Abstract which includes personal short-hand notes

International Gill Health Initiative 2017
University of Bergen, April 27-28

The International Gill Health Initiative 2017 is grateful for sponsorship from the following partners:

At a glance – IGHI Program

Day 1 – 27 April 2017

Chair	Time	Title	Presenter
	08:30	registration open	
	08:45	registration open	
	09:00	registration open - COFFEE	
	09:15	registration open - COFFEE	
	09:30	registration open - COFFEE	
	09:45	registration open - COFFEE	
	10:00	Introduction and welcome	Mark Powell/Christine Huynh
	10:05	Welcome to the University of Bergen	Ørjan Totland
CH	10:15	An update on Gill health in Norway 2016	Anne-Gerd Gjevre
	10:25	Gill disease situation 2016-2017	Mar Marco-lopez
	10:35	Update of gill health in Scotland	Angela Ashby
	10:45	Gill Disease - an Australian perspective	Troy Hein
	10:55	Gill health update - Chile	Sonia Stolz
	11:05	MHS Gill health in Scotland 2016-2017	Martin Røed
	11:15	AGD but no treatment in 2016	Stine Kolstø
	11:25	Gill disease: What did last year look like?	Stian Nylund
	11:35	Gill health research at the University of Tasmania	Barbara Nowak
IB	11:45	**Discussion - the state of gill diseases**	
	12:15	**LUNCH**	
NR	12:45	**Epidemiological tools for studying gill disease**	**Edgar Brun**
	13:20	Pathogens causing gill diseases in Norway.	Are Nylund
	13:40	Investigation of co-infections with pathogens associated with gill disease in Atlantic salmon during an amoebic gill disease outbreak in Ireland	Jamie Downes
	14:00	Longitudinal study of putative pathogens of Atlantic salmon (Salmo salar L.) complex gill disease	Ana Herrero
	14:20	Gill disease in Atlantic salmon - studies of multiple factors in challenge models	Anne-Gerd Gjevre
	14:40	**COFFEE**	
AA	15:00	Clinical approach of the main pathological manifestations present in Chile that affect the gill health in salmonids .	Alejandro Heisinger
	15:20	Salmonid Gill Poxvirus – hallmarks of typical infection and disease	Ole Bendik Dale
	15:40	Epitheliocystis - usually benign but sometimes lethal	Barbara Nowak
MML & AGG	16:00	**Discussion - case definitions and mulifactoral gill disease syndromes**	- IMP for Future studies eg. epidemiology
	17:00	End day 1	

Day 2 – 28 April 2017

Chair	Time	Title	Presenter
	08:00	welcome to day 2	Mark Powell
MC	08:10	Non-lethal molecular diagnostic test for Paramoeba perurans - experimental and field data from Norway	Hege Hellberg
	08:30	Non-Lethal skin and gill biopsies for Mucosal Mapping™ of Salmon Health – almost good to go!	Karin Pittman
	08:50	The gill parasite Paramoeba perurans compromises aerobic scope and swimming capacity in Atlantic salmon Salmo salar	Malthe Hvas
	09:10	Hypoxia tolerance during amoebic gill disease in Atlantic salmon (Salmo salar)	Morten Lund
	09:30	Physiological pathogenesis of AGD	Mark Powell
	09:50	**COFFEE**	
BN	10:10	Atlantic salmon physiological and immune response to amoebic gill disease and insight into the biology of the amoeba	Ottavia Benedicenti
	10:40	New smolt analysis shows that gill health affects the smoltification process	Elise Hjelle
	11:00	Genetic parameters for resistance to AGD in Atlantic salmon	Bjarne Gjerde
	11:20	The development of autogenous vaccines against Amoebic Gill Disease in the Atlantic salmon: an update	Sophie Fridman
MC & GR	11:40	**Discussion - knowledge gaps in understanding disease**	
	12:00	**LUNCH**	
AA	12:30	Gill Health Focus at Cargill	Ragna Heggebø
	12:50	A comparison of in vitro and in vivo results of potential functional feed candidates	Sindre Rosenlund
	13:10	Development of a functional diet against Amoebic Gill Disease	Julia Mullins
	13:30	Importance of nutrition on gill health and diseases	Rune Waagbø
	13:40	Snorkel cage barrier cage technology use and AGD infection	Lena Geitung
	14:00	Scottish research priorities for gill health management	Robin Shields
	14:20	**COFFEE**	
IB & GR	14:40	**Summing up - outcomes and the way forward**	
	15:00	End	

KEYNOTE SPEAKER

Epidemiological tools for studying gill disease

Edgar Brun

Dr Edgar Brun is an epidemiologist with the Norwegian Veterinary Institute with many years of experience in fish health related epidemiological projects including heart related diseases, and pancreas disease. Edgar has published widely on the topic of epidemiology and the associated tools for studying and evaluating diseases in farmed fish. The application of these tools and approaches to gill health related issues will be the focus of discussion.

Abstracts

UPDATES FROM AROUND THE GLOBE

An Update on Gill Health in Norway

Anne-Gerd Gjevre

Norwegian Veterinary Institute

In 2016 Norway produced about 1.2 mill tons of Atlantic salmon, 84 500 tons of rainbow trout and 25 mill cleaner fish (mainly lumpfish). Gill diseases are not notifiable in Norway. Hence, the fish health services are best updated on the situation. This update is mainly based on a survey conducted by the NVI in connection with data collection for the annual Fish Health Report. 37 persons working in 19 fish health services and 10 inspectors in the Norwegian Food Safety Authority participated in the survey. Additional information was collected from private laboratories. Generally, gill diseases have had great economic impact in the Norwegian salmon industry for many years, and the situation has not improved in 2016.

AGD has certainly come to stay. AGD is detected both in salmon and cleaner fish. The situation in 2016 was much like in 2015, i.e. did not become the severe threat we feared in 2014. This might be due to: 1) the industry is more experienced in handling the disease and seems to control AGD by gill scoring and early treatment with H_2O_2 or fresh water; 2) the summer in 2015 and 2016 had more rainfall and the sea temperatures were lower compared to previous years. In 2016 *Paramoeba perurans* was detected by real-time (RT)-PCR from the county Vest-Agder to Nord-Trøndelag. However, outbreaks of AGD were not detected north of Nord-Trøndelag. In September to November 2016 the number of treatments increased at sites on the southwest coast of Norway.

The complex gill diseases where several agents are involved, seems to give most concern in Norway. In 2016 the NVI **detected Salmonid Gill Pox Virus (SGPV)** in 11 smolt producing- and 9 on-growing farms with salmon. Infection with SGPV was on national basis, ranked at the same level as infection with IPNV, harmful algal blooms and jellyfish. In some smolt producing farms, however, the infection with SPGV can cause very high mortalities. *Ca.* Branchiomonas cysticola and *Desmozoon lepeophtherii* are also reported to cause problems in some smolt producing farms.

Gill health in Ireland in 2016

Mar Marcos-Lopez, Felix Scholz, Susie Mitchell, Hamish Rodger

Fish Vet Group Ireland, Unit 7b Oranmore Business Park, Oranmore, Co. Galway, Ireland

Gill health continues to be one of the main health challenges for the Atlantic salmon industry in Ireland. During 2016, all new smolt inputs (2015 S0s and 2016 S1s) became infected with *Neoparamoeba perurans* and displayed clinical amoebic gill disease (AGD) a few weeks or months after sea transfer. Overall however, mortalities and number of bath treatments (approx. 90% freshwater and 10% hydrogen peroxide) were low. An increase in proliferative gill disease and gill bleeding was observed in fish close to harvest size. A full diagnosis was not carried out in all cases, but phytoplankton species (*Ceratium* sp. and *Karenia mikimoto*) were diagnosed as the primary cause in two significant cases. Pathogens known to be associated with complex gill disease (i.e. *Desmozoon lepeophtherii*, salmon gill poxvirus and *Branchiomonas cysticola*) were also detected, but their role on the observed pathology is unclear. Clinical AGD has also been diagnosed in lumpfish and wrasse species in Ireland, and significant AGD-related mortalities occurred in lumpfish both in rearing facilities and in sea cages. The main challenges and research and management needs for both Atlantic salmon and cleaner fish in regards to gill health will be discussed during the presentation.

An Update on Gill Health in Scotland

Angela Ashby

Fish Vet Group UK

Gill health is widely considered to be one of the most significant health challenges facing the Scottish salmon industry. This presentation will provide an overview of gill health in Scotland, including clinical observations from the field and diagnostic trends.

Gill disease- Australian perspective

Troy Hein

Tassal Operations, Tasmania Australia

Gill diseases have great economic significance in Australia due to losses (direct) and the added cost of production from freshwater bathing. Amoebic gill disease (AGD) has been a major challenge for the industry, but through the selective breeding program, inroads have been made into AGD resistance/resilience of stock.

Emerging diseases that have seasonal impacts include necrotic branchitis associated with hydrozoan injury, and secondary infections with *Tenacibaculum* sp.- causing bacterial plaques on gills. These gill diseases are further compounded by thermal stress as the severity and prevalence of gill necrosis occurs in the summer months as temperatures peak (January to March).

Further research needs to be conducted in this area to understand the progression of disease caused by Australian species of hydrozoa; seasonal variation of biofouling species; and management practices that can be employed to mitigate gill injury. There also needs to be a close examination of in-situ net-cleaning practices and the role of total suspended solids and "blasting" effect of net cleaners which can dislodge and break-up hydrozoan colonies causing dispersal of nematocysts in the water column.

Gill health update – Chile

Sonia Stolz

Fish Vet Group Chile

MHS Gill health in Scotland 2016-2017

Martin Roeed

Marine Harvest Scotland

Marine Harvest is dedicated to the health and welfare of our fish, and we are passionate about solving the challenges we face in our operations. A healthy salmon is a high-performing salmon and in 2016 Marine harvest Scotland faced some challenges, related to poor gill health (AGD, PGD, algae bloom, jellyfish). Poor gill health both kills fish directly and also weakens fish that then succumb to other pathogens, it is possibly our most significant fish health challenge at present.

A complex gill disease involving bacteria, virus and parasitic organisms together can result in severe proliferative pathology with significant reduction in gill surface area. PGD has along with AGD proven to cause difficulties in operation related to handling of fish (harvest, treatments etc.)

The full impact on fish health from AGD is not fully understood; some farms can be positive, with quite high levels of amoeba for many months, but without showing any obvious negative effects, while the health of fish on other farms can deteriorate very quickly into very high mortality from low levels of infection. AGD is highly seasonal and it has a natural low presence and effect on fish health around late April/early May but by late summer almost all of our farms are re-infected and health impacted.

Spring 2017 has so far been used to battle sea lice and plan strategic treatments towards and prepare for the challenging summer months.

AGD but no treatment in 2016

Stine Kolstø

FoMAS, Haugesund, Norway

FoMAS is a fish health service company in the Southwest of Norway, and from 2013 when we had the first larger outbreak of AGD in our region we have worked closely with AGD and treatment in the field. In 2016 we had no treatment against AGD in our region, despite several diagnosis and development of gillscore. We will present our experiences from the field and compare it to previous years.

Gill disease: What did last year look like?

Stian Nylund, Pharmaq Analytiq, Bergen Norway

Gill disease has been recognized as a significant challenge during production of Atlantic salmon since the 1980s. The number of reported gill disease cases seems to increase every year and is also closely linked to high sea temperatures in late summer/early autumn. Geographically, the most strongly affected area has been, and still is, Western Norway, but in the latest years this area has slowly increased to include regions further north. Although the associated mortalities generally are low (approx. 10%), more severe isolated cases with heightened mortalities have been reported, typically following handling of fish and/or sea lice treatment.

Determining the cause of gill disease is not a straightforward task. Pathological changes in gill tissue can be caused by both environmental factors and a wide selection of pathogens. Since gill infections caused by disease agents is thought to be multifactorial they often include representatives from several different kingdoms of parasites. Common gill pathogens in Norway include intracellular bacteria (Chlamydia- or β-proteobcateria) causing epitheliocysts, exoparasites like *Paramoeba perurans* and *Ichytobodo* sp., the microsporidian *Paranucleospora theridion* and the viral agents Atlantic Salmon *ParamyxoVirus* (ASPV) and Salmonid Gill PoxVirus (SGPV). Although most of these are associated with disease in the seawater phase, several also represent a challenge in freshwater production. Determining which of these pathogens are primary- and secondary causes is a challenge, and a direct correlation with disease has only been shown for a few of them. Systematic monitoring for their presence during production using both realtime RT-PCR and histological examination can to a certain degree start to unravel the relative importance of the different agent in causing disease. The presentation will include a summary of field results and our experiences from last year's monitoring.

all yr long with peak at late summer.

High levels
- Branch. – prevalence high } Prevalence ↑ at the end of Summer
- Desmozoa - " "
- Poxvirus – FW end of the year ↑ prevalence (not data from other yrs)
- AGD – start end July and a pick Nov.

→ Swelling (blebbing) and loss epithelial cells from lamellae

Desmozoa, Poxvirus } ≠ pathology mean AGD

↳ problem in FW/SW

Amoebic Gill Disease – UTAS research update

Barbara Nowak
IMAS UTAS Tasmania Australia

Amoebic gill disease (AGD) was first reported from salmonids farmed in marine environment 30 years ago. Since then clinical AGD has been observed in fourteen countries across six continents. The causative organism, *Neoparamoeba perurans*, was described more recently. This presentation will review AGD research progress at UTAS.
We investigated the effects of fresh water treatment against Amoebic Gill Disease on the gut microbiome of farmed Atlantic salmon. The results showed high variability, in particular between different dates and potentially fish size. *N. perurans* gene sequences from isolates from different geographical locations were compared using MLST and RAPD. Further progress was made with regard to environmental detection of *N. perurans*. Challenges in the detection of *N. perurans* in benthic sediments associated with commercial salmon farming will be discussed.

studies MSLT Analysis - similarity
Genetic study of proximity of ≠ clad or strains from ≠ farms
→ Detection of AGD from sediments - could be found

GILL DISEASES IN THE ENVIRONMENT AND INTERACTIONS

Pathogens causing gill diseases in Norway.

Are Nylund

University of Bergen, Bergen, Norway

Production of Atlantic salmon *Salmo salar* in Norway has since the mid 90-ties suffered from gill diseases and the majority of the cases have been located to western Norway (Nygaard 2004). The exceptions are the parasites *Parvicapsula pseudobranchicola* that affects the pseudobranch, gills and other tissues of farmed Atlantic salmon mainly in Northern Norway (Karlsbakk et al 2002, Sterud et al 2003, Nylund et al 2005) and *Ichthyobodo* spp associated with gill diseases in both fresh and sea water in most part of Norway (Todal et al 2004, Isaksen et al 2010, 2011, 2012, Isaksen 2013). The gill diseases of Atlantic salmon in Norway have been named proliferative gill inflammation, PGI, associated with a paramyxovirus (Kvellestad et al. 2003, 2005, Fridell et al 2004, Nylund et al 2007, Steinum et al 2010), proliferative gill disease, PGD, associated with a poxvirus (Nylund et al. 2006, 2007, 2008, Gjessing et al 2015, 2017), amoebic gill disease (AGD) associated with *Paramoeba perurans* (Nylund et al 2007, 2008, Steinum et al 2008), bacterial gill disease (BGD) mainly caused by *Flavobacterium* spp. and *Tenacibaculum* sp. (Lorenzen 1999, pers.obs.), ichthyobodosis caused by *Ichthyobodo* spp (Poppe & Håstein 1982, Todal et al 2004, Nylund et al 2005, Isaksen et al 2010, 2011, 2012, Isaksen 2013), paranucleosporosis caused by *Paranucleospora theridion* (Nylund et al 2009abcd, 2010, 2011, Gunnarson et al 2016), parvicapsulosis caused by *P. pseudobranchicola* (Karlsbakk et al 2002, Sterud et al 2003, Nylund et al 2005), and epitheliocystis caused by members of Chlamydiales (*Candidatus* Piscichlamydia salmonis, *Ca.* Clavochlamydia salmonicola, and a new member of Simkaniaceae) and the β-proteobacterium *Candidatus* Branchiomonas cysticola (Nylund et al 1998, Drahgi et al 2004, Karlsen et al 2008, Steinum et al 2010, Repstad 2011, Toenshoff et al 2012, Vilinn Tolås 2012, Mitchell et al 2013, Nylund et al 2014). This presentation will give a review of microparasites involved in gill diseases in western Norway.

RAS system maybe a big issue.
Semicontained system
with salmon common Norwegian

Amoeba/bact — seems imp for the virulence of the amoeba

Investigation of co-infections with pathogens associated with gill disease in Atlantic salmon during an amoebic gill disease outbreak in Ireland

Microsporidean – CT < 20 no pathology → Prevalence cs papers

Jamie K. Downes[1,2*], Tadaishi Yatabe[3], Mar Marcos-Lopez[2,4], Hamish D. Rodger[4], Eugene MacCarthy[2], Ian O Conor[2], Evelyn Collins[1], Neil M. Ruane[1]

Disease 2017 – Temporal disease

[1]Fish Health Unit, Marine Institute, Oranmore, County Galway, Ireland; [2]Marine and Freshwater Research Centre, Galway Mayo Institute of Technology, Dublin Road, Galway, Ireland; [3]Center for Animal Disease Modeling and Surveillance (CADMS), Dept. Medicine & Epidemiology, School Veterinary Medicine, University of California, Davis, USA; [4]Fish Vet Group, Unit 6, Oranmore business park, Oranmore, County Galway, Ireland.

On a global scale, amoebic gill disease (AGD) is the most significant gill disease affecting farmed Atlantic salmon, while a number of other agents have been identified as potential pathogens involved in gill disorders. Gill disorders can be complex and multifactorial with co-infections common on farms and there is a lack of knowledge in relation to interactions and synergistic effects of these agents. The objective of this study was to determine if and what effect a number of pathogens, namely *Neoparamoeba perurans, Desmozoon lepeophtherii, Candidatus* Branchiomonas cysticola, *Tenacibaculum maritimum*, piscine reovirus (PRV), and salmon gill pox virus (SGPV) may have on the gills during an AGD outbreak. For this, gill samples were collected from stocking until harvest, every 2-4 weeks, from a marine Atlantic salmon farm in Ireland, on which real-time PCR was used to determine the presence and sequential infection patterns of these pathogens. Finally, a number of multi-level models were fit to determine the effect of these putative pathogens and their interaction on gill health (measured as Histopathology score), while adjusting for the effect of water temperature and time since the last freshwater treatment. Results indicate that between week 12 and 16 post-seawater transfer, colonisation of the gills by all pathogens had commenced and by week 16 of production each of the pathogens had been detected. *D. lepeophtherii, Candidatus* Branchiomonas cysticola and piscine reovirus (PRV) were by far the most prevalent of the potential pathogens detected during this study. Once established in the population, there was very little variation in the prevalence (*D. lep* 80 to 100%, *Ca.* B. cysticola 80 to 100% and PRV 60 to 100%). Detections of *T. maritimum* were found to be significantly correlated to temperature showing distinct seasonality. While detections of salmon gill pox virus (SGPV) were highly sporadic and it was detected in the first sampling point, suggesting a carryover from freshwater stage of production. Finally, model results indicate that there is no clear interaction or synergistic effect between any of the pathogens. Additionally, the models showed that temperature, the density of *Neoparamoeba perurans* and time (weeks) since last freshwater treatment have the greatest effect on the histopathology score. (Spleenish lipid stuff — very no google)

Psicirickensia salmonis (not so common)
Tenacibaculum sp — more in mucous not causing really lesion

Costia causing micro ridges of gills — penetrates skin
Could be a primary pathogen
Desmozoon – environment spores produce in the lyco
Spleenish-stuff lipids and microspore
epitheliocysts become ...

Longitudinal study of putative pathogens of Atlantic salmon (*Salmo salar* L.) complex gill disease

Ana Herrero[1*], Mark Dagleish[1], Hamish Rodger[2], Carolina Guitierrez[3], Chris Cousens[1], Jeanie Finlayson[1], Jorge del-Pozo[5], Chris Matthews[2], Giuseppe Paladini[4], James Bron[4], Alexandra Adams[4] and Kim D. Thompson[1]

[1]Moredun Research Institute, Pentlands Science Park, UK; [2]Fish Vet Group, Inverness, UK; [3]Marine Harvest, Fort William, UK; [4]Institute of Aquaculture, University of Stirling, UK; [5]Royal (Dick) School of Veterinary Studies, University of Edinburgh, UK.

Gill disorders have become a significant problem during the marine phase of Atlantic salmon farming. The aetiology can be a single pathogen, e.g. *Paramoeba perurans* in amoebic gill disease, or associated with the presence of several agents including bacteria, viruses and parasites. Other factors, such as previous insults, environmental conditions or stress due to handling can be predisposing factors. Establishing the causative aetiological agent(s) in gill disease is frequently complicated by the simultaneous presence of various pathogens. Furthermore, the effect of interactions between these different organisms in complex gill disease is unknown. In Scotland, complex gill disease has been reported more frequently from the end of the summer until the end of winter. We performed a longitudinal study from October 2016 until February 2017 at two salmon farms in different locations on the West coast of Scotland, both with a history of previous occurrence of gill disease. The aim was to determine the correlation between gill pathology and the presence and relative levels of the putative pathogens present in the gills. Six fish were sampled every two weeks from each farm and the presence and load of *P. perurans*, *Ca.* Branchiomonas cysticola, salmon gill poxvirus and *Desmozoon lepeophtherii* in the gills and head kidney were determined by specific quantitative reverse transcriptase polymerase chain reaction (qRT- PCR). A gill scoring technique for assessing histological lesions was also undertaken in samples from these fish, the results of which were compared to the presence and load of each pathogen. The results obtained to date will be presented and discussed.

Mitchell (2012) Scoring System
- Patogens are normaly found in fish
- factors may trigger the attack of disease

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

Anne-Gerd Gjevre

Norwegian veterinary Institute, Oslo, Norway.

Gills are multifunctional organs: respiration, osmoregulation, acid-base regulation and nitrogen excretion. Both infectious and non-infectious factors are associated with gill disease in farmed Atlantic salmon in seawater. The cause of the disease is complex, and is therefore referred to as multifactorial. The presentation sums up main results form an ongoing research project. The main objective was to study the significance of and interaction between the various factors associated with gill disease in maricultured Atlantic salmon. Standardized infection models was developed. Fish were exposed to environmental factors believed to be important for the development of gill disease and simultaneously challenged with *Paramoeba perurans*.

Clinical approach of the main pathological manifestations present in Chile that affect the gill health in salmonids

Alejandro Heisinger

Multiexport Food Co, Puerto Montt, Chile

The Chilean Aquaculture production has more than 25 years, achieving a position as the second worldwide producer, its important growth as the intensification of the production has led to the presence of different diseases, where the last 5 years has seen the appearance of diseases affecting the gill health of various noxa, such as parasites, viruses, bacteria, Harmful Algal Bloom, etc.

The following paper presents the main manifestations associated to gill disease, predisposing factors, clinical diagnosis, diagnosis tools, therapeutic alternatives, as well as prevention and control measures.

Salmonid Gill Poxvirus – hallmarks of typical infection and disease

Ole Bendik Dale

Norwegian Veterinary Institute, Oslo, Norway

A brief introduction to the newly characterized virus and the emerging disease in Atlantic salmon is given. Further, our experiences regarding infection and development of typical poxviral disease is reviewed.

Epitheliocystis - usually benign but sometimes lethal

Barbara Nowak

Institute for Marine and Antarctic sciences, University of Tasmania, Launceston, Tasmania Australia.

Epitheliocystis is a gill condition caused by an intracellular bacterial infection. It has been reported from both cultured and wild fish. While different species of Chlamydia have been confirmed as causative agents of epitheliocystis in many host species, in some cases Betaproteobacteria have been confirmed as aetiological agent. Epitheliocystis is often a benign infection but can also result in a proliferative host response leading to significant fish mortalities. This presentation will review the current state of knowledge of epitheliocystis and discuss its potential significance in co-infections and other gill diseases.

Effects of epitheliocystis on lysozime activity in striped trumpeter

Chlamydiae

Ca. Piscichlamydia salmonis

Betaproteobacteria

Ca. Branchiomonas cyticola

Ca. Clavichlamydia salmonicola

Ca. Syngnamydia salmonis

Ca. new species of epitheliocyst

Parilichlamydiacae

Epitheliocystis - usually benign but sometimes lethal

Barbara Nowak

Institute for Marine and Antarctic sciences, University of Tasmania, Launceston, Tasmania Australia.

Epitheliocystis is a gill condition caused by an intracellular bacterial infection. It has been reported from both cultured and wild fish. While different species of Chlamydia have been confirmed as causative agents of epitheliocystis in many host species, in some cases Betaproteobacteria have been confirmed as aetiological agent. Epitheliocystis is often a benign infection but can also result in a proliferative host response leading to significant fish mortalities. This presentation will review the current state of knowledge of epitheliocystis and discuss its potential significance in co-infections and other gill diseases.

Effects of epitheliocystis on lysozime activity in Striped Trumpeter

Chlamydiae

Ca. Piscichlamydia Salmonis

Betaproteobacteria

Ca. Branchiomonas cyticola

.Ca. Clavichlamydia salmonicola

.Ca. Syngnamydia Salmonis

Ca. new ~~tentacle~~ species epitheliocyst

Parilichlamydiacae

DIAGNOSTICS

Non-lethal molecular diagnostic test for *Paramoeba perurans* - experimental and field data from Norway

Hege Hellberg

Fish Vet Group Norge AS

Amoebic gill disease (AGD) and other gill diseases cause large losses in salmon farming. Developing non-lethal tests to monitor fish populations for pathogens would help improve production economy and fish welfare. A non-destructive molecular diagnostic test has showed improved detection of *Paramoeba perurans* (Downes et al. 2017). Results from experimental and field testing of the method in Norwegian salmon farming will be presented. The use of the method for detection of other gill pathogens will discussed.

Refs.: Downes et. 2017 "Evaluation of non-destructive molecular diagnostics for the detection of *Neoparamoeba perurans*", Frontiers in Marine Science, March 2017; volume 4.

- Swabs - 4 weeks at 4°C
  - -20 for 6 month