Chlamydia and Disease Backgrounder:

Scottish Farmed Salmon Killed by The Clap (Chlamydia) – World's Largest Salmon Farmer (Marine Harvest) Affected

The Pure Salmon Campaign has uncovered the fact that Scottish farmed salmon has suffered from a nasty dose of Chlamydia (known colloquially as 'the clap'[1]). In November 2007, *The Arran Voice* first identified Proliferative Gill Disease (PGD) as the culprit[2]. However, fish health inspection reports obtained via FOI by the Pure Salmon Campaign in April 2008 from the Scottish Government's FRS Marine Laboratory in Aberdeen exclusively reveal the full extent of Lamlash Bay's disease and parasite problems[3].

The Lamlash Bay salmon farm on the Isle of Arran, Scotland, affected by Chlamydia was formerly owned by Marine Harvest but is now operated by Lighthouse Caledonia (whose largest shareholder is Norwegian billionaire John Fredriksen – who also is the largest shareholder in Marine Harvest). Marine Harvest (also the 4th largest shareholder in Lighthouse Caledonia) is now appealing a decision by North Ayrshire Council to refuse an application for a second salmon farm on the Isle of Arran.

Chlamydia Countdown:

On 20th November 2007, the Argyll District Salmon Fishery Board [name blacked out but believed to be Jane Wright] wrote to the Scottish Government stating:

"A fish farm on Arran has PGD (clamidia) with the loss of four out of eight cages. You may not be aware of this as it is a non notifiable disease. The Argyll District Salmon Fishery Board asks for your help in informing on the implications for wild fish from this disease….This year appears to be particularly bad for clamidia – other farmers have reported having problems with it."

Dr David Mackay, Chairman of the Sea Trout Group, subsequently wrote to the Scottish Government's Environment Minister Mike Russell on 1st March 2008 raising the issue of "greatly increased incidence of "Proliferative Gill Disease" (caused by a Chlamydia-like bacterium) in Scotland during the autumn and early winter of 2007."[4].

Hand-written notes by the Fish Health inspector who visited the Lamlash Bay farm on 21st November 2007 reported: "So far over 40% lost", "4,000 per day morts at worst period" and "22.8 tonnes of waste fish and water sent every few days". The dead farmed

[1] http://wiki.answers.com/Q/What_causes_chlamydia
[2] http://www.arranvoice.com/detail.php?id=2268
[3] Information obtained on 17th April 2008 from Sarah Heath at the FRS Marine Laboratory in Aberdeen (PDF available upon request).
[4] http://www.seatroutgroup.org.uk/html/news.html

salmon (called 'morts' by the industry) were transported and reportedly incinerated by Granox Ltd in Nuneaton[5].

An email dated 5th December 2007 in reply to the Argyll District Salmon Fishery Board's email raising the issue of clamidia [sic] from the FRS Marine Laboratory Aberdeen (name blacked out) stated:

"We were aware the fish farm on Arran has been suffering from Proliferative Gill Disease but are not aware Chlamydia is the bacterium involved. We have had an inspector on site investigating the case…..More specific information on Chlamydia has been supplied by our pathologists; Chlamydia or a Chlamydia-like organism is the causative agent of epitheliocystis a term used loosely to describe gill infection".

A FRS Marine Laboratory Histopathology Report dated 13th December 2007 stated:

"Some fish have epitheliocystis, characterized by the presence of intracytoplasmic, granular inclusions in the epithelial cell (Chlamydia like infection)".

A FRS record sheet (reviewed on 10th January 2008) listed the diagnosis as "Gill pathology, Chlamydia and parasites". In addition to Chlamydia, the FRS Fish Health inspection reports detail problems with epitheliocystis, ichthyobodo, trichodina, amoeboid protists, a bacterial infection, focal haemorrhaging in the liver and pyloric caeca.

Chlamydia – Catching Up with the Science:

Chlamydia is better known to affect humans[6]. According to the UK's Department of Health, "Genital Chlamydia trachomatis infection is the most commonly diagnosed bacterial sexually transmitted infection in genitourinary medicine (GUM) clinics in the United Kingdom"[7]. Chlamydia infection is one of the most common sexually transmitted infections in people worldwide — about 2.8 million cases of chlamydia infection occur in the United States each year according to the US Department of Health and Human Services (Centers for Disease Control and Prevention)[8].

Chlamydia, epitheliocystis and Proliferative gill inflammation (PGI) problems started to rear their ugly heads on salmon farms in Australia[9], Ireland and Norway[10] in the late

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[5] http://www.pdm-group.co.uk/by-products_processing/processing.html
[6] http://en.wikipedia.org/wiki/Chlamydia_infection
[7] http://www.dh.gov.uk/en/Publichealth/Healthimprovement/Sexualhealth/Chlamydia/index.htm
[8] http://www.cdc.gov/std/Chlamydia/STDFact-Chlamydia.htm
[9] "Prevalence of epitheliocystis in Atlantic salmon, *Salmo salar* L., farmed in Tasmania, Australia" (Journal of Fish Disease, January 1999): http://www.blackwell-synergy.com/doi/abs/10.1046/j.1365-2761.1999.00140.x
[10] "Characterization of Candidatus piscichlamydia salmonis (Order chlamydiales), a chlamydia-like bacterium associated with epitheliocystis in farmed Atlantic Salmon (Salmo salar)" (Journal of Clinical Microbiology, 2004): http://cat.inist.fr/?aModele=afficheN&cpsidt=16264723 http://www.ncbi.nlm.nih.gov/pubmed/15528727

1990s and problems appear to have intensified over the last few years. A paper published in the *Journal of Clinical Microbiology* in 2004 by scientists from the University of Connecticut, University of Texas, University of Georgia and New York University Medical Center describes "*Candidatus* Piscichlamydia salmonis" (Order *Chlamydiales*), a Chlamydia-Like Bacterium Associated With Epitheliocystis in farmed Atlantic salmon in Norway and Ireland. Chlamydia has also been reported in other species of farmed fish such as Arctic charr, silver perch and barramundi[11].

[Graphic: Proliferative gill inflammation and epitheliocystis in seawater-reared Atlantic salmon. Gill from fish without (a) and with (b) detected pathological changes. A detailed view of b is shown in c, demonstrating extensive changes: Haemorrhages and lamellar thickening resulting partly in the reduction of interlamellar spaces. In the outermost cell layer many epitheliocystis, i.e. colonies of chlamydia- or rickettsia**-**like bacteria (arrowheads) may be seen[12]]

A 2006 review article – "Epitheliocystis in fish" - in the *Journal of Fish Diseases* at the School of Aquaculture in Tasmania, Austalia, reported that:

"Epitheliocystis is a condition affecting the gills and skin of fish, which has been reported from more than 50 freshwater and marine species…..Recently, four epitheliocystis agents from four different fish species have been characterized using molecular analysis. While they all belong to the order Chlamydiales, in a lineage separate from the Chlamydiaceae, they are distinct organisms and similarity analysis showed that they had highest similarity values with other chlamydia-like bacteria isolated from various sources, including humans or pig"[13].

A report – "New Diseases – Phenomena Developing into Problems" – published in 2007 by scientists at the Norwegian National Veterinary Institute and Norwegian Food Safety Authority stated that Epitheliocystis and Chlamydia-like organisms was an emerging problem with 'no effective treatment':

"So far, diagnosis of PGI has mainly been based on clinical symptoms and histological findings, the latter revealing intracellular accumulations of rickettsia- or clamydia-like organisms, termed "epitheliocysts" in the gills. These formations give rise to the term

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[11] "Characterization of a Neochlamydia-like bacterium associated with epitheliocystis in cultured Arctic charr Salvelinus alpinus" (Diseases of Aquatic Organisms, 2007): http://www.ncbi.nlm.nih.gov/pubmed/17718162
"Molecular evidence for association of chlamydiales bacteria with epitheliocystis in leafy seadragon (Phycodurus eques), silver perch (Bidyanus bidyanus), and barramundi (Lates calcarifer)" (Applied Environmental Microbiology, 2006): http://www.ncbi.nlm.nih.gov/pubmed/16391055?ordinalpos=1&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_Discovery_RA&linkpos=2

[12] http://www.imr.no/__data/page/4638/1.3_Helsesituasjonen_hos_laksefisk.pdf

[13] http://www.blackwell-synergy.com/doi/abs/10.1111/j.1365-2761.2006.00747.x

"epitheliocystis" for this condition. Typical findings in histology from gills are inflammation and increased numbers of surface cells; in recent years the disease has been called "proliferative gill inflammation" (PGI)…… No effective treatment has been identified for PGI. Bathing in different solutions has been tested, as well as antibiotics added to feed, but no evident effect has been demonstrated"[14].

Norwegian scientists from the University of Bergen's Department of Biology and Microbiology reported in 2008 on the "Characterization of '*Candidatus* Clavochlamydia salmonicola': an intracellular bacterium infecting salmonid fish"[15].

The authors concluded:

"While Draghi and colleagues (2004) proved that '*Candidatus* Piscichlamydia salmonis' was a causative agent of epitheliocystis in Norwegian and Irish Atlantic salmon, the study by Meijer and colleagues (2006), as well as the present study, suggests that 'the epitheliocystis agent' is not one bacterium, but rather a genetically diverse group of intracellular parasites that are only distantly related members of the order *Chlamydiales*. The pathogenic potential of these newly discovered *Chlamydiae* needs to be investigated; however, the lack of culturing methods strongly hampers such work. Presumably, these different *Chlamydiae* may inhabit quite different ecological niches, thus the appropriate way to manage PGI in the aquaculture industry could depend on which of these agents, if any, are involved in the development of disease".

The Norwegian Research Database (funded by the Research Council of Norway) refers to a "collaborative project with Marine Harvest Norway" also links PGI with Chlamydia-like organisms (CLO):

"Proliferative gill inflammation (PGI) is an important cause of losses related to mortality and reduced growth rate in seawater farmed Atlantic salmon (Salmo salar). Although reported since the 1980s, the disease appears to be increasing both in frequency and degree in later years. It is estimated that as many as 150 Norwegian sea-farms were affected in 2003 with mortality levels as high as 40%. The aetiology of PGI is apparently multifactorial and prevention is difficult due to our limited understanding of its causes.

Epithelial cell inclusions (epitheliocysts) containing chlamydia-like organisms (CLO) are frequently seen histologically in significant numbers. The disease has, therefore, often been termed epitheliocystis. Recently we isolated a new virus, Atlantic salmon paramyxovirus (ASPV), from the gills of fish with PGI. This virus has been detected in

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[14] Available to download as a PDF online via Google – in "Aquaculture Research: from cage to consumption" (Research Council of Norway, 2007) and online via: http://www.forskningsradet.no/servlet/Satellite?c=GenerellArtikkel&cid=1178533666381&pagename=havbruk%2FGenerellArtikkel%2FVis_i_dette_menypunkt_Eng

[15] "Characterization of '*Candidatus* Clavochlamydia salmonicola': an intracellular bacterium infecting salmonid fish" (Environmental Microbiology, January 2008): http://www.blackwell-synergy.com/doi/abs/10.1111/j.1462-2920.2007.01445.x

gills of diseased fish from different farms. There is, therefore, strong circumstantial evidence that CLO and ASPV are at least contributing causes of PGI"[16].

An unpublished 2007 farmed fish health status report on PGI by the Norwegian National Veterinary Institute states:

"Several fish health services have reported that proliferative gill inflammation (PGI) was a relatively significant problem in 2007, particularly so in individual farms in Hordaland, Sogn og Fjordane, Nordland, Troms and Rogaland. One site in Hordaland experienced 50% losses due to PGI in 2007. One of the largest commercial companies considers PGI to be the disease responsible for most losses in terms of both numbers of fish and biomass. It would appear that PGI appears to be spreading within some areas.

PGI is a term used to describe a condition which has been observed in sea-farmed salmon in Norway since the 1980's. It is most frequently observed in the autumn (August – December) in salmon transferred to sea in the same year. As autumn progresses the fish may develop serious gill injury in which the most common reaction is moderate to extensive thickening of the gills. Hemorrhage, necrosis and inflammation are also common observations. Epitheliocysts (colonies of the bacterium *Pischichlamydia salmonis*) are often identified within affected tissues. Liver necrosis is not uncommon in PGI affected fish.

The cause/s of PGI is/are unclear. In addition to investigation of the importance of bacteria, the contribution of a virus, *Atlantic salmon paramyxovirus*, is also under study. A condition similar to PGI, but apparently without the presence of epitheliocystis, was demonstrated in sea-run arctic char during 2007. No causal agent has been identified.

PGI is also reported from Scotland and Ireland, where considerable problems have been experienced. An initiative has been taken to coordinate international research on this condition"[17].

2006 disease data including PGI from Norwegian salmon farms is also available online (in Norwegian) from the Norwegian National Veterinary Institute[18].

A scientific paper published in 2005 in the journal Diseases of Aquatic Organisms also stated:

"Proliferative gill inflammation (PGI) causes significant losses in farmed Atlantic salmon Salmo salar L. in Norway, especially during the first months following seawater transfer.

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[16] http://dbh.nsd.uib.no/nfi/rapport/?Keys=29374&language=no

[17] "Proliferative Gill Inflammation" – a report ("soon ready for publication") provided by Atle Lillehaug (atle.lillehaug@vetinst.no) of the Norwegian National Veterinary Institute on 29th April 2008

[18] http://www.vetinst.no/nor/content/download/235/1587/file/vetinst_fiskerap07_4_web.pdf

The aetiology is apparently multifactorial, including infection with chlamydia-like bacteria and Atlantic salmon paramyxovirus (ASPV).[19]"

Intelligence gathering from scientists in Norway and Scotland:

Professor Hugh Ferguson of the Institute of Aquaculture at the University of Stirling in Scotland told The Pure Salmon Campaign on 1st May 2008:

"I am afraid that I cannot give you much in the way of detailed information about epitheliocystis in farmed salmon. Yes, we do see it here and in Ireland too (also Norway). It IS associated with significant mortalities, and I for one, have few doubts that they are causally related, although others here seem to adhere to the entrenched view, namely that they are merely incidentals. But I cannot give you numbers".

Dr Marius Karlsen of the Department of Microbiology at the University of Bergen in Norway told the Pure Salmon Campaign on 2nd May 2008:

"I do not know the exact numbers of PGI affected farms in Norway. According to the National Veterinary Institute (which you may want to ask that question) (Fiskehelserapport 2007), PGI is an increasing problem in Norway (usually in the sea). Mortality levels are usually between 0 and 20%, but higher than 40% due to PGI have also been reported later years (I have heard as high as 85% in extreme cases).

Associated with PGI is epitheliocystis. This condition is always caused by Chlamydiae, and PGI and epitheliocystis often occur together (which could indicate that the Chlamydiae are the causative agents of PGI in these cases).

Unfortunately, the agents of epitheliocystis have not been possible to culture in vitro yet, and we have therefore not been able to do controlled transmission trials with these (thus we have not proved their role in PGI).

In sea, the bacterium 'Candidatus Piscichlamydia salmonis' (Draghi et al 2004) is a very common causative agent of epitheliocystis both in Norway and Ireland. We have not found the Clavochlamydia in fish from the sea-phase yet, and we therefore think that it is less important in development of PGI in sea".

Terje Markem Steinum of the Norwegian National Veterinary Institute told the Pure Salmon Campaign on 5th May 2008:

"I have checked our register to find how many locations that got a Proliferative gill inflammation (PGI) diagnosis by our laboratory between 2003-2007.

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[19] "Atlantic salmon paramyxovirus (ASPV) infection contributes to proliferative gill inflammation (PGI) in seawater-reared Salmo salar" (Diseases of Aquatic Organisms, 2005): http://cat.inist.fr/?aModele=afficheN&cpsidt=17315803

It is difficult to say exactly how many cases per year and if there is an increasing trend, as this disease condition is not notifiable and it is voluntary for the local fish health services to send us information. It is however our impression that there is no clear increasing trend/problem. To the best of my knowledge, there is a random variation in number of affected fish farms from year to year.

This is what I have been able to find in our register regarding PGI diagnoses from our own section. Important: Incomplete information! The registered PGI cases at our 5 local laboratories are not included (it will take more time and help to acquire this information). The introduction of a new code for PGI in our register could have been made sometime during 2003 so it is possible that this search only could identify some of the PGI cases that year:

2003 - PGI at 2 locations, 2004 - PGI at 18 locations, 2005 - PGI at 6 locations, 2006 - PGI at 8 locations, 2007 - PGI at 15 locations".

Moreover:

"It is believed that respiratory diseases like PGI are complex in nature, and histopathology suggest multifactorial aetiology as two viruses also have been identified in diseased gill tissue (Atlantic salmon paramyxovirus (ASPV) and a poxvirus). We are currently also working to elucidate the role of these viruses in relation to the disease condition PGI at our section.

It is true that an initiative has been taken to coordinate international research on this condition and gill diseases in general (A Tri nation cooperation between Scotland, Ireland and Norway). Some of my colleagues will attend a Tri nation seminar in Ireland later this week. I believe it will be discussed in more detail then".

Dr Knut Falk of the Norwegian National Veterinary Institute told the Pure Salmon Campaign on 6th May 2008:

"PGI is not a notifiable disease in Norway, thus we do not have figures on the number of annual outbreaks or detection of CLO. However, PGI still seem to be major disease problem in Norwegian salmon farming industry."

Dr Falk wrote again on 6th May 2008:

"I have also heard that PGI is going to be an issue on the Tri-nation meeting, however I have no more details. However, I just looked up at the Marine Institute WEB site and found a programme for the meeting: http://www.marine.ie/home/community/events/8thTriNationSeminarOnPancreasDisease.htm"

During this Tri-Nation meeting on Pancreas Disease on 7th May 2008 there was an extra session, chaired by Dr Gordon Ritchie of Marine Harvest, on "Gill Pathologies". The

agenda stated that: “An extra session will be included to discuss the issues related to gill pathologies and interest in developing a similar Tri-Nation approach to dealing with the problem will be sought”[20].

Impacts on Human Health – a Leap in the Dark?:

A 2007 scientific paper concluded:

“This is the first molecular characterization of a chlamydia associated with epitheliocystis in Arctic charr and the fourth *Neochlamydia* spp. sequence to be associated with epitheliocystis. Presence of a clinical neochlamydial sequence, first identified from a cat, in Arctic charr suggests a possible mammalian and piscine host range for some environmental chlamydiae” [21].

Zoonotic diseases are diseases caused by infectious agents that can be transmitted between (*or are shared by*) animals and humans[22]. For example, some scientific reports link bird flue to fish farms[23] and aquarium finger (or "Fish TB" which can be fatal to humans)[24] are two examples of known interaction.

The New South Wales Department of Primary Industries in Australia has a summary of "Fish Diseases and Human Health" on their web-site listing “fish disease pathogens capable of infecting humans”[25].

Chlamydia-like organisms (CLO) such as ‘Chlamydia pneumoniae’ is a common cause of human respiratory disease/Cardiovascular Disease. Chlamydia pneumoniae was first isolated from the conjunctiva of a child in Taiwan in 1965 and was established as a major respiratory pathogen in 1983 when it was isolated from the throat of a college student at the University of Washington. Rabbits and mice are susceptible to C. pneumoniae infection and provide well-defined models of atherosclerosis. Respiratory disease in both species is characterized by multifocal interstitial pneumonia[26].

The European Bioinformatics Institute also report that:

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[20] http://www.marine.ie/home/community/events/8thTriNationSeminarOnPancreasDisease.htm

[21] “Characterization of a Neochlamydia-like bacterium associated with epitheliocystis in cultured Arctic charr Salvelinus alpinus” (Diseases of Aquatic Organisms, 2007): http://www.ncbi.nlm.nih.gov/pubmed/17718162

[22] http://www.vetmed.wisc.edu/pbs/zoonoses/

[23] “Chicken dung used to feed fish may help spread bird flu” (The Independent, 28th December 2005): http://www.independent.co.uk/environment/chicken-dung-used-to-feed-fish-may-help-spread-bird-flu-520875.html

[24] http://www.aquarticles.com/articles/management/Lawler_Tank_Safety.html

[25] http://www.dpi.nsw.gov.au/fisheries/aquaculture/publications/health/fish/fish-diseases-and-human-health

[26] “Chlamydia pneumoniae and Cardiovascular Disease” (Emerging Infectious Diseases, October/December 1998): http://www.cdc.gov/ncidod/EiD/vol4no4/campbell.htm

"Chlamydophila abortus is a cause of abortion and foetal loss in sheep, cattle and goats. Infection with strains of this microorganism has also been associated with abortion and other clinical symptoms in humans. Abortion isolates from sheep have produced abortion and mastitis in cattle, and pneumonia in pigeons, turkeys and sparrows. In addition, chlamydial isolates excreted in sheep and cattle faeces have also caused abortion in both of those ruminant species"[27].

Chlamydia-like organisms are also known to cause infections and problems in cats[28], guinea pigs[29], birds[30] and koala bears[31].

The Chlamydia-like organism (CLO) in farmed salmon has been identified variously by recent scientific papers as Candidatus Clavochlamydia salmonicola[32], Candidatus piscichlamydia salmonis[33] and Neochlamydia-like bacterium associated with epitheliocystis[34].

In terms of Atlantic salmon, the European Bioinformatics Institute has three data entries for "Candidatus Piscichlamydia salmonis"[353637].

The emerging scientific literature on various Chlamydia-like organisms in various species begs the legitimate question:

Are there any human health risks associated with Chlamydia-like organisms recently reported on Scottish and Norwegian salmon farms (either from eating raw farmed salmon sushi or from the salmon farm workers and processing plant staff handling diseased fish)?

The current state of scientific uncertainty means that we simply do not know and therefore unanswered questions remain.

Contacts:

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[27] http://www.ebi.ac.uk/2can/genomes/bacteria/Chlamydophila_abortus.html
[28] http://www.peteducation.com/article.cfm?cls=1&cat=1348&articleid=210
[29] http://www.ebi.ac.uk/2can/genomes/bacteria/Chlamydia_caviae.html
[30] http://www.petalia.com.au/templates/storytemplate_process.cfm?specie=Birds&story_no=2024
[31] http://wildlife-conservation.suite101.com/article.cfm/chlamydia_vaccine_to_help_koalas
[32] "Characterization of 'Candidatus Clavochlamydia salmonicola': an intracellular bacterium infecting salmonid fish" (Environmental Microbiology, January 2008): http://www.blackwell-synergy.com/doi/abs/10.1111/j.1462-2920.2007.01445.x
[33] "Candidatus piscichlamydia salmonis (Order chlamydiales), a chlamydia-like bacterium associated with epitheliocystis in farmed Atlantic Salmon (Salmo salar)" (Journal of Clinical Microbiology, 2004): http://cat.inist.fr/?aModele=afficheN&cpsidt=16264723
[34] "Characterization of a Neochlamydia-like bacterium associated with epitheliocystis in cultured Arctic charr Salvelinus alpinus" (Diseases of Aquatic Organisms, 2007): http://www.ncbi.nlm.nih.gov/pubmed/17718162
[35] http://srs.ebi.ac.uk/srsbin/cgi-bin/wgetz?-e+[EMBL:DQ310810]+-newId
[36] http://srs.ebi.ac.uk/srsbin/cgi-bin/wgetz?-e+[EMBL:DQ011662]+-newId
[37] http://srs.ebi.ac.uk/srsbin/cgi-bin/wgetz?-e+[EMBL:AY462243]+-newId

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Professor Salvatore Frasca Jr (Associate Professor of Pathobiology, Connecticut Veterinary Medical Diagnostic Laboratory, Department of Pathobiology and Veterinary Science, University of Connecticut): salvatore.frasca@uconn.edu (860-486-1138 and 860-486-3738) (authors of papers on farmed salmon and arctic charr: http://www.ncbi.nlm.nih.gov/pubmed/17718162 and http://www.int-res.com/abstracts/dao/v76/n1/p27-38/)

Dr Julie Bebak (US Department of Agriculture Agricultural Research Service, Aquatic Animal Health Research Laboratory): jbebak@ars.usda.gov (author of a 2007 paper on Chlamydia in farmed Arctic charr: http://www.int-res.com/abstracts/dao/v76/n1/p27-38/)

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Cecilie Myklebust (Norwegian Ministry of Fisheries and Coastal Affairs): cecilie.myklebust@fkd.dep.no and + 47 22 24 62 56 (author of: Myklebust CF, Holm JA. Epiteliocystis og proliferativ gjellebetennelse – felterfaringar. Norsk Fiskeoppdrett 2005; 30(12):58−59)

Dr Barbara Novak (School of Aquaculture, University of Tasmania): b.nowak@utas.edu.au (author of various papers on epitheliocystis in farmed Atlantic salmon: http://www.blackwell-synergy.com/doi/abs/10.1111/j.1365-2761.2006.00747.x and http://www.blackwell-synergy.com/doi/abs/10.1046/j.1365-2761.1999.00140.x)

Dr Adam Meijer (Diagnostic Laboratory for Infectious Diseases and Screening, National Institute of Public Health and the Environment , The Netherlands: adam.meijer@rivm.nl (+31 (0) 30 274 35 95) (co-author of a 2006 paper: http://www.ncbi.nlm.nih.gov/pubmed/16391055?ordinalpos=1&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_Discovery_RA&linkpos=2).

Other US scientists who could comment on Chlamydia:

2007 paper on "Characterization of a *Neochlamydia*-like bacterium associated with epitheliocystis in cultured Arctic charr *Salvelinus alpinus*" (http://www.int-res.com/abstracts/dao/v76/n1/p27-38/) authored by:

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2004 paper on "Characterization of Candidatus piscichlamydia salmonis (Order chlamydiales), a chlamydia-like bacterium associated with epitheliocystis in farmed Atlantic Salmon (Salmo salar)" (http://cat.inist.fr/?aModele=afficheN&cpsidt=16264723) authored by:

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Disease-ridden Scottish salmon farms – Opening a Can of Worms via FOI:

The Pure Salmon Campaign's 'Farmed Salmon Exposed' initiative is collating an international inventory of information allowing cross-comparisons between specific sites, companies and companies[38].

Specific information detailing companies affected by diseases during 2006 and 2007 (up to September) was also obtained by the Pure Salmon Campaign from the Scottish Government's FRS Marine Laboratory in October 2007[39]. In 2006, Epitheliocystis was only reported by the following companies: Hebridean Smolts Ltd, Rispond Estate and

[38] http://www.farmedsalmonexposed.org/global-statistics.html
[39] Information obtained from Amanda Walker at the FRS Marine Laboratory on 17th and 25th October 2007 (see Appendix)

Harris Fish Farming Co Ltd. In 2007, Epitheliocystis was only reported by the following companies: Migdale Smolts Ltd and Loch Duart Ltd (see Appendix).

In February 2008, the Scottish Government's FRS Marine Laboratory provided site specific details on 'Observations of Diseases on Scottish Fish Farms' for the first time (see Appendix)[40]. The only three salmon farm sites reporting Epitheliocystis during 2007 (up to September) were Loch Na Thull (Loch Duart Ltd), Duartmore Hatchery (Loch Duart Ltd) and Loch Merkland (Migdale Smolts Ltd). A FOI request for site specific disease data from September 2007 to February 2008 is still to be answered by the Scottish Government's FRS Marine Laboratory despite an answer being due in March.

Information obtained by the Pure Salmon Campaign via FOI reveals that Epitheliocystis was first reported by the Scottish Government's FRS Marine Laboratory on Scottish salmon farms in 1995: with cases reported in Shetland in 1998 and 2006, Highland in 2002, 2003 and 2004, the Western Isles in 2004, Orkney in 2004 and Strathclyde in 2003 and 2004[41].

Other documents obtained via FOI by the Pure Salmon Campaign in February 2008 reveal disease problems including Cardiomyopathy Syndrome, Bacterial Kidney Disease, Infectious Pancreatic Necrosis, vibrio species, Nephrocalcinosis and Moritella viscosa affecting nine other Marine Harvest and Lighthouse of Scotland sites (North Shore, Vuiabeag, Loch Harport, Camas Glas, Glencripesdale, Gousam, Ardessie B, Gorsten and Gasay Island) during 2007[42] (see Appendix).

[Fish Health inspection reports written by FRS Marine Laboratory scientists visiting Marine Harvest salmon farms during 2007 are available as PDFs]

Farming salmon at high stocking densities in open net cages is an ideal breeding ground for pathogens, bacterial and viral diseases and parasites[43]. Scottish salmon farms, like their counterparts in Norway, Chile and Canada, have been affected by a host of parasites and infectious diseases since its inception.

Disease data obtained via FOI by the Pure Salmon Campaign in 2006 from the Scottish Government reveals the extent of the disease problem on Scottish salmon farms and details specific diseases and disease agents since 1980 (over 70 in total)[44].

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[40] Information obtained from Sarah Heath at the FRS Marine Laboratory on 28th February 2008 (see Appendix)

[41] Information obtained on 21st June 2006 from Carrol Herbertson (Fish Health and Welfare Team) at the Scottish Executive (two Excel spreadsheets – available online via: http://farmedsalmonexposed.org/pdfs/ScotlandDiseases1.pdf and http://farmedsalmonexposed.org/pdfs/ScotlandDiseases2.pdf)

[42] Information obtained on 14th February 2008 from Sarah Heath at the FRS Marine Laboratory in Aberdeen (nine PDFs available upon request).

[43] "Diseases and parasites in farmed salmon" (The Pure Salmon Campaign): http://www.puresalmon.org/pdfs/diseases.pdf

[44] Information obtained on 21st June 2006 from Carrol Herbertson (Fish Health and Welfare Team) at the Scottish Executive (two Excel spreadsheets – available online via:

According to the Scottish Government data, over 70 different diseases and disease agents were reported on Scottish salmon farms between 1980 and 2006 including: Vibrio spp, Pseudomonas spp, Aeromonas *salmonicida*, Infectious Pancreatic Necrosis virus, Yersinia ruckeri, Aeromonas hydrophila, Bacterial Gill Disease, Cardiomyopathy syndrome, Diphylobothrium species, Epitheliocystis, Furunculosis, Gyrodactyloides, Hoferellus cyprini, Ichthyophthirius multifiliis, Listonella anguillarum, Moritella viscose, Nephrocalcinosis, Polycystic liver condition, Salmonid papillomatosis, Tenacibaculum maritimum and Viral haemorrhagic septicaemia virus.

The Types of Diseases and Disease Agents Present on Scottish Salmon Farms (1980-2005)

Disease/Condition	# Yrs
Aeromonas caviae	2
Aeromonas hydrophila	13
Aeromonas *salmonicida*	17
Aeromonas sobria	9
Alphavirus	1
Bacterial Gill Disease	1
BKD	5
Capriniana	5
Cardiomyopathy syndrome (CMS)	4
Chilodonella species	3
Cocci	1
Costia species	4
Cotylerus	2
Cryptocaryon irritans	0
Cryptocotyle	1
Dermocystidium species	3
Diphylobothrium species	7
Diplostomum species	3
Discocotyle species	1
Enterobacter aerogenes	1
Epitheliocystis	5
Eubothrium species	4
Exophiala	8
Fat cell necrosis	2
Flavobacterium	7
Flavobacterium columnare	1

Disease/Condition	# Yrs
Gyrodactyloides	2
Gyrodactylus derjavini	1
Gyrodactylus spp (not salaris)	5
Haemorrhagic smolt syndrome	0
Hafnia alvei	2
Hoferellus cyprinid	0
Ichthyobodo species	8
Ichthyophonus hoferi	4
Ichthyophthirius multifiliis	3
Infectious pancreatic necrosis virus (IPN)	17
Infectious salmon anaemia virus	1
Koi herpes virus	0
Listonella anguillarum	1
Loma brachialis	1
Microsporidium	1
Moritella viscose	9
Mycobacterious	1
Mycobacterium chelonae	2
Mycobacterium marinum	0
Mycobacterium sp.	1
Myxobolus cerebralis	1
Nematodes	1
Nephrocalcinosis	13
Pasteurella skyensis	0
Pasteurella species	2
Pancreas Disease (PD)	7

Disease/Condition	# Yrs
Proliferative gill syndrome	0
Proliferative kidney disease (PKD)	7
Pseudomonas spp	19
Pseudoterranova	1
Red mark syndrome	0
Renibacterium salmoninarum	10
Rhabdomyoma	2
Salmon pancreas disease virus	11
Salmonid papillomatosis	5
Saprolegnia species	3
Sea lice species	2
Serratia liquefaciens	2
Serratia sp.	1
Sleeping disease	1
SRS	3
Strawberry disease	0
Streptococcus iniae	0
Tenacibaculum maritimum	2
Trichodina species	6
Trichophyra species	4
Vibrio (Listonella) anguillarum	3
Vibrio salmonicida	3
Vibrio spp	21
Vibrio viscosis	1
Viral encephalopathy and retinopathy	0
Viral erythrocytic necrosis	4

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http://farmedsalmonexposed.org/pdfs/ScotlandDiseases1.pdf and
http://farmedsalmonexposed.org/pdfs/ScotlandDiseases2.pdf)

Flavobacterium psychrophilum (RFTS)	7
Flexibacter	3
Furunculosis	7
Glochidia	1

Photobacterium	1
Photobacterium damsela subsp. *piscicida*	1
Piscirickettsia salmonis	0
Polycystic liver condition	3

Viral haemorrhagic septicaemia virus	1
Yersinia ruckeri	12

Given the endemic disease and parasite problems on Scottish salmon farms it is not surprising that mortalities occur on a massive scale – in 2005, for example, Scottish farmed salmon producers incurred close to 8 million mortalities representing more than 6,450 tonnes of dead farmed salmon[45]. Cardiomyopathy syndrome (CMS), for example, was first reported in Scotland in 2000 (in an article in *The Independent*) where it killed 60% of a stock of 27,000 large adult salmon in a west coast sea loch over five weeks[46].

Other disease and parasite problems affecting Scottish salmon farms have been reported. Sea lice infestation from salmon farms is a well known problem as reported in 2007 and 2008 by *The Daily Telegraph*[47]. The *Herald* reported in June 2004 on how Infectious Pancreatic Necrosis (IPN) affected 70% of Scottish salmon farms[48] - including Marine Harvest's Lamlash Bay salmon farm[49]. Previously, Infectious Salmon Anaemia (ISA) decimated the Scottish salmon farming industry in that late 1990s (reported by *The Sunday Times*)[50].

Marine Harvest and Disease Problems Internationally:

Marine Harvest has disease and parasite problems everywhere they operate – not just in Scotland but also in Norway, Ireland, Chile and Canada.

[Insert here specific information from Annual and Quarterly Marine Harvest reports]

The Norwegian Research Database (funded by the Research Council of Norway) refers to a "collaborative project with Marine Harvest Norway" on the issue of Profilerative Gill Disease[51].

Marine Harvest sponsored Sea Lice 2008 in Chile which detailed problems with sea lice and chemical resistance internationally – in particular in Chile, Scotland, Canada and Norway[52].

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[45] Information obtained from SEPA via FOI in 2007 (available upon request)
[46] "Deadly heart disease is found at salmon farms"(The Independent, 2nd May 2000): http://www.findarticles.com/p/articles/mi_qn4158/is_20000502/ai_n14308415
[47] http://www.telegraph.co.uk/earth/main.jhtml?xml=/earth/2007/12/13/easalmon113.xml and http://www.telegraph.co.uk/earth/main.jhtml?xml=/earth/2008/01/04/eawigan104.xml
[48] http://www.practicalfishkeeping.co.uk/pfk/pages/item.php?news=314
[49] http://www.salmonfarmmonitor.org/pr010604.shtml
[50] http://www.rense.com/health3/salmonvirus_h.htm
[51] http://dbh.nsd.uib.no/nfi/rapport/?Keys=29374&language=no
[52] http://epi.cis.strath.ac.uk/SeaLice2008/sponsors.html

A 'Tri-Nation' Marine Harvest-sponsored seminar in November 2007 was held in Ireland on the issue of Pancreas Disease and SAV diseases – involving Norway, Scotland and Ireland[53]. In Ireland, 'gill disorders' were identified as the single largest cause of mortality on Irish salmon farms in 2005 and 2006 (Pancreas Disease is second). In Norway, Pancreas Disease (PD) has increased in incidence with over 70 salmon farms affected in 2007.

Another Tri-Nation Seminar on Pancreas Disease which is run by the Tri-Nation Initiative took place at the Marine Institute, Galway, on the 7th and 8th of May 2008. The Tri-Nation Initiative is a voluntary group consisting of personnel from the salmon farming industry, private veterinary practices, state agencies and third-level institutes from Ireland, Scotland and Norway. Representatives from England, France and the Faroe Islands have also been involved. During this meeting there was an extra session, chaired by Dr Gordon Ritchie of Marine Harvest, on "Gill Pathologies". The agenda stated that: "An extra session will be included to discuss the issues related to gill pathologies and interest in developing a similar Tri-Nation approach to dealing with the problem will be sought"[54].

Health Implications of Relocation to Larger Farms:

In 2005, the Scottish Executive's 'Aquaculture Health Joint Working Group' considered the 'health implications of relocation to larger farms'[55]. A report published in 2006 by the Scottish Executive stated that: "Larger farms contain more potential hosts and may therefore be larger reservoirs of pathogens, but if these pathogens are concentrated in one area the fraction of wild populations exposed may be reduced. The risk of disease may initially be higher on a larger farm, due to varied smolt sources, but the risk of transmission between farms is reduced by increased separation distances"[56].

Speaking in 2005, Dr Michael Foxley, vice-convener of Highland Council, warned of the risks of larger salmon farms:

"The industry is supportive [of larger farms] because that's what they've always wanted, but when they increased the size of the farms in the 1980s they got [the fish disease] furunculosis, and again in the late 1990s they had the ISA [infectious salmon anaemia] outbreak. If they expand again, they will have another disease outbreak"[57].

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[53] http://www.marine.ie/NR/rdonlyres/0C72B511-A751-447F-92AD-64EF3B188973/0/TriNationBergenDay2.pdf

[54] http://www.marine.ie/home/community/events/8thTriNationSeminarOnPancreasDisease.htm

[55] Murray (2005). Health implications of relocation to larger farms. Submission to Aquaculture Health Joint Working Group. FRS Marine Laboratory, Aberdeen: http://www.scotland.gov.uk/Publications/2006/05/02152749/17

[56] "Environmental Report for the Strategic Environmental Assessment of the Location / Relocation of Fish Farms Draft Programme Proposals: Final Draft/Consultation Report" (Scottish Executive, May 2006): http://www.scotland.gov.uk/Publications/2006/05/02152749/16

[57] "Plans for salmon 'super farms' raise new fears" (The Sunday Herald, 27th February 2005): http://www.spinwatch.org/content/view/735/9/

Impacts on Wild Fish?:

Disease-infected farmed salmon (especially escapees) have the capacity to spread diseases to wild fish. A report published in 2002 by the Scottish Executive stated that:

"The potential for bacterial and viral diseases to be transmitted from farmed fish to wild is real. Furunculosis (caused by the bacteria *Aeromonas salmonicida*) was believed to have been re-introduced to Norway *via* cultured-fish imports from Scotland in 1985 causing severe damage to both farmed and wild populations.

During and since the major outbreak of infectious salmonid anaemia (ISA) in several Scottish fish farms in 1998–1999 there have been several claims of a threat to wild populations. The presence of ISA in wild populations was confirmed in Scotland (Scottish Executive Press Release, 04/11/99) but it is not clear whether this was a consequence of the outbreak in farmed stocks nor is it clear what impact the disease had on wild populations.

Fisheries biologists have also expressed concerns about the possibility of Infectious Pancreatic Necrosis virus (IPN) transfer between farmed and wild stocks. IPN is widespread in some farming areas and it appears that it can be passed to wild stocks. However, very few samples have been analyzed from wild populations and further monitoring is required to determine the degree to which transfer is occurring and whether it has significance for wild populations."[58]

Dr David Mackay, Chairman of the Sea Trout Group, wrote to the Scottish Government's Environment Minister Mike Russell on 1st March 2008:

"We understand that there was greatly increased incidence of "Proliferative Gill Disease" (caused by a Chlamydia-like bacterium) in Scotland during the autumn and early winter of 2007. Indeed, we see nothing to indicate that the incidence of this disease has been reduced or eliminated. It appears that at least one company has lost almost 100% of the fish on one site due to PGD, and a very substantial tonnage on at least one more.

We would hope that the trend towards Norwegian stock market listing of salmon farming companies operating in Scotland will not in any way militate against good communication with the wider community of stakeholders on issues such as high mortalities due to non-notifiable disease.

While we accept that PGD is not a notifiable disease, we believe that such alarming incidence of any water-borne disease affecting salmonids gives cause for concern to the wild fish interest. We therefore believe that a new disease-reporting category should be introduced, which would not invoke such penalties as standstill notices on farms, but would mean that companies would be obliged to report all instances of significantly increased mortality to FRS, and to the relevant wild fish interests such as fishery trusts.

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[58] "Review and synthesis of the environmental impacts of aquaculture" (Scottish Executive, 2002): http://www.scotland.gov.uk/cru/kd01/green/reia-07.asp

It is only by ensuring that such widespread diseases are effectively monitored, and that information about mortalities is shared, that a better understanding of diseases such as PGD will be obtained"[59].

The Arran Voice (2nd May 2008) reported:

"The Chlamydia-like infection noted at St Molio's and other Scottish farms has prompted councillors and fisheries trusts to call for action. Chair of the Sea Trout Group Dr David MacKay has urged the Scottish Government to establish a new reporting category for PGD (proliferative gill disease) and Jane Wright of the Argyll Fisheries Trust agrees. She commented, 'If the disease has the potential to affect wild fish, it should be reported, whatever the EU rules say,' and went on, 'We know very little about the possibilities of wild fish being vectors for disease. The Government does not seem to know what effects farmed fish diseases have on wild fish populations.'"[60].

Lamlash Bay (St Molios) Salmon Farm – a history of problems:

Information obtained via FOI by the Pure Salmon Campaign from the Scottish Environment Protection Agency revealed that Marine Harvest's St Molios site in Lamlash Bay exceeded SEPA's discharge consent (i.e. the maximum allowable biomass of farmed salmon permitted on site) every month from February to June 2007 - with over 20% exceedance in April 2007[61] (SEPA will be making available July 2007 to December 2007 data in May 2008).

Monthly data reported by Marine Harvest to SEPA via the Scottish Pollutant Release Inventory included:

January 2007
- used 100,800.00 grams of SLICE (active ingredient is Emamectin benzoate)
- 1,628 kg of morts

February 2007
- exceeded SEPA's biomass limit (i.e. breached their discharge consent) by 6.95%
- used 119700.0037 grams of SLICE (active ingredient is Emamectin benzoate)
- 634 kg of morts

March 2007
- exceeded SEPA's biomass limit (i.e. breached their discharge consent) by 14.56%
- 1,455 kg of morts

April 2007

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[59] http://www.seatroutgroup.org.uk/html/news.html
[60] "Fish farm disease disclosed" (The Arran Voice, 2nd May 2008): http://www.arranvoice.com/detail.php?id=3734
[61] Information obtained via FOI by the Pure Salmon Campaign from SEPA in 2008 (available as Excel spreadsheets via CD)

- exceeded SEPA's biomass limit (i.e. breached their discharge consent) by 20.72%
- 733 kg of morts

May 2007
- exceeded SEPA's biomass limit (i.e. breached their discharge consent) by 10.37%
- 962 kg of morts

June 2007
- exceeded SEPA's biomass limit (i.e. breached their discharge consent) by 10.90%
- 589 kg of morts

In 2006, the Marine Harvest St Molios site in Lamlash Bay reported the following to SEPA[62]:

- 15,890 grams of SLICE (Emamectin benzoate) used in October 2006
- 1,111,934 kg of feed
- 56041.48 kg release of Nitrogen
- 7739.06 kg release of Phosphorus
- 179799.73 kg release of Total Organic Carbon
- 55.8291 kg release of Zinc
- 2.6234172 kg Copper loss via feed only
- 28,155 mortalities (3,542 kg) in February 2006
- ca. 50,000 mortalities during 2006

Marine Harvest, Pan Fish and Lighthouse on the Isle of Arran, Scotland:

Marine Harvest Scotland has operated a salmon farm in Lamlash Bay on the Isle of Arran since the 1980s – arguably without a proper environment impact assessment. North Ayrshire Council's planning committee reported in 2006 that it was the Lamlash Bay salmon farm that the Marine Conservation Society cited as an example of the UK's government failure to implement the Environmental Assessment Directive when it lodged a complaint in 1989 with the European Commission[63].

In 2006, Pan Fish's takeover of Marine Harvest was investigated by the UK's Competition Commission[64] - with the merger being cleared in December 2006[65]. However, the French competition authorities ruled there had to be a divestment within the UK and Lighthouse Caledonia was formed in late 2007 by the integration of the former Pan Fish Scotland, Fjord Seafood Scotland. The company also includes several farming

[62] Information obtained via FOI by the Pure Salmon Campaign from SEPA in 2007 (available as Excel spreadsheets via CD)
[63] http://www.north-ayrshire.gov.uk/ChiefExec/comRA.nsf/e9ee67f48fbb9003802569d700533758/1acc8cb814d1954b80257199002b6fb3?OpenDocument
[64] http://www.foodproductiondaily.com/news/ng.asp?id=68975-pan-fish-marine-harvest-salmon
[65] http://www.competition-commission.org.uk/inquiries/ref2006/panfish/index.htm

sites formerly operated by Marine Harvest Scotland[66]. The largest shareholder in Lighthouse Caledonia is John Fredriksen's Geveran Trading at 20% with Marine Harvest the 4th largest shareholder at 8.14%[67]. Norwegian billionaire John Fredriksen – the UK's 8th richest man[68] and 104th richest man in the world[69] - is also the largest shareholder in Marine Harvest.

The activities of Marine Harvest (Pan Fish and Lighthouse Caledonia) on the Isle of Arran in Scotland have attracted recent media attention.

The Arran Voice reported in early November 2007 (9th) that:

"Lorry loads of dead fish were seen leaving the St Molio's fish farm site near Kings Cross on Arran's eastern shore last week. Fiona Cameron, spokesperson for Pan Fish, who have recently taken operational control of the site, said, 'We will get it under control.' She admitted that a 'small batch of fish' had been affected by Proliferative Gill Disease (PGD), but the scale of the disease seems considerable. Three separate lorry trips were made on separate days to remove the fish that had suffered from the poorly-understood disease, a water-borne organism which attacks the gills of fish.

When pushed to disclose the number of fish affected by the disease, Fiona Cameron initially said that 'no number can be put on it, because it is a situation that we are still dealing with.' However, subsequent to a further enquiry, she admitted that 'the numbers are known, but that is a number that is not available.' Pan Fish continue to withhold information on the extent of the outbreak, claiming that the number of fish affected is 'commercially sensitive information.'

Early speculation suggests that the disease was imported from another site. The Pan Fish spokeswoman admitted that they had ''moved a generation of fish from a PFS [Pan Fish Scotland] Kyles of Bute site to that [Lamlash] site since we took it over, so that we had a single generation of fish at the Arran site. There was no sign of disease at that point,' she said earlier this week……..

Because the disease is in Pan Fish's own words 'still not fully understood,' there are numerous questions of science that are yet to be answered. It is not a notifiable disease according to the Fisheries Research Services - which begs the question of whether it should be. There are some concerns that it could affect the mussel farm located nearby and it is not known whether the disease could affect the water course, and hence infect the wild stock, which at this time of the year is beginning its breeding run up Arran's rivers.

The recent outbreak comes at an awkward time for Pan Fish. Having just assumed control of the site from sister company Marine Harvest, an application is presently being considered by SEPA to increase the number of fish that can be legally farmed at the St

[66] http://www.lighthousecaledonia.com/panfish.aspx
[67] http://www.lighthousecaledonia.com/largestShareholders.aspx
[68] http://www.timesonline.co.uk/richlist/person/0,,46955,00.html
[69] http://www.forbes.com/lists/2007/10/07billionaires_John-Fredriksen_5E12.html

Molios. The disease outbreak 'will not affect a recent application to increase the volume of fish stocks', says Steve Bracken, press officer for Marine Harvest"[70].

The Arran Banner (9th November 2007) also reported:

"A spokeswoman for Pan Fish, which maintains the Arran fish farm on behalf of fish farming giant Marine Harvest, confirmed that there had been a disease outbreak at the island unit and that the affected fish had been removed from the site. 'There was some loss of fish on part of the Lamlash site,' she said. However, the spokeswoman would not confirm how many fish have been affected. She added: 'PGD is not uncommon in fish farms. 'We were told on Monday that the staff had noticed some of the fish were sick. 'In three separate removals the fish were taken away, off the island, and incinerated.'

PGD is carried by water-borne parasites and can prove lethal to infected fish within a matter of days. The disease causes salmon to suffocate due to severe damage to the gill area. Symptoms include swelling and red and white mottling of the gill area, giving them a sore and raw appearance. As infection is caused by a parasite circulating in the water there are fears that the diseasecould be passed on to wild fish in the area.

Lamlash community councillor Brenda Stewart said: 'This latest problem is why we don't want another massive fish farm in Lamlash Bay. 'There are so many questions that need to be addressed mainly; will this disease be detrimental to the wild fish in the bay? 'I have strongly objected to this new fish farm all along and this latest development shows us what a danger the fish farm could be'[71]".

The Arran Voice reported on 17th November 2007:

"Since the outbreak of Proliferative Gill Disease (PGD) at the St Molio's fish farm two weeks ago, Pan Fish, which operates the site, has been working to keep the disease under control. Mortality figures are still being withheld by the company and probably won't be available until March 2008. In the meantime, Pan Fish have said they are unsure what has caused the outbreak. The farm's biomass figures (published below) have led to speculation that the disease is the result of consistent overstocking throughout this year.

In February 2006, 25,000 farmed salmon died at St Molio's, according to SEPA data. Pan Fish say the recent fish mortalities are the result of PGD. But it remains open to question whether the PGD at the St Molio's site has been caused or exacerbated by overstocking at the farm. Amanda Walker of the Fisheries Research Service (FRS), says that 'as the Pan Fish farm in question is a sea water farm another bacterium may be implicated.' She explains that 'similar if not identical' symptoms can result from other 'opportunistic bacteria' or a more 'highly pathogenic bacterium' in different conditions. 'The disease is found more often where fish are held in crowded conditions or where gill irritation or

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[70] "Fish farm disease" (The Arran Voice, 9th November 2007): http://www.arranvoice.com/detail.php?id=2268

[71] "Fish farm deaths fuel fears" (The Arran Banner, 9th November 2007): http://www.growfish.com.au/content.asp?contentid=10377

damage may be present,' she said, and added that 'other factors contributing to the occurrence include low oxygen, high turbidity and high ammonia levels.' These bacteria can occur in the natural environment, but wild fish as well as mussels can harbour them without developing any disease"[72].

A *Reuters* article – "Marine Harvest says fish disease in Scotland minor" - reported later in November 2007 (23rd) that:

"Marine Harvest, the world's biggest fish farmer, said on Friday a fish disease that had hit one of its Scottish units would have a marginal effect on harvest volumes for 2008. The company said only one of its fish farming sites in Scotland, operated by its Lighthouse Caledonia unit, has been affected by proliferative gill disease (PGD).

"The situation will have only marginal effect on the harvest volume for 2008," Marine Harvest said in a statement. It said it would have no effect on forecast 2009 volumes. It also said it had no indications that fish at other sites were affected.

Lighthouse Caledonia, which Marine Harvest plans to list as a separate company on the Oslo Axess list for smaller companies, operates 41 sites in Scotland with an annual harvest volume of around 24,000 tonnes. The disease has affected around 150 tonnes of the fish at the Arran site, the company said. Lighthouse Caledonia has said the harvest volume will increase from around 24,000 tonnes in 2007 to around 30,000 tonnes in 2009.

"Lighthouse Caledonia regards the removal (of the 150 tonnes of affected fish) as an ordinary operating action that can be expected occasionally, because PGD is caused by a water-borne organism and hits fish farms sporadically," it said".[73].

The Lighthouse Caledonia prospectus issued in December 2007 however indicated a much larger problem:

"6.3.3 Recent development

Diseases *(Extract form page 29)*
Proliferative Gill Disease (PDG)
Another site which was acquired from Fjord Seafood Scotland, located in East Loch Roag, Western Isles has been affected by PGD. The site has suffered severe mortalities, and it is anticipated that as much as 60% of the fish in this site could be lost as a result of the disease. The effect will result in a reduced harvest volume in second half of 2008 of approximately 600 tonnes.

A large volume of fish at another of Lighthouse Caledonia's sites (the Arran site) has been removed after also being affected by PGD. This will have impact on the planned harvesting volume for the second half of 2008 with approximately 1,600 tonnes"[74].

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[72] "Marine Harvest overstocking in St Molio's" (The Arran Voice, 17th November 2007)
[73] "Marine Harvest says fish disease in Scotland minor" (Reuters, 23rd November 2007): http://uk.reuters.com/article/companyOutlooksNews/idUKL2354635820071123

The Arran Voice (17th February 2008) reported that:

"Lighthouse Caledonia, the fish farm company formed recently in the break-up of Marine Harvest's Scottish operations, has posted results on the Oslo Stock Exchange that have been described as 'flagging'. The company runs Arran's existing fish farm in St Molio's, but the outbreak of disease last autumn may have caused some concern to shareholders.

Lighthouse Caledonia was formed to satisfy the French competition authorities, who deemed Marine Harvest's large share of the market to be near-monopolistic, but a breakdown of the company's structure show little has changed. According to the latest information published on 20th December 2007, the major shareholder in Lighthouse Caledonia continues to be Geveran Trading, owned by oil and shipping magnate John Fredriksen, with 27.4% of the shares. This investment firm indirectly controls the world's leading salmon farming company, Marine Harvest, which itself is the second biggest shareholder, owning 11.7%. The rest of the shares are spread across a raft of smaller investors, mostly banks, led by the Bank of New York, Brussels Branch, with 4%. All other holdings fall well below this figure. The French authorities may well feel that their objections have not been answered"[75].

In February 2008, Lighthouse Caledonia stated in their Q4 2007 financial report that: "There are no presently no biomass challenges except for PGI compromised stock at two sites"[76]. Furthermore that:

"The Lamlash site purchased from Marine Harvest and the Greinham site purchased from Fjord had high mortality due to PGI in the fourth quarter. The stock at Greinham is compromised, but remains a part of the plan and will be harvested in second half of 2008. A site on Mull proved positive on PD, but without mortalities, in the fourth quarter".

One of the "key priorities" highlighted in Lighthouse Caledonia's Q4 2007 company presentation to investors was "Controlling the PGI situation"[77].

On 4th March 2008, North Ayrshire Council's Planning Committee refused Marine Harvest's application for a second site on the Isle of Arran following 102 letters of objection including the Isle of Arran Community Council, Kenneth Gibson, MSP, North Ayrshire Councillor Anthony Gurney, the Community of Arran Seabed Trust (COAST), the Clyde Fishermen's Association, the Firth of Clyde Forum and Scottish Natural Heritage[78].

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[74] www.lighthousecaledonia.com
[75] http://www.arranvoice.com/detail.php?id=3108
[76] http://www.lighthousecaledonia.com/Uploads/pdfs/4thQuarter.pdf
[77] http://www.lighthousecaledonia.com/Uploads/pdfs/4thQuarterPres.pdf
[78] http://www.north-ayrshire.gov.uk/ChiefExec/minutes.nsf/6878f745b37e98ec802572dd0046d888/108e577b79bb4506802573fe004d9517?OpenDocument

The Arran Banner reported on 7th March 2008: "A jubilant COAST[79] spokesman said: 'We welcome this democratic decision by the councillors of North Ayrshire Council to apply the 'precautionary principle' by refusing the massive fish farm next to the no-take zone. 'We look forward to a secure future of the marine environment for future generations of islanders.'[80]".

The Arran Voice reported in April 2008 that:

"Global aquaculture company Marine Harvest will redouble efforts to develop a fish farm beside the site of Scotland's first ever Community Marine Conservation area planned for Isle of Arran's Lamlash Bay. An application for a salmon fish farm was turned down by North Ayrshire Council planners in early March this year, but Marine Harvest now say they will appeal the decision. "We feel that the expansion that we put forward was sustainable," said Ben Hadfield, seawater manager for the Norwegian-owned aquaculture company. "The company position is to progress an appeal."

Chair of the Clyde Fishermen's Association Patrick Stewart told *The Arran Voice*: "It is absolutely monstrous to think that Marine Harvest could imagine it is helping the ecology of the Clyde by putting the fish farm where they propose."

A Marine Harvest spokesman said that the company will bolster their appeal with "additional modelling" and "further consultation". The aquaculture company uses established, peer-reviewed modelling programmes to assess the likely environmental impacts of the fish farm. Marine Harvest's appeal will be referred to the Scottish Government's Inquiry Reporters Unit which will examine the grounds for refusal, in the context of the overall application. 'The Crown Estate will implement the recommendation of the Reporter,' said a spokesman for the Crown Estates Commission. The Scottish Government's Department for Environment and Rural Affairs declined to comment on the issue[81].

Appendix:

Information supplied by the Scottish Government's FRS Marine Laboratory in Aberdeen on 17th October 2007:

Positive Results 01/01/07 – 20/09/07

[79] http://www.arrancoast.co.uk/
[80] http://www.arranbanner.co.uk/news/fullstory.php/aid/937/Huge_fish_farm_rejected.html
[81] "Fish farm appeal puts Scotland's 'No Take Zone' in doubt" (The Arran Voice, 25th April 2008): http://www.arranvoice.com/detail.php?id=3657

Company	Result	Species	No of Cases
Landcatch Ltd	Furunculosis (histology)	Salmon	1
Marine Harvest (Scotland) Ltd	IPN	Salmon	5
Marine Harvest (Scotland) Ltd	BKD	Salmon	2
Marine Harvest (Scotland) Ltd	Moritella viscosa	Salmon	1
Marine Harvest (Scotland) Ltd	Cardiomyopathy syndrome	Salmon	1
Marine Harvest (Scotland) Ltd	Heart Pathology	Salmon	1
Marine Harvest (Scotland) Ltd	Skin Pathology	Salmon	2
Marine Harvest (Scotland) Ltd	Adhesions	Salmon	2
Marine Harvest (Scotland) Ltd	Vibrio species	Salmon	3
Marine Harvest (Scotland) Ltd	Salmonid Alphavirus (PCR)	Salmon	1
Scottish Sea Farms Ltd	Gill Pathology	Salmon	2
Scottish Sea Farms Ltd	IPN	Salmon	1
Scottish Sea Farms Ltd	Vibrio species	Salmon	1
Scottish Sea Farms Ltd	Adhesions	Salmon	1
Scottish Sea Farms Ltd	Skin Pathology	Salmon	1
Scottish Sea Farms Ltd	Cardiomyopathy syndrome	Salmon	1
Thule Fisheries	IPN	Salmon	1
Fjord Seafood Scotland Farming Ltd	Adhesions	Salmon	1
Fjord Seafood Scotland Farming Ltd	IPN	Salmon	1
Fjord Seafood Scotland Farming Ltd	Vibrio species	Salmon	1
Fjord Seafood Scotland Farming Ltd	Yersinia ruckeri (ERM)	Salmon	1
Pan Fish Scotland Ltd	IPN	Salmon	4
Pan Fish Scotland Ltd	Vibrio species	Salmon	2
Pan Fish Scotland Ltd	Skin Pathology	Salmon	1
Pan Fish Scotland Ltd	Cataract	Salmon	2
Pan Fish Scotland Ltd	Kidney Pathology	Salmon	2
Pan Fish Scotland Ltd	Liver Pathology	Salmon	2
Pan Fish Scotland Ltd	Muscle Pathology	Salmon	2
Pan Fish Scotland Ltd	Pancreas Pathology	Salmon	2
Pan Fish Scotland Ltd	Adhesions	Salmon	1
Pan Fish Scotland Ltd	Gill Pathology	Salmon	1

Pan Fish Scotland Ltd	Heart Pathology	Salmon	1
Pan Fish Scotland Ltd	Diphyllobothrium species	Salmon	1
Pan Fish Scotland Ltd	Nephrocalcinosis	Salmon	1
Pan Fish Scotland Ltd	Pasteurella skyensis	Salmon	1
Pan Fish Scotland Ltd	Salmonid Alphavirus (PCR)	Salmon	1
John Eccles Hatcheries	Gyrodactylus derjavini	Salmon	1
Collafirth Salmon Ltd	Gill Pathology	Cod	1
Collafirth Salmon Ltd	Aeromonas salmonicida	Cod	1
West Minch Salmon Ltd	Skin Pathology	Salmon	1
West Minch Salmon Ltd	Vibrio species	Salmon	1
West Minch Salmon Ltd	Suspect Bacterial infection	Salmon	1
Seafield Centre	Gyrodactylus derjavini	Salmon	1
Migdale Smolts Ltd	Cocci	Salmon	1
Migdale Smolts Ltd	Pseudomonas species	Salmon	1
Migdale Smolts Ltd	IPN	Salmon	1
Migdale Smolts Ltd	Saprolegnia species	Salmon	1
Migdale Smolts Ltd	Adhesions	Salmon	1
Migdale Smolts Ltd	Epitheliocystis	Salmon	1
Mainsteam Scotland Ltd	Salmonid Alphavirus	Salmon	2
Mainsteam Scotland Ltd	IPN	Salmon	1
Mainsteam Scotland Ltd	Vibrio species	Salmon	1
Mainsteam Scotland Ltd	Unidentified bacteria (histology)	Salmon	1
Westside Salmon	Gill Pathology	Salmon	1
Skelda Salmon Farms Ltd	Vibrio species	Salmon	1
Skelda Salmon Farms Ltd	IPN	Salmon	1
Skelda Salmon Farms Ltd	Suspect Bacterial infection	Salmon	2
Skelda Salmon Farms Ltd	Gill Pathology	Salmon	1
Loch Duart Ltd	Gyrodactylus derjavini	Salmon	1
Loch Duart Ltd	Epitheliocystis	Salmon	2
Loch Duart Ltd	Flavobacterium (histology)	Salmon	1
Loch Duart Ltd	Unidentified bacteria	Salmon	1
Loch Duart Ltd	Adhesions	Salmon	1
Loch Duart Ltd	Flavobacterium species	Salmon	1

Loch Duart Ltd	Aeromonas hydrophila	Salmon	1
Hjaltland Seafarms Ltd	IPN	Salmon	4
Hjaltland Seafarms Ltd	BKD	Salmon	1
Hjaltland Seafarms Ltd	Salmonid Alphavirus (PCR)	Salmon	1
Hjaltland Seafarms Ltd	Skin Pathology	Salmon	2
Hjaltland Seafarms Ltd	Nephrocalcinosis	Salmon	1
Hjaltland Seafarms Ltd	Moritella viscosa	Salmon	1
Hjaltland Seafarms Ltd	Vibrio species	Salmon	4
Hebridean Smolts Ltd	Skin Pathology	Salmon	1
Hebridean Smolts Ltd	Gill Pathology	Salmon	1

Information supplied by the Scottish Government's FRS Marine Laboratory in Aberdeen on 25th October 2007:

Results 01/01/06 – 31/12/06

Company	Result	Species	No of Cases
Murray Seafoods Ltd	Adhesions	Salmon	1
Murray Seafoods Ltd	Gill Pathology	Salmon	1
Murray Seafoods Ltd	Vibrio species	Salmon	1
Torhouse Trout Ltd	BKD	Salmon	1
Torhouse Trout Ltd	Capriniana	Salmon	3
Torhouse Trout Ltd	IPN	Salmon	1
Torhouse Trout Ltd	Dermocystidium species	Salmon	1
Torhouse Trout Ltd	Yersinia ruckeri (ERM)	Salmon	2
Torhouse Trout Ltd	Pseudomonas species	Salmon	1
Landcatch Ltd	Nephrocalcinosis	Salmon	1
Landcatch Ltd	Haemorrhagic smolt syndrome	Salmon	1
Hoganess Salmon Ltd	Suspect Bacterial infection	Salmon	1
Hoganess Salmon Ltd	Unidentified bacteria (histology)	Salmon	1
Hoganess Salmon Ltd	Vibrio species	Salmon	1
Thompson Bros Salmon Ltd	IPN	Salmon	1
Thompson Bros Salmon Ltd	Moritella viscosa	Salmon	1
Thompson Bros Salmon Ltd	Vibrio species	Salmon	1
North Uist Fisheries Ltd	Capriniana	Salmon	1
North Uist Fisheries	Yersinia ruckeri (ERM)	Salmon	1

Ltd			
Harris Fish Farming Co Ltd	Aeromonas hydrophila	Salmon	1
Harris Fish Farming Co Ltd	Capriniana	Salmon	1
Harris Fish Farming Co Ltd	Epitheliocystis	Salmon	1
Harris Fish Farming Co Ltd	IPN	Salmon	1
Harris Fish Farming Co Ltd	Salmon pancreas disease (histology)	Salmon	1
Marine Harvest (Scotland) Ltd	IPN	Salmon	5
Marine Harvest (Scotland) Ltd	Gill Pathology	Salmon	3
Marine Harvest (Scotland) Ltd	Myxosporean species	Salmon	1
Marine Harvest (Scotland) Ltd	Vibrio species	Salmon	5
Marine Harvest (Scotland) Ltd	Moritella viscosa	Salmon	1
Marine Harvest (Scotland) Ltd	Vibrio species (histology)	Salmon	4
Marine Harvest (Scotland) Ltd	Salmon pancreas disease PCR	Salmon	1
Marine Harvest (Scotland) Ltd	Adhesions	Salmon	2
Marine Harvest (Scotland) Ltd	Unidentified bacteria (histology)	Salmon	1
Marine Harvest (Scotland) Ltd	Aeromonas hydrophila	Salmon	1
Scottish Sea Farms Ltd	Gill pathology	Salmon	1
Scottish Sea Farms Ltd	IPN	Salmon	6
Scottish Sea Farms Ltd	Vibrio species	Salmon	5
Scottish Sea Farms Ltd	Adhesions	Salmon	3
Scottish Sea Farms Ltd	Suspect bacterial infection	Salmon	1
Scottish Sea Farms Ltd	Cardiomyopathy syndrome	Salmon	1
Scottish Sea Farms Ltd	Vibrio species (histology)	Salmon	1
Scottish Sea Farms Ltd	Cataract	Salmon	1
Scottish Sea Farms Ltd	Salmon pancreas disease (histology)	Salmon	2
Scottish Sea Farms Ltd	Moritella viscosa	Salmon	1
Scottish Sea Farms Ltd	Kidney pathology	Salmon	1
Scottish Sea Farms Ltd	Muscle pathology	Salmon	1
Scottish Sea Farms Ltd	Exophiala	Salmon	1

Howietoun Fishery	Gyrodactylus derjavini	Salmon	2
Howietoun Fishery	Unidentified Gyrodactylus species	Salmon	2
Fjord Seafood Scotland Farming Ltd	IPN	Salmon	1
Fjord Seafood Scotland Farming Ltd	Cardiomyopathy syndrome	Salmon	2
Fjord Seafood Scotland Farming Ltd	Gill Pathology	Salmon	1
Fjord Seafood Scotland Farming Ltd	Vibrio species	Salmon	1
Fjord Seafood Scotland Farming Ltd	Moritella viscosa	Salmon	1
Fjord Seafood Scotland Farming Ltd	Vibrio species (histology)	Salmon	1
Fjord Seafood Scotland Farming Ltd	Eubothrium species	Salmon	1
Pan Fish Scotland Ltd	IPN	Salmon	4
Pan Fish Scotland Ltd	Cataract	Salmon	2
Pan Fish Scotland Ltd	Vibrio species	Salmon	2
Pan Fish Scotland Ltd	Gill Pathology	Salmon	4
Pan Fish Scotland Ltd	Gyrodactylus derjavini	Salmon	1
Pan Fish Scotland Ltd	Adhesions	Salmon	1
Pan Fish Scotland Ltd	Ichthyobodo species	Salmon	1
Rispond Estate	Nephrocalcinosis	Salmon	1
Rispond Estate	Epitheliocystis	Salmon	1
Rispond Estate	Proliferative kidney disease (histology)	Salmon	1
Rispond Estate	Saprolegnia species	Salmon	1
John Eccles Hatcheries	Gyrodactylus derjavini	Salmon	1
John Eccles Hatcheries	Unidentified Gyrodactylus species	Salmon	1
Terregles Salmon Company Ltd	IPN	Salmon	1
Terregles Salmon Company Ltd	Gill Pathology	Salmon	1
Terregles Salmon Company Ltd	Nephrocalcinosis	Salmon	1
Westray Salmon	IPN	Salmon	1
Westray Salmon	Muscle pathology	Salmon	1
Westray Salmon	Vibrio species	Salmon	1
Seafield Centre	Gyrodactylus derjavini	Salmon	1
Mainsteam Scotland Ltd	IPN	Salmon	2
Mainsteam Scotland	Adhesions	Salmon	1

Ltd			
Mainsteam Scotland Ltd	Pancreas pathology	Salmon	1
Mainsteam Scotland Ltd	Salmon pancreas disease (histology)	Salmon	1
Mainsteam Scotland Ltd	Salmon pancreas disease PCR	Salmon	1
Mainsteam Scotland Ltd	Aeromonas salmonicida (furunculosis)	Salmon	1
Mainsteam Scotland Ltd	Furunculosis (histology)	Salmon	1
Mainsteam Scotland Ltd	Vibrio anguillarum	Salmon	1
Orkney Sea Farms Ltd	Gill Pathology	Salmon	2
Orkney Sea Farms Ltd	Adhesions	Salmon	1
Orkney Sea Farms Ltd	IPN	Salmon	1
Orkney Sea Farms Ltd	Vibrio species	Salmon	1
Skelda Salmon Farms Ltd	IPN	Salmon	1
Skelda Salmon Farms Ltd	Adhesions	Salmon	1
Loch Duart Ltd	Flavobacterium species	Salmon	1
Loch Duart Ltd	Flavobacterium psychrophila (RTFS)	Salmon	1
Loch Duart Ltd	Bacterial gill disease	Salmon	1
Lakeland Smolt Ltd	Flavobacterium species	Salmon	1
Lakeland Smolt Ltd	Gill Pathology	Salmon	1
Lakeland Unst Seawater	Adhesions	Salmon	1
Lakeland Unst Seawater	Ichthyobodo species	Salmon	1
Lakeland Unst Seawater	Gill Pathology	Salmon	1
Lakeland Unst Seawater	Nephrocalcinosis	Salmon	1
Lakeland Unst Seawater	Piscirickettsia salmonis (SRS) (PCR)	Salmon	1
Lakeland Unst Seawater	Vibrio species	Salmon	1
Lakeland Unst Seawater	Cardiomyopathy syndrome	Salmon	1
Johnson Marine Ltd	Heart pathology	Cod	1
Johnson Marine Ltd	Vibrio anguillarum	Cod	1
Hjaltland Seafarms Ltd	IPN	Salmon	3
Hjaltland Seafarms Ltd	BKD	Salmon	1

Hjaltland Seafarms Ltd	Adhesions	Salmon	1
Hebridean Smolts Ltd	Skin Pathology	Salmon	1
Hebridean Smolts Ltd	Adhesions	Salmon	1
Hebridean Smolts Ltd	Unidentified bacteria (histology)	Salmon	1
Hebridean Smolts Ltd	Flavobacterium species	Salmon	1
Hebridean Smolts Ltd	Suspect bacterial infection	Salmon	1
Hebridean Smolts Ltd	Yersinia ruckeri (ERM)	Salmon	1
Hebridean Smolts Ltd	IPN	Salmon	1
Hebridean Smolts Ltd	Epitheliocystis	Salmon	1

Information supplied by the Scottish Government's FRS Marine Laboratory in Aberdeen on 28th February 2008:

Observations of Disease on Scottish Fish Farms 1.1.7 – 20.9.7

Company	Site	Result	Species	No of Cases
Landcatch Ltd	Loch A'Chnuic Bhric (Inver)	Furunculosis (Histology)	Salmon	1
Caledonian Trout Co	Braevallich Farm	Furunculosis (Histology)	Salmon	1
Marine Harvest (Scotland) Ltd	Ardessie B	BKD	Salmon	1
Marine Harvest (Scotland) Ltd	Gorsten	BKD	Salmon	2
Marine Harvest (Scotland) Ltd	Gorsten	*Moritella viscosa*	Salmon	1
Marine Harvest (Scotland) Ltd	Ardessie B	Cardiomyopathy Syndrome	Salmon	1
Marine Harvest (Scotland) Ltd	North Shore	*Vibrio* spp.	Salmon	1
Marine Harvest (Scotland) Ltd	Camas Glas	IPN	Salmon	1
Marine Harvest (Scotland) Ltd	North Shore	IPN	Salmon	1
Marine Harvest (Scotland) Ltd	Glencripisdale	IPN	Salmon	1
Scottish Sea Farms Ltd	Brunaness	Cardiomyopathy Syndrome	Salmon	1
Lighthouse Caledonia	Gousam	IPN	Salmon	1
Lighthouse Caledonia	Gousam	Nephrocalcinosis	Salmon	1
West Minch	Treanay	*Vibrio* spp	Salmon	1

Salmon Ltd				
Migdale Smolts Ltd	Loch Merkland	*Saprolegnia* infection	Salmon	1
Migdale Smolts Ltd	Loch Merkland	Epitheliocystis	Salmon	1
Mainstream Scotland Ltd	Chalmers Hope	Pancreas Disease	Salmon	1
Mainstream Scotland Ltd	Bight of Breiwick	*Vibrio* spp	Salmon	1
Skelda Salmon Farms Ltd	Setter Voe	*Vibrio* spp	Salmon	1
Loch Duart Ltd	Loch Na Thull	Epitheliocystis	Salmon	1
Loch Duart Ltd	Duartmore Hatchery	Epitheliocystis	Salmon	1
Hjaltland Seafarms Ltd	Cole Deep	IPN	Salmon	1
Hjaltland Seafarms Ltd	Cole Deep	Nephrocalcinosis	Salmon	1
Hjaltland Seafarms Ltd	Papa	Pancreas Disease	Salmon	1
Hjaltland Seafarms Ltd	Bomlo	*Vibrio* Spp	Salmon	1

FOI request filed by the Pure Salmon Campaign to the Scottish Government's FRS Marine Laboratory in Aberdeen (Sarah Heath: S.P.Heath@marlab.ac.uk) on 7th May 2008:

Further to the information on Chlamydia released on 17th April 2008 (FOISA 2008/16 Lamlash bay) could you please provide access to the following information?:

1) all correspondence, papers, emails, photos, laboratory reports, post-mortem results, fish health inspection reports, documentation including any Tri-Nations discussions and personal notes and reports about "Gill Pathologies" held in Galway today (7th May 2008) and any other information citing Chlamydia, Chlamydia-like organisms (CLO), Proliferative Gill Disease (PGD), Bacterial Gill Disease, Gill Disorders, Gill Pathologies and Epitheliocystis since 1st October 2007.

- As background here, please note the email of 20th November 2007 by Argyll District Fishery Board raises the issue of PGD (clamidia) and the 5th December 2007 reply by FRS goes into further detail on Chlamydia. The email of 20th November 2007 stated: "A fish farm on Arran has PGD (clamidia) with the loss of four out of eight cages...This year

appears to be particularly bad for clamidia – other farmers have reported having problems with it."

The reply on 5th Deccember 2007 included:

"We were aware the fish farm on Arran has been suffering from Proliferative Gill Disease but are not aware Chlamydia is the bacterium involved. We have had an inspector on site investigating the case…..More specific information on Chlamydia has been supplied by our pathologists; Chlamydia or a Chlamydia-like organism is the causative agent of epitheliocystis a term used loosely to describe gill infection".

A FRS Marine Laboratory Histopathology Report dated 13th December 2007 stated:

"Some fish have epitheliocystis, characterized by the presence of intracytoplasmic, granular inclusions in the epithelial cell (Chlamydia like infection)".

A FRS record sheet (reviewed on 10th January 2008) listed the diagnosis as "Gill pathology, Chlamydia and parasites".

Dr David Mackay, Chairman of the Sea Trout Group, subsequently wrote to the Scottish Government's Environment Minister Mike Russell on 1st March 2008 raising the issue of "greatly increased incidence of "Proliferative Gill Disease" (caused by a Chlamydia-like bacterium) in Scotland during the autumn and early winter of 2007": http://www.seatroutgroup.org.uk/html/news.html

The Arran Voice (2nd May 2008) reported:

"The Chlamydia-like infection noted at St Molio's and other Scottish farms has prompted councillors and fisheries trusts to call for action. Chair of the Sea Trout Group Dr David MacKay has urged the Scottish Government to establish a new reporting category for PGD (proliferative gill disease) and Jane Wright of the Argyll Fisheries Trust agrees. She commented, 'If the disease has the potential to affect wild fish, it should be reported, whatever the EU rules say,' and went on, 'We know very little about the possibilities of wild fish being vectors for disease. The Government does not seem to know what effects farmed fish diseases have on wild fish populations.'": "Fish farm disease disclosed" (The Arran Voice, 2nd May 2008): http://www.arranvoice.com/detail.php?id=3734

A Tri-Nation Seminar (attended by at least two FRS scientists - Dr Sandy Murray and Dr David Bruno) on Pancreas Disease took place at the Marine Institute, Galway, on the 7th (and 8th) of May 2008. During this meeting there was an extra session, chaired by Dr Gordon Ritchie of Marine Harvest, on "Gill Pathologies". The agenda stated that: "An extra session will be included to discuss the issues related to gill pathologies and interest in developing a similar Tri-Nation approach to dealing with the problem will be sought": http://www.marine.ie/home/community/events/8thTriNationSeminarOnPancreasDisease.htm

2) Specific information including all correspondence, papers, emails, photos, laboratory reports, post-mortem results, fish health inspection reports, documentation and any other information relating to reports of Epitheliocystis during 2007 and 2008.

- As background here, please note that specific information detailing companies affected by diseases during 2006 and 2007 (up to September) was obtained previously by the Pure Salmon Campaign from the FRS Marine Laboratory in October 2007 [1]. In 2006, Epitheliocystis was reported by the following companies: Hebridean Smolts Ltd, Rispond Estate and Harris Fish Farming Co Ltd. In 2007, Epitheliocystis was reported by the following companies: Migdale Smolts Ltd and Loch Duart Ltd.

In February 2008, the FRS Marine Laboratory provided site specific details on 'Observations of Diseases on Scottish Fish Farms' for the first time [2]. The only three salmon farm sites reporting Epitheliocystis during 2007 (up to September) were Loch Na Thull (Loch Duart Ltd), Duartmore Hatchery (Loch Duart Ltd) and Loch Merkland (Migdale Smolts Ltd).

[1] Information obtained from Amanda Walker at the FRS Marine Laboratory on 17th and 25th October 2007 (see Appendix)
[2] Information obtained from Sarah Heath at the FRS Marine Laboratory on 28th February 2008 (see Appendix)

Please note that a FOI request for site specific disease data from September 2007 to February 2008 is still to be answered and may detail more cases of Epitheliocystis. Any new cases and reports of Chlamydia, Chlamydia-like organisms (CLO), Proliferative Gill Disease (PGD), Bacterial Gill Disease, Gill Disorders and Gill Pathologies would be covered as above in 1).

Please consider this an official request for information under both the relevant Freedom of Information and Environmental Information regulations.

Please provide this email electronically.

Please acknowledge receipt of this FOI request.