

Disease data collection in aquaculture; how to collect and interpret data

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Veterinærinstituttet
— Norwegian Veterinary Institute

Why this talk?

- Data = knowledge
- Data is a set of values of qualitative or quantitative variables.
- Difficult to get good data
- Good data=Data fit for purpose



Fit for purpose:

- Formulating hypothesis is alpha-omega!
- Examples:
 - Surveillance
 - Population data and sample data required
 - Tracing outbreaks
 - Sequence data required
 - Modelling disease spread
 - «Negative» data required
 - Documenting disease freedom
 - Production data and geographic coordinates required
 - Informed idea of prevalence
 - Etc



Identify data sources

Disease data:

- National/regional screening programs
- National reference laboratories
- Private/industry initiated screening programs
- Private laboratories
- Medicine registers
- Insurance companies
- Projects with specific purpose for sampling



Identify data sources

Production data:

- National/official registers
- Aquaculture associations
- Slaughterhouses
- Questionnaires/interview
- Feed producers, boat handlers etc



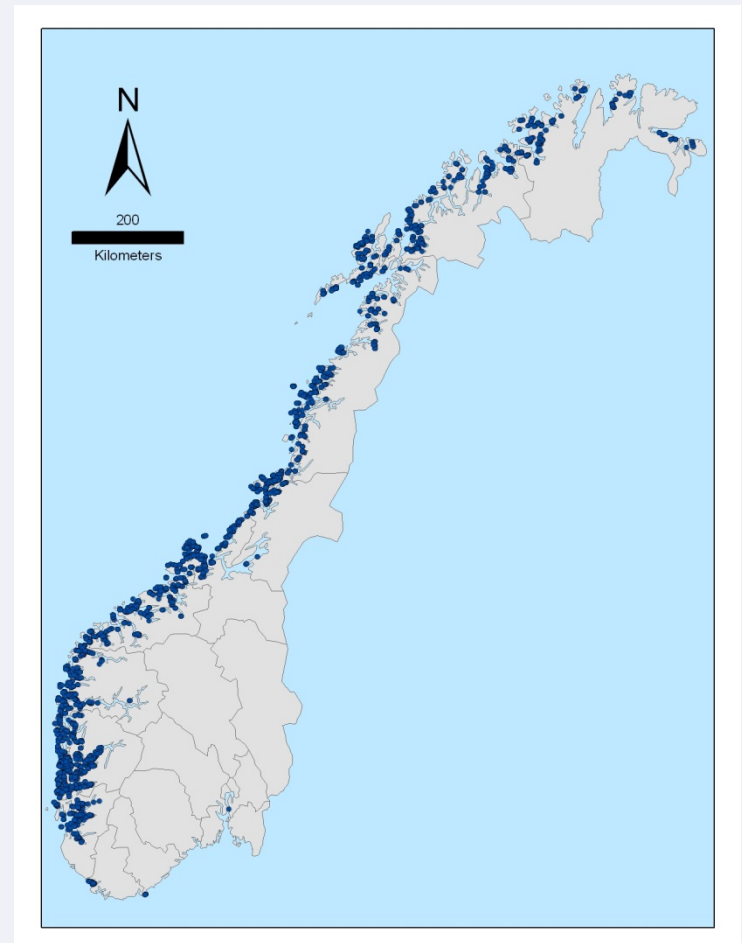
Data collection

- Logistic systems must be in place
 - to handle the data
 - for sharing obtained information with the competent authorities and the public.
- Different systems for data collection are available
 - preferable are those which are automated and require little work from the suppliers of data.



Official data: Data from aquaculture register

- Geo-references
- Ownerships
- Production characteristics
 - Type
 - Species
 - Size
- (Category as required by EU-law)



Official data: Laboratory/NRL data

- Notifiable diseases
 - Date for diagnosis
 - Species
 - Removal of stock
 - Subtype/genotype
- Non-notifiable diseases
 - If farmers agree
 - Screening data



Considering disease data:

- Case definition:
 - PCR/histo/serology/patognomonic symptoms
 - Clinical disease?
 - «Accidental finding»/Disease investigation
- Positive cases
 - Time for diagnosis
 - Sequence
 - Geographical coordinates
- Negative locations
 - Screening/inspection program?
 - Known negative or unknown status?



Examples of data use: www.barentswatch.no

The screenshot displays the BarentsWatch website interface. On the left, a navigation menu includes 'Fish Health in Norwegian aquaculture', '353 hits', and filters for 'SALMON LICE' (Reported, Not reported, All sites) and 'DISEASE TREATMENTS'. The main area features a map of Norway with colored markers representing aquaculture sites. A search bar at the top left is labeled 'Aquaculture site name or id'. A data table is overlaid on the map, listing site details. On the right, a 'WEEK 21' summary panel shows lice counts and disease statistics.

WEEK 21
22. May - 28. May 2017

The deadline for sending lice report for this week is not expired.

13
ABOVE LICE LIMIT.

6% of the aquaculture sites which have reported lice

213
ARE BELOW CURRENT LICE LIMIT.

94% of the aquaculture sites which have reported lice

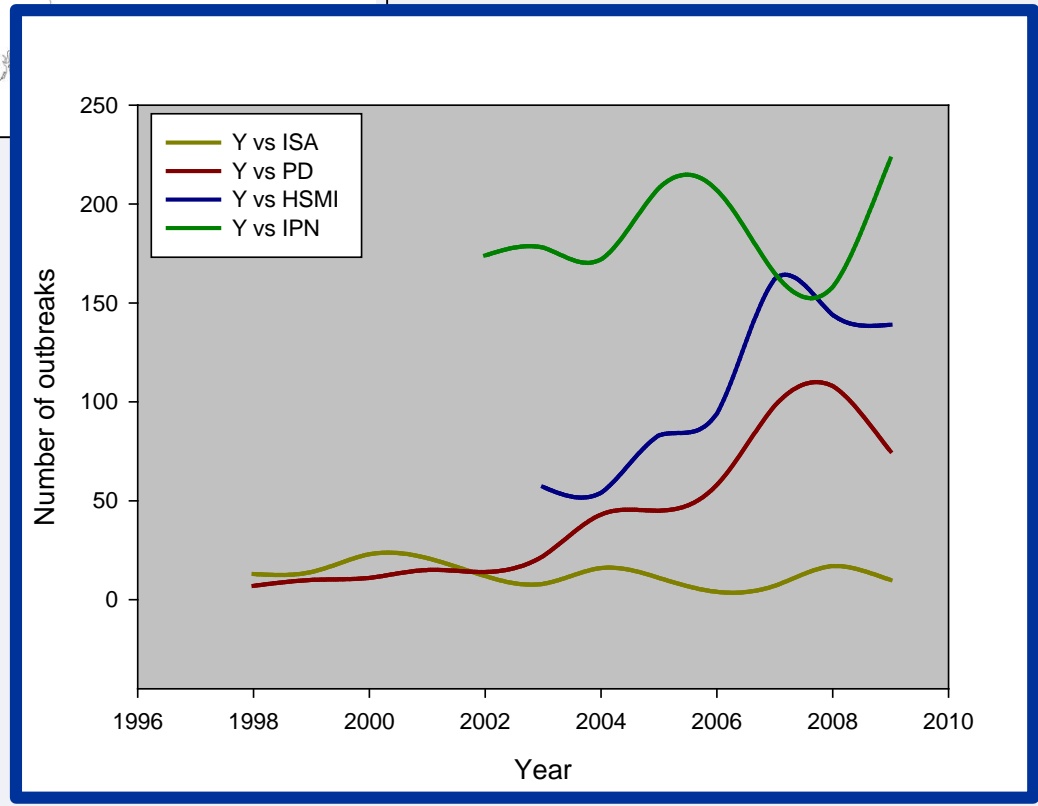
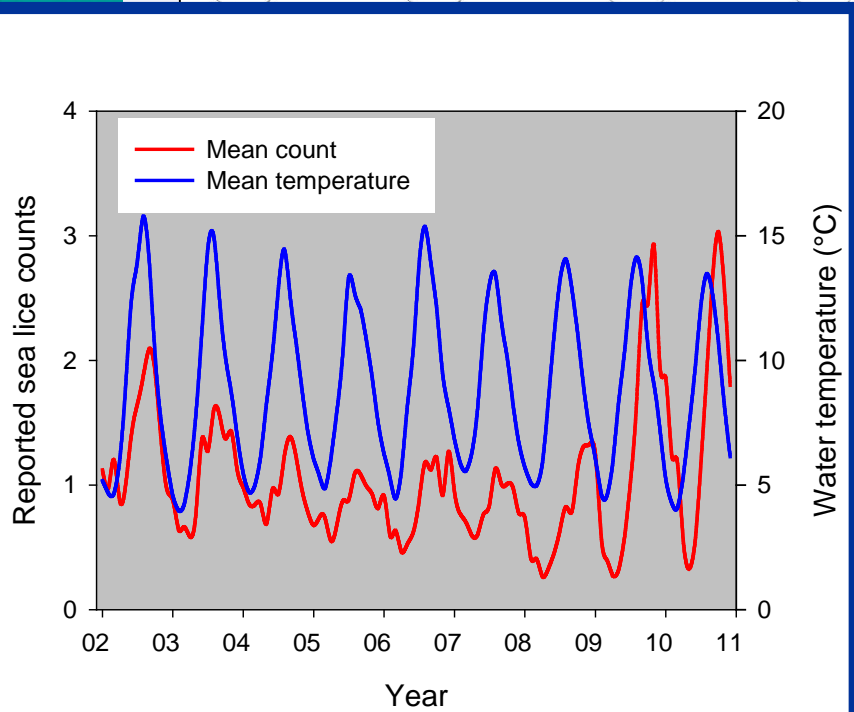
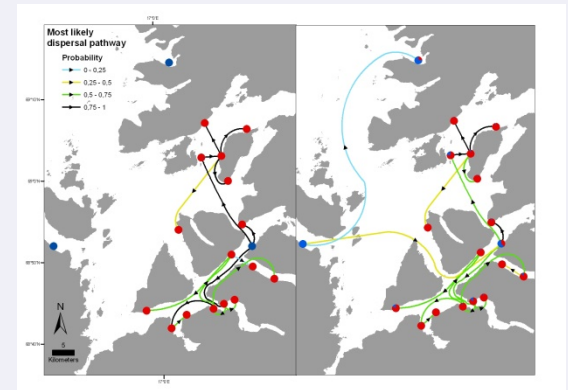
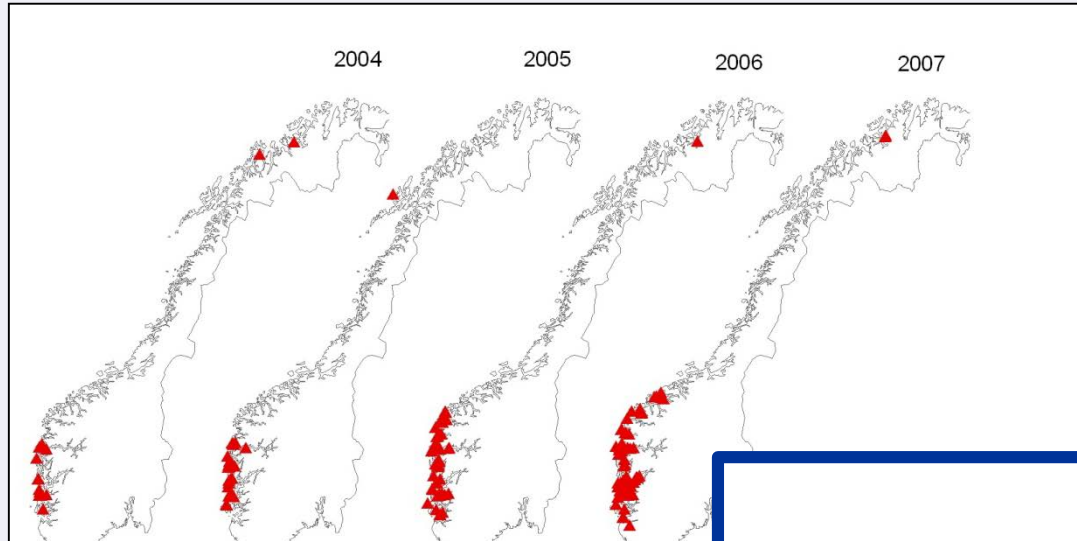
PD 129
129 of the aquaculture sites have pancreatic disease (PD) or are suspected of having PD

ILA 8
8 of the aquaculture sites have infectious salmon anemia (ISA) or are suspected of having ISA

Download

LokNr	Kjennelse	Dato	Analytt	
13531	Mistanke	22.05.2017	ILA	
30216	Mistanke	18.05.2017	ILA	
31517	Påvist	16.09.2016	ILA	
23816	Påvist	28.10.2016	ILA	
10828	Påvist	30.12.2016	ILA	
35877	Påvist	26.01.2017	ILA	
11198	Påvist	10.03.2017	ILA	
24937	Påvist	18.05.2017	ILA	
10054	Påvist	01.07.2016	PD	
10091	Påvist	20.06.2016	PD	
10137	Påvist	28.04.2016	PD	
10194	Påvist	23.09.2016	PD	
10197	Påvist	28.07.2016	PD	
10223	Mistanke	21.04.2017	PD	
10229	Påvist	01.11.2016	PD	
10324	Påvist	04.03.2016	PD	
10332	Mistanke	19.05.2017	PD	
10338	Påvist	06.04.2017	PD	
11488	Påvist	11.07.2016	PD	
11543	Påvist	10.03.2017	PD	
11559	Påvist	06.05.2016	PD	
11575	Påvist	24.02.2017	PD	
11611	Mistanke	22.05.2017	PD	
11652	Påvist	07.04.2017	PD	
11700	Påvist	10.02.2017	PD	
11714	Påvist	23.08.2016	PD	
11719	Påvist	30.01.2017	PD	
11770	Påvist	28.03.2017	PD	
11771	Mistanke	15.05.2017	PD	
11772	Mistanke	08.02.2017	PD	
11925	Påvist	22.02.2017	PD	
11971	Påvist	12.01.2017	PD	
12007	Mistanke	28.04.2017	PD	
12019	Påvist	22.11.2016	PD	
12022	Påvist	01.06.2016	PD	
12081	Påvist	11.07.2016	PD	

Disease development over time



Implementation and dissemination: App with map of simulated salmon lice

■ www.vetinst.no/lusekart

The screenshot shows a web browser window displaying the application 'Lusekart' from Veterinærinstituttet. The browser address bar shows the URL <http://35.158.65.144/lusekart/>. The page title is 'Veterinærinstituttet -----> Smittekart for lakselus'. The navigation menu includes 'Lusekartkart', 'Lokalitetsliste', and 'Om kartet'. The main content area features a map of Norway with a color-coded risk area around Bergen. A red pin is placed on the map near Folgefonna. A search panel on the left, titled 'Søkealternativer', includes the following options:

- Velg liste:
 - Hele Norge
 - Zoom inn på valgt lokalitet
- Velg lokalitet:
 - 10332
- Kilometer radius rundt lokalitet ved zooming:
 - 50
- Vis bare valgt lokalitet
- Vis lokaliteter innen valgt område
- Ikke vis lokaliteter
- Velg uke:
 - Uke 201721

A legend on the right, titled 'Smittepress', shows a color scale from 0-2 (lightest) to 18-20 (darkest). The map shows a large area of high risk (red) around Bergen, with a red pin indicating a specific location near Folgefonna. The map also shows various landscape protection areas (landskapsvernområde) such as Hollingskarvet, Hardangervidda, and Telemark.



How to collate good data for outbreak investigation

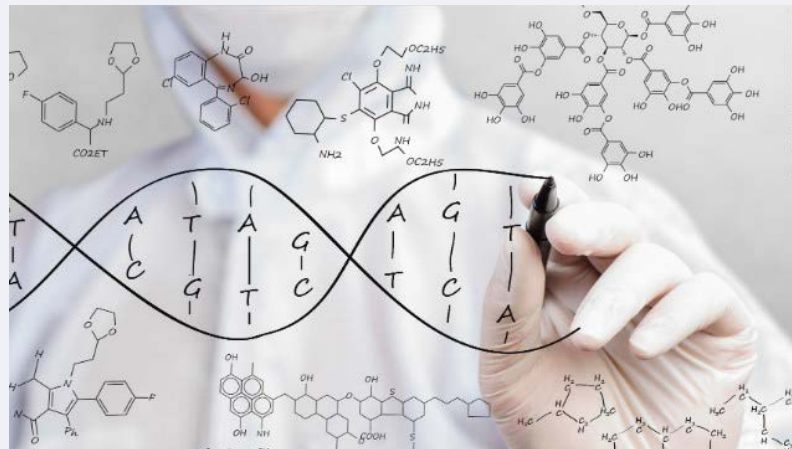
- Test if the genotyping supports associations between virus outbreaks and risk factors for transmission
- Identify possible risk factors:
 - Smolt/egg supplier
 - Ownership
 - Broodstock
 - Geographical (Climate, river etc)



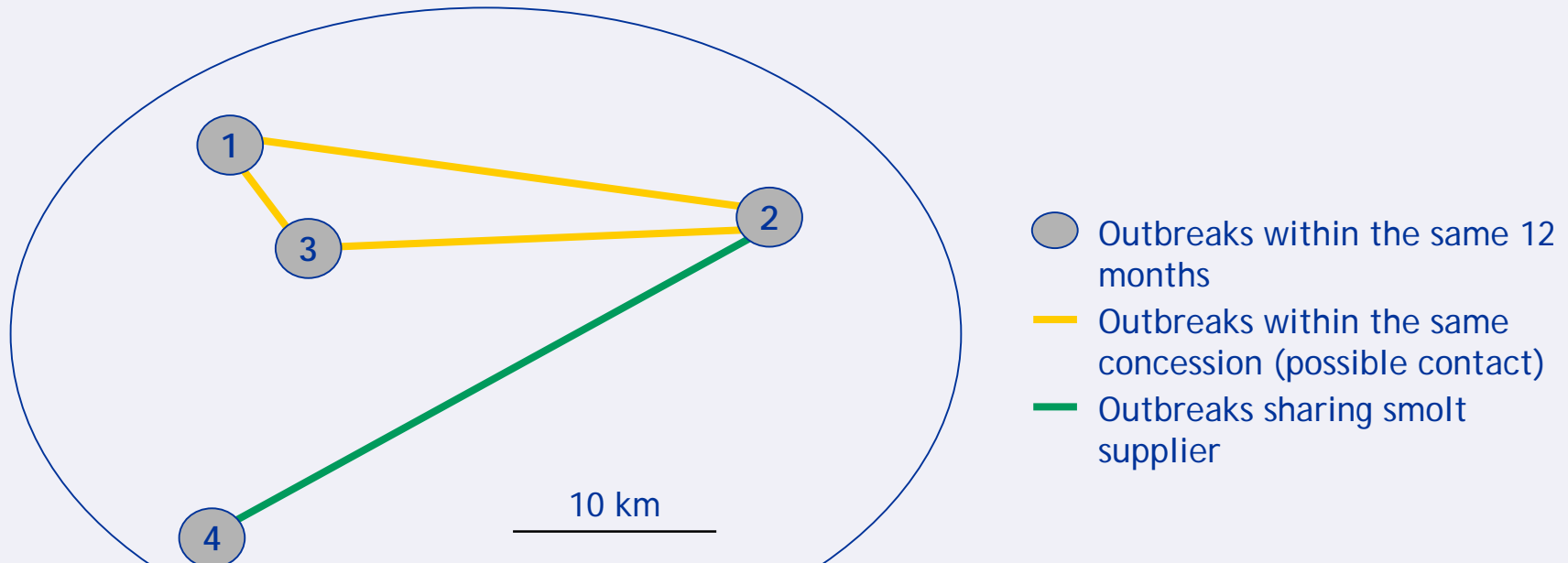
Outbreak investigation

■ Assumptions:

- any pair of virus isolates from different sites may or may not share a common source of infection...
- directly sharing an infected source → genetically similar
- not sharing an infected source → no expectations



Example of how data can be compiled



Matched outbreak	Proximity	Contact (Same concession)	Smolt supplier
1 & 2		X	
1 & 3	X	X	
1 & 4			
2 & 3		X	
2 & 4			X
3 & 4			

Statistical test

A binomial test can be used to test if the number of successes are higher than expected by chance for each of the three risk factors

S=success

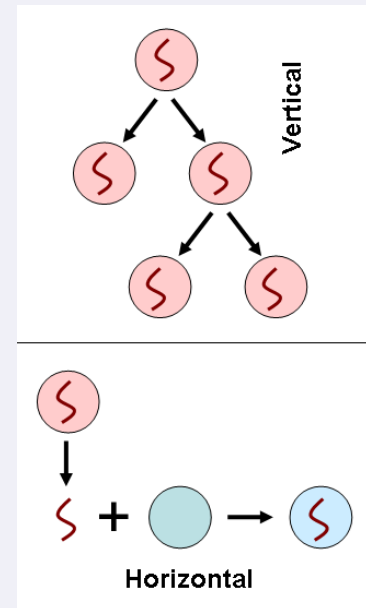
F=failure

Matched Outbreaks	Months apart	Genogroup	Proximity	Contact	Smolt Supplier
1 - 10	9	G3, G3			S
2 - 14	11	G1, G1	S		
3 - 7	1	G1, G1	S	S	
4 - 5	<1	G2, G2	S	S	
4 - 6	1	G2, G2			S
5 - 6	1	G2, G2	S	S	S
6 - 8	3	G2, G2	S	S	S
8 - 9	<1	G2, G3			F
10 - 16	3	G3, G3			S
11 - 15	3	G1, G3			F
12 - 20	9	G2, G3			F
13 - 18	8	G1, G1	S		
16 - 17	1	G3, G3			S
17 - 20	7	G3, G3			S
18 - 19	4	G1&G3, G1	S	S	
19 - 22	5	G1, G2			F
20 - 21	3	G3, G1			F
Summary statistics binomial test					
N			7	5	12
Observed S			7	5	7
Expected S			2.8	2.0	4.8
P			0.002	0.011	0.16



How to collate good data for molecular tracing

- Disease transmission:
 - Use the relationship between virus gene sequences to test different transmission pathways of virus
- Transmission pathways
 - Horizontal transmission
 - Vertical transmission
- Data required:
 - Cases
 - Incl. sequences
 - Population at risk



Challenges when collating data

- Only information on cases:
 - No knowledge of «population at risk»
 - You can test if cases are genetically similar
 - But not associations with risk factors
 - Tracing outbreaks is challenging:
 - For example: Similarity between genes from cases and smolt supplier does not necessarily mean that the virus came from this supplier if you have no knowledge of the status of other suppliers
 - Can help suggest possible risk factors



Challenges when collating data

- Problems with case definition:
 - Not notifiable disease
 - You do not know if all cases are reported -> controls can actually be cases
 - Clinical disease required or not?
 - Different practices at different labs:
 - Protocols/cut-off values/histopath definitions etc
 - Controls can turn into cases



Challenges when collating data

- Problems with production data:
 - No national/regional register
 - Required by EU-legislation
 - No knowledge on which farms are active
 - Information on production confidential to farmers
 - Can be solved though anonymization
 - Can be solved through cooperation with farmers and use of questionnaires
 - Maybe select a sub-set of the population at risk



Take home message:

- Quality of data is very important!
 - You must «know your data» - strengths and weaknesses
- Data must be fit for purpose
 - Formulate hypothesis/what do you want to know?
 - Then collect data
- But if you can't do that, see what you can get -often you can find something suitable....

