



30 years of AGD R&D: Why are we still freshwater bathing?

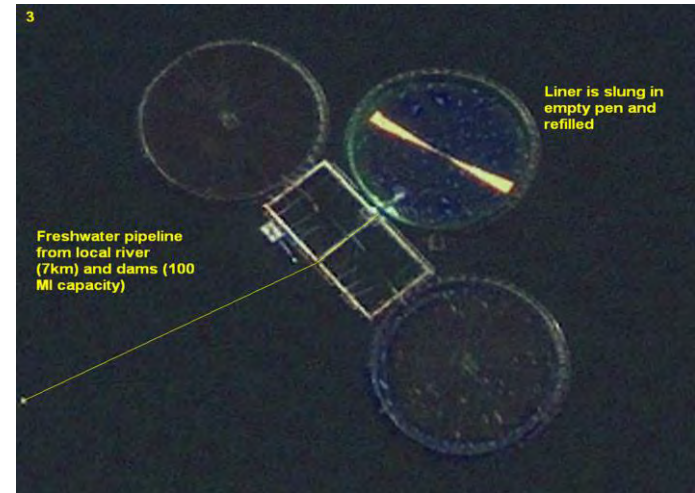
Mathew T Cook

FOOD FUTURES FLAGSHIP
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Why is FW bathing so effective

- No requirement for a therapeutic window
- Clean and Green – no nasty chemicals
- Promotes healing
- No withdrawal time required
- Established standard practice in Australia
- Potential for reuse

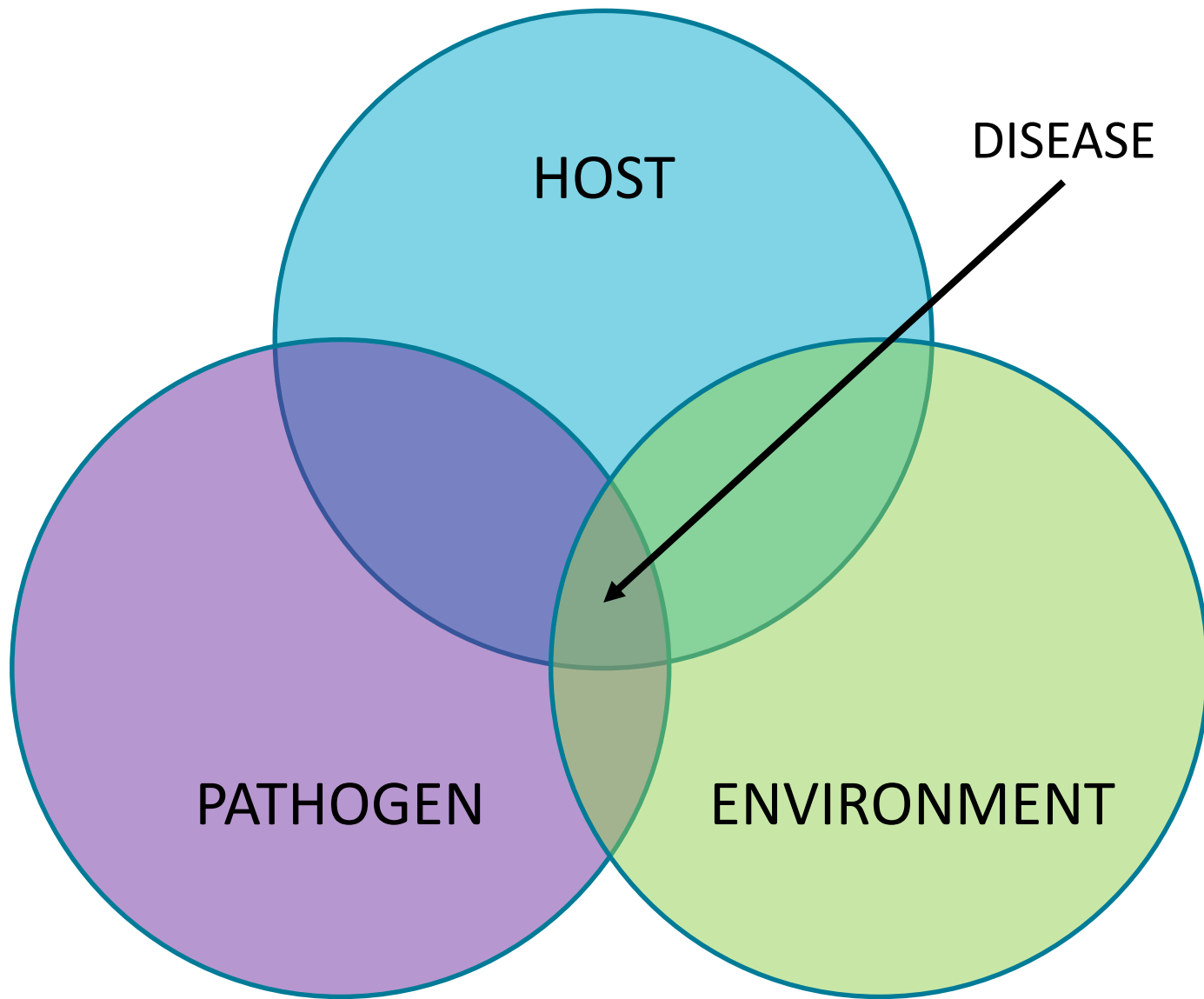


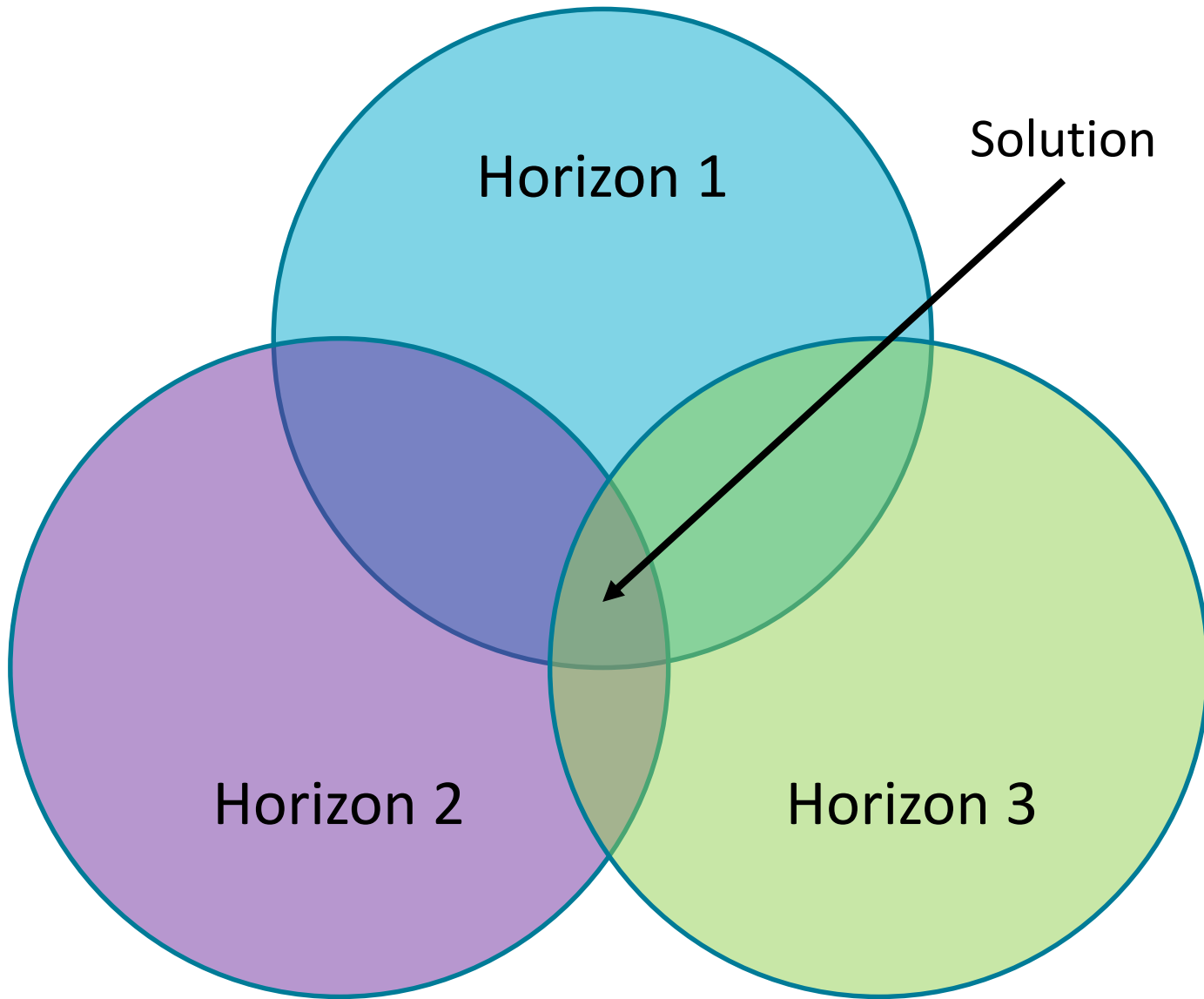
AGD In context

	AGD	Malaria	AIDS
Host	<ul style="list-style-type: none"> Limited immune response Genome now available Lack of tools 	<ul style="list-style-type: none"> Complex immune response Fully sequenced genome Associated 'Tools' 	<ul style="list-style-type: none"> Complex immune response Fully sequenced genome Associated 'Tools'
Pathogen	<ul style="list-style-type: none"> Amoeba Large genome which is unexplored Contains an endosymbiont 	<ul style="list-style-type: none"> Plasmodium Fully sequenced and annotated genome 	<ul style="list-style-type: none"> HIV Fully sequenced and annotated genome Rapid evolution
Interaction	<ul style="list-style-type: none"> External parasite 	<ul style="list-style-type: none"> Internal parasite 	<ul style="list-style-type: none"> Virus
R&D Budget	<ul style="list-style-type: none"> \$Millions p.a. 	<ul style="list-style-type: none"> \$Billions p.a. 	<ul style="list-style-type: none"> \$10's Billions p.a.
Labs involved	<ul style="list-style-type: none"> 4-20 	<ul style="list-style-type: none"> 50+ 	<ul style="list-style-type: none"> 100+

Key Milestones in AGD R&D

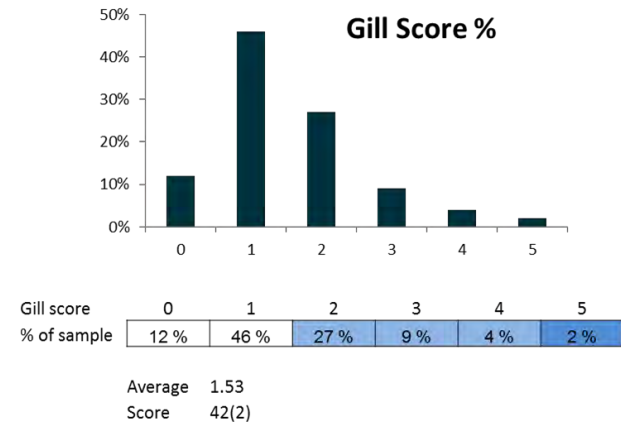
Year	Achievement
1985	AGD first encountered in Tasmania
1990's	Commercial FW bathing adopted
2000-2008	Large co-ordinated R&D focus
2007	Identification and naming of <i>P. perurans</i> as the causative agent
2010	Kochs postulates fulfilled
2012	'We are not Alone' – AGD in Europe
2012	Reduction in baths of 28% due to breeding
2013-15	GHI – Multi-national 'focus' on AGD





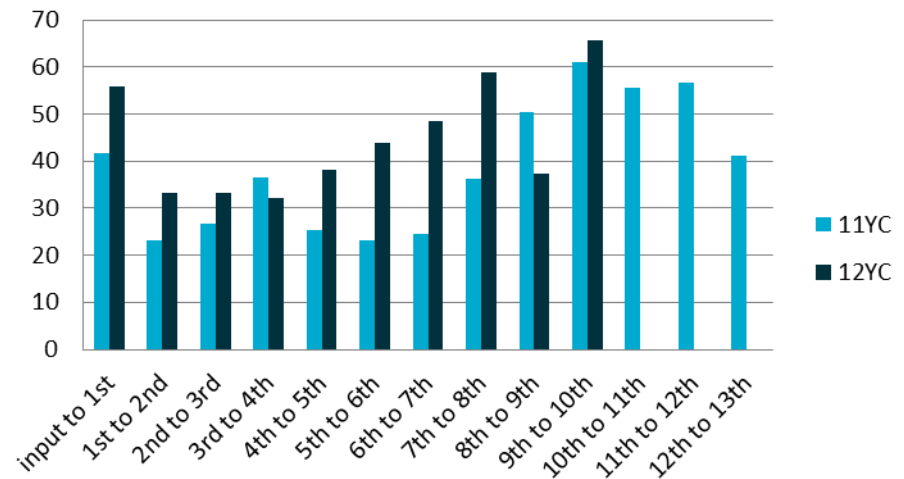
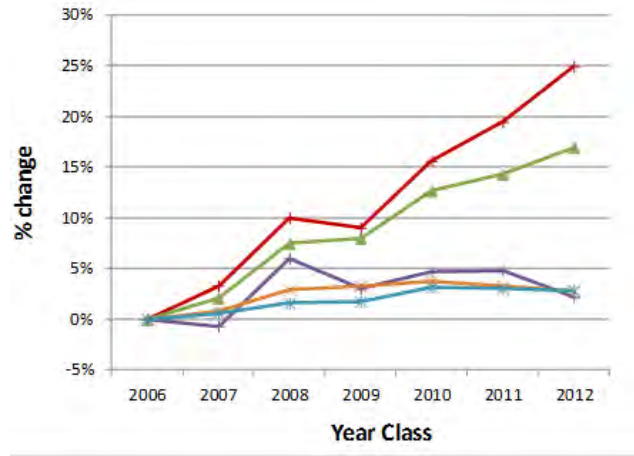
Horizon 1 Research

- Here and now
- Incremental gains
- Mainly done 'on farm' or by industry
- Largely anecdotal and outcome focused
- e.g. Freshwater bathing, gill scoring protocols



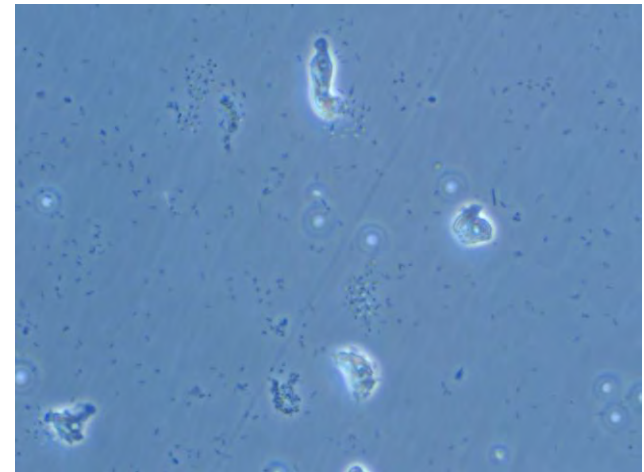
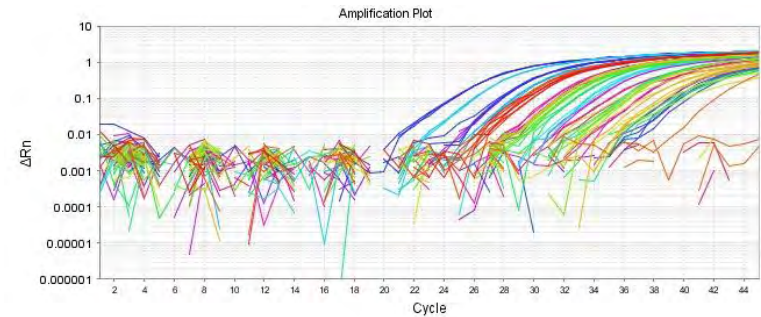
Horizon 2 Research

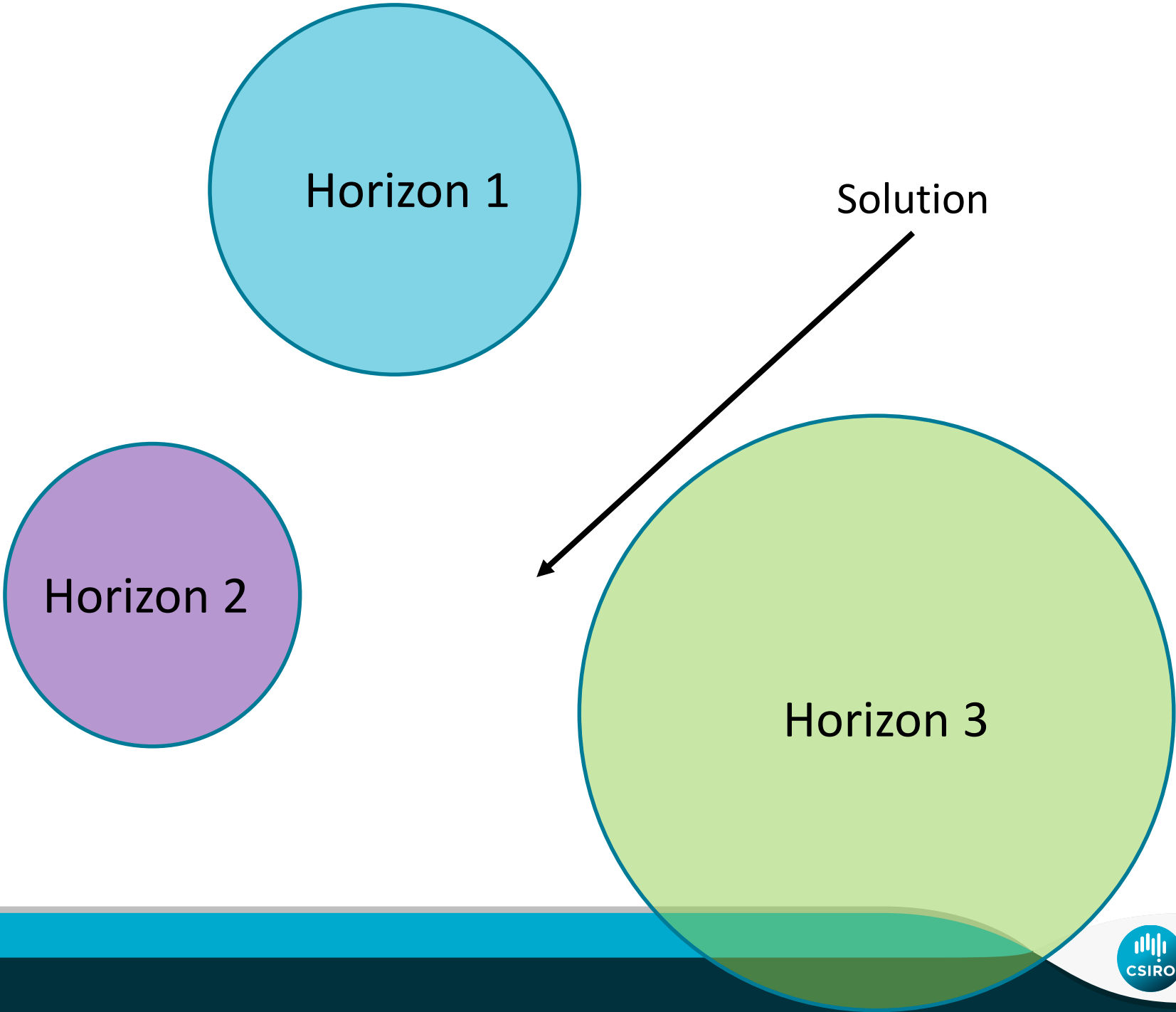
- Applied R&D
- More rigorous than H1
- Mix of industry and core R&D providers
- e.g. Breeding for disease resistance



Horizon 3 Research

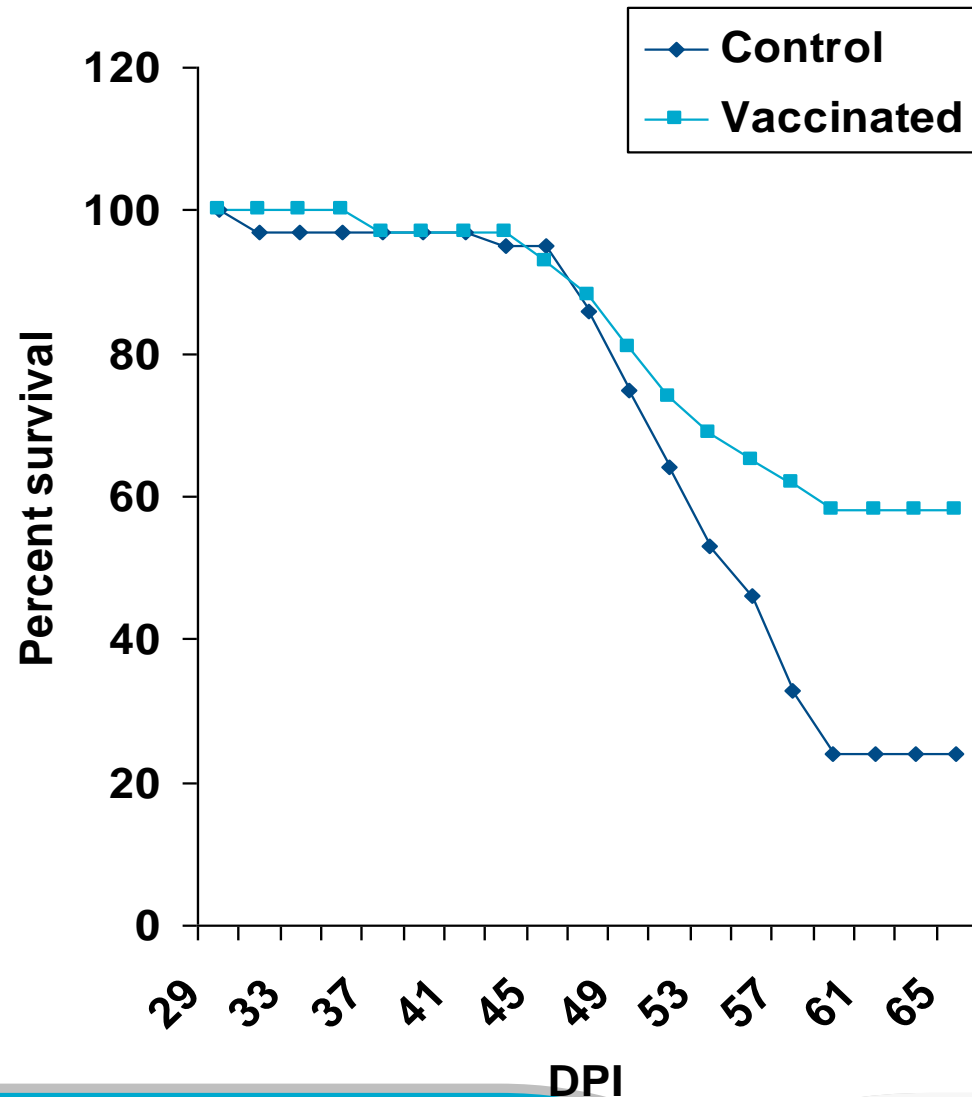
- Strategic in nature
- Knowledge foundation
- Highest scientific rigour
- Outputs are knowledge and papers
- e.g. Identification of the causative agent





Case Study 1: A Vaccine for AGD

- Magic bullet approach
- Traditional methods were not successful
- DNA vaccine approach
- 40% RPS but no effect on gill score



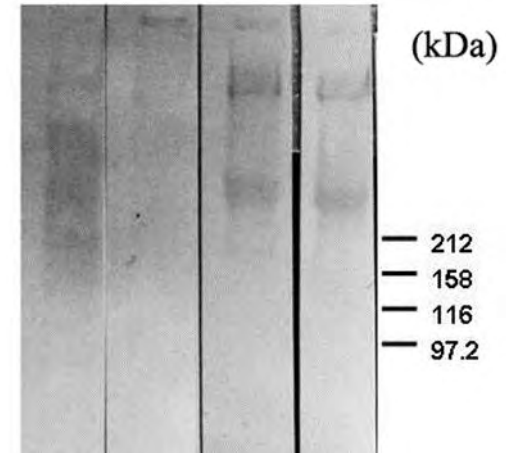
Issue 1: Co-dependent development

- Try to develop and test a vaccine while at the same time develop a reliable challenge system
- 7/10 laboratory based vaccine trials were compromised by co-infection issues.
- Issue remains; e.g. Valdenegro et al 2015. FSI 44:592-602



Issue 2: Lack of fundamental knowledge

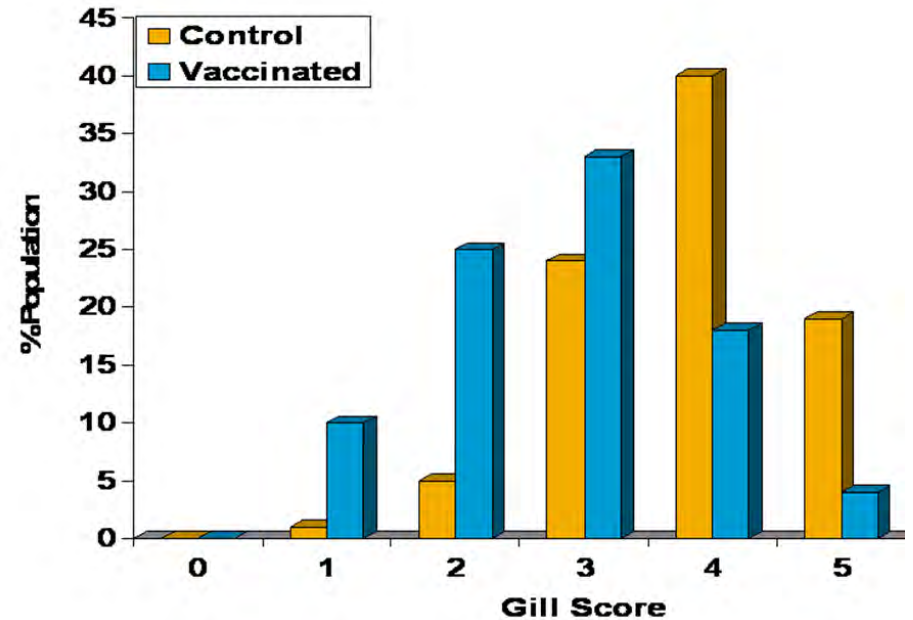
- No knowledge on the development of natural immunity
- What is the appropriate immune response?
- Disagreement on acquisition of response
- 1st vs subsequent infection



	h^2	Infection 1	Infection 2	Infection 3	Infection 4	Infection 5
Infection 1	0.14					
Infection 2	0.35	0.47				
Infection 3	0.40	0.27	0.81			
Infection 4	0.30	0.22	0.63	0.87		
Infection 5	0.25	0.25	0.60	0.60	0.80	
Infection 6	0.23	0.21	0.75	0.67	0.86	0.92

Issue 3: No defined measure of success

- Ultimately 'gill score' is the commercial measure
- Vaccines are traditionally associated with RPS
- Scientific and biological significance vs commercial significance



**So, where to from here. How
can we achieve more in the
next 5 years than we have
done in the last 30?**

Firstly some 'core' principles.

- Collaboration is Key – don't shy away from rigorous debate!
- Close contact and communication with the end users
- Dynamic R&D environment
- Get the balance between output and outcomes right
- We ALL have a role to play – need to play to our strengths
- Don't re-invent the wheel

Horizon 1 focus area ideas

- Development of an applicable gill score guide and measuring system – Uniformity across sites/countries
- Optimisation of ‘on farm’ detection and treatment protocols
- Development of combination treatments to ward off pathogen resistance

Horizon 2 focus area ideas

- The incorporation and use of genomic selection for AGD resistance
 - Increased gains

- Robust/repeatable and standardised challenge systems for the rigorous testing of new treatments – Correlation between laboratory and field challenges

- Development of correlates between molecular and traditional diagnosis methods

Horizon 3 focus area ideas

- Standardised and axenic culture of *P. perurans* with associated cryopreservation ability
- Annotated genome of both *P. perurans* and its endosymbiont
- Comprehensive understanding of why fish become resistant – i.e. mechanisms of resistance
- Interrelatedness of *P. perurans* across AGD affected regions – more than a single gene test

Thank you

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