Effect of vaccines against pancreas disease in commercially reared Atlantic Salmon

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Objectives

Measure efficacy of PD vaccines in commercially reared Atlantic salmon using mortality and growth as the key outcome variables

With emphasis on the two most recent commercial PD vaccines.
(Clynav™ and Alpha Ject micro® 1 PD)
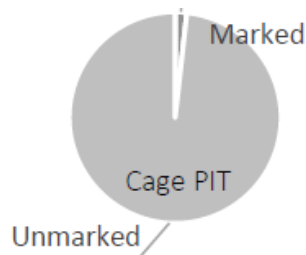
PIT-tag study	Maxilla study	Cage study

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Vaccines used in field trial

Vaccine Group ID	Vaccine name	Dose	Group	Applied in study
AJm6	ALPHA JECT micro®6	0.05 ml	Control	PIT-tag, Maxilla, Cage study
Clm6	ALPHA JECT micro® 6	0.05 ml	Test vaccine	PIT-tag, Maxilla, Cage study
	Clynav™	0.05 ml		
PDm6	ALPHA JECT micro® 6	0.05 ml	Test vaccine	PIT-tag, Maxilla, Cage study
	ALPHA JECT micro® 1 PD	0.05 ml		
Saline	Saline	0.05 ml	Control	PIT-tag
PD7	Aquavac PD 7 vet.	0.1 ml	Test vaccine	PIT-tag
A6	Aquavac 6 vet.	0.1 ml	Control	PIT-tag

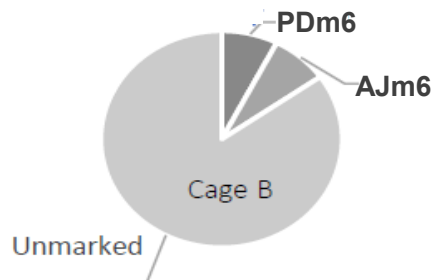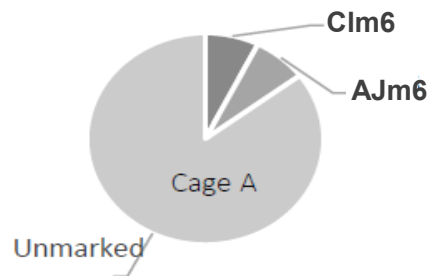All groups were in addition vaccinated i.p. with ALPHA DIP ERM

Experimental outline

PIT-tag study

Vaccine group	Starting no. fish
AJm6 (control)	580
Clm6	589
PDm6	567
Saline	478
PD7	583
A6	538
Total	**3,335**

Maxilla study

~15,000 marked fish per group per cage

Cage study

Cage 1
AJm6
193,603

Cage 2
AJm6
195,533

Cage 3
Clm6
191,470

Cage 4
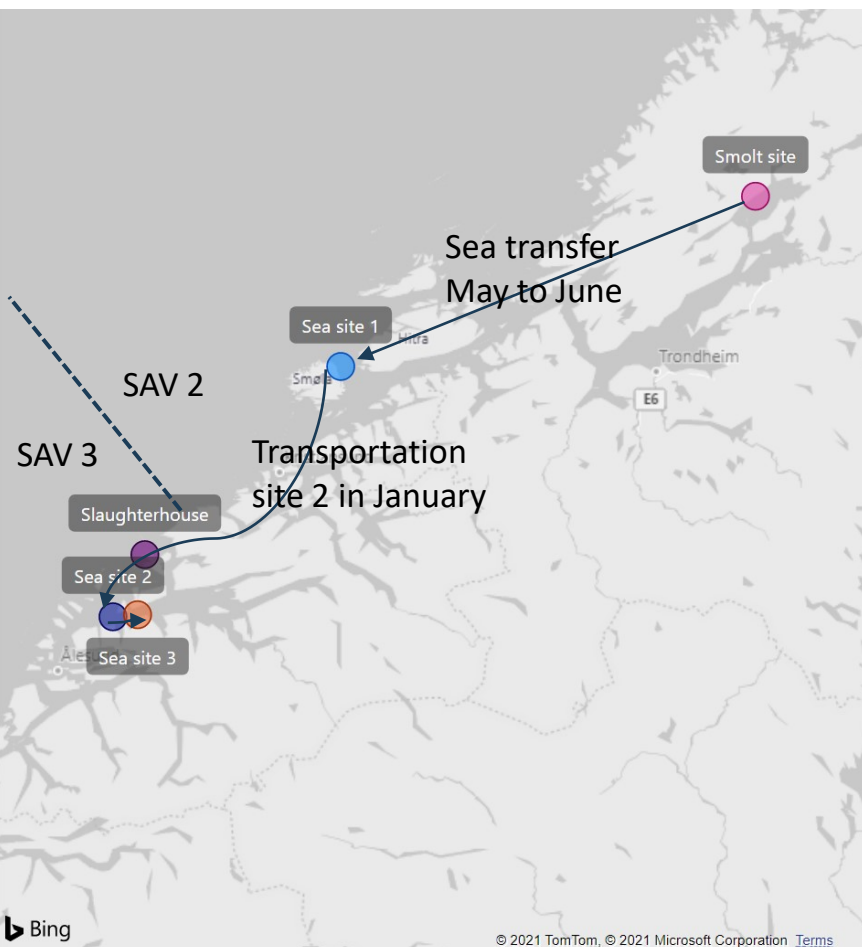**Clm6**
194,180

Cage 5
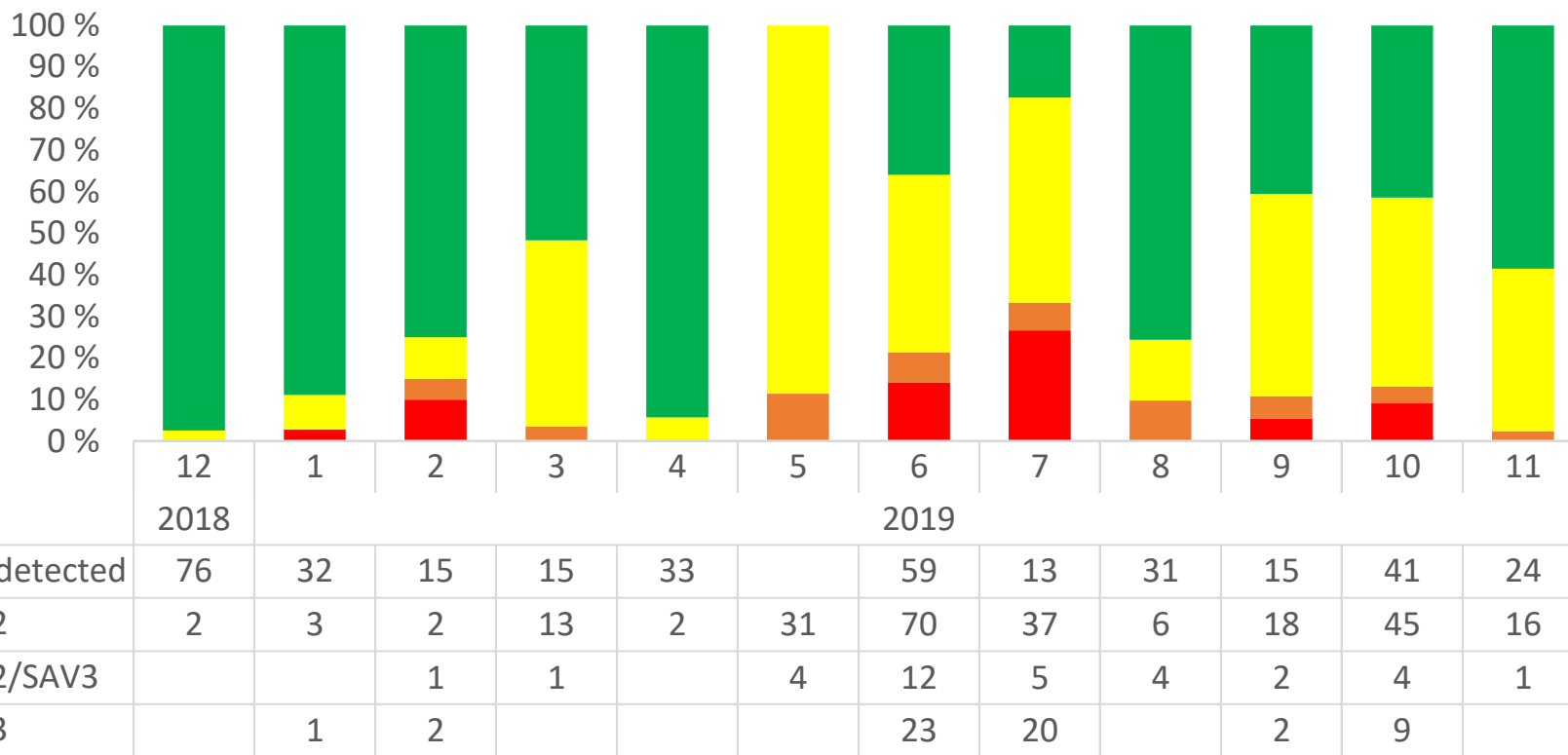**PDm6**
185,723

Cage 6
PDm6
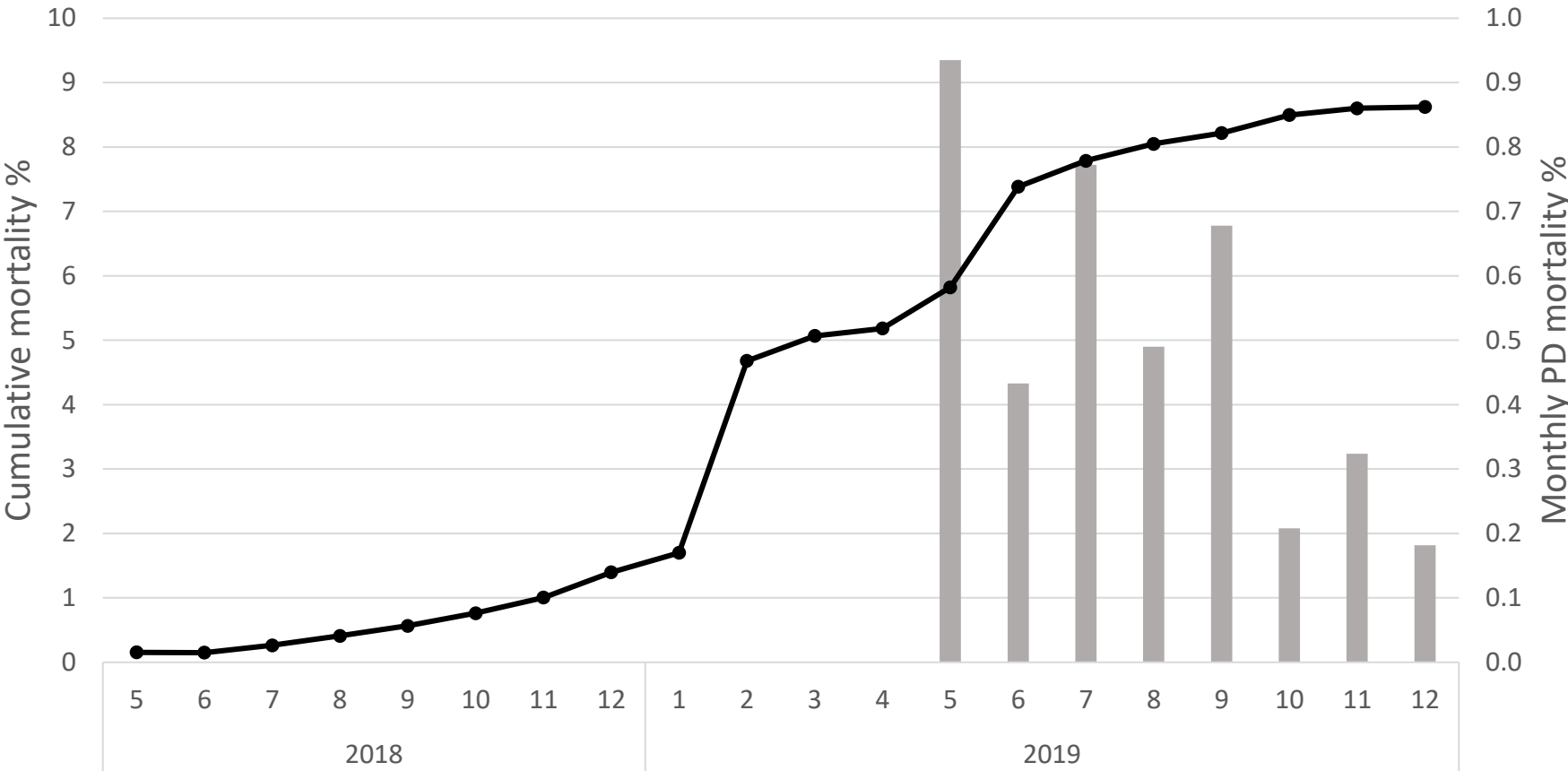190,873

Timeline target population

- Vaccinated Jan- Feb 2018
- Sea transfer in May to June 2018
- Moved south to SAV3 area in January 2019
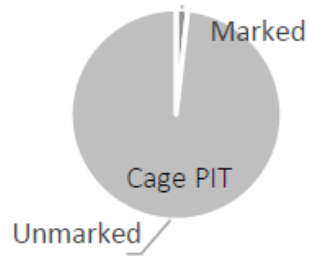- Harvested from June to December 2019

Prevalence of SAV subtypes

	12	1	2	3	4	5	6	7	8	9	10	11
	2018						2019					
Not detected	76	32	15	15	33		59	13	31	15	41	24
SAV2	2	3	2	13	2	31	70	37	6	18	45	16
SAV2/SAV3			1	1		4	12	5	4	2	4	1
SAV3		1	2				23	20		2	9	

Cumulative mortality of target population (all causes vs. PD)

PIT-tag study

Vaccine group	Starting no. fish
AJm6	580
Clm6	589
PDm6	567
Saline	478
PD7	583
A6	538
Total	**3,335**

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PIT-tag study - mortality

Period with PD mortality
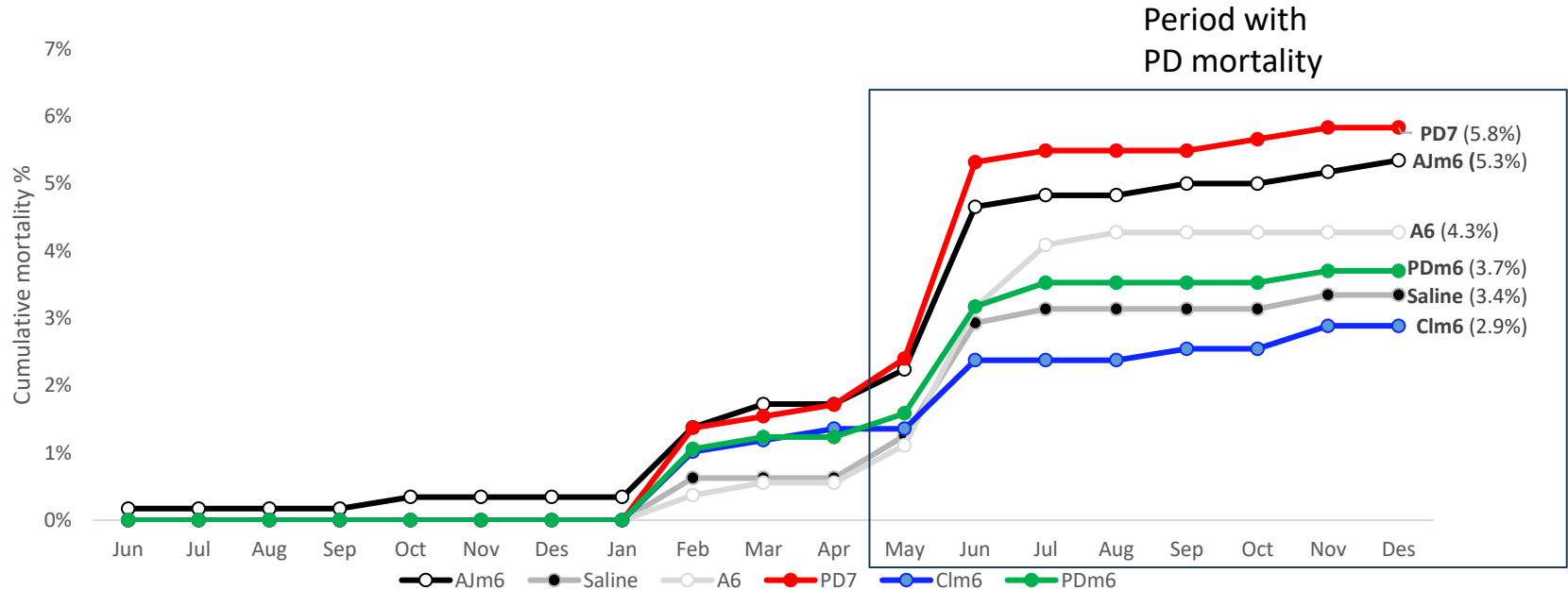
Vaccine group	AJm6	Clm6	PDm6	Saline	PD7	A6
Recatch (%)	60	65	59.3	63.2	59.3	58.2
CI: Diff. from baseline %	Baseline	-10.7, 0.7	- 5.1, 6.7	-9.2, 2,9	-6.4, 5.3	-4.1, 7.8
No. fish sampled	348	383	336	302	353	313

PIT-tag study – weights at slaughter

Bled non-gutted
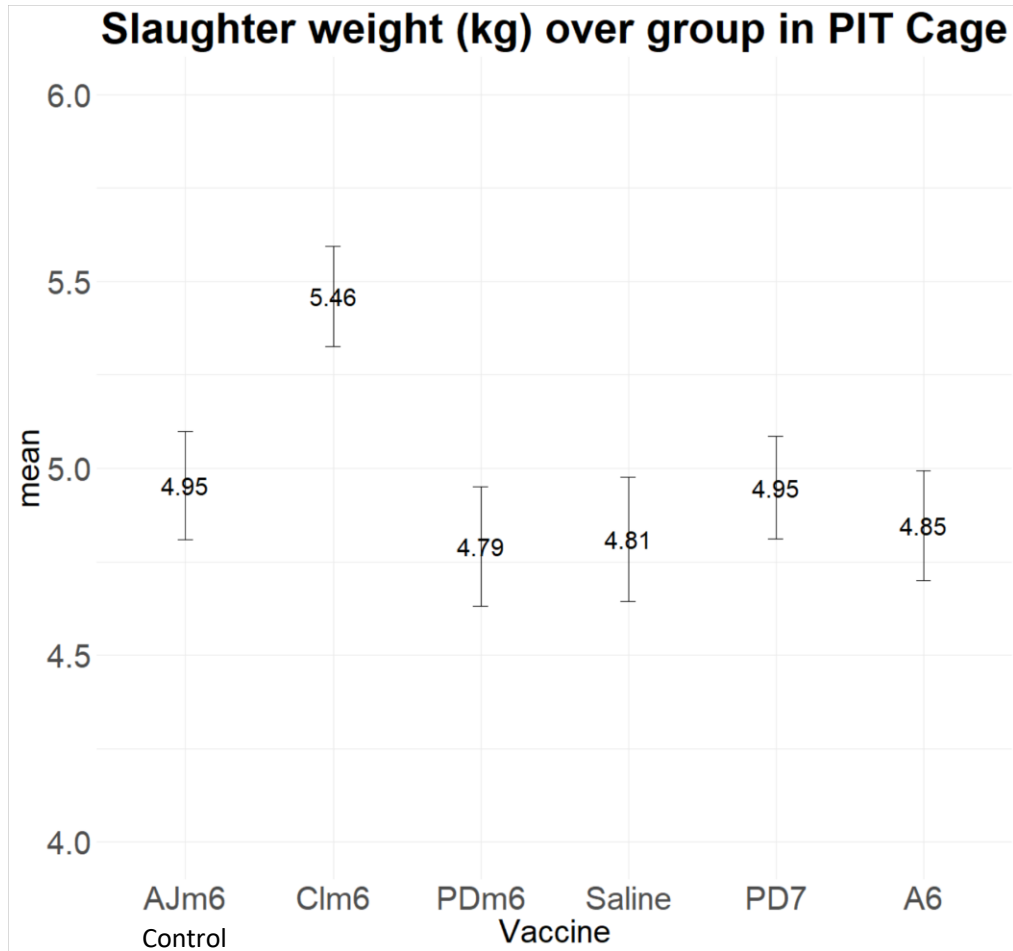
PIT-tag study – results of statistical analysis (OLS regression)

Explanatory variables	Estimate	CI	p-value
Intercept	2.02	1.68, 2.36	<0.01
Vaccine group (AJm6)			
Clm6	**0.43**	**0.29, 0.57**	**<0.01**
PDm6	-0.01	-0.16, 0.13	0.48
Saline	0.01	-0.15, 0.15	0.21
PD7	-0.02	-0.17, 0.12	0.71
A6	-0.10	-0.25, 0.05	0.48
Sex (male)	**1.09**	**1.00, 1.18**	**<0.01**
Weight vaccination (g)	**0.05**	**0.04, 0.06**	**<0.01**
Runt(no)	**-2.11**	**-2.24,-0.1.98**	**<0.01**

Results of Ordinary Least Square (OLS) regression analysis with slaughter weight in kg as outcome variable. Control vaccine AJm6, as baseline among the vaccine groups, female as baseline in sex and no as baseline in runts. Total 2031 observation, four observations deleted due to missing values. Adjusted R^2= 0.50.
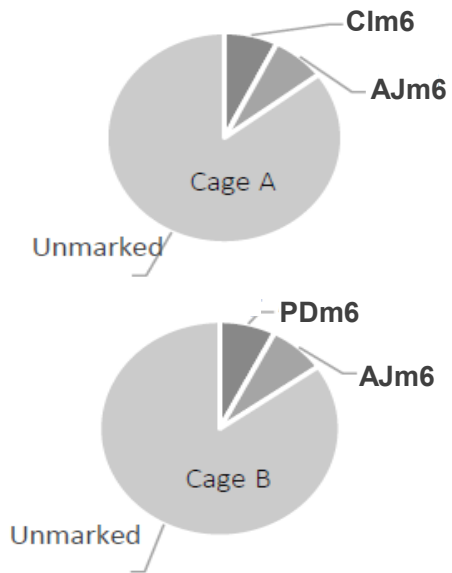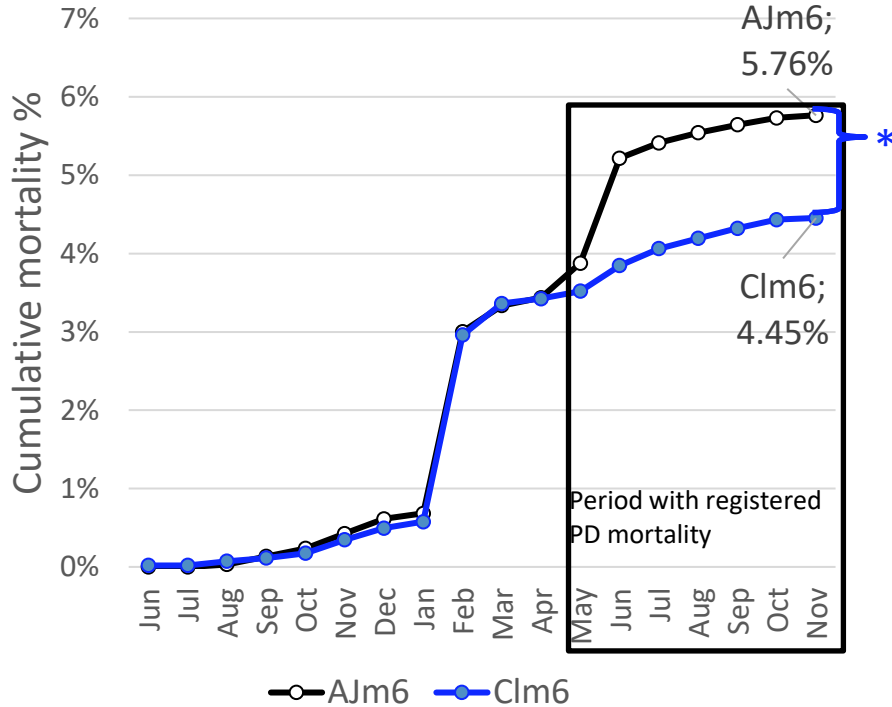
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Maxilla study

Cage A
- Clm6
- AJm6
- Unmarked

Cage B
- PDm6
- AJm6
- Unmarked

~15,000 marked fish per group per cage

Normal

Maxilla clipped

Maxilla study – SAV RNA (T-qPCR results / June 2019)

Cage A (n=60)

Cage B (n=60)
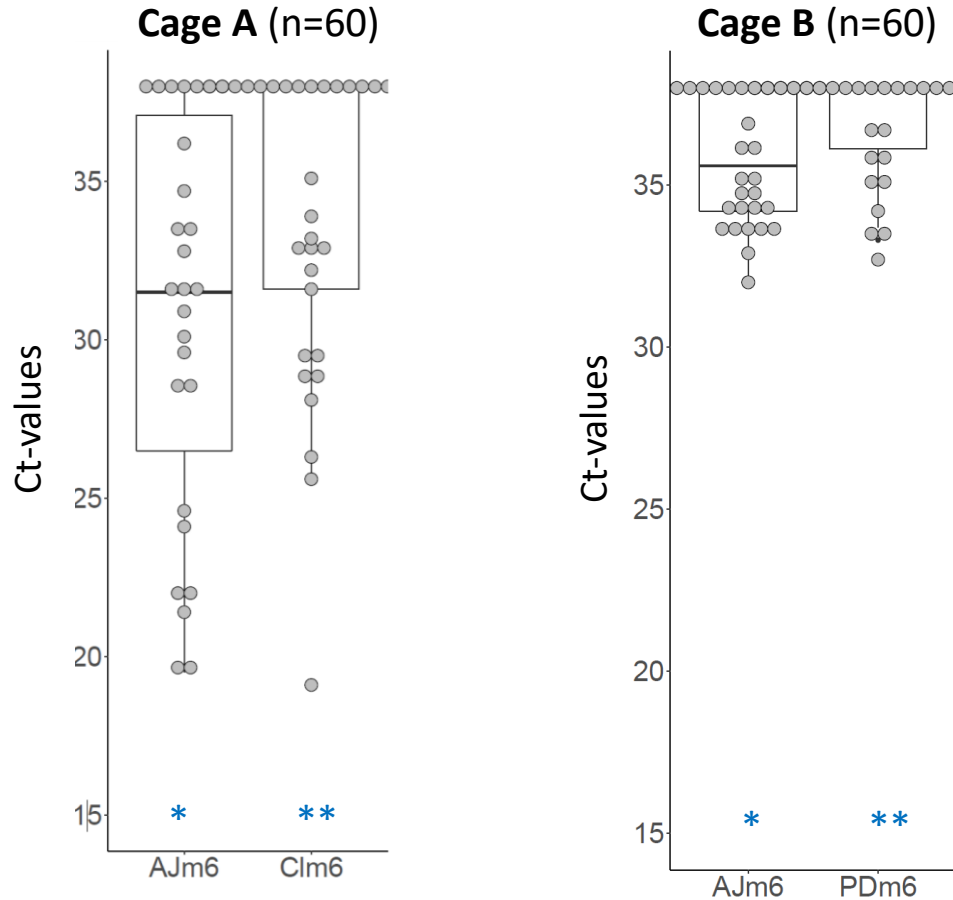
* vs.** within each cage represent significant differences between test and control groups (Wilcoxon rank sum test; p=0.03)

Maxilla study – weights at slaughter

Bled non-gutted

Slaughter weight (kg) over group in Cage A

5.58

5.02

N=430   N=450

AJm6   Clm6

Vaccine

Cage A

Unmarked

Slaughter weight (kg) over group in Cage B

5.37

5.22

N=500   N=500

AJm6   PDm6

Vaccine

Cage B

Unmarked
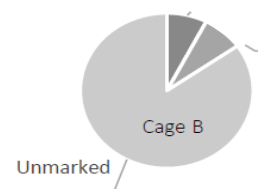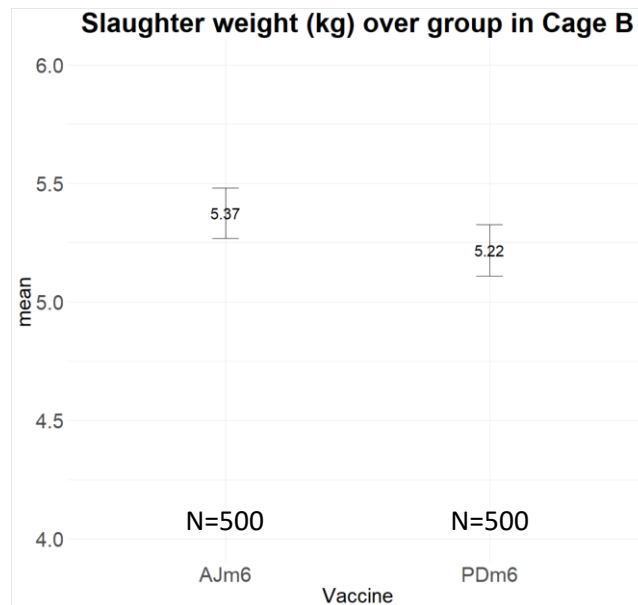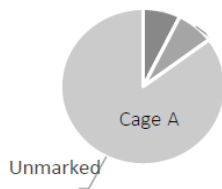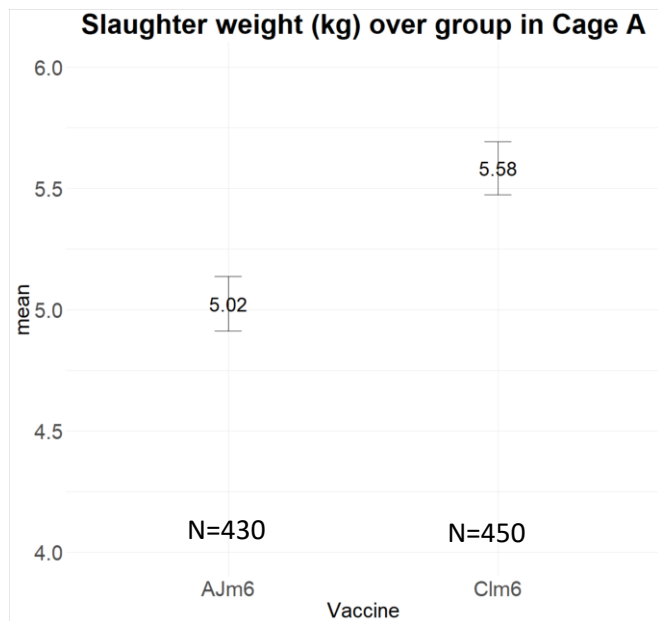
Maxilla study – results of statistical analysis (slaughter weights)

Cage	Explanatory variables	Estimate	CI	p-value
Cage A	Intercept	5.23	5.12, 5.34	<0.01
	Vaccine group (AJm6)			
	Clm6	**0.51**	**0.36, 0.65**	**<0.01**
	Runt(no)	-1.30	-1.51,-1.09	<0.01
Cage B	Intercept	5.48	5.38, 5.58	<0.01
	Vaccine group (AJm6)			
	PDm6	-0.12	-0.26, 0.2	0.10
	Runt(no)	-2.07	-2.36, 1.78	<0.01

Result of OLS regression with harvest weight in kg as outcome variable in the maxilla study. Control vaccine AJm6, no as baseline in runts. In cage A total of 885 (AJm6; 455 and Clm6; 430) observation 1000 (500 in each group) observations in cage B. Adjusted R^2= 0.19 in cage A and R^2= 0.17 in cage B.

Cage study – results from slaughter

Vaccine group	Cage	Harvest period in 2019	RGI	Harvest weight	Norm. harvest weight	No. Lice treatm.	Days starved	bFCR	Cum. mort	PD mort	Sup. grade
AJm6	1	14.06-06.11	95.0	4.99	5.17	3	38	1.22	10.0 %	3.4 %	98 %
AJm6	2	01.11-18.11	91.8	5.18	4.52	4	42	1.27	8.6 %	2.6 %	98 %
Clm6	3	14.06-03.07	96.9	3.69	**5.78**	1	27	**1.10**	13.2 %	**0.2 %**	96 %
Clm6	4	12.08-19.10	96.3	5.11	**5.60**	2	27	**1.18**	6.0 %	**0.9 %**	98 %
PDm6	5	24.10-04.11	94.7	5.30	5.12	4	31	1.26	9.5 %	3.9 %	98 %
PDm6	6	24.10-24.11	94.9	5.69	5.15	3	37	1.24	7.5 %	2.5 %	98 %

Conclusion

- Mortality was lower in the Clm6 group in both the PIT-tag and Maxilla study, significantly in the Maxilla study

- Only the Clm6 vaccine group showed significant increase in harvest weight. The effect was consistent in the PIT-tag and Maxilla study

Thanks to

- Elanco for providing funding for this study

- Åkerblå fish health services

- Pharmaq for providing injections pistol's and contributing with marking of fish in the maxilla trial (Cage B)

- Skala Maskon for development and testing of triple injection

- VESO Vikan: partnering in design and execution of the trial

- Staff at Vikenco

- SalMar colleagues

- Last and special thanks to SalMar staff at smolt facility and sea sites

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