

Infectious agents and chronic gill inflammation (PGI)

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Main findings during PhD

- *Clavochlamydia salmonicola* (freshwater) can no longer be detected in gills of Atlantic salmon a few weeks following sea transfer
- *Neoparamoeba perurans* caused the first reported cases of AGD in Norway in 2006
- *Piscichlamydia salmonis* is the only agent that are exclusively detected in fish from farms with an outbreak of PGI
- The epiteliocysts observed in relation with chronic gill inflammation in Atlantic salmon in Norway (and Ireland) contains *Branchiomonas cysticola* not *Piscichlamydia salmonis*
- *Branchiomonas cysticola* og microsporidian *Desmozoon lepeophtherii* are apparently very common in healthy Atlantic salmon, but the load increases dramatically for both agents in fish with moderate to severe chronic gill inflammation



Chronic gill inflammation(PGI), virus

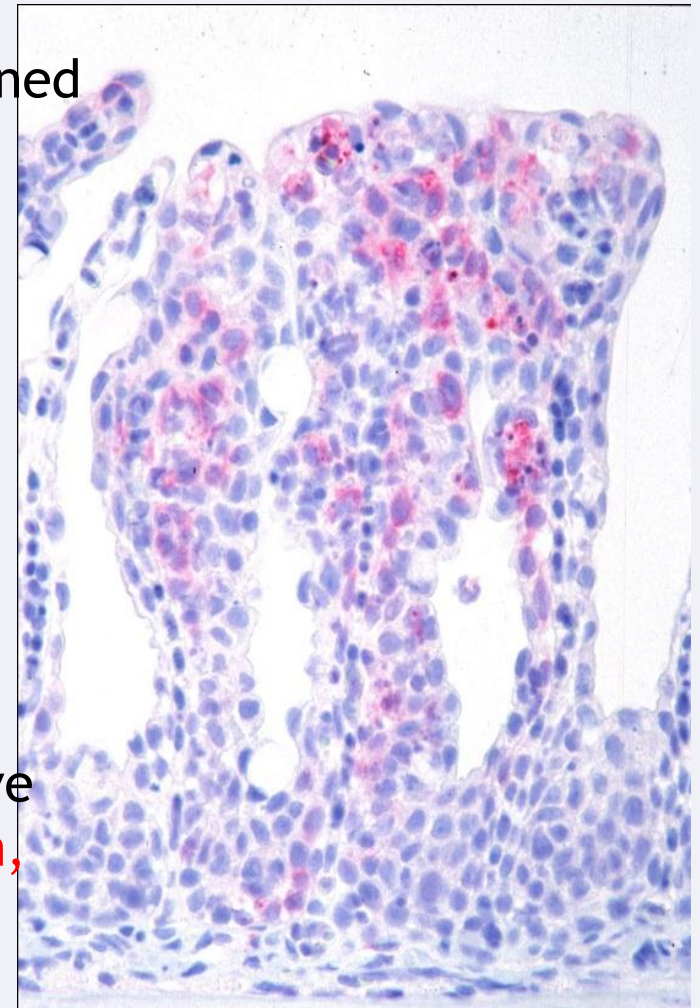
Atlantic salmon paramyxovirus (ASPV)
detected in tissue with pathology

Immunohistochemistry
photo: Agnar Kvellestad

The virus was found in 4 out 438 examined fish (Low prevalence in fish with/without chronic gill inflammation, important in some few cases?)

The virus didn't result in disease/ mortality in challenge trial (injection)

Salmonid gill poxvirus have also been said to be 'associated with' proliferative gill disease (AGD was the main problem, few fish examined, importance???)



Chronic gill inflammation(PGI), bacteria

Why not *P. salmonis*?

PCR results \neq visual detection of epitheliocysts

Similar morphology, but no typical 'head-and-tails' cells

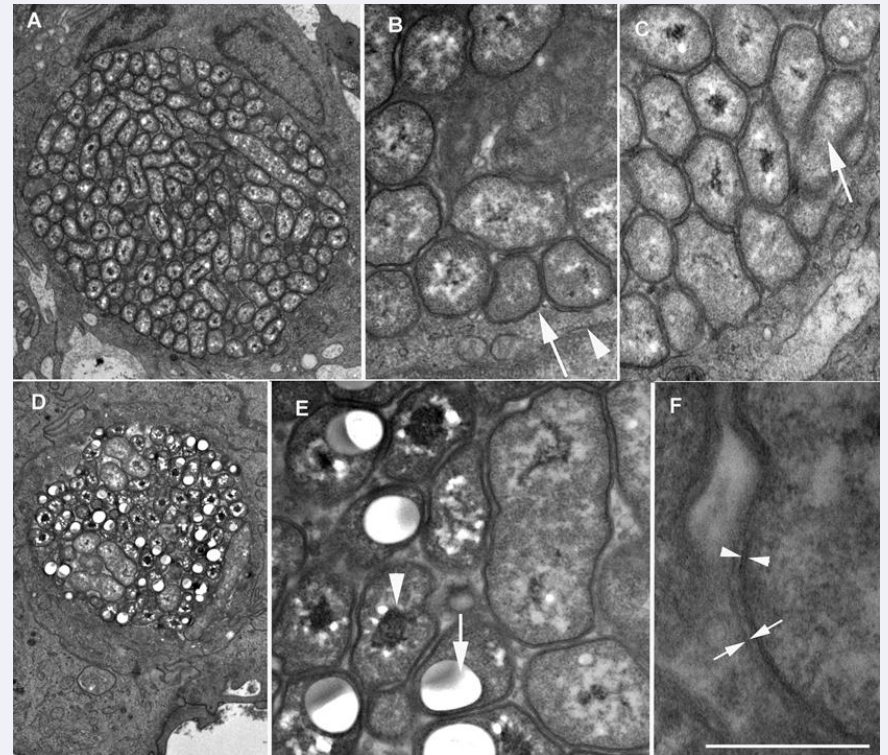
Failed 'in situ' hybridization

Where is *P. salmonis* hiding?

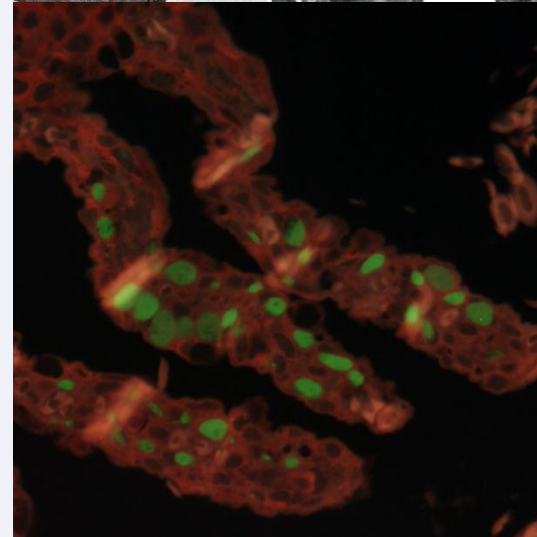
Branchiomonas cysticola

Good correlation PCR-findings and observation of cysts (gamma =0.6)

'In situ' hybridization successful



EM, photo:
Agnar Kvellestad



FISH, photo:
Terje Steinum

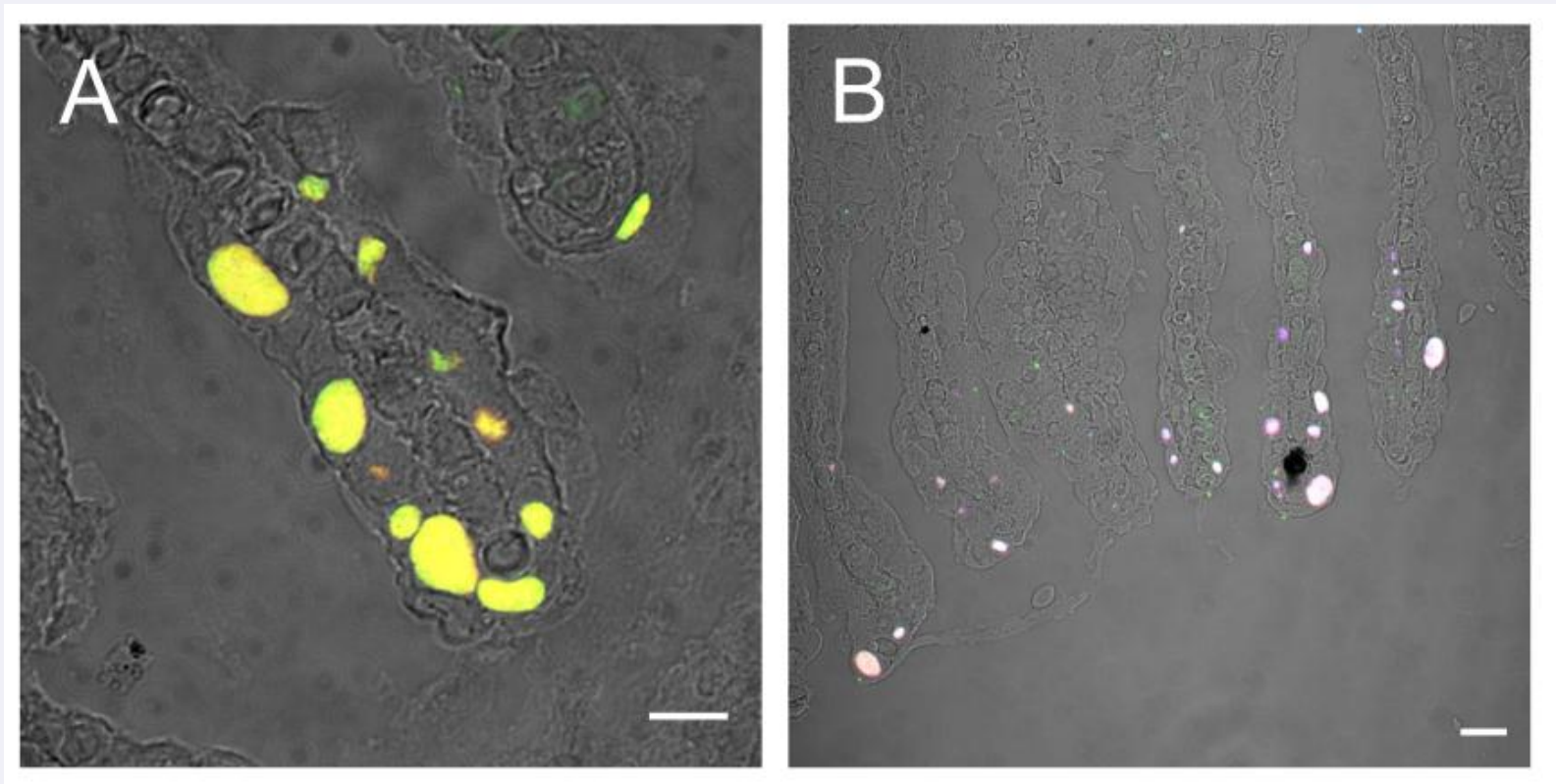


Chronic gill inflammation(PGI), bacteria

Fluorescence in situ hybridization(FISH)

Epitheliocysts = 'Ca. *Branchiomonas cysticola*'

photo: Elena
Tönshoff



2 probe mix;

'universal' = green
B. cysticola = red
combined = yellow

3 probe mix;

'universal' = blue; *B. cysticola* = red
Betaproteo= green; combined = white

Chronic gill inflammation(PGI), parasites

Desmozoon lepeophtherii, first discovered in salmon lice, the detected in farmed Atlantic salmon.

Atlantic salmon intermediate host
(systemic infection)

Infects(including):

Endoepithelial cells of vascular system

Epithelial cells (Nucleus/Cytoplasm)

Leukocytes/Macrophages-like cells



Chronic gill inflammation(PGI), parasites

In relation to proliferative gill disease:

‘..associated with 80% mortality in commercial fish farm.’

‘..results in 50% mortality in challenge trials.’

Statements in publications, **but no data presented.**

Costia/Tricodinids observed in highest numbers in the most affected fish and farms (**may contribute to the problem?, no consistent findings**)



All real time PCR-results from PhD

Presence in apparently healthy fish:

P. salmonis - 24% (the only agent only detectable in outbreak farms)

D. lepeophtherii - 76% (similar presence also in farms without disease)

B. cysticola - 80%

Presence in fish with severe chronic gill inflammation:

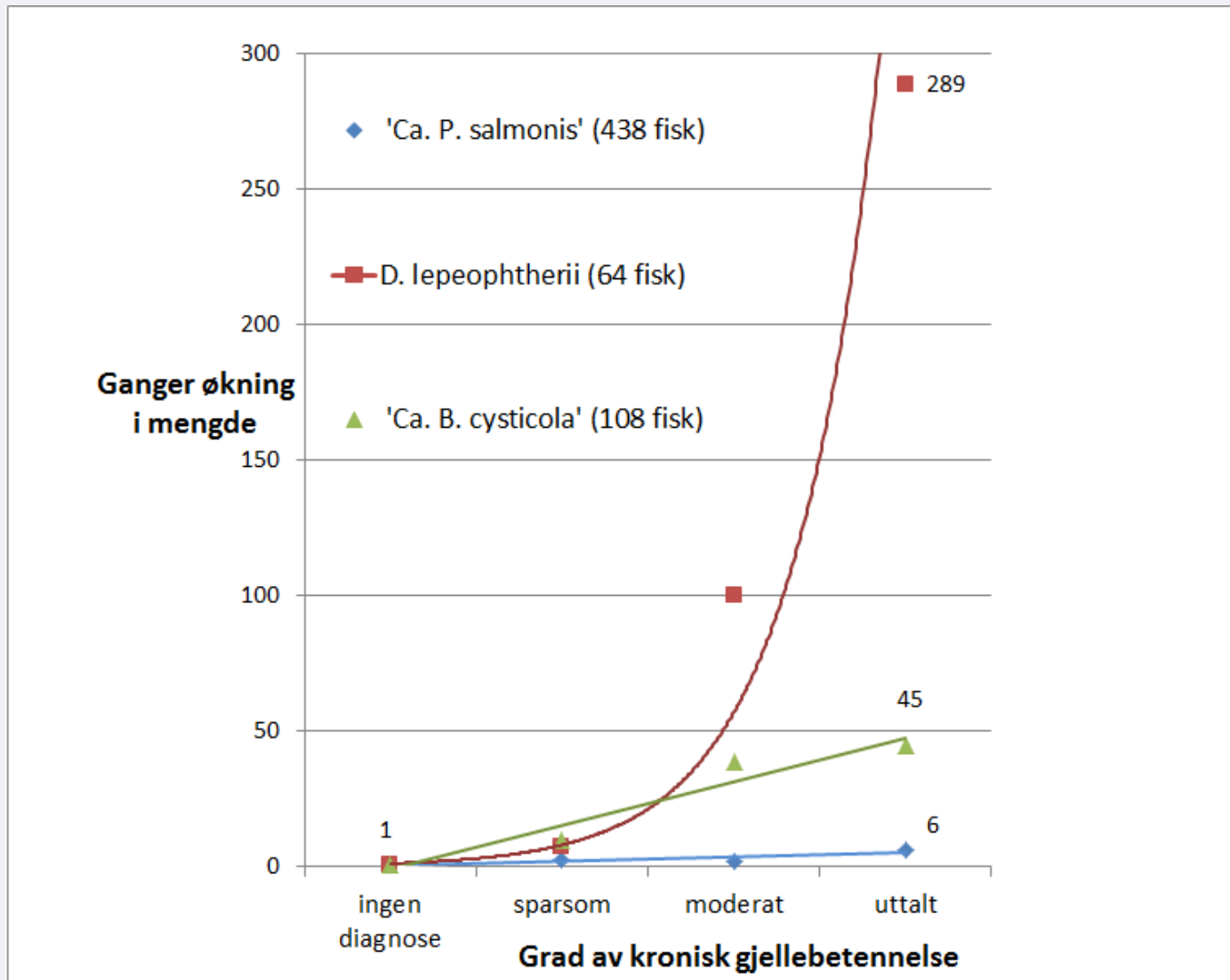
P. salmonis - 60%

D. lepeophtherii - 100%

B. cysticola - 100%



All real time PCR-results from PhD



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