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NATURAL MALE TILAPIA
INTERNATIONAL
YY-Technology

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The sustainable solution to All Male Tilapia production

Hormone sex-reverse

Testosterone is traditionally used in the tilapia industry worldwide....

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But is not always applied successfully resulting in uncontrolled spawning in many African ponds....

The best genetics is reduced to stunted animals.....

YY-Technology!

3 Steps:

1. Development of the YY-line

2. Increasing Male-Ratio

3. Crossing with other female lines

The First Step
1995

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The development of the YY-line

The development of the YY-line

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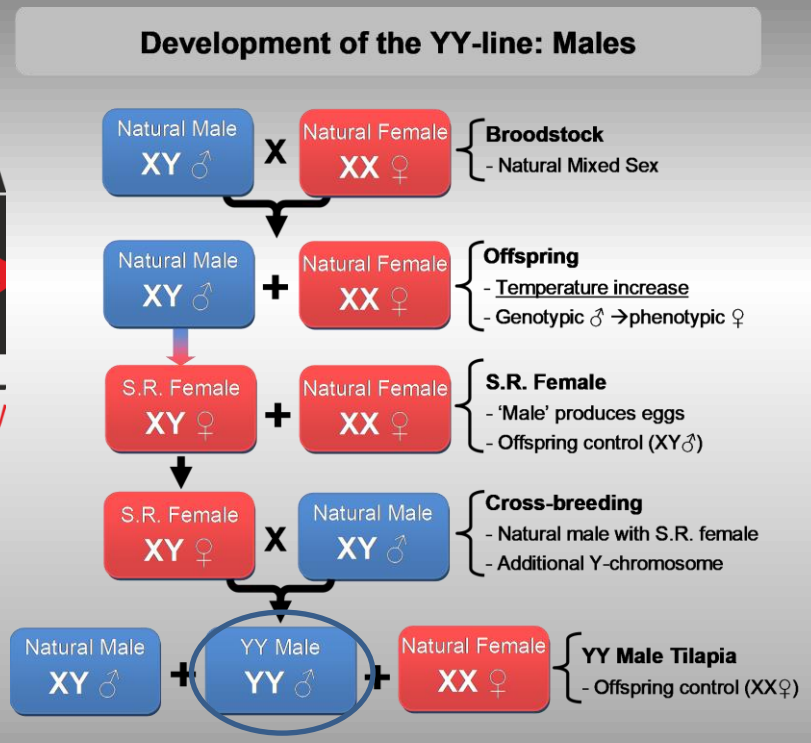

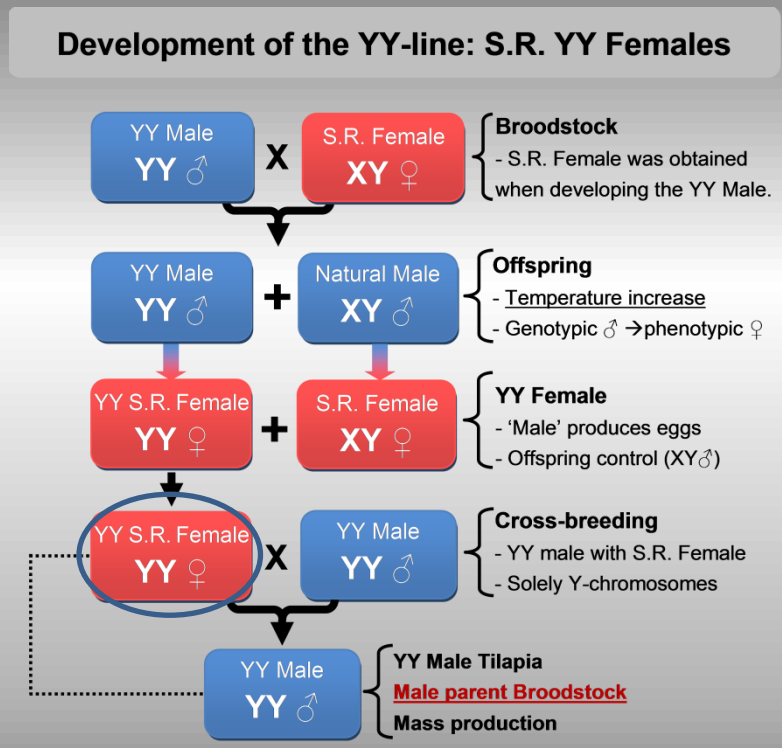

Production of NMT through YY-Technology:

YY-Breed Line:
YY Male mass production

YY Male
YY ♂

X

YY Female
YY ♀

Natural Breed Line:
XX Natural Female mass production

Natural Male
XY ♂

X

Natural Female
XX ♀

YY Male
YY ♂

X

Natural Female
XX ♀

Proper management of broodstock required!

Natural Male
XY ♂

Natural Male Tilapia

100% XY Males

Mass production

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Male Ratio - 2000

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96.0%

The Second Step
2000

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The development of a PURE YY-line

Manual selection for 100% male offspring

YY-♂ x XX-♀

YY-♀ x XY-♂

Male Ratio Control – Progeny testing

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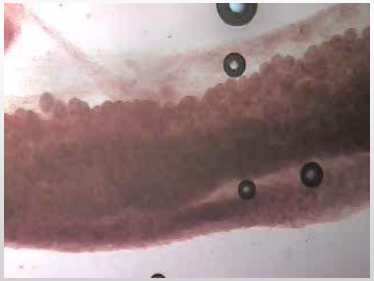
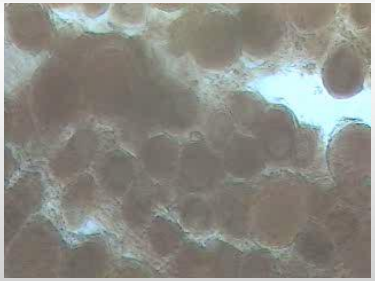


Ovaria 40x



100x

200x

Testis 40x

100x

200x

Male Ratio - 2018

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99.7%

Chip_Nr	Product	Co-operator	Date	Number	Males	Females	Male-Ratio
201709219	Manzala Silver YY MALE Aquarium 058	Hanneke van den	19-10-17	107	106	1	**99,1**
201733549	Manzala Silver YY MALE Aquarium 058	Hanneke van den	17-10-17	121	120	[illegible]	**99,2**
201713963	Manzala Silver YY MALE Aquarium 058	Hanneke van den	17-10-17	105	105	0	**100,0**
201734452	Manzala Silver YY MALE Aquarium 058	Hanneke van den	17-10-17	103	102	[illegible]	**99,0**
201709284	Manzala Silver YY FEMALE Aquarium 042	Hanneke van den	17-10-17	104	104	0	**100,0**
201721450	Manzala Silver YY FEMALE Aquarium 042	Hanneke van den	17-10-17	116	116	0	**100,0**
201714334	Manzala Silver YY FEMALE Aquarium 042	Hanneke van den	11-10-17	112	110	2	**98,2**
201720323	Manzala Silver YY FEMALE Aquarium 042	Hanneke van den	11-10-17	103	103	0	**100,0**
201722062	Manzala Silver YY FEMALE Aquarium 042	Hanneke van den	10-10-17	85	85	0	**100,0**

Sex ratios loci on XX/XY

....departures from the sex ratios predicted on the XX/XY model were strongly associated with the XX/XY system, due to multiple alleles, rather than being associated with loci in other LGs

M. G. Q. Khan, 2011, PhD Thesis, MARKER-ASSISTED SELECTION IN ENHANCING GENETICALLY MALE NILE TILAPIA (*Oreochromis niloticus* L.) PRODUCTION

15th generation YY-Male

YY-males grow 2-3 times faster than XY-males.....!

96% - “Under construction”

The Third Step
2015 - today

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Testing of Til-Aqua YY-males with female-strains of different origin

Female strain X Til-Aqua YY:

Til-Aqua	NMT	99%
Kenyan	NMT	96%
Egyptian	NMT	97%
Philippine	NMT	97%
A GIFT	NMT	98%

Still to test:

GIFT

Abbassa

GST

Spring

Akosombo

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WHY YY

Dr Michael Phillips, Director of Science and Aquaculture, WorldFish 19 March 2017

Quote: *"Tilapia were previously considered to have good disease resistance. While the report and the emergence of TiLV will not dent the species' dominance in global aquaculture, ..."*

"It is a sign that greater efforts will have to be made to ensure tilapia's hardy reputation."

https://www.worldfishcenter.org/content/egyptian-fish-mortality-mystery-closer-being-solved-scientists-identify-tilapia-lake-virus

Tilapia Lake Virus - TiLV

WORLD ORGANISATION FOR ANIMAL HEALTH

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Genetically produced male Tilapia shows highly genetic resistance to TiLV

OiE – Tilapia Lake Virus (TiLV) May 2017

Ferguson et All (2014). Syncytial hepatitis of farmed tilapia, Oreochromis niloticus (L.): A case report. Journal of Fish Diseases, 37(6), 583–589.

Tilapia Lake Virus - TiLV

Ferguson (2014):

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"If it is simply a case of genetic resistance, as seems the most likely explanation, then until such time as a vaccine becomes available or the cause is identified, close attention should be paid to **breeding programmes**....."

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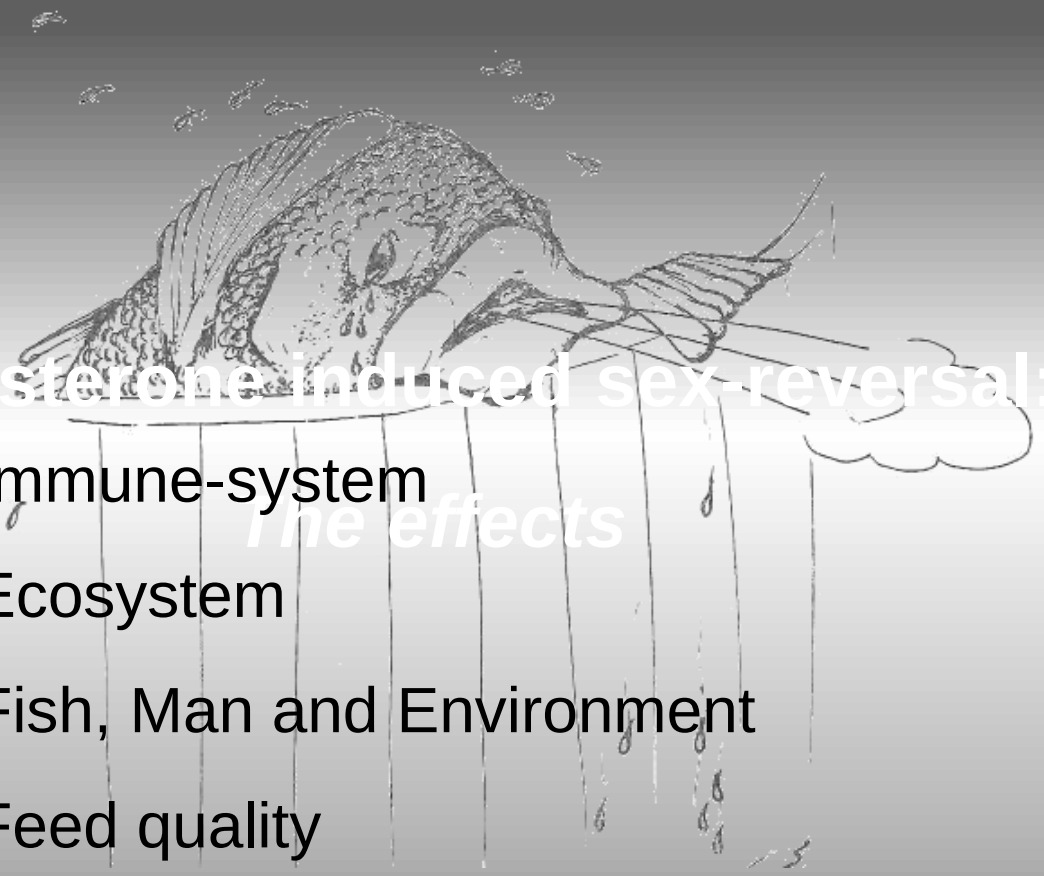

Testosterone induced sex-reversal:

The effects

Immune-system

Ecosystem

Fish, Man and Environment

Feed quality

Mixed sex is NOT an option

Testosterone induced sex-reversal:

The effects

The immune-system

Testosterone has direct negative effect on the immune system and in particular on the mucus (skin-defense); creating free access for parasites, mold and bacteria. This decreased development of the immune system will obviously affect performance in later stages of life.

Haitham G.Abo-Al-El Abeer et all, 2017
The extent to which immunity, apoptosis and detoxification gene expression interact with 17 alpha-methyltestosterone

Sayeed and Moneeb, 2015, *Hematological and biochemical characters of monosex tilapia (Oreochromis niloticus, Linnaeus, 1758) cultivated using methyltestosterone*

Harris and Bird, 2000, *Modulation of the fish immune system by hormones.*

Haitham G.Abo-Al-El Abeer et all, 2017
Conclusions

- MT greatly disrupted the immunity, apoptosis and detoxification systems.
- MT had a significant impact on these genes, and this impact varied from induction to repression during and after the MT treatment.
- Immune alternation caused by MT is clearly reflected on the survivability.

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Testosterone induced sex-reversal:

The effects

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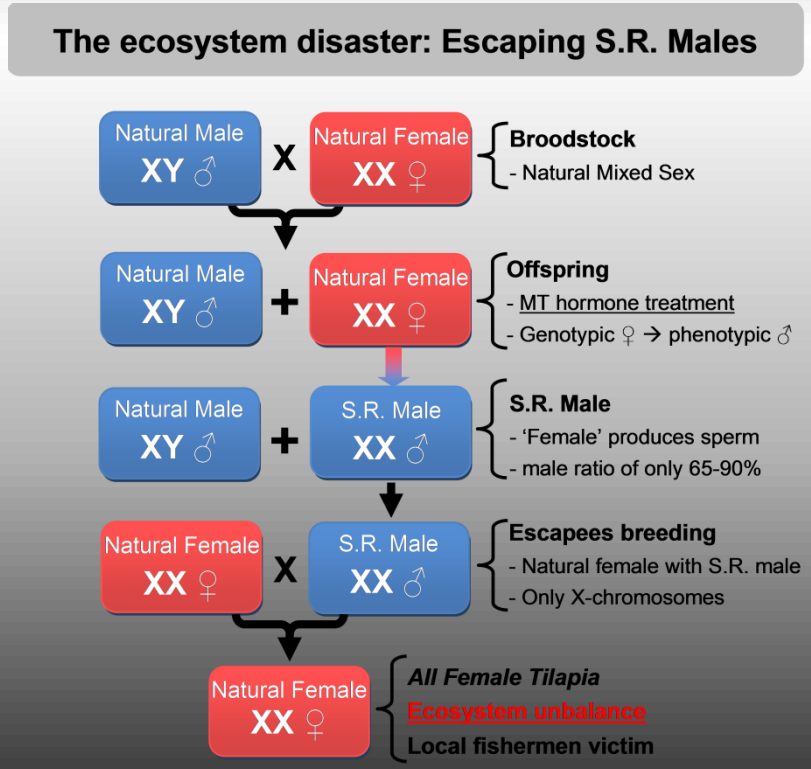
- Defective immune system
- Suffering from parasites
- Sickeningly
- Death

Testosterone induced sex-reversal:

The effects

The ecosystem

If such a fish escapes into the environment and spawns with natural females this will result in an all female offspring, causing an sex-unbalance in the surrounding ecosystem.



Testosterone induced sex-reversal:

The effects

Fish, Man and Environment

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Employees are in contact with testosterone (feed!):

- **often with lacking procedures to follow**
- **no regulation or control.**
- **There are serious doubts about the effect of testosterone on human physiology; i.e. vital organs, muscles, social behavior and libido.**

Meghowon and Mojekwa, 2014, *Testosterone and its effect on Fish, Man and Environment*

Testosterone induced sex-reversal:

The effects

Feed quality

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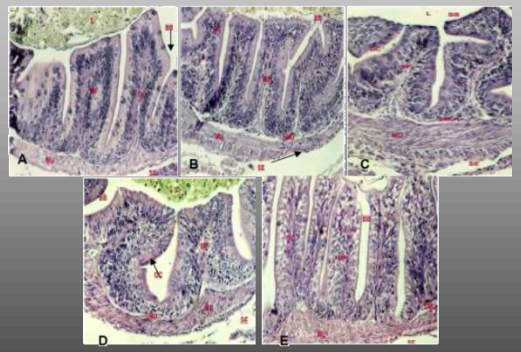

Evangeline E. aravata, Annabelle A. Herrera and Jose S. Abucay, 2004, *Impact of the Quality of First Food on Digestive Enzymes and Development of the Anterior Intestine and Hepatopancreas.*

Testosterone induced sex-reversal:

The effects

Feed quality

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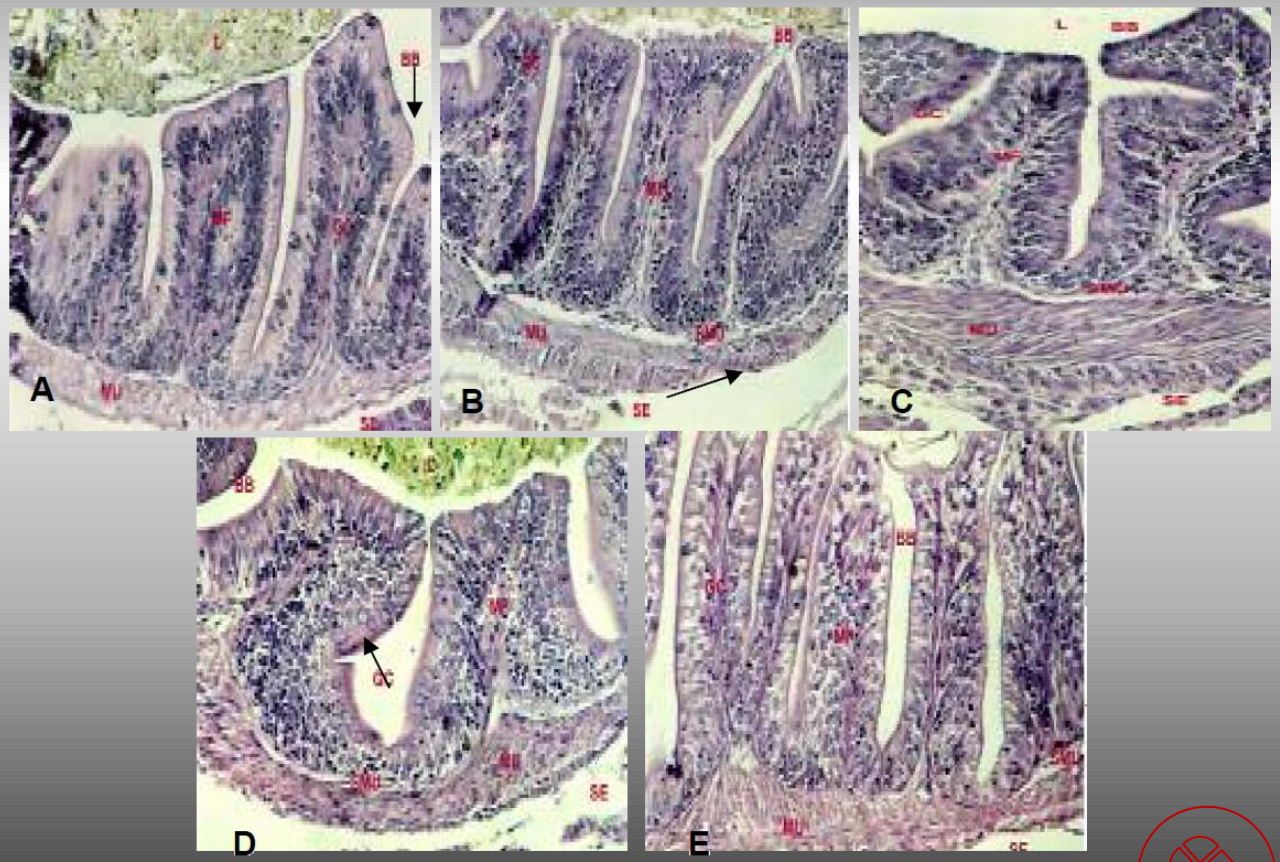

A good start

=

a good end

Mixed sex NOT an option

The use of mixed sex populations is no option for an efficient tilapia production:
- reproduction will decrease performance
- female growth is significantly slower than male growth
- <u>Feed Conversion Rate (FCR) for mixed sex is high due to social interaction.</u>

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New insights on growth, feeding, and social interactions in tilapia (Oreochromis niloticus). Fauconneau Benoît, Toguyeni Aboubacar, Fostier Alexis, Le Bail P.Y., Boujard T., Baroiller Jean-François. 1997. In : Proceedings of the fourth international symposium on tilapia in aquaculture = [Actes du 4ème congrès international sur tilapia en aquaculture]. Fitzsimmons K. (ed.) s.l.:s.n., pp. 151-168.

Table 2: Growth parameters and feed utilization ratio of monosex male and female and mixed group fed on self-feeders during a 31 days period in tilapia.

Groups	Monosex male	Monosex female	Mixed	
			male	female
Growth				
Initial weight (g)	12.8 ± 0.7	9.4 ± 1.0	12.2 ± 0.4	9.8 ± 0.8
Final weight	70.1 ± 2.1	42.8 ± 1.2	58.4 ± 2,0	40.1 ± 1.0
Volontary Feeding (%)	3.6 ± 0.1	3.9 ± 0.1	4.1 ± 0.1	
Feed Conversion Ratio	**0.98 ± 0.04**	**1,13 ± 0.03**	**1.22 ± 0.03**	
Protein Efficiency Ratio	2.4 ± 0.1	1.9 ± 0.0	1.93 ± 0.4	
Net Protein Utilization (%)	38.7 ± 1.2	31.2 ± 0.9	30.2 ± 1.1	
Net Lipid Utilization (%)	80.5 ± 1.5	62.8 ± 1.5	65.1 ± 3.0	
Net Energy Utilization (%)	48.6 ± 0.9	38.5 ± 0.6	38.8 ± 1.4	

PER: Body Weight Growth (g) / Protein ingested (g), Net Nutrient Utilization (Nutrient deposited / Nutrient Fed %)

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Mixed sex NOT an option

25%

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WHY YY-Technology?

- ✓ **Easy and effective!**
- ✓ **Stock as usual and harvest all-male**
- ✓ **Male Ratio = 99% (all XY-males)**
- ✓ **Higher resistance (TiLV)**
- ✓ **Heterosis**
- ✓ **Uniform batches**
- ✓ **Environment friendly**
- ✓ **No effect on immune system**
- ✓ **No harm to fish, employee, ecosystem**

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More easy and more effective

The coexistence

WorldFish

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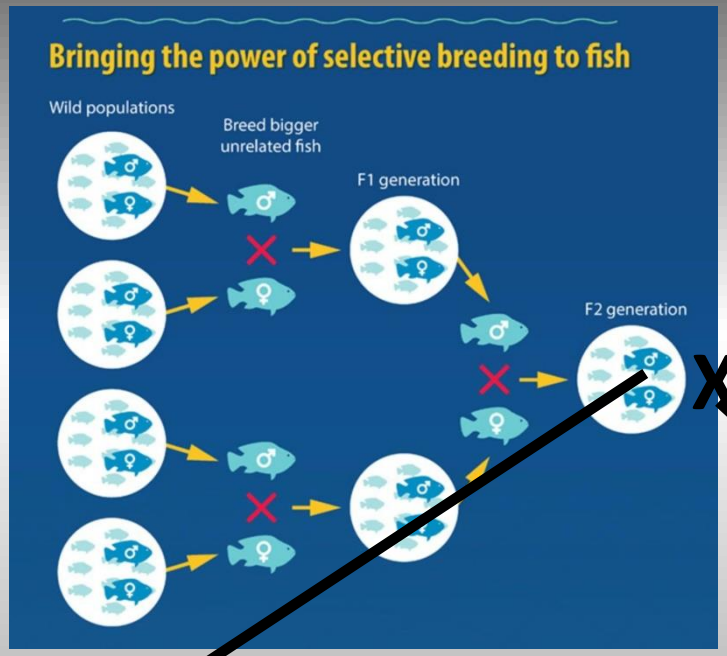

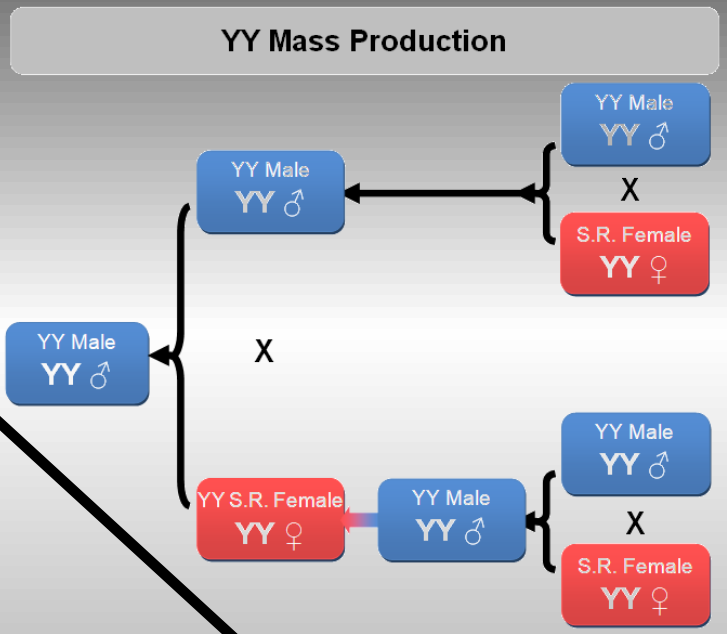

GIFT
-SRT-

&

GIFT
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THANK YOU