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STREPTOCOCCUS CHALLENGE TESTS IN NILE TILAPIA

A Benchmark Company

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Topics

- General Introduction
- Genetic material
- Results

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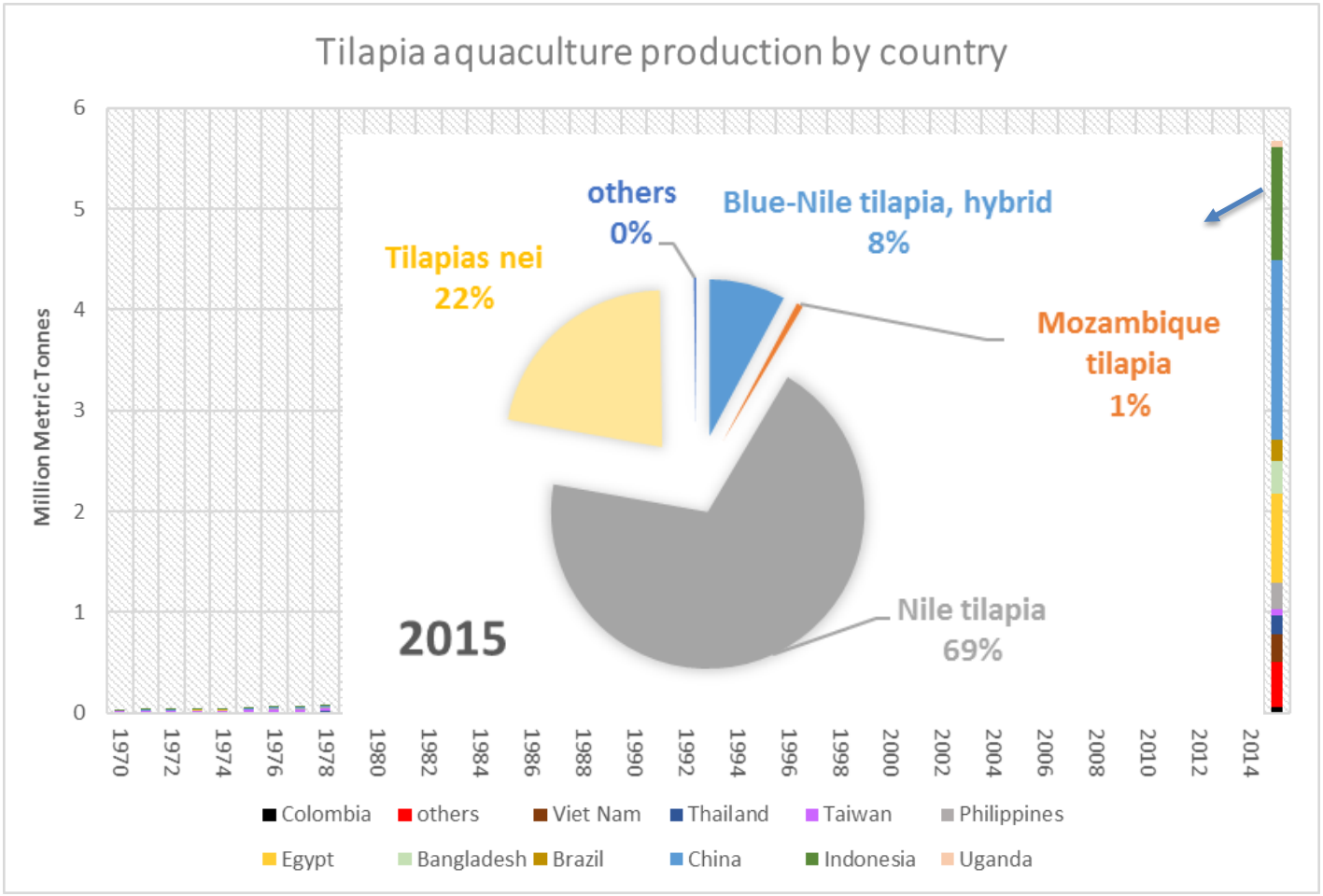

Based on FAO figis dataset (accessed 2017)

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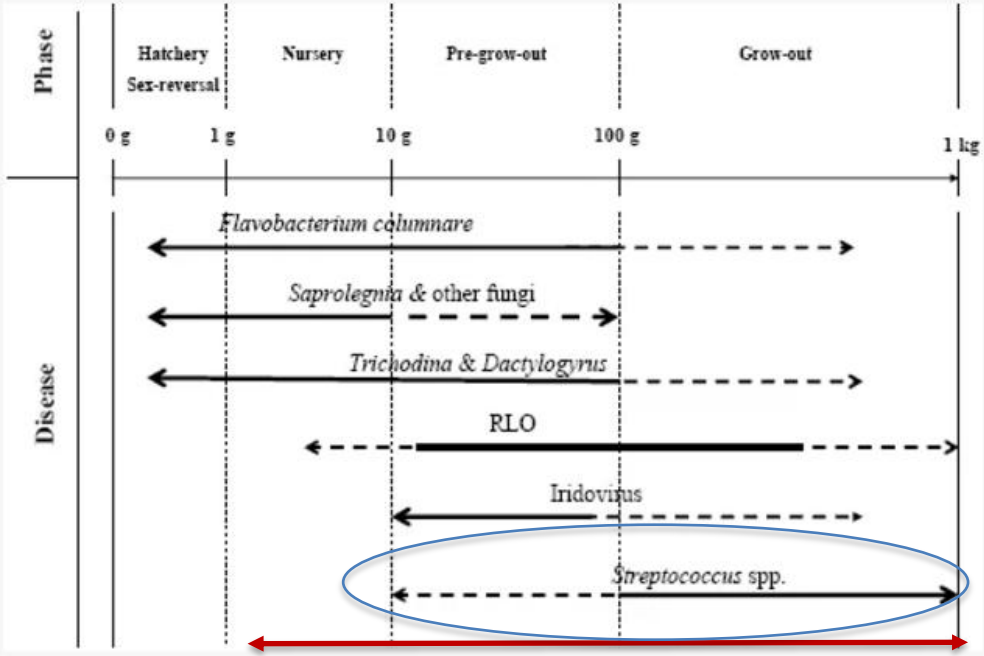
DISEASES



Major diseases affecting tilapia during the farming cycle

TLV

Figure and fotos from the fish site: https://thefishsite.com

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STREPTOCOCCUS

- *"Streptococcus agalactiae* and, to a lesser extent, *Streptococcus iniae* appear to be the principal agents of streptococcosis in tilapia."

- "Streptococcus agalactiae has two distinct clusters (Biotype 1 and Biotype 2)"

- "Immunity to *S. agalactiae* is biotype-specific"

From Sheehan et al 2009, Streptococcosis in tilapia: A more complex problem than expected?

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STREPTOCOCCUS

	Global prevalence (as % of total streptococcal isolations)*
S. agalactiae Biotype 1	26
S. agalactiae Biotype 2	56
S. iniae	18

* Data generated by Intervet/Schering-Plough Animal Health, Singapore

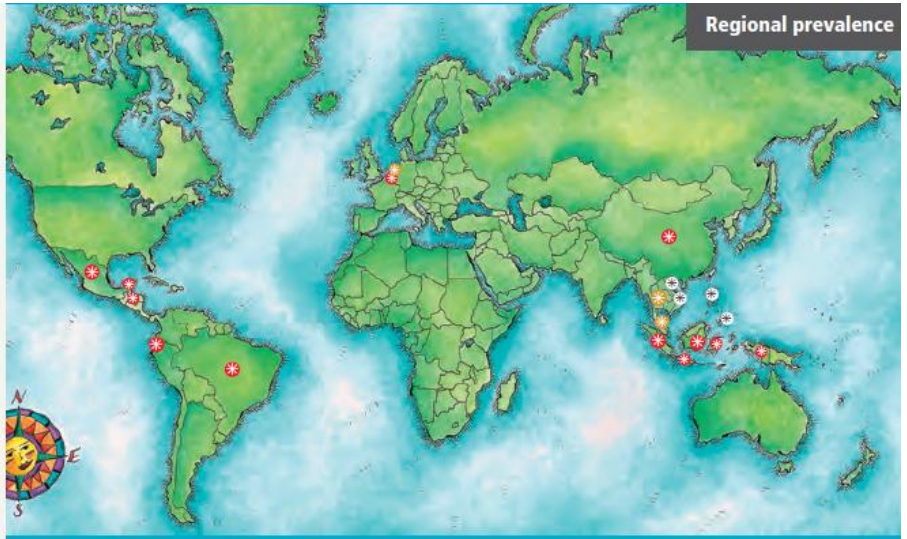

Figure 1. Global distribution of *S. iniae*, *S. agalactiae* Biotype 1 and *S. agalactiae* Biotype 2 in tilapia and the countries where these pathogens have been identified and associated with disease.

- *S. agalactiae* Biotype 2 (and *S. iniae*)
- *S. agalactiae* Biotype 1 (and *S. iniae*)
- *S. agalactiae* Biotype 1 and 2 (and *S. iniae*)

From Sheehan et al 2009, Streptococcosis in tilapia: A more complex problem than expected?

S. agalactiae vaccine strain	*S. agalactiae* challenge strain	Treatment group	% mortality	RPP*
S. agalactiae Biotype 1	*S. agalactiae* Biotype 1	VACCINATES	7	93%
		CONTROL	93	
	S. agalactiae Biotype 2	VACCINATES	87	0
		CONTROL	80	

Table 2. Sa1 vaccines do not protect against Sa2 challenge.

* RPP (relative percent protection) includes mortality and recovery of challenge organism from surviving fish at the end of the observation period. RPP is calculated as RPP = (1-(infection in vaccinates/infection in controls)) x 100.

S. agalactiae vaccine strain	*S. agalactiae* challenge strain	Treatment group	% mortality	RPP*
S. agalactiae Biotype 2	*S. agalactiae* Biotype 1	VACCINATES	53	0
		CONTROL	53	
	S. agalactiae Biotype 2	VACCINATES	13	80%
		CONTROL	67	

Table 3. Sa2 vaccines do not protect against Sa1 challenge.

* RPP (relative percent protection) includes mortality and recovery of challenge organism from surviving fish at the end of the observation period. RPP is calculated as RPP = (1-(infection in vaccinates/infection in controls)) x 100.

From Sheehan et al 2009, Streptococcosis in tilapia: A more complex problem than expected?

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BASE POPULATION - SPRING GENETICS

Origin :

- **Gift Project** 1988-1997 (5 Generations of selection)
- **RIA 1** 1997-2004 (4 Generations of selection)
- **Nicanor** 2004-2009 (3 Generations of selection)

To create the base population fry from Nicanor were introduced to Miami in 2010

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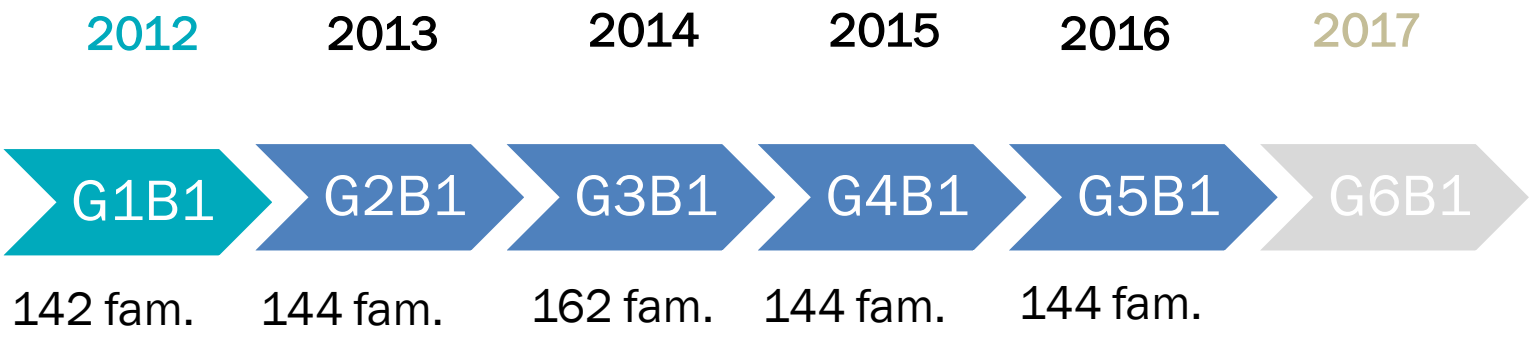
FAMILY PRODUCTION



Base population

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FAMILY PRODUCTION

1 couple per tank.
Natural mating

Collect eggs

Incubation

Transfer to nursery

Separate rearing units

Rear until pit-tagging

Photos : Hideyoshi Segovia

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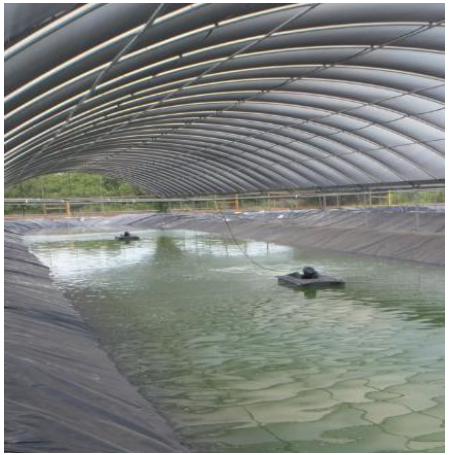
TESTING

TAGGING

Stretptococcus
Ch-tests

Pond 2 (Breeding Candidates)



Pond 1

Photos: Hideyoshi Segovia

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STREP. CH-TESTS

Generation	Method	chall_date	# per fam	weight(g)
G3B1	S.iniae_cohab	2014-12-02	10	179
G3B1	S.iniae_IP	2014-12-02	10	180
G4B1	S.agal_IM	2015-11-12	15	179
G4B1	S.iniae_IP	2015-09-22	20	29
G5B1	S.agal_NO	2016-09-13	20	65

Agalactiae Biotype 2 used.

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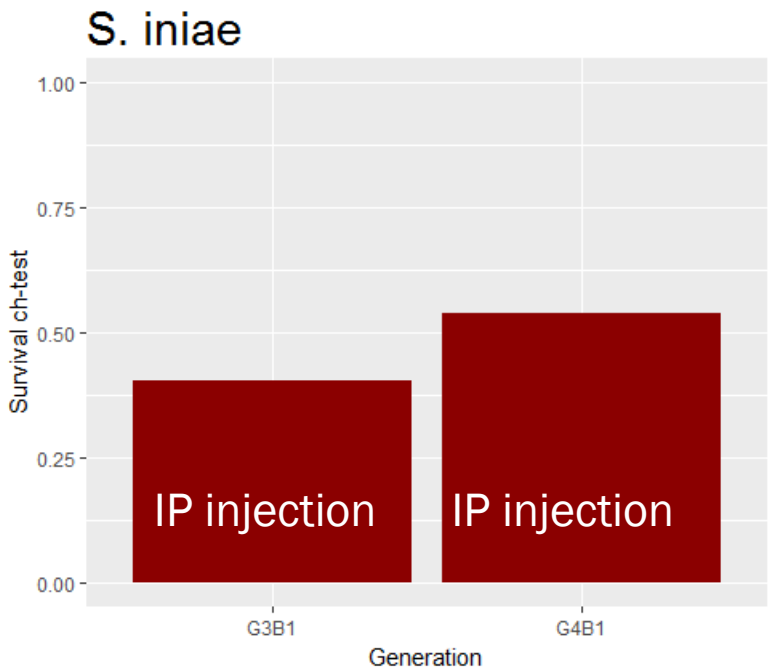
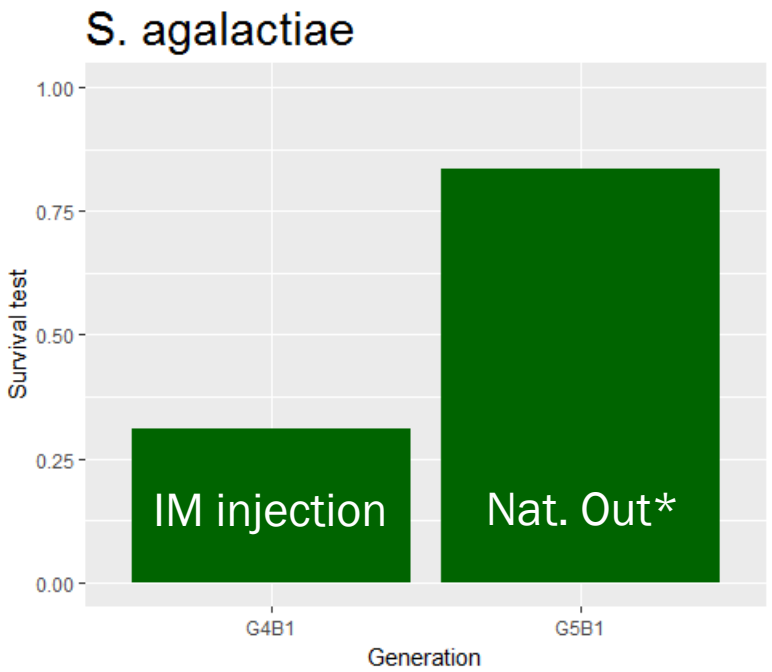
STREPTOCOCCUS SURVIVAL





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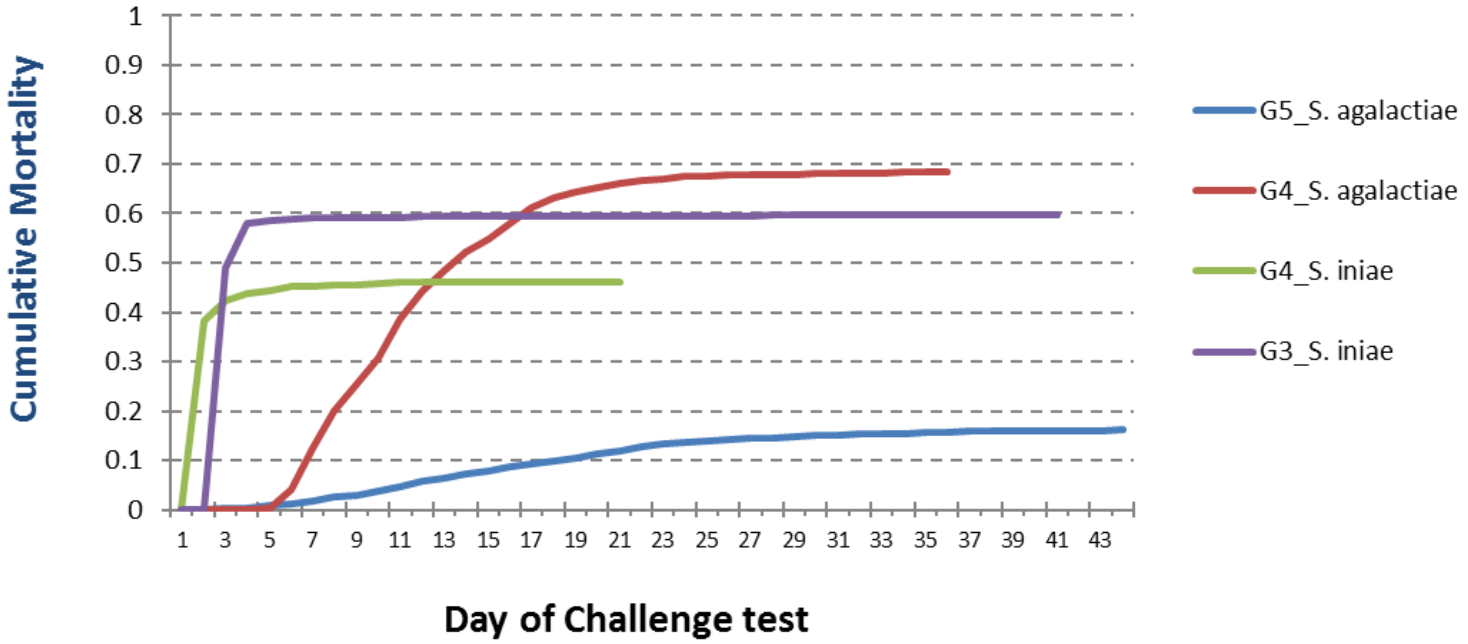
CHALLENGE TEST *STREPTOCOCCUS*



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HERITABILITIES

Gen	Trait	h^2 ± SE	c^2 ± SE
3	Survival S. iniae*	0.41 ± 0.13	0.01 ± 0.05
4		0.53 ± 0.12	0.03 ± 0.04
All		**0.49 ± 0.08**	**0.02 ± 0.02**
4	Survival S. agalactiae*	0.36 ± 0.11	0.01 ± 0.04
5		0.12 ± 0.04	0.02 ± 0.02
All		**0.16 ± 0.03**	**0.05 ± 0.01**

Data (G3 and G4):

*S. iniae*_survival = Gen + p_day + id + unit + e

Data (G4 and G5):

*S. agalactiae*_survival = Gen + p_day + id + unit + e

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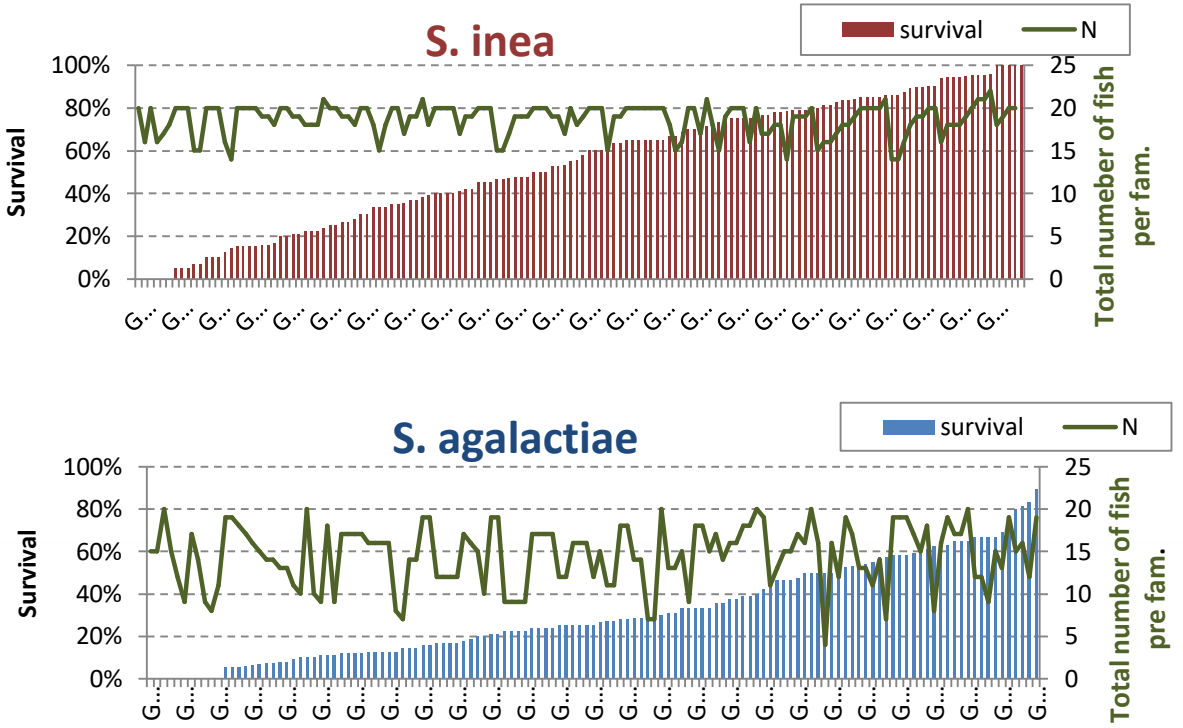
G4B1 (e.g)



r_G = - 0.07 (ns)

CHALLENGE TEST *S. INIAE*

Assortative mating groups	*Number of families*	avg_S. inea G3B1 index parents*	Survival to inea in G4B1		
			Average**	Min	Max
none	132	101.6	54 %	0 %	100 %
yes_high	6	121.9	88 %	60 %	100 %
yes_low	6	80.2	10 %	0 %	42 %
Grand Total	144				

* Index (mean=100, sd=10). Avg=(sire idex +dam index)/2

** mean family survival to *S. inea* during challenge test.

Both G3B1 and G4B1 challenge tests were done with injection

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CHALLENGE TEST *S. AGALACTIAE*

Assortative mating groups	*Number of families*	avg_S. aga. G4B1 index parents*	Survival to agalactiae in G5B1		
			Average**	Min	Max
none	132	103.8	85 %	30 %	100 %
yes_high	6	122.8	98 %	95 %	100 %
yes_low	6	83.7	61 %	40 %	75 %
Grand Total	144				

* Index (mean=100, sd=10). Avg=(sire idex +dam index)/2

** mean family survival to *S. agalactiae natural* during challenge test.

G4B1 S. aga. challenge test was done with injection

G5B1 S. aga. challenge test was a natural outbreak

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CONCLUSIONS

- Additive genetic component found for survival in fish infected with either *S. iniae* or *S. agalactiae* .
- Results of Ch-test carried out for *Streptococcus* have been validated.
- When analyzing all generations, no relationship was found between survival to *S. iniae* and *S. agalactiae.* Simultaneous selection for both traits is required.

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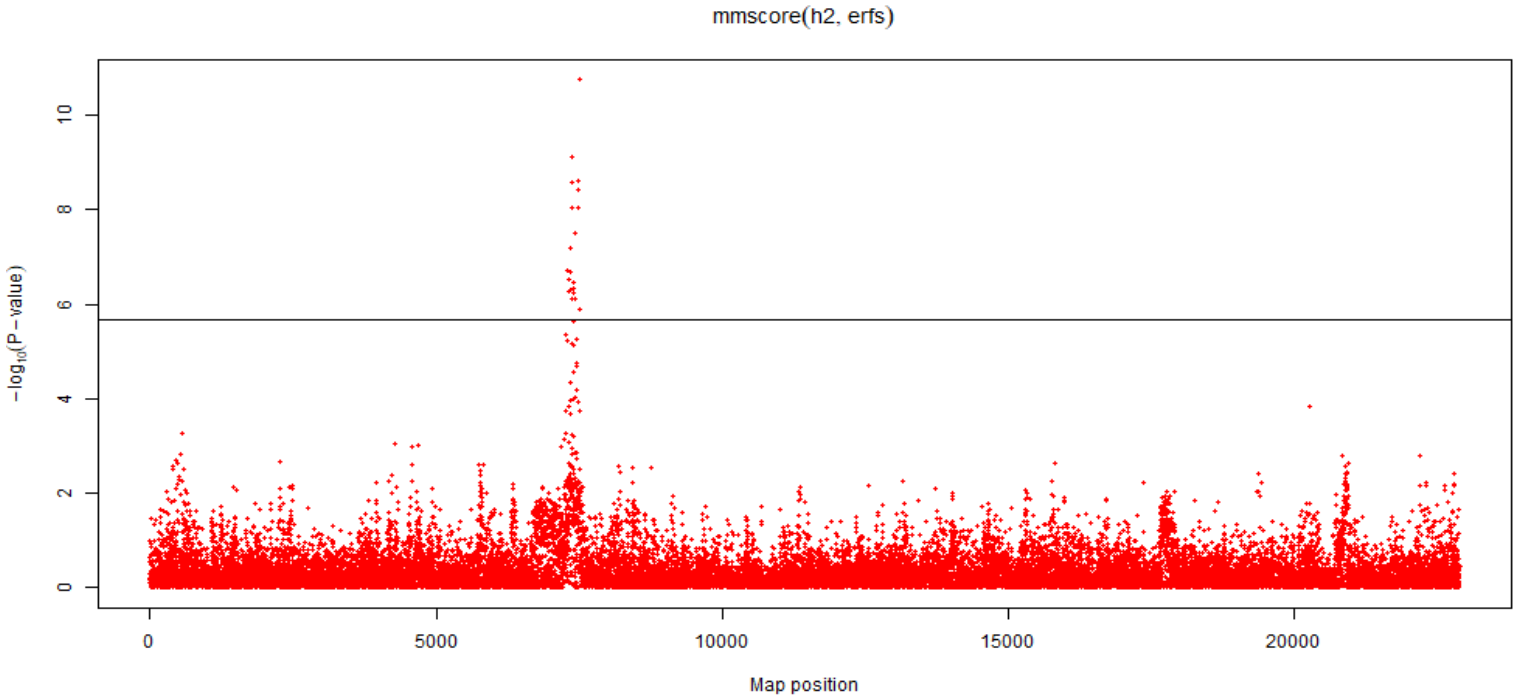
S. INIAE GENOMIC ANALYSIS



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Thank you

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USDA United States Department of Agriculture
Agricultural Research Service

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