

Site-level differences between marine SAV2 and SAV3 in Norway

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Background

- Spring 2011: marine SAV2 detected in Norway
- 2010 + 2011: 13 cases of marine SAV2
- Lower mortality and milder clinical signs?



What is the significance of a new SAV subtype for Norwegian aquaculture?

- Project work packages:
 - 1) Virus characterisation
 - 2) Infection trails
 - 3) Geographical spread
 - 4) Mortality, risk factors and production parameters



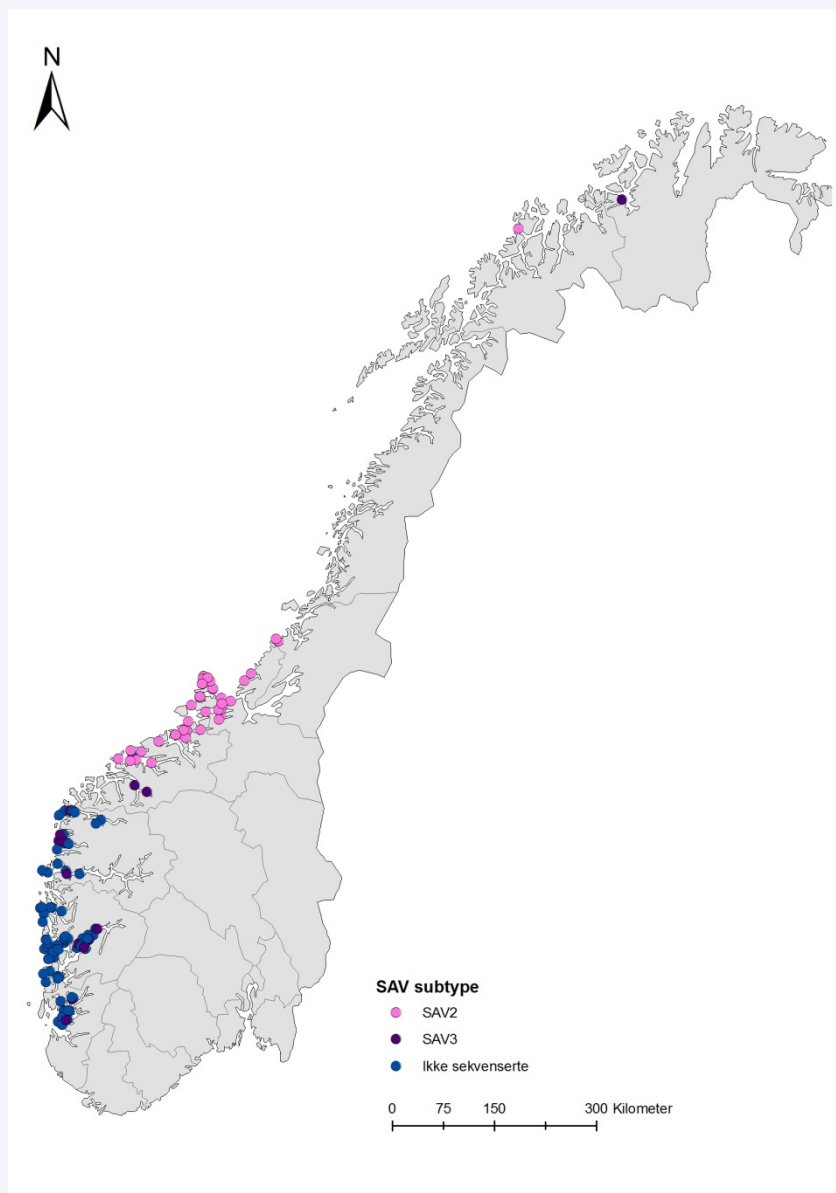
Work package 4:

Investigate site-level differences between marine SAV2 and SAV3:

- 1) Variations in clinical signs?
- 2) Variations in mortality?
- 3) Similar use of preventive and disease-reducing measures?
- 4) Does any variations also manifest as different results at slaughter?



PD/SAV-positive sites in 2012



n = 137



Site selection

- Based on PD/SAV-positive sites in 2012
- Only Atlantic salmon sites included
 - 10 rainbow trout sites and 3 Atlantic salmon sites excluded
- Total: 124 sites
 - 44 marine SAV2
 - 80 SAV3

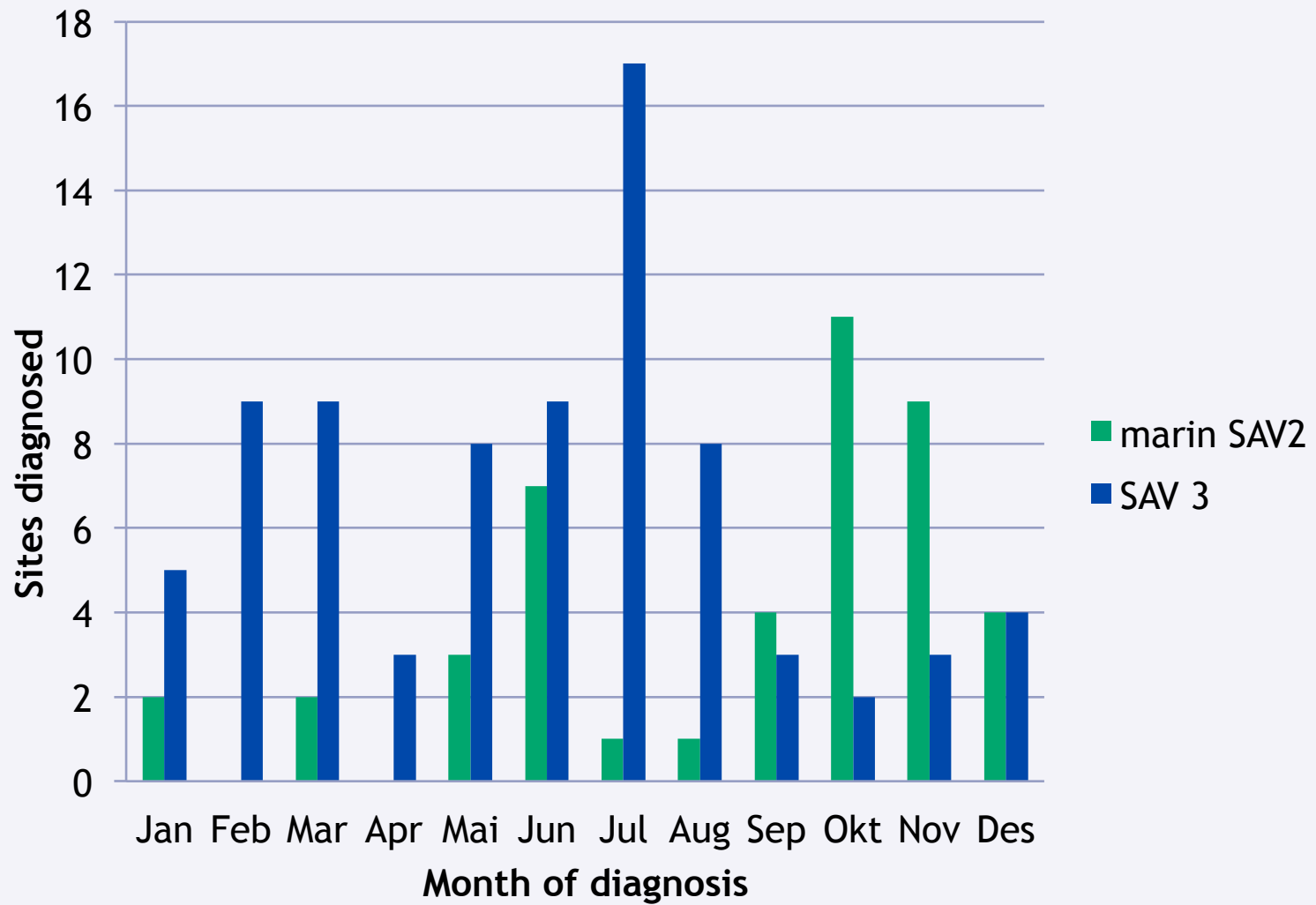


Included Atlantic salmon sites

| County | marine SAV2 | SAV3 |
|------------------|-------------|-----------|
| Rogaland | - | 17 |
| Hordaland | - | 46 |
| Sogn og Fjordane | - | 16 |
| Møre og Romsdal | 18 | - |
| Sør-Trøndelag | 23 | - |
| Nord-Trøndelag | 2 | - |
| Troms | 1 | - |
| Finnmark | - | 1 |
| Total | 44 | 80 |



Month of diagnosis 2012 (included sites)



Data sources

- 2 sources:
 - 1) MATS (statutory, central database of key monthly production parameters)
 - 2) Emailed questionnaires



Questionnaire return

| SAV subtype | Included sites | Returned questionnaires | % Returned questionnaires |
|-------------|----------------|-------------------------|---------------------------|
| marine SAV2 | 44 | 44 | 100 % |
| SAV3 | 80 | 54 | 67.5 % |
| Total | 124 | 98 | 79 % |



Variations in clinical signs?

- Information on clinical signs collected by questionnaire:
 1. Presence of PD-related clinical signs:
 - PD-related mortality
 - PD-related moribunds
 - PD-related drop in feed intake
 2. Duration of PD-related clinical signs



One or more clinical signs of PD

| | marine SAV2 | SAV3 | p |
|-------------------------------|-------------|------------|-------|
| Questionnaires (N) | 44 | 54 | - |
| Clinical signs reported n (%) | 30 (68.2%) | 51 (94.4%) | 0.001 |

Variation in inclusion criteria due to endemic status of SAV3



Reporting of PD-related mortality

| | marine SAV2 | SAV3 | p |
|---|-------------|-----------|--------|
| Questionnaires (N) | 44 | 54 | - |
| Reported mortality (n (%)) | 11 (25%) | 39 (72%) | <0.001 |
| Duration (weeks) (average (min-max)) | 5.5 (2-10) | 11 (2-31) | 0.002 |



Reporting of PD-related moribunds

| | | marine SAV2 | SAV3 | p |
|---|---------|-------------|------------|---------|
| Questionnaires | (N) | 44 | 54 | - |
| Reported moribunds | (n (%)) | 20 (45.5%) | 44 (81.5%) | < 0.001 |
| Duration (weeks) (average (min-max)) | | 10.5 (2-25) | 12 (2-40) | 0.596 |



Reporting PD-related drop in feed intake

| | marine SAV2 | SAV3 | p |
|--------------------------------------|-------------|------------|-------|
| Questionnaires (N) | 44 | 54 | - |
| Reported drop in feed intake (n (%)) | 29 (65.9%) | 46 (85.2%) | 0.040 |
| Duration (weeks) (average (min-max)) | 8 (3-17) | 11 (2-35) | 0.026 |



Variations in mortality?

- Subtype-specific mortality:
 - 3 time periods
 - Based on questionnaire information on start-point and duration

| Period | marine SAV2 (n) | SAV3 (n) |
|---|-----------------|----------|
| Month of diagnosis | 39 | 74 |
| Average over 4 months (1 mth prior - 2 mths after Dx) | 43 | 80 |
| Average over 7 months (2 mths prior - 4 mths after Dx) | 43 | 80 |

All sites:

| Period | marine SAV2 | SAV3 | p |
|--------------------------------------|-------------------------|--------------------------|--------|
| Month of diagnosis (min-max %) | 0.78 % (0.08 - 2.92) | 2.18 % (0.12 - 10.71) | 0.0001 |
| Average over 4 months (min-max %) | 0.58 % (0.07 - 2.04) | 1.80 % (0.02 - 8.76) | 0.0001 |
| Average over 7 months (min-max %) | 0.56 % (0.05 - 2.24) | 1.51 % (0.14 - 7.16) | 0.0001 |



Real difference?

Used questionnaire replies to group sites depending on the presence/absence of PD-related mortality



Distribution of observed mortality

| Period | marine SAV2 | marine SAV2 | SAV3 | SAV3 |
|--------------------|-------------|--------------|-----------|--------------|
| | mortality | no mortality | mortality | no mortality |
| Month of diagnosis | 10 | 29 | 35 | 14 |
| Over 4 months | 11 | 32 | 39 | 15 |
| Over 7 months | 11 | 32 | 39 | 15 |



Sites with observed mortality

| Period | marine SAV2 | SAV3 | p |
|--------------------------------------|-------------------------|--------------------------|--------|
| Month of diagnosis (min-max %) | 0.53 % (0.20 - 1.16) | 2.48 % (0.23 - 10.71) | 0.0003 |
| Average over 4 months (min-max %) | 0.66 % (0.21 - 1.84) | 1.70 % (0.02 - 5.99) | 0.0010 |
| Average over 7 months (min-max %) | 0.58 % (0.17 - 1.56) | 1.51 % (0.22 - 6.43) | 0.0005 |



Sites without observed mortality

| Period | marine SAV2 | SAV3 | p |
|--------------------------------------|-------------------------|-------------------------|--------|
| Month of diagnosis (min-max %) | 0.87 % (0.08 - 2.92) | 1.13 % (0.12 - 5.16) | 0.5908 |
| Average over 4 months (min-max %) | 0.55 % (0.07 - 2.04) | 1.11 % (0.15 - 8.76) | 0.3496 |
| Average over 7 months (min-max %) | 0.56 % (0.05 - 2.24) | 0.89 % (0.16 - 7.16) | 0.4907 |



Regression analyses: sites with observed mortality

- Assessed mortality at month of diagnosis, average over 4 months and average over 7 months
- A range of confounding factors assessed, including:
 - Fish numbers, average fish weight
 - Concurrent disease (CMS, HSMI, clinical gill disease)
 - Water temperature
 - Number of months at sea at diagnosis
- Only SAV-subtype that was consistently associated with differences in mortality



Use of measures

- Questionnaire responses
- In 3 different settings:
 - At SAV-detection
 - At PD-diagnosis
 - When increased risk of horizontal transfer
- Separate analyses intended but insufficient response variation



PD-vaccination

| | | marine SAV2 | SAV3 | p |
|----------------|---------|-------------|-----------|--------|
| Questionnaires | (N) | 44 | 54 | - |
| PD-vaccination | (n (%)) | 8 (18 %) | 51 (94 %) | <0.001 |



Non-vaccination measures

- Questionnaire data on:
 - 1) Depopulation of site
 - 2) Depopulation of cage
 - 3) Cessation of handling
 - 4) Increased removal of dead and moribund fish
 - 5) Reduced feeding (beyond reduced appetite)
 - 6) "PD-diet"



All sites

| Measures | | marine SAV2 | SAV3 | p |
|-------------------|---------|-------------|------------|--------|
| Questionnaires | (N) | 44 | 54 | - |
| Site depopulated | (n (%)) | 6 (13.6 %) | 7 (13.0%) | 0.987 |
| Cage depopulated | (n (%)) | 4 (9.1%) | 6 (11.1%) | 0.843 |
| Stop in handling | (n (%)) | 7 (15.9%) | 22 (40.7%) | 0.020 |
| Increased removal | (n (%)) | 22 (50.0%) | 44 (81.5%) | 0.016 |
| Reduced feeding | (n (%)) | 10 (22.7%) | 35 (64.8%) | <0.001 |
| PD-diet | (n (%)) | 18 (40.9%) | 28 (51.9%) | 0.503 |



Sites with PD-related clinical signs

| Measures | | marine SAV2 | SAV3 | p |
|-------------------|---------|-------------|------------|-------|
| Questionnaires | (N) | 30 | 51 | - |
| Site depopulated | (n (%)) | 6 (20.0%) | 3 (5.9%) | - |
| Cage depopulated | (n (%)) | 2 (6.7%) | 5 (9.8%) | - |
| Stop in handling | (n (%)) | 3 (10.0%) | 22 (43.1%) | 0.005 |
| Increased removal | (n (%)) | 15 (50.0%) | 41 (80.4%) | 0.015 |
| Reduced feeding | (n (%)) | 10 (33.3%) | 35 (68.6%) | 0.006 |
| PD-diet | (n (%)) | 16 (53.3%) | 28 (54.9%) | 0.999 |



Results at slaughter

- Questionnaire data
- Two parameters:
 - «Average» feedfactor
 - Proportion superior (%) at slaughter

| | | marine SAV2 | SAV3 |
|--------------------------------|---------|-------------|------------|
| Questionnaires | (N) | 44 | 54 |
| Slaughtered out | (n (%)) | 23 (52.3%) | 31 (57.4%) |
| Replied to feedfactor | (n (%)) | 19 (82.6%) | 30 (96.8%) |
| Replied to proportion superior | (n (%)) | 20 (87.0%) | 28 (90.3%) |

Feedfactor

| | marine SAV2 | SAV3 | p |
|------------------------|-------------|-------------|-------|
| Number of replies | 19 | 30 | |
| Average feedfactor | 1.18 | 1.19 | 0.769 |
| Feedfactor (min.-max.) | (1.07-1.40) | (1.08-1.45) | - |



Proportion superior (%)

| | marine SAV2 | SAV3 | p |
|--------------------------------|-------------|-------------|-------|
| Number of replies | 20 | 28 | |
| Average proportion superior | 91.4 | 90.9 | 0.724 |
| Proportion superior (min.-max) | (80.0-98.0) | (79.0-97.0) | - |



Conclusions I

- 1) Clinical signs less frequently observed at sites with marine SAV2 (may be related to inclusion criteria)
- 2) Partially shorter duration of PD-related clinical signs in sites with marine SAV2
- 3) Lower mortality with marine SAV2 compared to SAV3, both in month of diagnosis and over longer periods
- 4) Difference in mortality level only present for sites with observed PD-related mortality when stratified by observation status



Conclusions II

- 5) Lower uptake of PD-vaccination amongst marine SAV2 sites (will change?)
- 6) Less frequent instigation of measures at marine SAV2 sites
- 7) No apparent difference in the measures slaughter results



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