

Gill diseases in maricultured Atlantic salmon in Norway

- results from ongoing projects

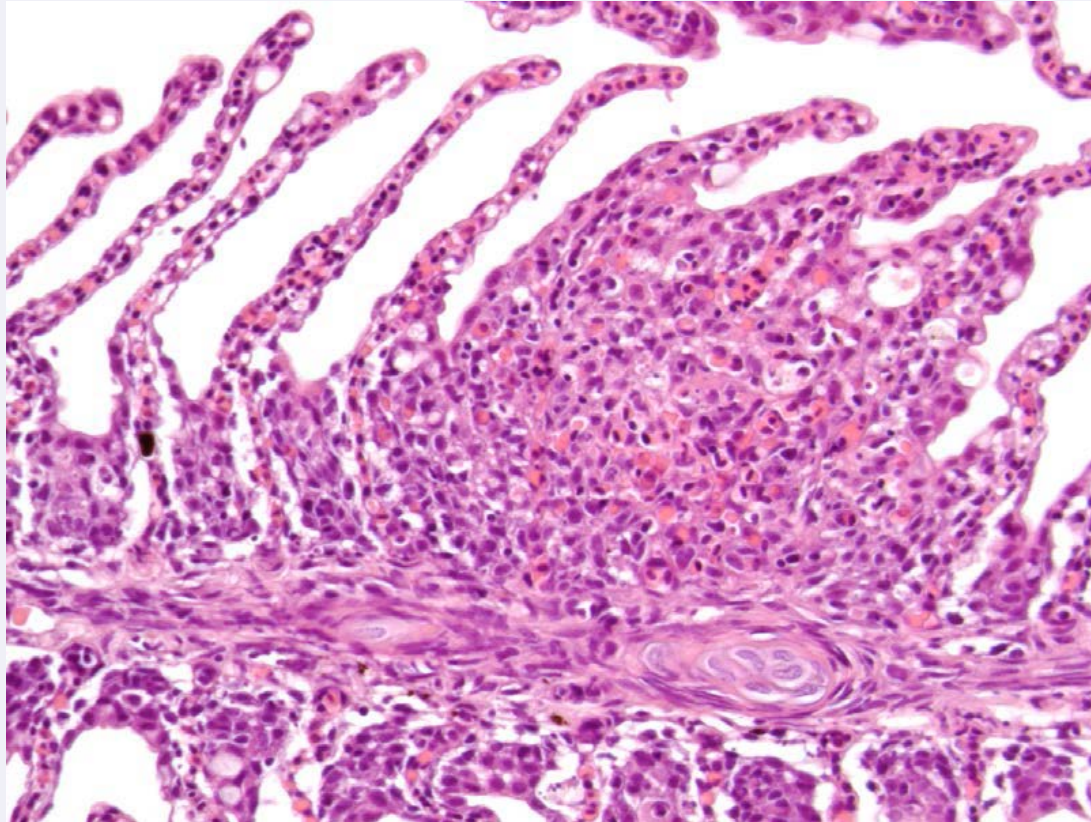
Terje Steinum, Mona Gjessing, Duncan Colquhoun, Anne Berit Olsen, Kai-Inge Lie* and Anne-Gerd Gjevre



Veterinærinstituttet
Norwegian Veterinary Institute

*FishVetGroup

«PGI» = Proliferative gill inflammation



- Inflammation
- Epithelial hyperplasia
- Cell death (necrosis)
- Circulatory disturbances



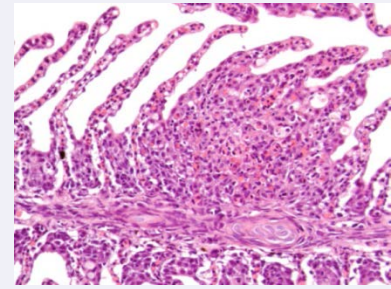
Chronic gill disease

Chronic gill diseases

- A significant problem in Norway
- Problems occur in late summer and autumn
 - Stress triggers clinical disease
 - “High risk” farms
- A **multifactorial aetiology** strongly suspected
- Our studies focus on four agents
 - **Epitheliocyst** forming bacteria
 - ‘*Ca. Branchiomonas cysticola*’
 - ‘*Ca. Piscichlamydia salmonis*’
 - **Microsporidian** *Desmozoon lepeptherii*
 - **Amoeba** *Paramoeba perurans*
 - *Correlation agent: histological lesions*
 - *Epidemiology: Defining “on site” risk factors*



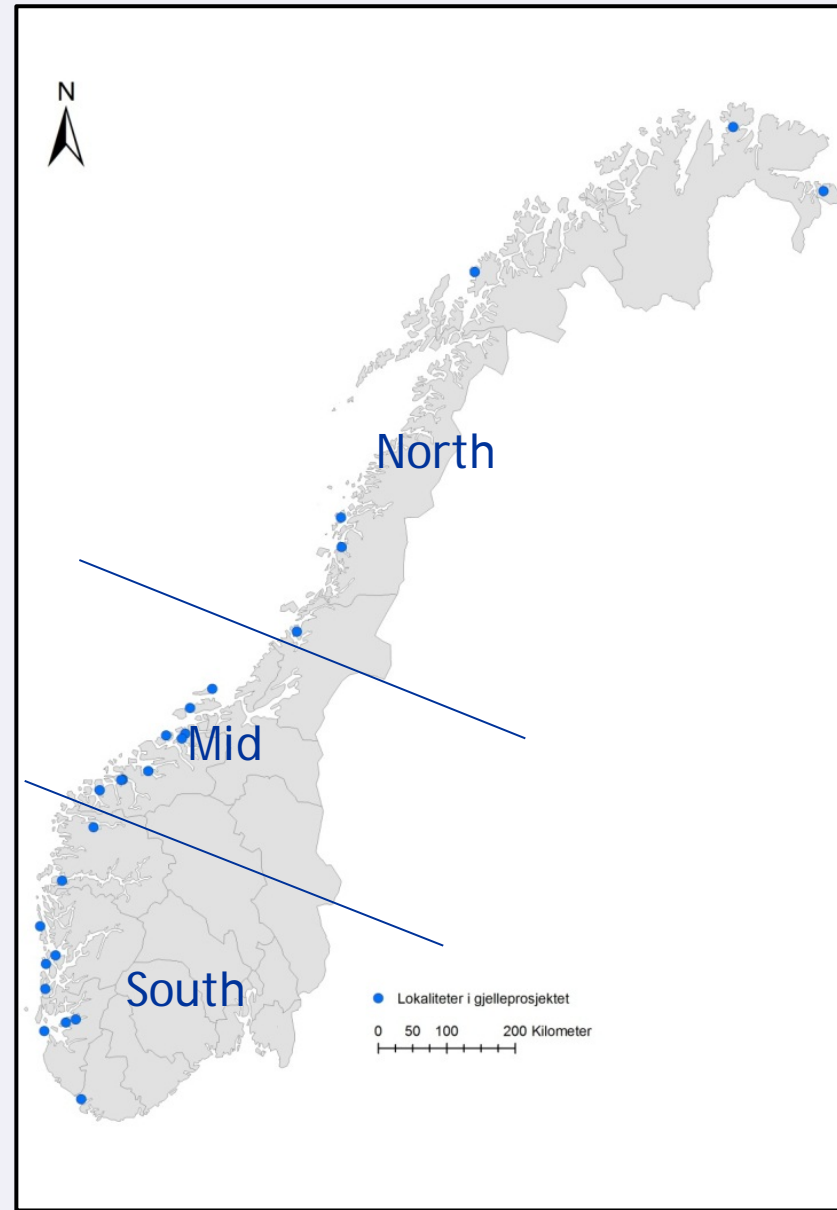
Outline



- Results
 - the «**Outbreak study**» (suspected gill disease)
 - a «**Longitudinal study**» of one farm «at risk»
 - **In situ** hybridization
 - Metagenomics
 - **Infection trial** «*B. cysticola*»
- New project: «Studies of multiple factors in «**challenge models**»»

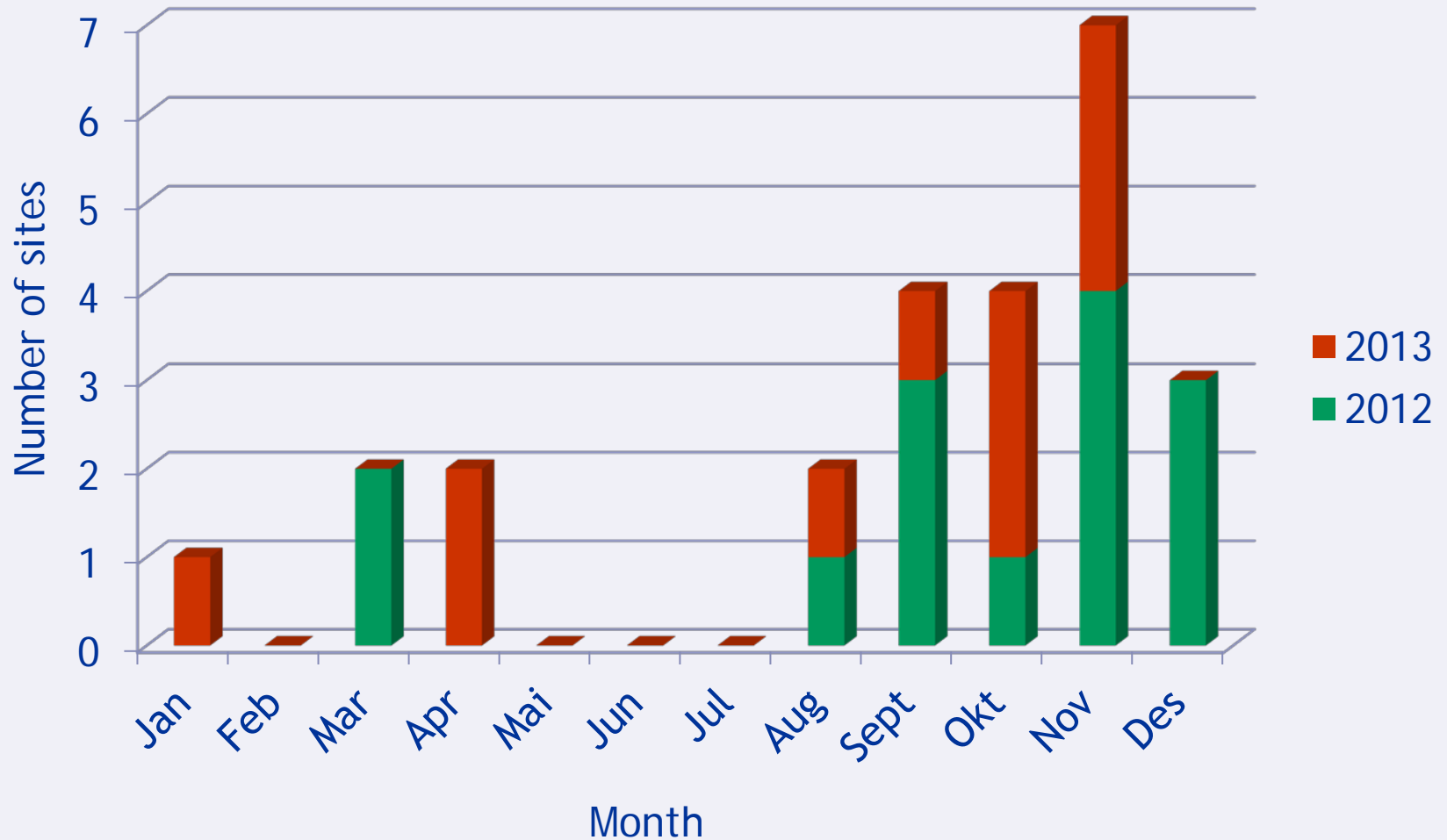
Farm location and material size

- 2012 and 2013
- Samples from 25 seawater sites
 - 41 % in South
 - 32 % in Mid
 - 27 % in North
- 600 real time PCR analyses
 - Four agents detected
- 112 gill sections scored



Results from «*Outbreak study*» 2012-2013

Monthly distribution of collected samples



Results from «*Outbreak-study*» 2012-213

< 50% infected fish
low load
medium load
high load

Distribution of agents in 21 farms

Area	Farm no.	Branchiomonas cysticola % positive fish	Desmozoon lepeophtherii % positive fish	Piscichlamydia salmonis % positive fish	Paramoeba perurans % positive fish
	1 (1)	100	83	100	not detected
	1 (2)	60	100	100	not detected
	2	100	94	53	not detected
Southern Norway	3 (AGD)	100	100	not detected	100
	4 (AGD)	60	100	80	70
	5 (AGD)	100	100	50	80
	6	100	100	17	not detected
	7	93	97	90	not detected
	8	not detected	100	not detected	not detected
	9 (AGD)	100	100	40	100
	10	100	90	70	not detected
	11	100	97	93	not detected
	12	100	100	not detected	not detected
Mid Norway	13	97	97	not detected	not detected
	14	100	100	not detected	20
	15	100	80	3	not detected
	16	100	100	27	not detected
	17	100	60	50	not detected
	18 (1)	100	not detected	not detected	not detected
Nothern Norway	18 (2)	100	not detected	7	7
	19	100	not detected	13	not detected
	20	80	30	67	not detected
	21	100	17	7	3



Temporal distribution of agents

< 45% infected fish
low load
medium load
high load

- ✓ "Site X" followed from June-December 2013
- ✓ 12 samplings of at least 20 fish = 240 fish examined
- ✓ **No gill disease** outbreak during the study period
- ✓ All 4 agents present, 3 already detected by the end of June

Farm X Sample date	Branchiomonas cysticola % positive fish	Desmozoon lepeopherii % positive fish	Piscichlamydia salmonis % positive fish	Paramoeba perurans % positive fish
05.06.2013	not detected	5	not detected	not detected
21.06.2013	55	not detected	not detected	5
10.07.2013	100	5	not detected	not detected
01.08.2013	100	5	not detected	not detected
21.08.2013	100	25	not detected	not detected
27.08.2013	100	45	10	not detected
11.09.2013	100	80	25	not detected
01.10.2013	100	100	90	not detected
10.10.2013	95	100	100	5
24.10.2013	95	100	100	20
12.11.2013	95	100	100	10
03.12.2013	85	100	100	45



Metagenomics

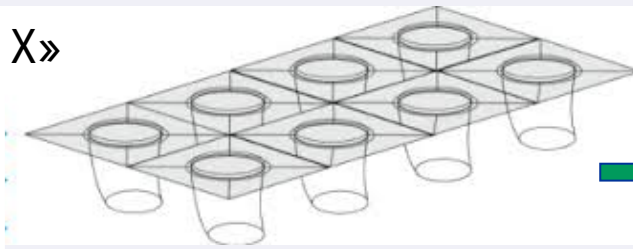
- **Small scale metagenomics** on total DNA isolated from salmon with chronic gill disease
- 1/8 plate -> 106 000 sequences
- Less than 1 % non-salmonid sequences
- Binning (via blast) reveal sequences most likely representing the **epithelocyst forming** bacteria and the **microsporidian**
- Other sequences suggest the presence of "**other respiratory microorganisms**"
 - A stepping stone for a new gill study at the NVI?



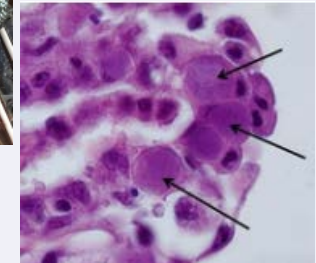
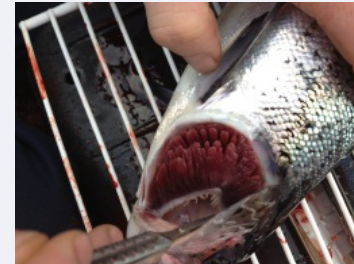
Infection trial at VESO Vikan:

Can «*B. cysticola*» be transferred between fish?

«Farm X»



Gills from 25 salmon



Conclusion

We could not confirm transfer of *B. cysticola* to or development of gill disease in experimental fish within the study period

Homogenization



4 week trial

*Sampling
Gill and kidney*

*Bath infection - postsmolt - sea water
Intra-peritoneal infection - parr - fresh water*



Funding



«FHF 900800: Proliferative gill disease in sea farmed Atlantic salmon»



«Gill disease in Atlantic salmon - studies of multiple factors in challenge models»

- April 2014 to March 2017
- Partners NVI and NIVA
- Main goals is to...
 - ..establish laboratory cultures of selected microbes
 - ...establish a multifactorial «gill challenge model»
 - ...systematize the pathophysiological, histopathological and immunological effects of selected factors



Funding



NFR 233585: «Gill disease in Atlantic salmon - studies of multiple factors in challenge models»



Thank you for your attention!

