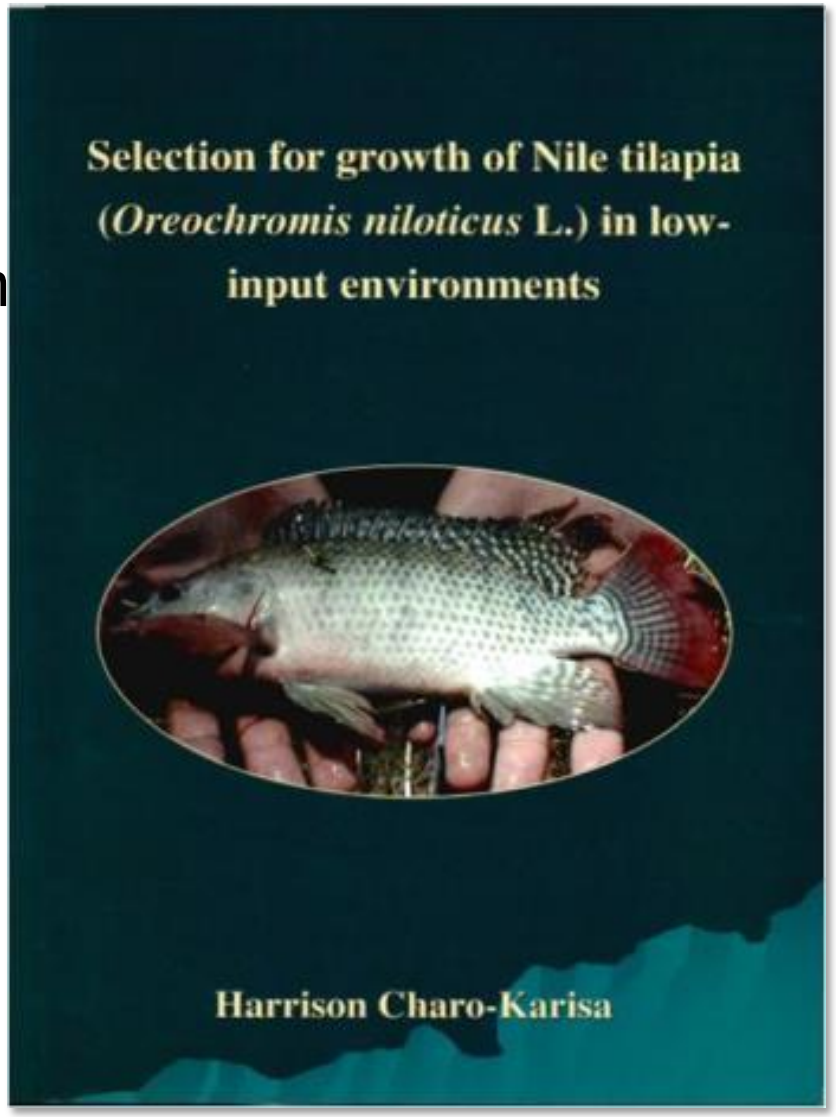

Challenges for Abbassa breeding programs

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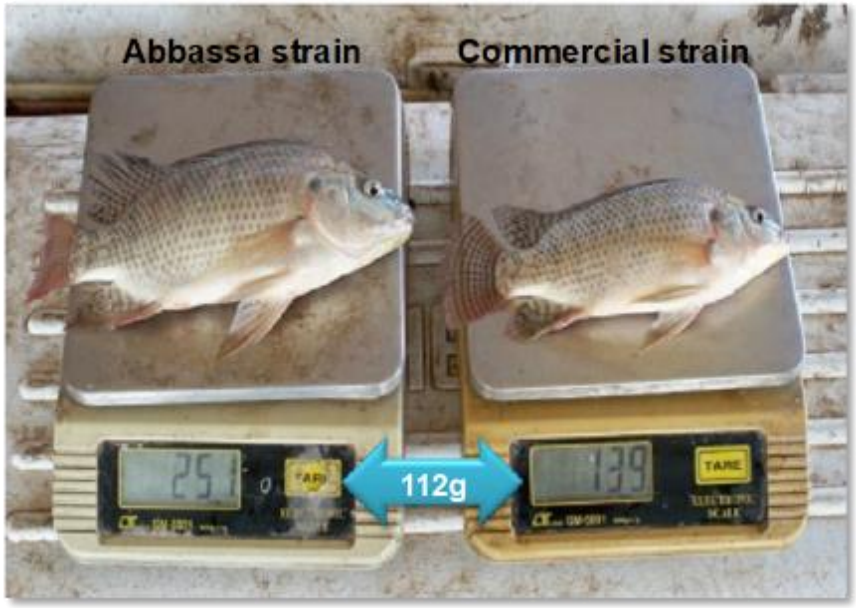
Selective breeding improvement program

- Genetic Gain
  - 3.8-7.0% per generation
- GIFT experienced higher genetic gain per generation
  - ~7.1-15.0% on average
- Why?
  - Differences in animal diversity?
  - Errors in record keeping?



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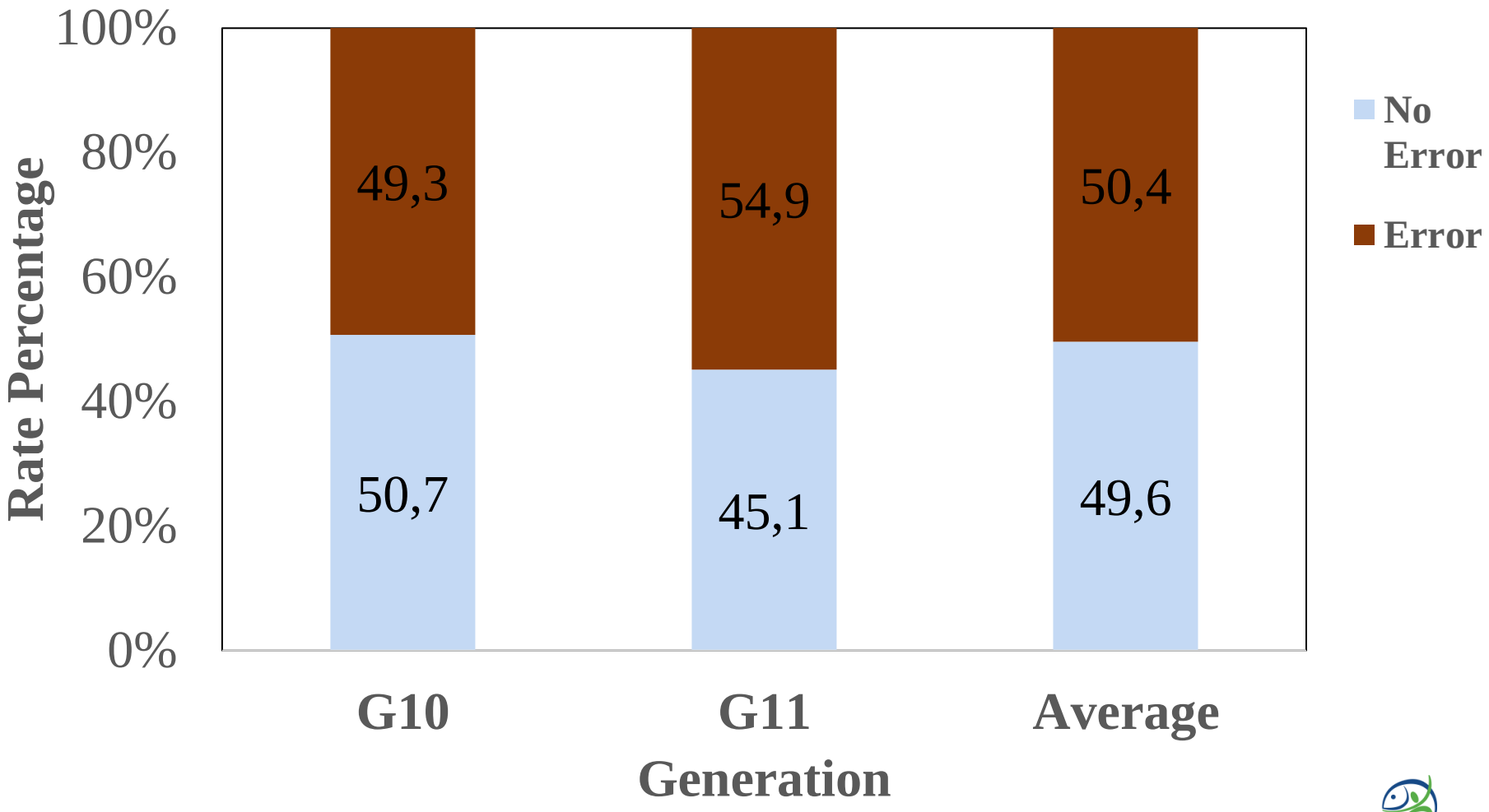
Comparison of Paper & Molecular Pedigrees



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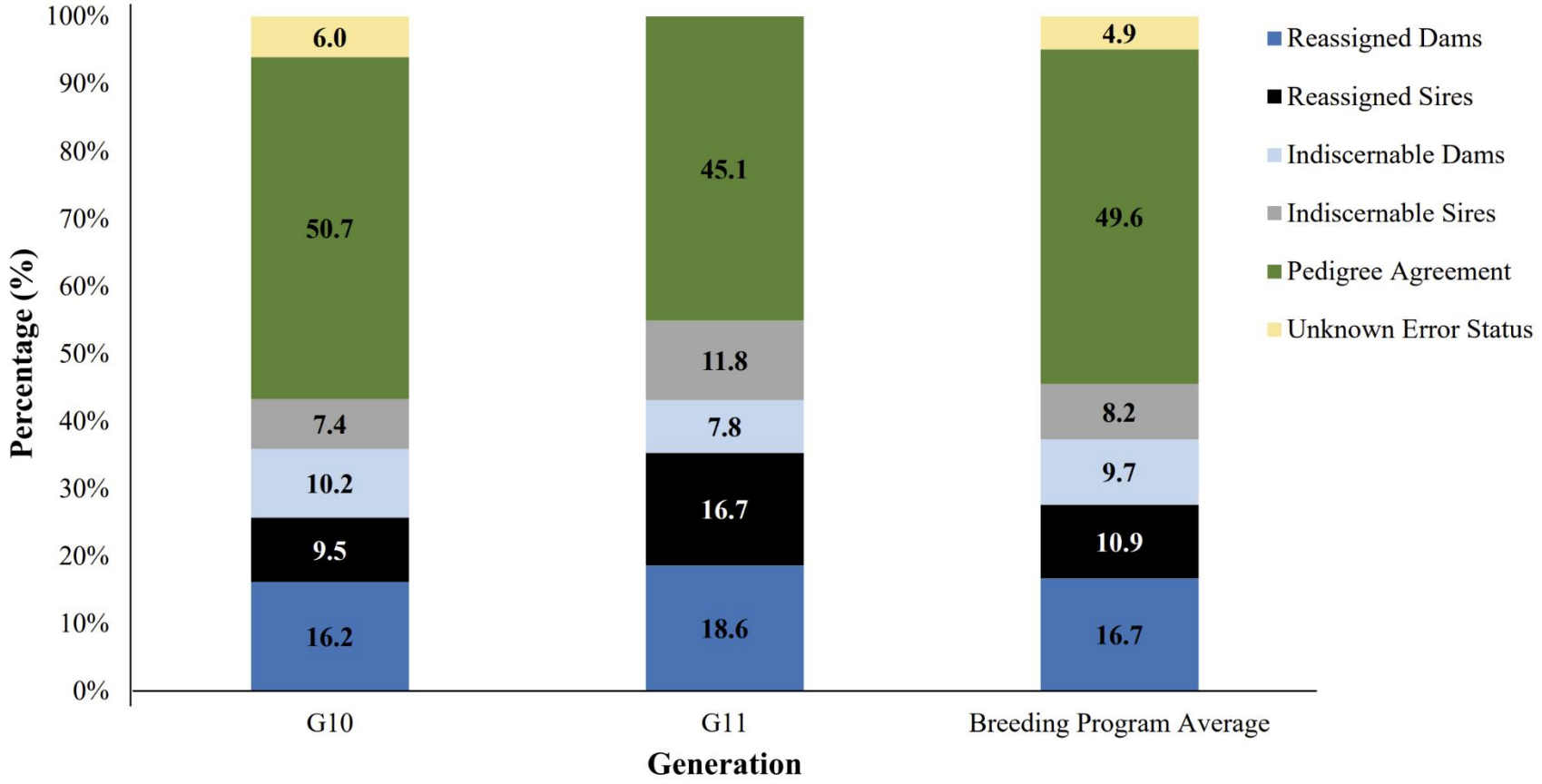

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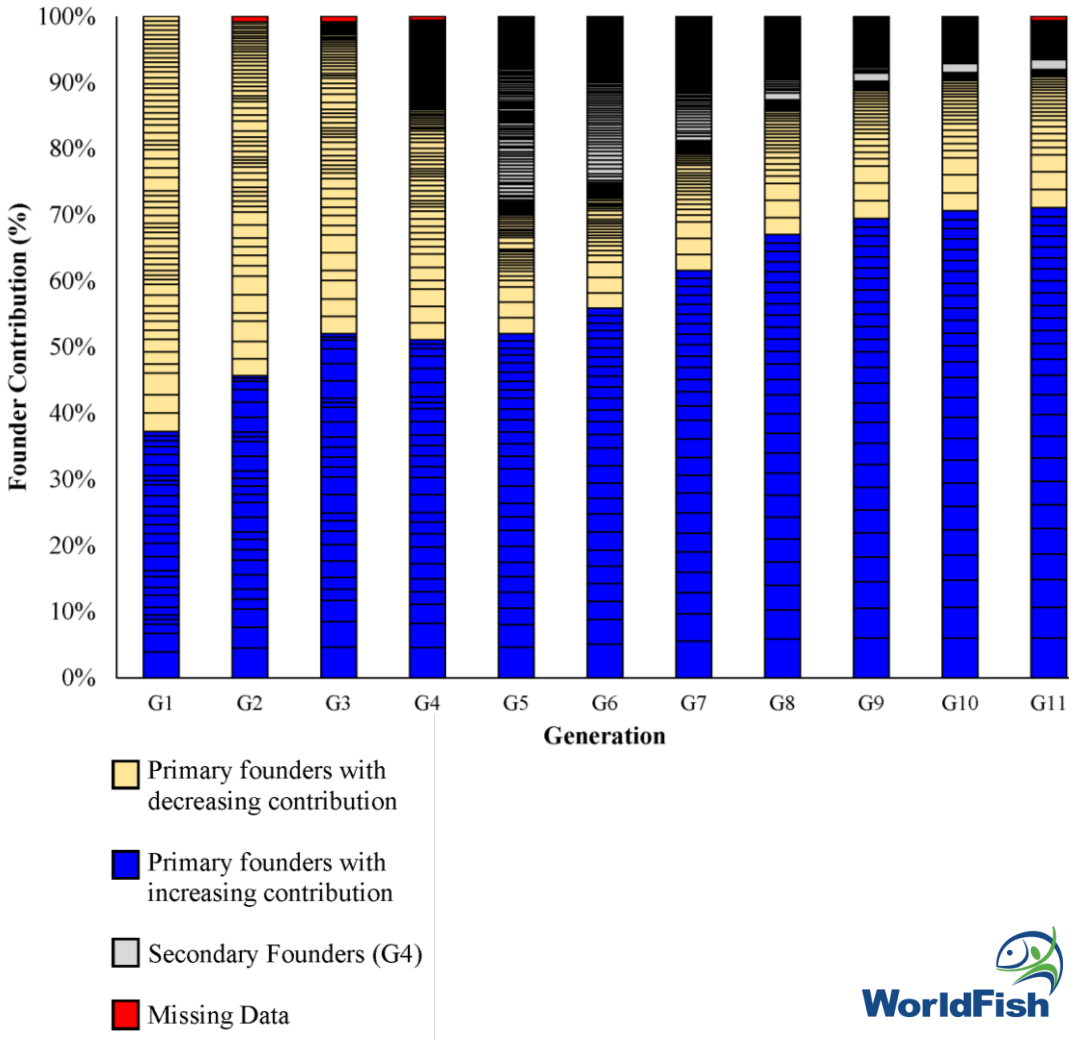
Why Such a High Error Rate?

- Multiple naming protocols
- Transcription errors
- Unmonitored spawning and/or mixing of untagged fish amongst hapas
- Historical errors
- Unrecorded changes to mating schemes



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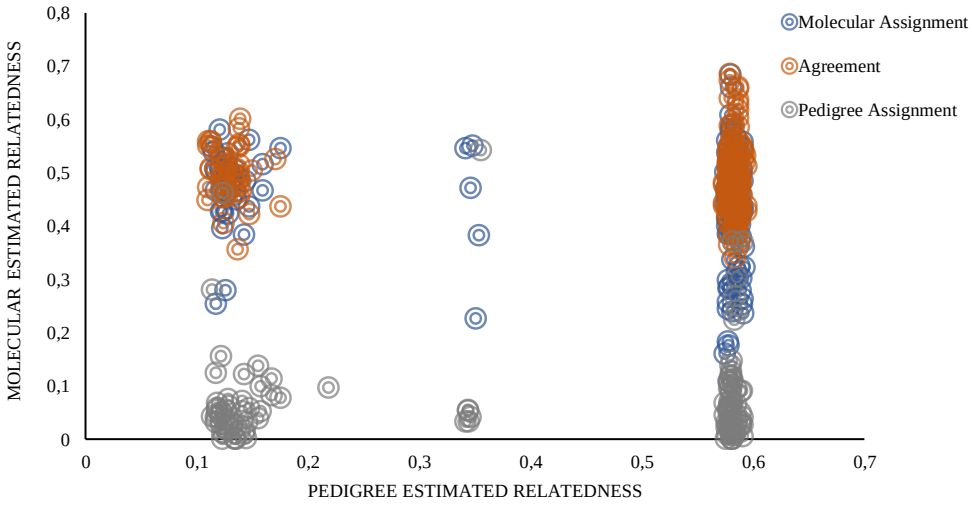
Genetic Diversity: The good news

- Inbreeding coefficient is lower than expected for a program it's age
- Heterozygosity levels are similar to those of wild populations
- How is this possible?
  - Combination of planned mating scheme (~50%), random mating (~30%), and mated with siblings of selected broodstock (~20%)
- Was decided that the program could continue with changes in procedures moving forward



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Current status

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Current Status

For G16

- 4174 Fish **tagged** and **biometrics** data recorded in **April** 2022.
- Two earthen ponds were prepared and stocked with G16 families, each family is divided between the two ponds.
- G16 was **harvested in August** and stocked in 28 concrete tanks. Biometrics data was recorded and sent for analysis.
- Extracting the spleen from 399 fish from Generation 16 to conduct 200 TiLV challenge test which all came back negative.

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Plans for the breeding program (G17)

A **mating list has been made** from G16 will be used to produce G17.

Mating is expected to be in April and May.

Currently items procurement is underway(fish feed, hapas, PIT scanners water quality devices

The Plan forward

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Plan forward

Producing G17

Lessons learned in Abbassa breeding program

Comparison experiment between strains

A dissemination plan for new generation

Producing G17

- The mating for G16 starts in April-May
- Spawning and Nursing for two months
- Tagging and stocking in July
- Harvest in October or next April-March 2024
- Fin clips to be collected
- New traits to be selected beside growth rate

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Lessons learned in Abbassa breeding program

- A recording system and unified naming protocol must be developed for researchers to follow.
- A frequent test to ensure the relation between G15, G16 and G17 is accurate
- The genetics team in Abbassa needs to be expanded (A consultant – a research assistant-interns and workers)
- Capacity building for Abbassa genetics team from all levels (research assistants-workers-technicians)

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New generation dissemination

In 2012, a dissemination strategy was adopted to disseminate the G9 of GIANT strain countrywide

Farmers response in midterm review of the Sustainable Transformation of Egypt (**STREAMS**) project stated that almost 38% of the total Egyptian fish farms received and used Abbassa strain by 2017 in four governorates, namely Kafr el Sheikh, Behera, Fayoum and Sharkia, which have significant aquaculture industries.

The dissemination for any new strain depends on the results of Comparison experiments.

A study on performance of the newly produced strains (G15 and G16) compared to the commercial strains should be conducted.

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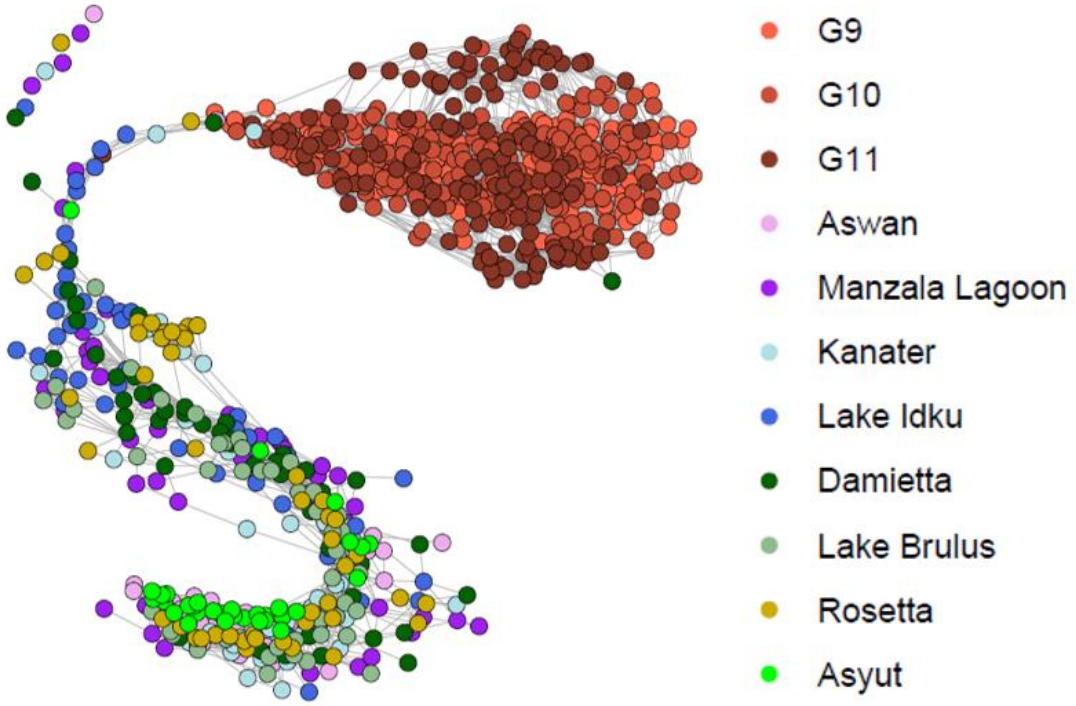
Fine-scale Population Structure



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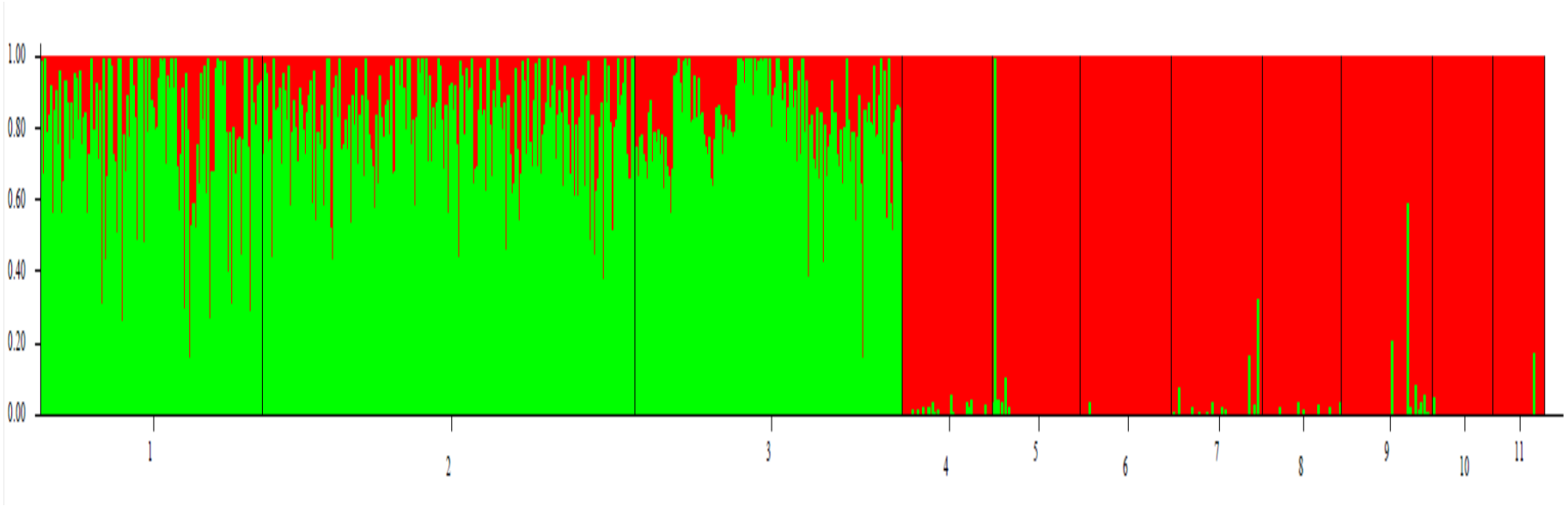
Broad Scale Population Structure



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Thank You

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JAMES COOK UNIVERSITY AUSTRALIA

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