The Scottish Government
St. Andrew's House
Regent Road
Edinburgh
EH1 3DG

28 November 2022

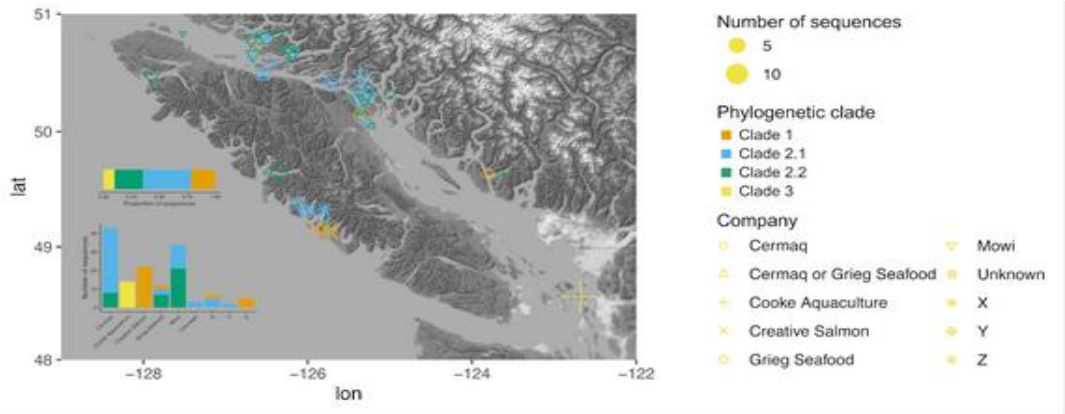
Dear Scottish Ministers,

PRV/HSMI risks to wild fish: please test salmon farms, hatcheries & processing plants!

A scientific paper published this month raises serious questions about Piscine Orthoreovirus (PRV) and Heart & Skeletal Muscle Inflammation (HSMI) in farmed salmon and the risks to wild salmon. $camon $cotland (formerly Scottish Salmon Watch) reiterates previous calls for increased testing of salmon farms - including hatcheries and processing plants - for PRV/HSMI. Science demands urgent action to protect wild fish from disease-ridden salmon farms.

Scientists in Canada collected biological samples adjacent to 56 marine net pens from five different companies and two farm salmon processing plants with 70% of samples testing positive for *Piscine orthoreovirus*-1 (PRV-1) reported the Canadian Journal of Fisheries and Aquatic Sciences (18 November 2022). This compares to Marine Scotland Science detecting PRV in 52% of farmed salmon tested in 2018/2019 - data disclosed by the Scottish Government via FOI in June 2019 revealed 399 PRV positives out of 774 farmed salmon samples.

"Consistent with previous studies, samples collected near Atlantic salmon (*Salmo salar*) farms were related to a lineage of PRV-1a commonly detected in both farmed and wild salmon in British Columbia, while a related lineage of PRV-1a was detected near Chinook salmon (*Oncorhynchus tshawytscha*) farms," reported the scientific paper: 'Detection and phylogenetic assessment of PRV-1 via sampling of biological materials released from salmon farms in British Columbia'. "Similarity in sequence within companies suggests that Atlantic salmon freshwater



hatcheries are a probable source of this virus to the marine environment, concordant with recent detections of PRV-1 within those hatcheries".

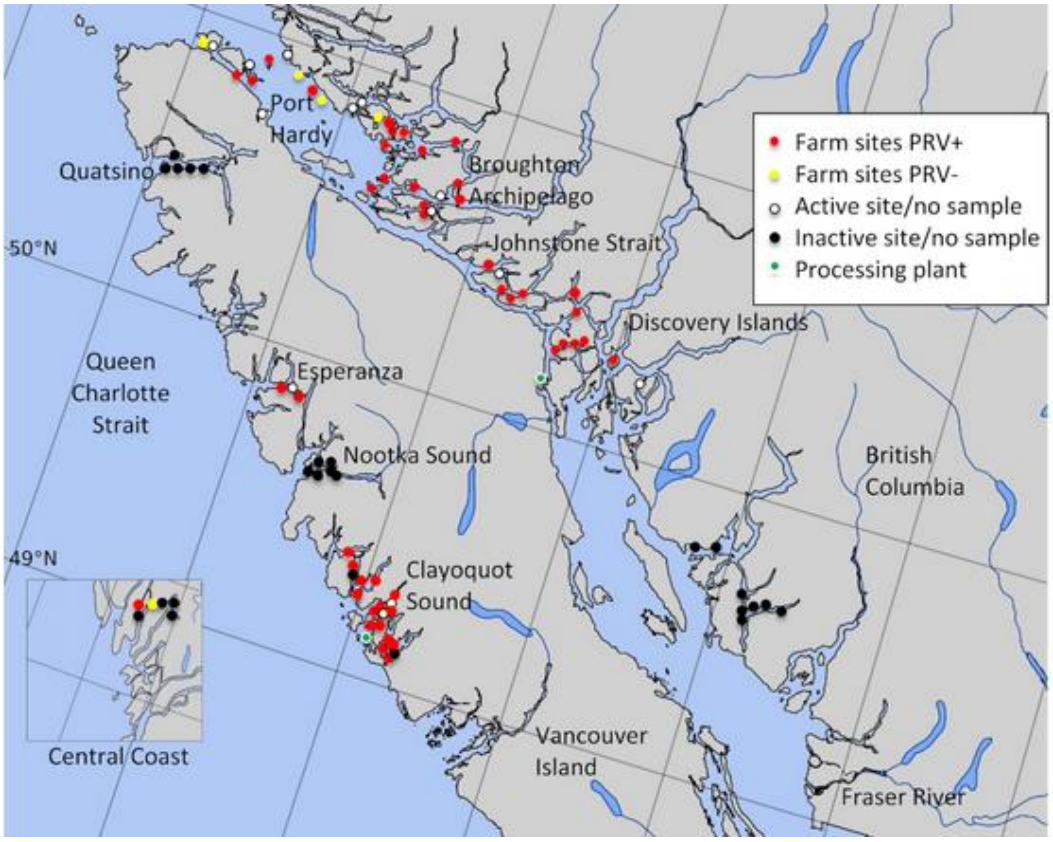
The scientific paper reported:

- *Piscine orthoreovirus* (PRV) is omnipresent in farm salmon in BC and present in wild Pacific salmon at varying levels (Morton et al. 2017; Polinski et al. 2020; Mordecai et al. 2021)

- PRV-1 is thought to be capable of spreading over long distances between infected salmon farms (Kristoffersen et al. 2013)

- In Atlantic salmon challenges carried out in Norway, all tested isolates of PRV-1 (including both PRV-1a and PRV-1b) caused inflammatory heart lesions (Wessel et al. 2020), with the most severe lesions manifested after infection by some, but not all, isolates of PRV-1b (Wessel et al. 2017, 2020)

- There is increasing evidence of PRV-1a being associated with, or being the cause of, disease (Di Cicco et al. 2017, 2018; Wessel et al. 2020)



- PRV-1 prevalence in wild Atlantic salmon is relatively higher in areas with Atlantic salmon farming activity (Vendramin et al. 2019*a*); and similarly, in BC, Canada, PRV-1a infection is common in farmed Atlantic salmon, with infection becoming almost ubiquitous over the production cycle (Bateman et al. 2021; Mordecai et al. 2021)

- Genomic sequencing of PRV-1 in farmed and wild salmon in BC has found evidence of transmission of PRV-1 between farmed and wild salmon, and the probability of PRV-1 infection is elevated in wild Pacific salmon in proximity to salmon farms (Morton et al. 2017; Mordecai et al. 2021)

- Recent studies with access to farm salmon found that certain infectious agents (including PRV-1) are detected in freshwater hatcheries, and these are likely translocated to the marine environment via transfer of fish from infected hatcheries into marine farms (Bateman et al. 2021)

- In this study, PRV-1 was detected in all types of biological samples collected adjacent to the net pens of all the various companies we tested, as well as in the effluent from salmon processing plants

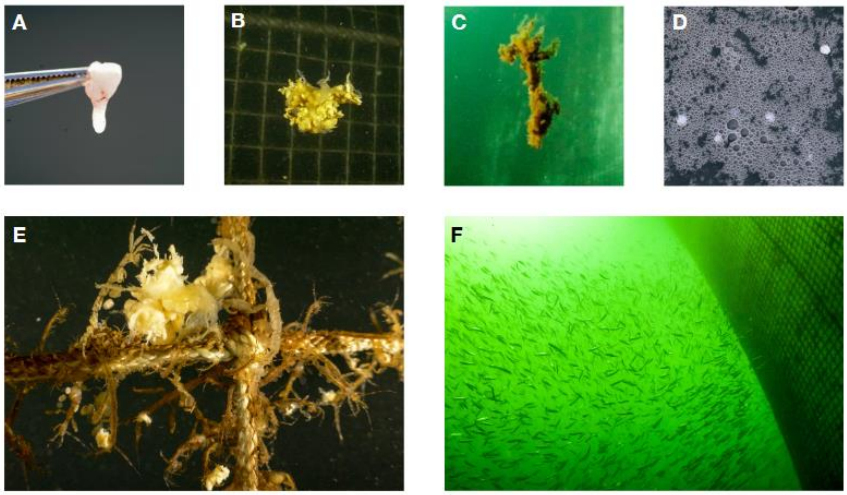


Figure S1
Representative images of the types of the biological material collected adjacent to the farms; A) Lipid-like, B) Unidentified biological material, C) Feces-like and D) Scales. E) the caprellid amphipod, (*Caprella kennerlyi*) heavily populated the nets and were observed feeding on the free-floating biological material. F) Pacific herring (*Clupea pallasii*) aggregations in the order of thousands of fish were observed feeding along the outside of the nets.

- The source of PRV in marine farmed fish remains debated, but detections of PRV-1 (as well as other infectious agents) in Atlantic salmon in freshwater hatcheries suggest that as these infected fish are transferred into marine farms, they can become a source of the virus to the marine environment (Bateman et al. 2021)

- Whether sterilization of eggs by the industry has addressed issues of PRV infection in freshwater hatcheries is an open research question which has not been addressed in the peer reviewed literature

- Although surveillance of market farm fish yielded important insights into the emergence and origin of PRV in BC (Kibenge et al. 2013), it cannot link a virus to a specific site or hatchery, especially since aquaculture companies do occasionally stock their pens with smolts purchased from different companies

- We found that PRV intensity was significantly higher in the samples of the effluent from salmon processing plants

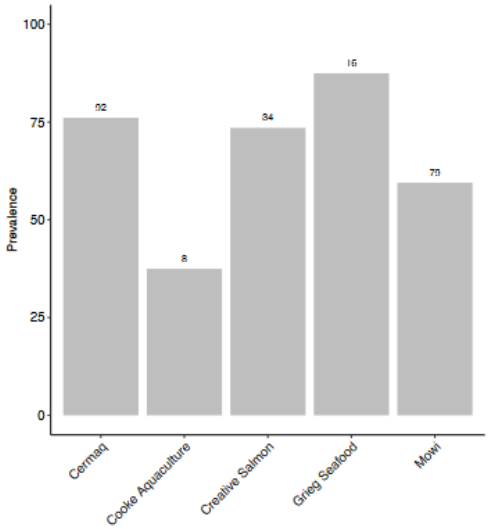
- As PRV-1 is known to infect the intestine and be shed via the feces (Hauge et al. 2016), positive detections in feces support the hypothesis that feces may serve as a route of transmission between salmon farms and the surrounding environment

- The detection of PRV-1 in a sea-lice/scale sample raises the question of whether sea-lice play a role in the transmission of PRV-1 between farmed and wild fish

- Earlier studies based on limited sequences obtained from farmed salmon purchased from markets, suggested that the virus originates from Norway (Kibenge et al. 2013). The virus's European origin has since been confirmed with extensive sequencing and phylogeographic analysis by separate groups (Siah et al. 2020; Mordecai et al. 2021)

- The majority of farmed salmon samples acquired in Western Canada markets were PRV-positive (Kibenge et al. 2013) and this has also been corroborated by more recent studies (Bateman et al. 2021; Mordecai et al. 2021). Laurin et al. (Laurin et al. 2019), which received access to government audit samples of farmed salmon (identified by region, but not site) reported that ~70% of salmon in farms throughout BC were PRV-positive. More recently, a longitudinal study of 4 Atlantic salmon cohorts, as well as an analysis of aquaculture audit samples, found that PRV infection becomes almost ubiquitous by the end of the production cycle (Bateman et al. 2021; Mordecai et al. 2021)

Figure S3 Prevalence (%) of positive detections in each company. Numbers show the total number of samples tested for each company (n).



- Detections of PRV in freshwater hatcheries suggest that the source hatchery may exert significant influence on the presence/absence of PRV in farmed salmon upon ocean entry, but it

seems that eventually, almost all fish on farms become infected regardless (Bateman et al. 2021; Mordecai et al. 2021), likely via infection from neighbouring sites stocked with different cohorts, or alternatively, from wild fish migrating past multiple farms and thus acting as carriers between farms

- In most cases, the aquaculture industry maintains geographic distance between companies, with the exception of one area in the Discovery Islands where Mowi, Cermaq, and Grieg Seafoods operated 4 farms within 7 km of the narrow Okisollo Channel, increasing the potential for transfer of pathogens between companies

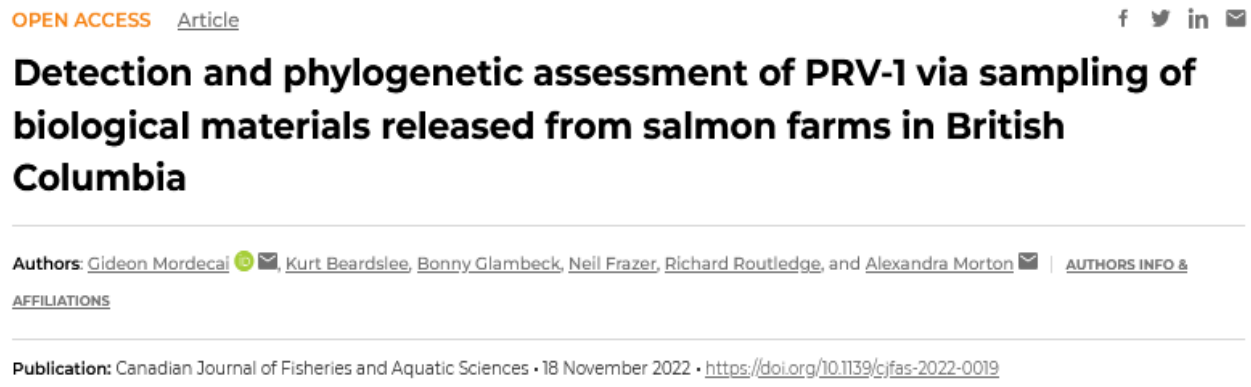
- We suggest that the direction of transmission is mainly from farmed fish to wild. This is supported by two independent studies, both of which reported that PRV-1 prevalence in wild salmon increases with exposure to salmon farms (Morton et al. 2017; Mordecai et al. 2021)

- While the impact of PRV on non-salmonid species is unknown, observations of native species consuming farmed Atlantic salmon detritus from farms where PRV has been detected in detritus provide evidence of a pathway that aquaculture-source pathogens are entering the marine food chain with undetermined consequences

- The observations of gulls swimming among farm-source detritus and eating it indicates the potential for long-distance dispersal of aquaculture pathogens on their feathers and through their digestive tract, although we note that whether the virus remains infective via this potential route of transmission needs to be assessed

- This work reaffirms that a precautionary approach to managing PRV in BC is highly warranted, especially in light of the evidence that PRV-1 is a disease agent (Di Cicco et al. 2017, 2018; Wessel et al. 2020) and is transmitted between farmed and wild salmon populations (Mordecai et al. 2021)

Scottish Ministers are encouraged to read the scientific paper in full online here


OPEN ACCESS Article

Detection and phylogenetic assessment of PRV-1 via sampling of biological materials released from salmon farms in British Columbia

Authors: Gideon Mordecai, Kurt Beardslee, Bonny Glambeck, Neil Frazer, Richard Routledge, and Alexandra Morton | AUTHORS INFO & AFFILIATIONS

Publication: Canadian Journal of Fisheries and Aquatic Sciences • 18 November 2022 • https://doi.org/10.1139/cjfas-2022-0019

The Globe & Mail reported last week (21 November 2022): "Ottawa accused of suppressing research on fish-farm virus in B.C. despite warnings it could harm wild salmon".

The weight of scientific evidence warrants urgent attention by Scottish Ministers and Marine Scotland Science. In 2017, a scientific paper published in PLOS ONE suggested that "PRV transfer is occurring from farmed Atlantic salmon to wild Pacific salmon, that infection in farmed salmon may be influencing infection rates in wild salmon, and that this may pose a risk of reduced fitness in wild salmon impacting their survival and reproduction".

The effect of exposure to farmed salmon on piscine orthoreovirus infection and fitness in wild Pacific salmon in British Columbia, Canada

Alexandra Morton, Richard Routledge, Stacey Hrushowy, Molly Kibenge, Frederick Kibenge

Published: December 13, 2017 • https://doi.org/10.1371/journal.pone.0188793

Article | Authors | Metrics | Comments | Media Coverage

Correction
Abstract
Introduction
Materials and methods
Results
Discussion
Conclusions
Supporting information
Acknowledgments
References

Reader Comments
Figures

Correction

16 Mar 2021: Morton A, Routledge R, Hrushowy S, Kibenge M, Kibenge F (2021) Correction: The effect of exposure to farmed salmon on piscine orthoreovirus infection and fitness in wild Pacific salmon in British Columbia, Canada. PLOS ONE 16(3): e0248912. https://doi.org/10.1371/journal.pone.0248912 | View correction

Abstract

The disease Heart and Skeletal Muscle Inflammation (HSMI) is causing substantial economic losses to the Norwegian salmon farming industry where the causative agent, piscine orthoreovirus (PRV), is reportedly spreading from farmed to wild Atlantic salmon (*Salmo salar*) with as yet undetermined impacts. To assess if PRV infection is epidemiologically linked between wild and farmed salmon in the eastern Pacific, wild Pacific salmon (*Oncorhynchus* sp.) from regions designated as high or low exposure to salmon farms and farmed Atlantic salmon reared in British Columbia (BC) were tested for PRV. The proportion of PRV infection in wild fish was related to exposure to salmon farms ($p = 0.0097$). PRV was detected in: 95% of farmed Atlantic salmon, 37–45% of wild salmon from regions highly exposed to salmon farms and 5% of wild salmon from the regions furthest from salmon farms. The proportion of PRV infection was also significantly lower ($p = 0.0008$) where wild salmon had been challenged by an arduous return migration into high-elevation spawning habitat. Inter-annual PRV infection declined in both wild and farmed salmon from 2012–2013 ($p \leq 0.002$). These results suggest that PRV transfer is occurring from farmed Atlantic salmon to wild Pacific salmon, that infection in farmed salmon may be influencing infection rates in wild salmon, and that this may pose a risk of reduced fitness in wild salmon impacting their survival and reproduction.

Ecojustice, which has taken legal action against the Canadian Government over PRV and the failure to protect wild fish from disease-ridden salmon farms, report on their website:

> Research shows that PRV is present in up to 80 per cent of farmed salmon. There is also mounting evidence that the highly-contagious virus could harm wild Pacific salmon. A 2018 peer-reviewed study co-authored by Department of Fisheries and Oceans (DFO) scientists found PRV can enter blood cells in Chinook salmon and ultimately cause them to burst, a condition that can result in liver and kidney damage, anemia, and even death.
>
> Furthermore, scientists have identified PRV as the most likely cause of Heart and Skeletal Muscle Inflammation (HSMI), a severe disease that affects the muscle and heart of salmon. The disease HSMI has caused widespread harm in farm fish in Norway and Scotland.

Ecojustice reported in 2014 (citing a study in 2005 which first reported HSMI in Scotland):

What is piscine reovirus (PRV)?
Piscine reovirus was discovered in 2010 and is thought to cause a severe infectious fish disease known as Heart and Skeletal Muscle Inflammation (HSMI).[1]

What is Heart and Skeletal Muscle Inflammation (HSMI)?
HSMI is an infectious disease syndrome first observed in farmed Atlantic salmon in a single fish farm in Norway in 1999. There are now 419 farms infected with HSMI in Norway.

Not all fish that develop HSMI die from the disease. Farm salmon with the disease, HSMI, are seen lying on their sides on the bottom of the net cage still alive, but too weak to move.[2] Farm fish with HSMI may recover, but wild salmon with HSMI would be extremely vulnerable to predation if found lying on their side, on the seafloor.

Piscine reovirus is contagious and appears able to transfer from farmed to wild fish

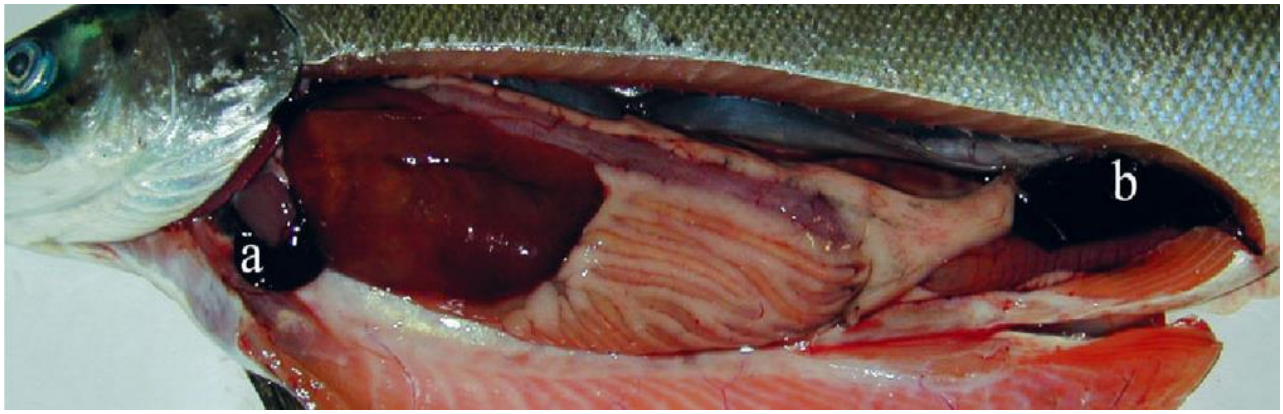
PRV has spread rapidly through Norwegian farms:

1999 – first noticed[1]
2002 – 41 farms infected[6]
2007 – 162 farms infected[6]
2010 – 419 farms infected[1]

[1] Palacios G, Lovoll M, Tengs T, Hornig M, Hutchison S, Hui J, Kongtorp RT, Savji N, Bussetti AV, Solovyov A, Kristoffersen AB, Celone C, Street C, Trifonov V, Hirschberg DL, Rabadan R, Egholm M, Rimstad E, Lipkin WI: 2010 Heart and skeletal muscle inflammation of farmed salmon is associated with infection with a novel reovirus. *PLoS One* 2010, 5:e11487. http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0011487

[6] Garseth ÅH, Fritsvold C, Opheim M, Skjerve E, Biering E. 2012. Piscine reovirus (PRV) in wild Atlantic salmon, Salmo salar L., and sea-trout, Salmo trutta L., in Norway. *Journal Fish Disease*. http://www.ncbi.nlm.nih.gov/pubmed/23167652

[2] Ferguson, H.W., Kongtorp, R.T., Taksdal, T., Graham, D., Falk, K. 2005 An outbreak of disease resembling heart and skeletal muscle inflammation in Scottish farmed salmon, *Salmo salar* L., with observation on myocardial regeneration. *Journal of Fish Disease* 28, 119-123. www.ncbi.nlm.nih.gov/pubmed/15705157



A scientific paper published in the Journal of Fish Diseases in February 2005 was the first report of HSMI in farmed salmon in Scotland – detected at an unnamed marine salmon farm "on the West of Scotland" but there is still no published data on the prevalence of PRV/HSMI on Scottish salmon farms (marine and freshwater), inside hatcheries or processing plants:

JOURNAL OF
FISH DISEASES

An outbreak of disease resembling heart and skeletal muscle inflammation in Scottish farmed salmon, *Salmo salar* L., with observations on myocardial regeneration

H W Ferguson, R T Kongtorp, T Taksdal, D Graham, K Falk

First published: 10 February 2005 | https://doi.org/10.1111/j.1365-2761.2004.00602.x | Citations: 59

The present report documents an outbreak of disease in sea-caged salmon in Scotland in which the lesions mirror those described for HSMI. If it is indeed the same as HSMI, this outbreak would represent the first time the condition has been described outside Norway.

A marine salmon farm on the west of Scotland experienced significant mortality of second year grower fish from the third week in June 2004 until the site was cleared in September. Cumulative mortality for this period approached 9% and at the height of the outbreak was escalating sharply, precipitating the decision to slaughter out. Prior to this, health status had been good and the only significant health problem had been clinical infectious pancreatic necrosis (IPN) as post-smolts during summer 2003, resulting in approximately 7% mortalities.

The Fish Site reported on PRV in June 2015 in a story sourced from Angela Ashby from the Fish Vet Group Scotland (sold in 2020 by Benchmark to Zoetis/Pharmaq Analytiq) including the suggestion that PRV is "fairly ubiquitous" in Scottish salmon farms:

Piscine Reovirus (PRV): An Underestimated Pathogen in the Scottish Salmon Industry?

WELFARE · HUSBANDRY · HEALTH

by Lucy Towers
15 June 2015, at 1:00am

In recent years, piscine reovirus has emerged as a pathogen of interest to European salmon producers. The complete spectrum of effects that this virus has on infected fish is not yet fully understood, making it difficult to ascertain the full implications to the salmon production industry. Angela Ashby from the Fish Vet Group Scotland provides a summary of what is known about this virus and the diseases it has been associated with in farmed Atlantic salmon.

Piscine Reovirus and Heart and Skeletal Muscle Inflammation

Heart and skeletal muscle inflammation (HSMI) was first described in Norway in 1999. In 2010, a newly discovered virus was identified from the hearts of HSMI affected fish. This virus, piscine reovirus (PRV) is widespread amongst Norwegian salmon farms even in the absence of clinical disease, but the viral load is significantly elevated during an HSMI outbreak. Whilst PRV is widely accepted as the causative agent of HSMI, much remains unknown about the relationship between the two.

PRV has been observed in a number of wild and farmed fish species in Canada, Chile, Norway and Scotland. Although PRV has been found in wild fish species, HSMI has so far not been recorded in wild populations.

In a survey conducted in Norway from 2007-2009, PRV was found present in 13.4% of wild Atlantic salmon, however, no HSMI-type microscopic changes were observed. It is likely that the absence of disease in many wild and farmed salmon despite PRV infection is because other factors must be present concurrently with PRV infection to result in the development of clinical HSMI.

Current Piscine Reovirus Status of Scottish Salmon

HSMI has been observed across all farming regions of Scotland, however published information regarding the occurrence of HSMI on Scottish farms is limited to a single report on a suspected outbreak in 2004 and a recent report on HSMI outbreaks in the Shetland Isles from 2005 - 2012.

In the Shetland Isles, the number of HSMI cases from 2005 - 2012 varied between zero and two annually, with resultant mortality reaching 35% during an outbreak on one site. Since testing for this virus became available, some producers have reported up to 95% of their sites consistently testing positive for PRV.

It is believed this virus is fairly ubiquitous across Scottish farms as is the case in Norway. The prevalence of PRV in wild fish populations in Scotland and Ireland remains to be elucidated.

The study on HSMI in the Shetland Isles reported in 2015 that since 2005 “we have encountered zero-four cases annually, with an average one per year” with “most cases in August”:

Situation of PD, HSMI & CMS in Shetland Isles, Scotland

David Sutherland

HSMI

- First diagnosis 2005. Since then, we have encountered zero-four cases annually, with an average one per year.
- Most cases in August, but seen in winter as well
- Some areas more susceptible than others (East> North-west)
- Time from input to diagnosis 5 – 15 months (average eight)
- Signs – lethargy, increased mortality
- Internally – no food in the gut, casts. Pale liver, some ascitic fluid, (enlarged spleen) pale, floppy heart
- Mortality <1 – 35% (but factor in two other cases)
- Outbreak lasts about two months, and surviving fish
- Both S1s & S0s affected

In April 2021, Marine Scotland Science presented Scottish data on HSMI for 2019 and 2020 to a TriNations meeting but relied upon 'limited' data published by the Scottish Salmon Producers Organisation (SSPO) that only reported HSMI on two occasions in 2020 and reported zero cases in 2019:

CMS, HSMI & PD – Scottish data 2019 & 2020

Scottish Government
Riaghaltas na h-Alba
gov.scot

Eann Munro, Valentina Romano & Stephen Ives

marinescotland
science

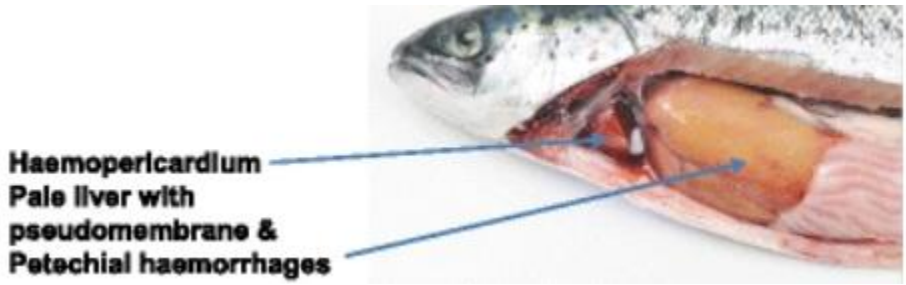
- Only 2 cases of HSMI reported via either data set used in this analysis.

SSPO monthly mortality data

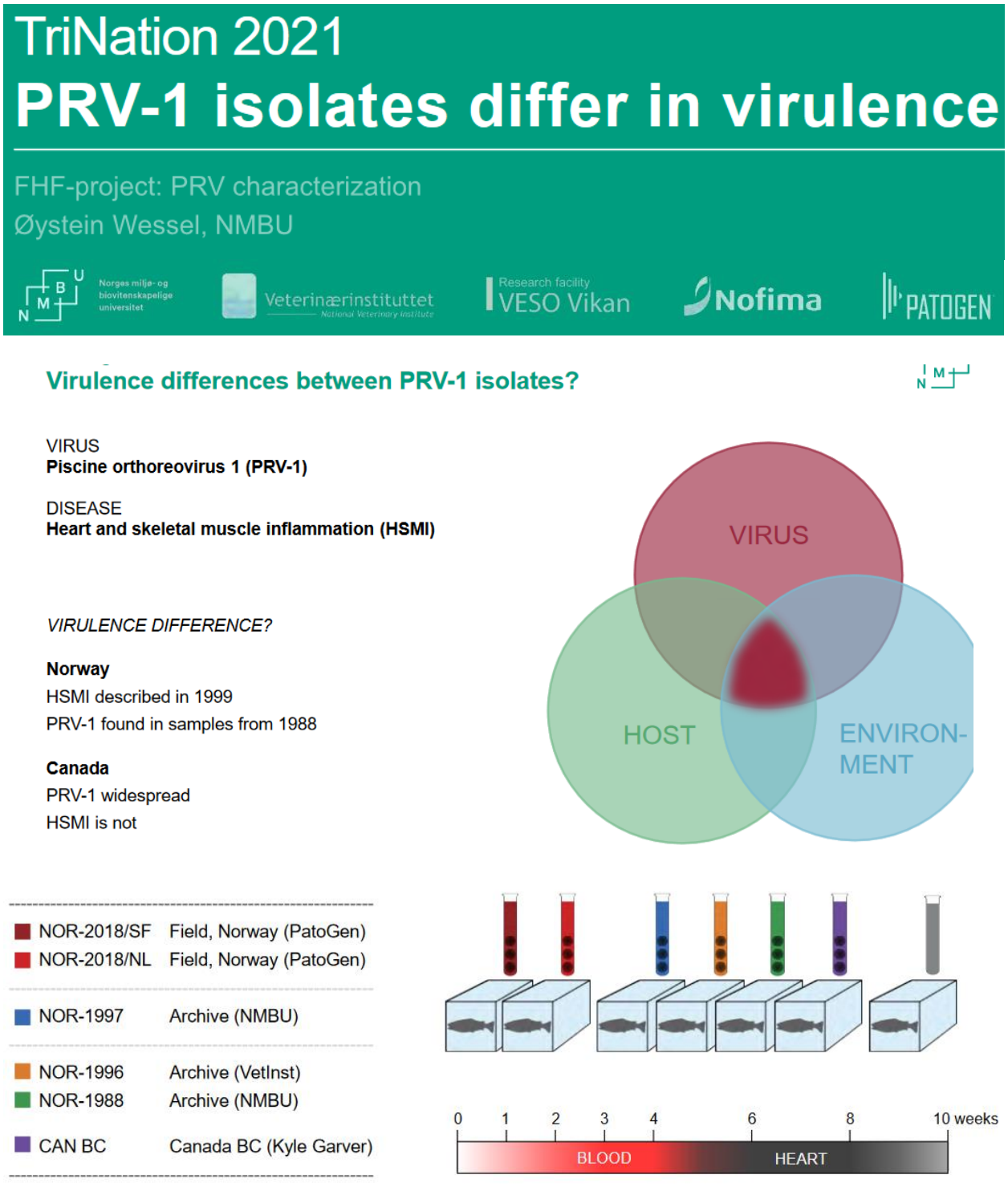
	2019			2020		
	Only	Multiple	Total	Only	Multiple	Total
CMS	24	10	34	12	26	38
HSMI	0	0	0	1	1	2
PD	8	19	27	6	15	21

CoGP for Scottish Finfish Aquaculture mortality data

	2019			2020		
	Only	Multiple	Total	Only	Multiple	Total
CMS	18	22	40	12	28	40
HSMI	0	0	0	0	2	2
PD	6	15	21	1	15	16



Another paper [presented at the April 2021 TriNation meeting] detailed differences in PRV virulence – citing Norway and Canada but not Scotland:



A scientific paper – [‘Sleeping With the Enemy? The Current Knowledge of Piscine Orthoreovirus (PRV) Immune Response Elicited to Counteract Infection’] - published in the Journal of Immunology in April 2022 from scientists in Chile cited Scotland:

Recently, with all Gen Bank available PRV sequences (May 2020) and using new PRV S1 and M2 segment sequences was determined that a significant number of the publicly available sequences belong to the PRV-1 subtype (subgenotypes Ia and Ib), less belong to the PRV-3 subtype (subgenotype IIa) and there are few sequences of PRV-2 subtype (subgenotype IIb) (15). PRV is the etiological agent of HSMI in Norway, Canada, Germany, Scotland, Iceland, and Chile. Recently, it was suggested that PRV-1 subgenotype Ib can be responsible for HSMI in Atlantic salmon (15) while the subgenotype Ia was associated with low virulence (12, 15). PRV-2 is a virus found only in Coho salmon in Japan (not associated with HSMI symptoms); while PRV-3 induces a disease similar to HSMI in rainbow trout and salmon coho in Norway, Germany and Chile (12, 15, 21, 22).

Figure 1

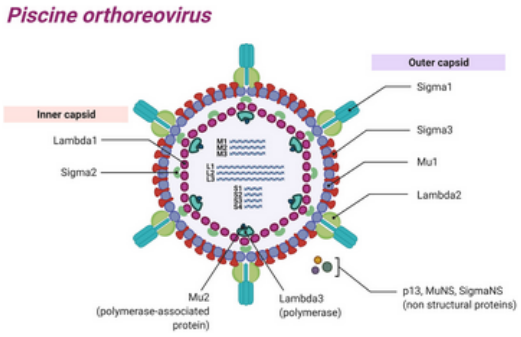
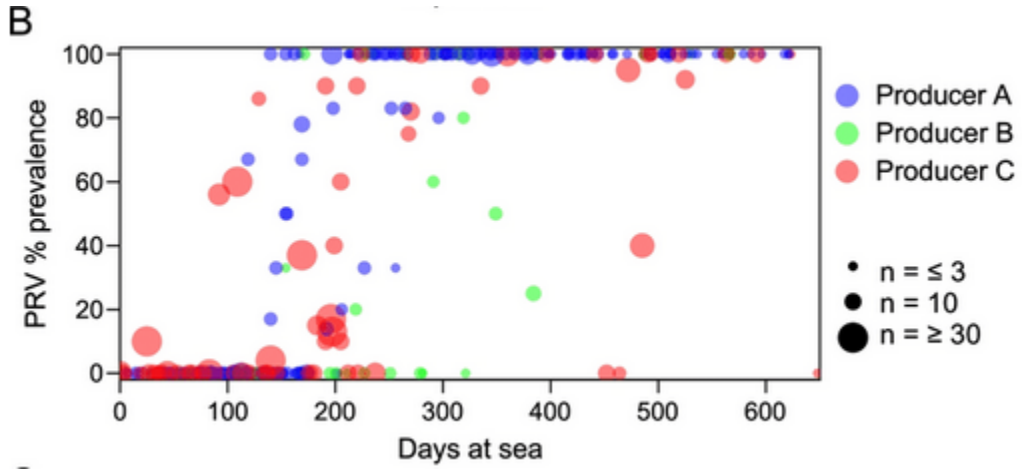


FIGURE 1 Schematic representation of Piscine orthoreovirus: Structural proteins, dsRNA segments and non-structural proteins are represented.

Whilst the Scottish Government is tight-lipped on PRV/HSMI and does not conduct routine surveillance, the Canadian Government published a scientific paper in August 2022 detailing sampling of over 2,000 farmed salmon for PRV (including identification of three salmon farming producers – albeit confidentially):

"From August 2016 to November 2019, 2,070 fish sampled at 64 Atlantic salmon net-pen farm sites during 302 sampling events from British Columbia, Canada, were screened for PRV-1 using real-time qPCR. Nearly all populations became PRV-1 positive within one year of seawater entry irrespective of location, time of stocking, or producer. Cohorts became infected between 100–300 days at sea in > 90% of repeatedly sampled sites and remained infected until harvest (typically 500–700 days at sea)."



This is not the first time the issue of PRV/HSMI has been raised with the Scottish Government. In May 2018, Scottish Salmon Watch wrote to Scottish Ministers calling for testing of salmon farms and processing plants for infectious diseases and viruses (citing the science and positive PRV tests reported in Canada).

SCOTTISH SALMON WATCH DISEASES

Cabinet Secretary for Environment, Climate Change and Land Reform
Cabinet Secretary for Rural Economy & Connectivity
The Scottish Government
St. Andrew's House
Regent Road
Edinburgh
EH1 3DG

7 May 2018

Dear Cabinet Secretaries,

Slipping Through the Net: Infectious Diseases, Viruses, Pathogens & Bacteria in Salmon Farm & Processing Plant Effluents

Further to previous correspondence (see Appendix 1), could you please explain why the Scottish Government does not test salmon farm and processing plant effluents for infectious diseases, viruses, pathogens, bacteria and contaminants?

In view of the problems plaguing Scottish salmon farming and positive tests for viruses in processing plant effluents in Canada the lack of Scottish Government testing is a serious oversight which must be corrected as a matter of urgency.

Data obtained via Freedom of Information from the Scottish Government has revealed that Scottish salmon farms during 2017 were not only riddled with lice but also disease-ridden.

Scottish Salmon Watch sincerely hopes that the Scottish Government reconsiders the lack of testing of salmon farm and processing plant effluents. An audit of Scottish salmon farms and processing plants - as is currently taking place in Canada - would surely be a sensible starting point? Please close the net on disease-ridden salmon farming.

In April 2019, Scottish Salmon Watch wrote to Scottish Ministers calling for increased surveillance and testing of PRV/HSMI in ova imports, smolts in the hatchery, sea cage farmed salmon and market-ready farmed salmon in processing plants.

SCOTTISH SALMON WATCH DISEASES

Scottish Ministers
St. Andrew's House
Regent Road
Edinburgh
EH1 3DG
scottish.ministers@gov.scot

5 April 2019

Dear Scottish Ministers,

Surveillance of Salmon Farms, Hatcheries & Ova to Minimise Disease Risks

Will Scottish Ministers commit to a program of increased testing and sampling of farmed salmon (including smolts and ova in hatcheries as well as in sea cages and processing plants) for infectious diseases, pathogens, bacteria, parasites and viruses?

In order to safeguard the health of wild fish (as well as farmed salmon), Scottish Salmon Watch challenges the Scottish Government to establish a strict surveillance regime which would test and report publicly on infectious diseases, pathogens, bacteria, parasites and viruses in the following:

a) Ova imports
b) Smolts in the hatchery prior to transfer to sea-cages
c) Harvest-ready farmed salmon immediately prior to slaughter
d) Market-ready farmed salmon in the processing plant

Scottish Salmon Watch is seriously concerned at the lack of monitoring and sampling of salmon farms, hatcheries and ova imports. The surveillance of emerging viruses and emerging diseases such as Piscine Orthoreovirus (Heart & Skeletal Muscle Inflammation), Amoebic Gill Disease and Pasteurella skyensis appears woefully inadequate and even the surveillance of more established 'Notifiable Diseases' is seriously lacking.

The letter to Scottish Ministers in April 2019 cited cases where PRV had been reported on salmon farms in Scotland – and questioned the 'haphazard' testing for PRV:

However, the sampling and testing regime for the FHI 'Case Information' reporting since 2013 appears haphazard. For example, Case # 2018-0078 (The Scottish Salmon Company's

Tarbert South site in Loch Fyne) tested five samples for PRV in addition to other diseases and viruses:

Case No:	2018-0078			Date of visit:	21/03/2018		
Site No:	FS0767			Inspector:	JET		

Results Summary	Freq	Date of Notification						
		Database	Insp	Phone	Insp	Writing	Insp	2nd Insp
MG_IHN	0/1	28/03/2018	JET	28/03/2018	JET	11/04/2018	JET	ALW
MG_IPN	0/1	28/03/2018	JET	28/03/2018	JET	11/04/2018	JET	ALW
MG_ISA	0/1	28/03/2018	JET	28/03/2018	JET	11/04/2018	JET	ALW
MG_SAV	0/1	28/03/2018	JET	28/03/2018	JET	11/04/2018	JET	ALW
MG_VHS	0/1	28/03/2018	JET	28/03/2018	JET	11/04/2018	JET	ALW
MG_PMV	0/1	06/04/2018	JET	06/04/2018	JET	11/04/2018	JET	ALW
MG_PRV	1/1	06/04/2018	JET	06/04/2018	JET	11/04/2018	JET	ALW
HIST_PRV	1/5	06/04/2018	JET	06/04/2018	JET	11/04/2018	JET	ALW
HIST_SULC	4/5	06/04/2018	JET	06/04/2018	JET	11/04/2018	JET	ALW
HIST_SKIN	4/5	06/04/2018	JET	06/04/2018	JET	11/04/2018	JET	ALW
HIST_HPAT	1/5	06/04/2018	JET	06/04/2018	JET	11/04/2018	JET	ALW
HIST_ADHE	5/5	06/04/2018	JET	06/04/2018	JET	11/04/2018	JET	ALW
HIST_PMCH	5/5	06/04/2018	JET	06/04/2018	JET	11/04/2018	JET	ALW
HIST_LPAT	4/5	06/04/2018	JET	06/04/2018	JET	11/04/2018	JET	ALW
BACT_VVIS	5/5	06/04/2018	JET	06/04/2018	JET	11/04/2018	JET	ALW
BACT_VSPE	4/5	06/04/2018	JET	06/04/2018	JET	11/04/2018	JET	ALW

The March 2019 report cited:

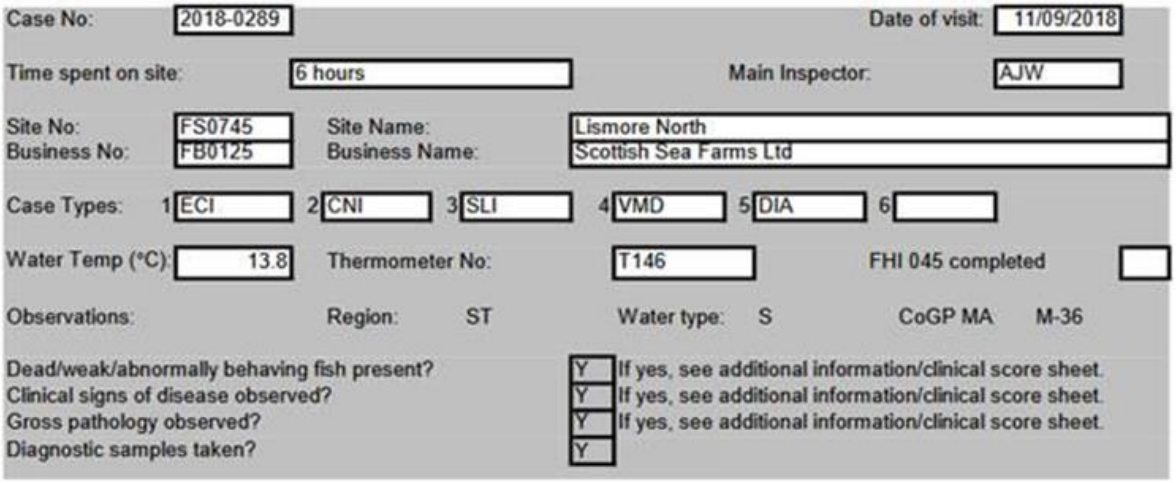
- "Haemorrhagic necrosis of skeletal muscle", "marked red skeletal muscle degeneration" and lesions on the flank including "a lesion on the ventral surface through which the heart was exposed" reported at The Scottish Salmon Company's Tarbert South site in Loch Fyne in March 2018 (positive tests reported for PRV, Moritella vicosa/Winter Ulcer disease and Vibrio).

Yet Case # 2018-0507 (Nevis C operated by Scottish Sea Farms) does not appear to have tested for PRV at all and only tested two samples for other diseases and viruses:

Site No:	FS0546	Site Name:	Nevis C (Ardintigh)
Business No:	FB0125	Business Name:	Scottish Sea Farms Ltd

Histo samples taken on 27/09/2018 by FVG. Report noted variable gill disease ranging from mild to severe, suggesting previous AGD. Heart disease of an inflammatory nature from fish from pen 1. low grade HSMI possible. PCR samples collected 10/10/2018 by FVG.

The [letter to Scottish Ministers in April 2019] cited other PRV/HSMI cases buried in the Scottish Government's 'Case Information' [published online by the Fish Health Inspectorate]:

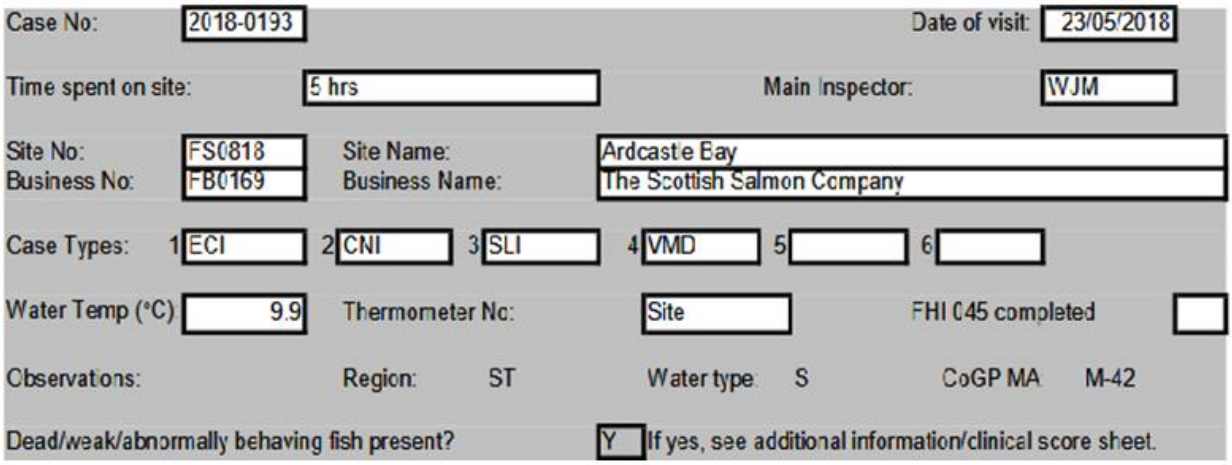


Case No:	2018-0289							Date of visit:	11/09/2018		
Time spent on site:	6 hours							Main Inspector:	AJW		
Site No:	FS0745	Site Name:	Lismore North								
Business No:	FB0125	Business Name:	Scottish Sea Farms Ltd								
Case Types:	1 ECI	2 CNI	3 SLI	4 VMD	5 DIA	6					
Water Temp (°C):	13.8	Thermometer No:	T146			FHI 045 completed					
Observations:		Region:	ST	Water type:	S		CoGP MA	M-36			
Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.									
Clinical signs of disease observed?	Y	If yes, see additional information/clinical score sheet.									
Gross pathology observed?	Y	If yes, see additional information/clinical score sheet.									
Diagnostic samples taken?	Y										

Gill scores have been high but are improving. - increase thought to be in part due to net cleaning. Currently scores are 1 or 2. vet report;AGD, Branchiomonas, Paranucleospora theridion, salmon gill pox; complex gill pathology

moritella toxaemia - report 4/9/18 Piscine reovirus (HSMI) in report 4/9/18 - CMS negative - SAV negative - IPN negative; results from MS via fish vet group.

3. Any significant results? If yes, detail (if not detailed under recent disease problems).
complex gill issues and HSMI



Case No:	2018-0193							Date of visit:	23/05/2018		
Time spent on site:	5 hrs							Main Inspector:	WJM		
Site No:	FS0818	Site Name:	Ardcastle Bay								
Business No:	FB0169	Business Name:	The Scottish Salmon Company								
Case Types:	1 ECI	2 CNI	3 SLI	4 VMD	5	6					
Water Temp (°C)	9.9	Thermometer No:	Site			FHI 045 completed					
Observations:		Region:	ST	Water type	S		CoGP MA	M-42			
Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.									

Recent veterinary reports suggest signs of pancreas disease and pcr results positive for piscine reovirus but no increase in mortalities. Fish sampled for VMD looked healthy.

3. Any significant results?	Y
If yes, detail (if not detailed under recent disease problems).	Symptoms suggestive of chronic pancreas disease. PCR positive for PRV

Case No:	2018-0219					Date of visit:	06/06/2018		
Time spent on site:	4 hours					Main Inspector:	JET		
Site No:	FS0853	Site Name:	Lochmaddy						
Business No:	FB0398	Business Name:	Loch Duart Ltd						
Case Types:	1 REP	2 DIA	3	4	5	6			
Water Temp (°C):	10	Thermometer No:	T147			FHI 045 completed			
Observations:		Region:	WI	Water type:	S	CoGP MA	W-12		
Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.							
Clinical signs of disease observed?	Y	If yes, see additional information/clinical score sheet.							
Gross pathology observed?	Y	If yes, see additional information/clinical score sheet.							
Diagnostic samples taken?	Y								

3. Any significant results?	Y	
If yes, detail (if not detailed under recent disease problems).	PD (SAV 4) confirmed on site, HSMI was also identified via histology in March 2018, but hasn't been observed since.	

Case No:	2018-0078					Date of visit:	21/03/2018		
Time spent on site:	6 hours					Main Inspector:	JET		
Site No:	FS0767	Site Name:	Tarbert South						
Business No:	FB0169	Business Name:	The Scottish Salmon Company						
Case Types:	1 ECI	2 CNI	3 SLI	4 VMD	5 DIA	6			
Water Temp (°C):	10	Thermometer No:	T147			FHI 045 completed			
Observations:		Region:	ST	Water type:	S	CoGP MA	M-42		
Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.							
Clinical signs of disease observed?	Y	If yes, see additional information/clinical score sheet.							
Gross pathology observed?	Y	If yes, see additional information/clinical score sheet.							
Diagnostic samples taken?	Y								

Fish 5 also showed marked myocarditis and red skeletal myositis resembling heart and skeletal muscle inflammation (HSMI) and the presence of the causative agent, piscine reovirus (PRV), was confirmed by real-time PCR (QPCR). Mild hepatic degeneration and necrosis also noted.

Virology: Tissue samples were tested for segments of nucleic acid indicative of the presence of the pathogens specified below using real-time PCR (QPCR).

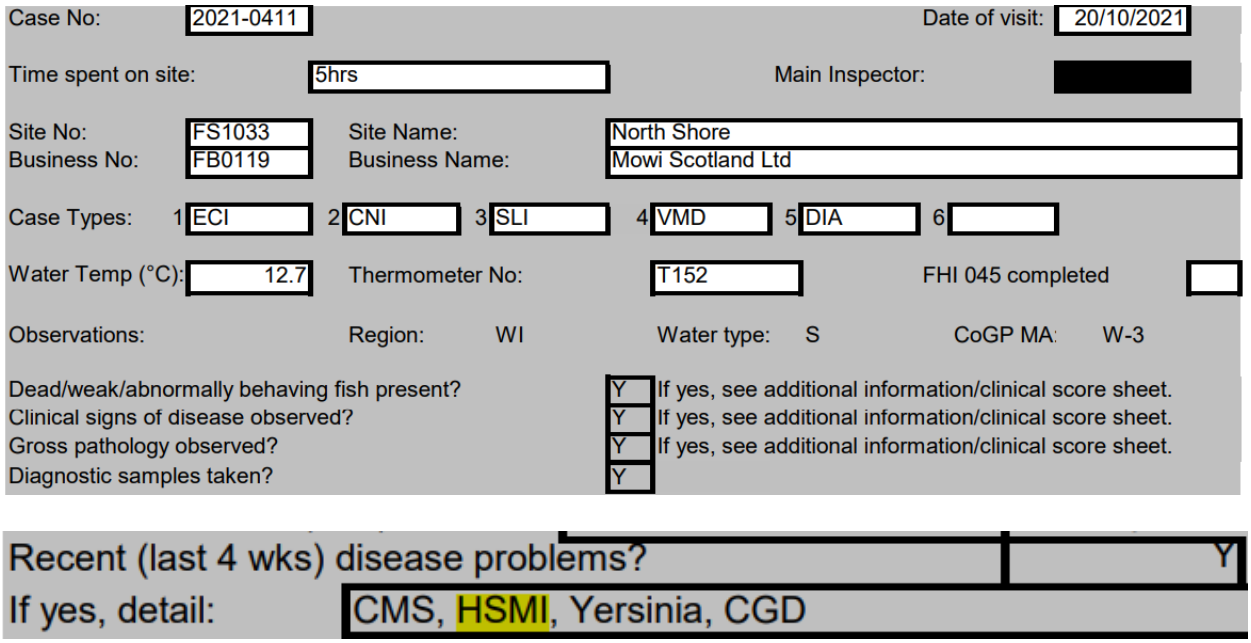
Piscine reovirus (PRV)

Pool Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
P1	18.18	26.13	25.93	26.06	Positive

Over the last week, $camon $cotland trawled through the 2022, 2021, 2020 and 2019 '[Case Information' published online by the Scottish Government's Fish Health Inspectorate] as well as ['Mortality Event Reports' published online by the Scottish Government on 1 November 2022] (which detail mass mortalities – including over 50 references to PRV/HSMI – since 2017). Here is a map of 37 PRV/HSMI positive cases reported on sea cage salmon farms across Scotland since November 2017 (Shetland and Orkney are excluded in the map below but not in the data presented below):

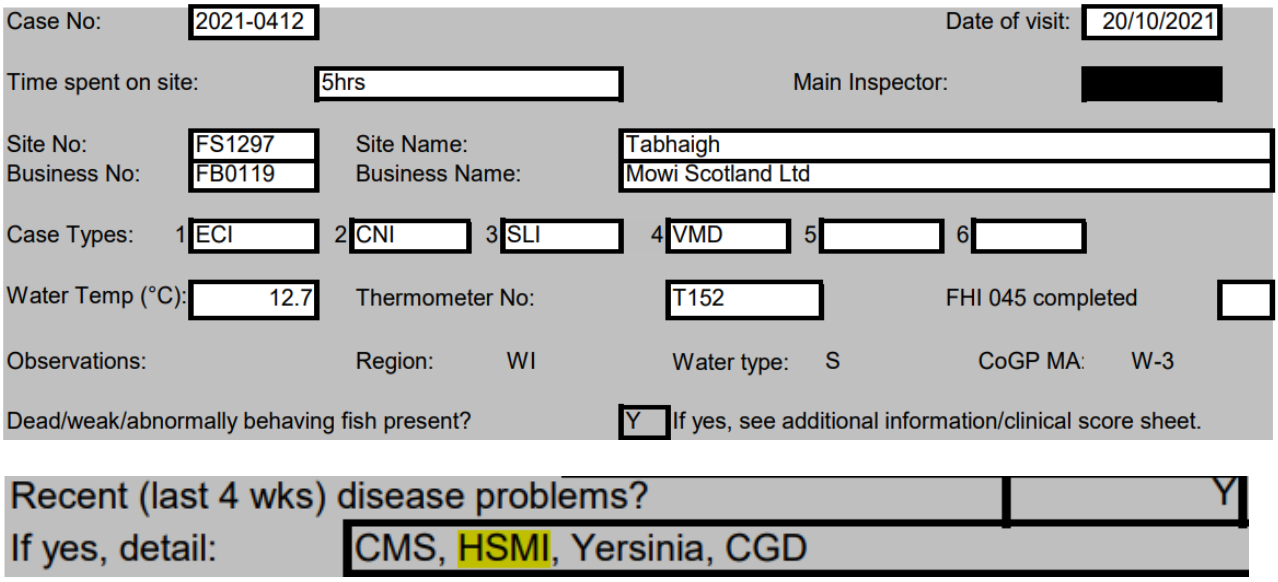
Note that many more cases of PRV/HSMI are [hidden in the Scottish Government's 'Case Information' archive for 2013 to 2017] but not all are reported here since the extraction of the information is akin to going to the dentist (i.e. the data is buried in hundreds of case reports and the process of extraction is extremely time-consuming).

The [Scottish Government's 'Case Information'] includes the following cases where PRV and/or HSMI were reported:



Case No:	2021-0411							Date of visit:	20/10/2021		
Time spent on site:	5hrs					Main Inspector:	[redacted]				
Site No:	FS1033	Site Name:	North Shore								
Business No:	FB0119	Business Name:	Mowi Scotland Ltd								
Case Types:	1 ECI	2 CNI	3 SLI	4 VMD	5 DIA	6					
Water Temp (°C):	12.7	Thermometer No:	T152			FHI 045 completed					
Observations:		Region:	WI	Water type:	S	CoGP MA:	W-3				
Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.									
Clinical signs of disease observed?	Y	If yes, see additional information/clinical score sheet.									
Gross pathology observed?	Y	If yes, see additional information/clinical score sheet.									
Diagnostic samples taken?	Y										
Recent (last 4 wks) disease problems?	Y										
If yes, detail:	CMS, HSMI, Yersinia, CGD										

[Despite HSMI being recorded, the Scottish Government did not test for PRV/HSMI]



Case No:	2021-0412							Date of visit:	20/10/2021		
Time spent on site:	5hrs					Main Inspector:	[redacted]				
Site No:	FS1297	Site Name:	Tabhaigh								
Business No:	FB0119	Business Name:	Mowi Scotland Ltd								
Case Types:	1 ECI	2 CNI	3 SLI	4 VMD	5	6					
Water Temp (°C):	12.7	Thermometer No:	T152			FHI 045 completed					
Observations:		Region:	WI	Water type:	S	CoGP MA:	W-3				
Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.									
Recent (last 4 wks) disease problems?	Y										
If yes, detail:	CMS, HSMI, Yersinia, CGD										

[Despite HSMI being recorded, the Scottish Government did not test for PRV/HSMI]

Case No:	2021-0200			Date of visit:	23/06/2021
Time spent on site:	4 hrs			Main Inspector:	[redacted]
Site No:	FS0242	Site Name:	Loch Odhairn (Gravir)		
Business No:	FB0169	Business Name:	The Scottish Salmon Company		
Case Types:	1 ECI	2 CNI	3 SLI	4 VMD	5	6
Water Temp (°C):	11.5	Thermometer No:	T148	FHI 045 completed	
Observations:		Region: WI	Water type: S	CoGP MA W-4	
Dead/weak/abnormally behaving fish present?		Y	If yes, see additional information/clinical score sheet.		
Clinical signs of disease observed?		Y	If yes, see additional information/clinical score sheet.		

PD and PRV has been detected on site, but no increased mortalities as a result.

[Despite PRV being recorded, the Scottish Government did not test for PRV/HSMI]

This [case reported by the Fish Health Inspectorate for April 2021] at the Barcaldine Hatchery operated by Scottish Sea Farms refers to "pre transfer health reports" for PRV (and other viruses) testing negative but Scottish Government inspectors did not test for PRV during their inspection:

Case No:	2021-0089			Date of visit:	27/04/2021
Time spent on site:	1 hour			Main Inspector:	[redacted]
Site No:	FS1321	Site Name:	Barcaldine Hatchery Incubation 1		
Business No:	FB0125	Business Name:	Scottish Sea Farms Ltd		

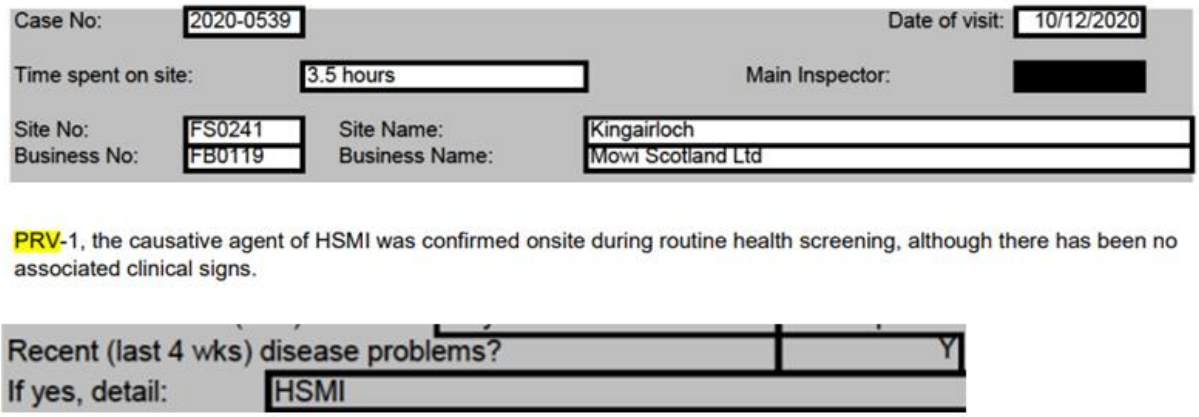
Pre transfer heath reports QPCR -IPN, PRV, PMCV and histo by Vet group - all reports since opening have been negative for viruses.

Another [case reported by the Fish Health Inspectorate for April 2021] at Shuna salmon farm operated by Scottish Sea Farms in Loch Linnhe reported PRV (detected by health surveillance carried out by, or on behalf, of Scottish Sea Farms) but again the Scottish Government did not test for PRV during their inspection:

Case No:	2021-0078			Date of visit:	28/04/2021
Time spent on site:	4 hours			Main Inspector:	[redacted]
Site No:	FS0695	Site Name:	Shuna		
Business No:	FB0125	Business Name:	Scottish Sea Farms Ltd		

Results of Surveillance	
1. Has any animal health surveillance been carried out by, or on behalf of, the business?	Y
2. If yes, are results available for inspection?	Y
3. Any significant results?	Y
If yes, detail (if not detailed under recent disease problems).	
AGD, PRV, Pox	
Records checked between:	19/10/20- 28/4/21

A case reported by the Fish Health Inspectorate for December 2020 confirmed PRV-1 (described as "the causative agent of HSMI") "during routine health screening" but Scottish Government inspectors did not take any samples during their visit (the assumption being that Mowi conducted their own testing via the Fish Vet Group, Patogen or another diagnostic company):



Case No:	2020-0539	Date of visit:	10/12/2020
Time spent on site:	3.5 hours	Main Inspector:	[redacted]
Site No:	FS0241	Site Name:	Kingairloch
Business No:	FB0119	Business Name:	Mowi Scotland Ltd

PRV-1, the causative agent of HSMI was confirmed onsite during routine health screening, although there has been no associated clinical signs.

Recent (last 4 wks) disease problems?	Y
If yes, detail:	HSMI

A Fish Health Inspectorate report for November 2020 details HSMI and PRV at The Scottish Salmon Company (renamed Bakkafrost in June 2022) at Plocrapol salmon farm:

Case No:	2020-0499						Date of visit:	17/11/2020	
Time spent on site:	4hrs						Main Inspector:	[redacted]	
Site No:	FS1256	Site Name:	Plocrapol						
Business No:	FB0169	Business Name:	The Scottish Salmon Company						
Case Types:	1 ECI	2 CNI	3 SLI	4 VMD	5 DIA	6			
Water Temp (°C):	11	Thermometer No:	Site				FHI 045 completed	Y	
Observations:		Region:	WI	Water type:	S		CoGP MA:	W-8	

Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.
Clinical signs of disease observed?	Y	If yes, see additional information/clinical score sheet.
Gross pathology observed?	Y	If yes, see additional information/clinical score sheet.
Diagnostic samples taken?	Y	

Numerous moribunds observed in almost every cage across the site. Many fish were displaying lesions, physical damage and were hanging around at the surface.

Recent (last 4 wks) disease problems?	Y
If yes, detail:	HSMI, CMS, PD

5. Evidence of recent increased/atypical mortalities?	Y
If yes, facility nos/no mortality per facility/no stock per facility/reason:	
Post-treatment losses exacerbated by CMS, HSMI and PD on site.	

Results of Surveillance

1. Has any animal health surveillance been carried out by, or on behalf of, the business?	Y
2. If yes, are results available for inspection?	Y
3. Any significant results?	Y
If yes, detail (if not detailed under recent disease problems).	CMS, PD, HSMI and gill health issues identified on

In this case, the Fish Health Inspectorate tested one pooled sample of farmed salmon for PRV and it was positive via QPCR but "histopathology results were not consistent with HSMI disease":

Histopathology examination revealed mixed pathology. All fish showed evidences of complex gill issues with mild, multifocal, necrotizing hyperplasic branchitis, presence of epitheliocystis and mild amoebic gill diseases. Fish also displayed evidences of pancreas diseases (PD) and cardiomyopathy syndrome (CMS), confirmed by positive QPCR results for the salmonid alphavirus (SAV) and the piscine myocarditis virus (PMCV). Multifocal, necrotizing hepatitis and mild peritonitis (likely associated with vaccine administration) were also noted. Positive results for the piscine reovirus (PRV), the causative agent for heart and skeletal muscle inflammation (HSMI), was also detected by QPCR. However, histopathology results were not consistent with HSMI disease.

Piscine reovirus (PRV)

Pool Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
P1	17.62	34.30	34.33	34.22	POSITIVE

Case No: 2020-0499 Date of visit: 17/11/2020

Site No: FS1256 Inspector: [redacted]

Results Summary	Freq.	Date of Notification						
		Database	Insp	Phone	Insp	Writing	Insp	2nd Insp
MG IHN	0/1	24/11/2020	[redacted]	24/11/2020	[redacted]	11/12/2020	[redacted]	[redacted]
MG IPN	0/1	24/11/2020		24/11/2020		11/12/2020		
MG ISA	0/1	24/11/2020		24/11/2020		11/12/2020		
MG VHS	0/1	24/11/2020		24/11/2020		11/12/2020		
MG SAV	1/1	24/11/2020		24/11/2020		11/12/2020		
AMGD	1/5	02/12/2020		03/12/2020		11/12/2020		
CGDH	5/5	02/12/2020		03/12/2020		11/12/2020		
EPIT	3/5	02/12/2020		03/12/2020		11/12/2020		
HPAT	3/5	02/12/2020		03/12/2020		11/12/2020		
LPAT	5/5	02/12/2020		03/12/2020		11/12/2020		
SALH	3/5	02/12/2020		03/12/2020		11/12/2020		
PMCH	5/5	02/12/2020		03/12/2020		11/12/2020		
CMPS	1/5	02/12/2020		03/12/2020		11/12/2020		
MG PMCV	1/1	01/12/2020		03/12/2020		11/12/2020		
MG PRV	1/1	01/12/2020		03/12/2020		11/12/2020		
NSIG	2/5	07/12/2020		07/12/2020				
PSFL	3/5	07/12/2020		07/12/2020		11/12/2020		

A Fish Health Inspectorate report for November 2020 cited HSMI at Mowi's Sconser Quarry salmon farm (detected via surveillance carried out by, or on behalf of, Mowi) but Scottish Government inspectors did not test for PRV/HSMI during their visit:

Case No:	2020-0462								Date of visit:	03/11/2020	
Time spent on site:	2.5 hours					Main Inspector:	[redacted]				
Site No:	FS1330	Site Name:	Sconser Quarry								
Business No:	FB0119	Business Name:	Mowi Scotland Ltd								
Case Types:	1 ECI	2 CNI	3 SLI	4 VMD	5	6					
Water Temp (°C):	11.6	Thermometer No:	Site				FHI 045 completed	Y			
Observations:		Region:	HI	Water type:	S		CoGP MA:	M-28			
Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.									

Results of Surveillance	
1. Has any animal health surveillance been carried out by, or on behalf of, the business?	Y
2. If yes, are results available for inspection?	Y
3. Any significant results?	Y
If yes, detail (if not detailed under recent disease problems).	AGD and HSMI detected, gill scores up slightly,

A Fish Health Inspectorate report for August 2020 detailed PRV at Mowi's Eilean Grianain (Carradale) salmon farm in Kilbrannan Sound – the scene of a mass escape of 48,834 farmed salmon on 20 August 2020 (escapees were caught in West coast rivers) – including 12/12 samples tested by Patogen which were positive for PRV-1:

Case No:	2020-0344			Date of visit:	28/08/2020
Time spent on site:	4 hours		Main Inspector:	[redacted]	
Site No:	FS1176	Site Name:	Eilean Grianain		
Business No:	FB0119	Business Name:	Mowi Scotland Ltd		

Recent (last 4 wks) disease problems?	Y	Any escapes (since last visit)?	Y
If yes, detail:	Complex gill patholgy and AGD (gill scores about 1-2). PRV diagnosed but no clinical signs.		

7. Have increased (unexplained) mortalities been reported to vet or FHI?	Y
If yes, detail action:	Reported to company biologist, Patogen and FVG.

3. Any significant results?	Y
If yes, detail (if not detailed under recent disease problems).	Some gill pathology. PatoGen visited on 11/08/2020 and tested for PMCV, pasteuralle syensis, Yersinia and SAV/PD, all were negative. 12/12 were positive for PRV-1.

A letter from the Scottish Government to Mowi in September 2020 explained that no samples were taken for disease analysis even though almost 50,000 farmed salmon – which may all have been infected with PRV/HSMI – escaped into the wild (there is no record of PRV/HSMI testing of wild salmon – including escapees caught in the River Leven, River Stinchar, River Doon and the River Girvan):

marinescotland science

Scottish Government
Riaghaltas na h-Alba
gov.scot

[redacted]
Mowi Scotland Ltd
Stob Ban House
Glen Nevis Business Park
Fort William
PH33 6RX
[redacted]

FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

BUSINESS NO	FB0119	**DATE OF VISIT**	28/08/2020
SITE NO	FS1176	**SITE NAME**	Eilean Grianain
INSPECTOR	[redacted]	**CASE NO**	20200344

Escape Investigation

The site was inspected following notification of an escape of 48,834 Atlantic salmon on 20th August 2020. (Marine Scotland escape incident number: MSe200820SAL1)

An enhanced containment inspection was conducted and a report will be issued separately.

All epidemiological units were inspected.

On this occasion no samples were taken for disease analysis. The Inspector did not observe any clinical signs associated with the listed diseases as described in the Aquatic Animal Health (Scotland) Regulations 2009.

Figure 1: Cage 1 the day following the incidient (21/08/2020)

A Fish Health Inspectorate report for July 2020 reported that Grieg Seafood's Gob Na Hoe salmon farm in Loch Dunvegan "tested positive for HSMI" (the health surveillance or diagnostic investigation was carried out by, or on behalf of, Grieg Seafood) but no samples were tested by the Scottish Government:

Case No:	2020-0248			Date of visit:	06/07/2020
Time spent on site:				Main Inspector:	[redacted]
Site No:	FS1287	Site Name:	Corlarach		
Business No:	FB0440	Business Name:	Grieg Seafood Shetland Ltd		

Fish at Gob Na Hoe tested positive for HSMI, although no clinical signs observed.

Any disease on site? (since last inspection)	Y
If yes, detail:	HSMI
Has any animal health surveillance or diagnostic investigations been carried out by, or on behalf of, the business?	Y
Any significant results?	Y
If yes, detail	HSMI +ve

A Fish Health Inspectorate report for September 2022 reported HSMI at Mowi's ASC-certified and RSPCA Assured salmon farm at Stulaigh (health surveillance was carried out by, or on behalf of, Mowi) but Scottish Government inspectors failed to take samples during their visit:

Case No:	2022-0418								Date of visit:	07/09/2022	
Time spent on site:	5hrs								Main Inspector:	[redacted]	
Site No:	FS1259	Site Name:	Stulaigh								
Business No:	FB0119	Business Name:	Mowi Scotland Ltd								
Case Types:	1 REP	2 DIA	3		4		5		6		
Water Temp (°C):	13.9	Thermometer No:	T152				FHI 045 completed				
Observations:		Region:	WI		Water type:	S		CoGP MA:	W-20		

Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.
Clinical signs of disease observed?	Y	If yes, see additional information/clinical score sheet.
Gross pathology observed?	Y	If yes, see additional information/clinical score sheet.
Diagnostic samples taken?	Y	

In addition to poor gill health, PD, CMS and HSMI have also been detected in the stocks but are currently not contributing to the mortalities on site. Poor gill health has been reported as the primary cause for mortality on the site.

Results of Surveillance	
1. Has any animal health surveillance been carried out by, or on behalf of, the business?	Y
2. If yes, are results available for inspection?	Y
3. Any significant results?	Y
If yes, detail (if not detailed under recent disease problems).	PD, CMS, HSMI, AGD and SGPV

The Fish Health Inspectorate report (which included photos despite efforts by Mowi to block publication) detailed tests for a host of diseases and viruses but not PRV/HSMI:

Case No:	2022-0418			Date of visit:	07/09/2022		
Site No:	FS1259			Inspector:	[redacted]		

Results Summary	Freq.	Date of Notification						
		Database	Insp	Phone	Insp	Writing	Insp	2nd Insp
MG_SAV	1/5	13/09/2022	[redacted]	13/09/2022	[redacted]	13/09/2022	[redacted]	[redacted]
MG_ISA	0/5	13/09/2022	[redacted]	13/09/2022	[redacted]	13/09/2022	[redacted]	[redacted]
MG_VHS	0/5	13/09/2022	[redacted]	13/09/2022	[redacted]	13/09/2022	[redacted]	[redacted]
MG_PARA_THER_Q	5/5	13/09/2022	[redacted]	13/09/2022	[redacted]	13/09/2022	[redacted]	[redacted]
MG_SAL_POX	5/5	13/09/2022	[redacted]	13/09/2022	[redacted]	13/09/2022	[redacted]	[redacted]
MG_AGDQ	5/5	13/09/2022	[redacted]	13/09/2022	[redacted]	13/09/2022	[redacted]	[redacted]
MG_PMCV	3/5	13/09/2022	[redacted]	13/09/2022	[redacted]	13/09/2022	[redacted]	[redacted]
VSPE	5/5	28/09/2022	[redacted]	28/09/2022	[redacted]	28/09/2022	[redacted]	[redacted]
AMGD	3/5	28/09/2022	[redacted]	28/09/2022	[redacted]	28/09/2022	[redacted]	[redacted]
EPIT	2/5	28/09/2022	[redacted]	28/09/2022	[redacted]	28/09/2022	[redacted]	[redacted]
CGDH	4/5	28/09/2022	[redacted]	28/09/2022	[redacted]	28/09/2022	[redacted]	[redacted]
GPAT	4/5	28/09/2022	[redacted]	28/09/2022	[redacted]	28/09/2022	[redacted]	[redacted]
HPAT	5/5	28/09/2022	[redacted]	28/09/2022	[redacted]	28/09/2022	[redacted]	[redacted]
LPAT	4/5	28/09/2022	[redacted]	28/09/2022	[redacted]	28/09/2022	[redacted]	[redacted]
CMPS	4/5	28/09/2022	[redacted]	28/09/2022	[redacted]	28/09/2022	[redacted]	[redacted]
MG_IHNQ	0/5	28/09/2022	[redacted]	28/09/2022	[redacted]	28/09/2022	[redacted]	[redacted]
MG_IPN	0/5	28/09/2022	[redacted]	28/09/2022	[redacted]	28/09/2022	[redacted]	[redacted]

A [Fish Health Inspectorate report for September 2019] cited PRV at Grieg Seafood's Cole Deep salmon farm in Shetland:

Case No:	2019-0558					Date of visit:	30/09/2019	
Time spent on site:	5 hours				Main Inspector:	[redacted]		
Site No:	FS0489	Site Name:	Cole Deep					
Business No:	FB0440	Business Name:	Grieg Seafood Shetland Ltd					
Case Types:	1 REP	2 DIA	3 VMD	4	5	6		
Water Temp (°C):	11.8	Thermometer No:	T274			FHI 045 completed		
Observations:		Region:	SH	Water type:	S	CoGP MA	S-8b	
Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.						
Clinical signs of disease observed?	Y	If yes, see additional information/clinical score sheet.						
Gross pathology observed?	Y	If yes, see additional information/clinical score sheet.						
Diagnostic samples taken?	Y							

Additional Case Information:

Site inspected following notification from operator of increased mortality levels. Mortality levels began to increase in cage 11 at the end of August. Cage 7 has been worst affected cage, losing 23,992 fish from 2-30/9/19 (46%). Total loss on site from 2-30/9/19 has been 100,423 (18%). Three cages (2, 5 and 12) seem to be unaffected with mortality levels low over September (only 0.43% in cage 12). Mortality levels decreased slightly last week.

There was a chaetoceros bloom at the start of August which affected all three sites in the area (Olna South and East of Papa Little). Oxygen has been lower at night. No increase in mortalities at Papa Little and small increase at Olna South last week (see case 2019-0568 for details). Aeration system active at Cole Deep and Olna South (15m depth).

All cages treated with freshwater for lice in July and all (except 1, 8, 9 and 12) treated at start of September. Using Ronja Polaris for treatments. Fish transferred on board and held in freshwater for 10-12 hours. Two cages will be treated before freshwater is discharged (collecting freshwater from tarpaulins near Olna).

Slice used on site for lice. Planning Salmosan/peroxide treatment in tarpaulins for site later this week.

Samples taken last week showed significant mixed gill pathology, probably post acute response to direct waterborne irritant (likely environmental, possibly harmful algae). There was also evidence of AGD, Branchiomonas colonies and suspicion of Desmozoon lepeophtherii . Have had positive PCR samples for PRV.

Due to start harvesting here once completed at Olna South, but company currently discussing whether to bring harvest forward and use the Norwegian Gannet which will allow them to harvest 5-6 cages in one load.

On site, not many moribund fish visible, but 5 removed for further examination and sampling from cages 7, 10 and 11. Also removed one feeding fish from cage 12 (no increased mortalities in this cage) for VMD samples and included in diagnostic sample for comparison.

Despite reference to "positive PCR samples for PRV", Scottish Government inspectors [failed to test for PRV/HSMI]:

Case No:	2019-0558	Date of visit:	30/09/2019
Site No:	FS0489	Inspector:	[redacted]

Results Summary	Freq.	Date of Notification						
		Database	Insp	Phone	Insp	Writing	Insp	2nd Insp
ISA PCR	0/1	04/10/2019	[redacted]	04/10/2019	[redacted]	12/11/2019	[redacted]	[redacted]
VHS PCR	0/1	04/10/2019	[redacted]	04/10/2019	[redacted]	12/11/2019	[redacted]	[redacted]
IHN PCR	0/1	04/10/2019	[redacted]	04/10/2019	[redacted]	12/11/2019	[redacted]	[redacted]
SAV PCR	0/1	04/10/2019	[redacted]	04/10/2019	[redacted]	12/11/2019	[redacted]	[redacted]
IPN PCR	1/1	04/10/2019	[redacted]	04/10/2019	[redacted]	12/11/2019	[redacted]	[redacted]
AGD PCR	5/6	04/10/2019	[redacted]	04/10/2019	[redacted]	12/11/2019	[redacted]	[redacted]
Para Ther PCR	6/6	04/10/2019	[redacted]	04/10/2019	[redacted]	12/11/2019	[redacted]	[redacted]
Sal Pox PCR	6/6	04/10/2019	[redacted]	04/10/2019	[redacted]	12/11/2019	[redacted]	[redacted]
Vibrio species	6/6	17/10/2019	[redacted]	17/10/2019	[redacted]	12/11/2019	[redacted]	[redacted]
AGD Histology	1/6	24/10/2019	[redacted]	24/10/2019	[redacted]	12/11/2019	[redacted]	[redacted]
Epitheliocystis histology	1/6	24/10/2019	[redacted]	24/10/2019	[redacted]	12/11/2019	[redacted]	[redacted]
Gill pathology	6/6	24/10/2019	[redacted]	24/10/2019	[redacted]	12/11/2019	[redacted]	[redacted]
Complex gill issues	6/6	24/10/2019	[redacted]	24/10/2019	[redacted]	12/11/2019	[redacted]	[redacted]
Carnobacterium species	3/6	08/11/2019	[redacted]			12/11/2019	[redacted]	

A Fish Health Inspectorate report for September 2019 confirmed the presence of PRV (HSMI) at Mowi's Cairdh salmon farm in Loch Ainort on the Isle of Skye – a site identified as the source of a roadspill of disease-ridden morts on the A86:

Case No:	2019-0529	Date of visit:	24/09/2019
Time spent on site:	4.5 hours	Main Inspector:	[redacted]
Site No:	FS0252	Site Name:	Cairidh
Business No:	FB0119	Business Name:	Mowi Scotland Ltd

Additional Case Information:

Previous cycle fallow date - 18/08/19, site was then stocked with fish from Rum 21/08/19 - 31/08/19. As the site was not fallow for a minimum period of 4 weeks as recommended in the Scottish finfish Aquaculture Code of Good Practice (CoGP), the site has been listed as practices not in accordance with the CoGP in the surveillance frequency section of this case sheet.

Risk assessment (RA) in place for the movement of 206,000 salmon from Rum to Cairidh (between management areas, RA stated that lice levels were low and no signs of AGD. Confirmed presence of PRV (HSMI), PCMV (CMS), Paranucleospora and Yersinia, however these were not leading in clinical signs in fish prior to transfer. RA states previous stock at Cairidh was of a similar or lesser disease status. RA notes Cairidh is in a farm management area with 4 sites, two of which are stocked, no reference given to the health status of the fish stocked on those sites.

Vets attended site on 28/08/19 after site was restocked, pcr samples for PD carried out, returned negative.

Prior to inspection of the site, FHI were made aware that mortality waste from Cairidh, had been spilled on the A86 (near Wolftrax) during transport of waste to Dundas Chemicals in a Gogar services vehicle. Mowi had requested a documented incident investigation to be carried out by Gogar Services, a documented report was sent to Mowi on 24/09/19 and was made available for inspection. Document stated the spill of fish was caused by the driver braking hard having attempted to overtake cyclists when oncoming traffic required the driver to brake sharply. Fish spilled from the trailer over the front of the vehicle. Gogar Services sent a clean-up team to the incident location. Spilled fish were cleared from the road and then loaded into a sealed skip. Road surface was cleaned with degreaser agent and water. BEAR Scotland then laid down approx 7 tonnes of salt over the spill area of the road. Some fish remained at the side of the road, due to poor light the clean-up resumed the following day using a liquid ring tanker to suck up the fish from the side of the road. All fish waste material was then taken to Dundas Chemicals for disposal. SEPA attended incident site and were satisfied no waste would have entered any watercourse. Following the incident Gogar has stated that all trailers used for transporting mortality waste will be fitted with splash plates at the front and back of trailers. Plates will be made from aluminium sheets which will extend four feet back over the top of the load area, the intention is that any wash from heavy braking will be directed back into the load area. APHA and Mowi have reviewed the actions as satisfactory.

Here's video footage of the disease-ridden roadspill on the A86 in September 2019:

Scottish Salmon Watch reported in January 2020:

"Alarmingly, the farmed salmon were moved in late August 2019 from a disease-ridden salmon operated by Mowi on the Isle of Rum where a Risk Assessment (RA) had confirmed the presence of Piscine Reovirus (PRV) - the causative agent of Heart & Skeletal Muscle Inflammation (HSMI), Piscine myocarditis virus (PMCV) - the causative agent of Cardiomyopathy Syndrome (CMS), Paranucelospora - a primary agent in Proliferative Gill Disease - and Yersinia - the etiological agent of enteric redmouth (ERM) disease."

A [Fish Health Inspectorate report for March 2019] cited HSMI at Cooke Aquaculture's Lyrawa Bay salmon farm in the Orkney Islands:

Case No:	2019-0121						Date of visit:	19/03/2019	
Time spent on site:	4 hours					Main Inspector:	[redacted]		
Site No:	FS0054	Site Name:	Lyrawa Bay						
Business No:	FB0095	Business Name:	Cooke Aquaculture Scotland Ltd						
Case Types:	1 ECI	2 CNI	3 SLI	4 VMD	5 DIA	6			
Water Temp (°C):	7.3	Thermometer No:	T147			FHI 045 completed			
Observations:		Region:	OR	Water type:	S	CoGP MA	O-3		
Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.							
Clinical signs of disease observed?	Y	If yes, see additional information/clinical score sheet.							
Gross pathology observed?	Y	If yes, see additional information/clinical score sheet.							
Diagnostic samples taken?	Y								

Additional Case Information:

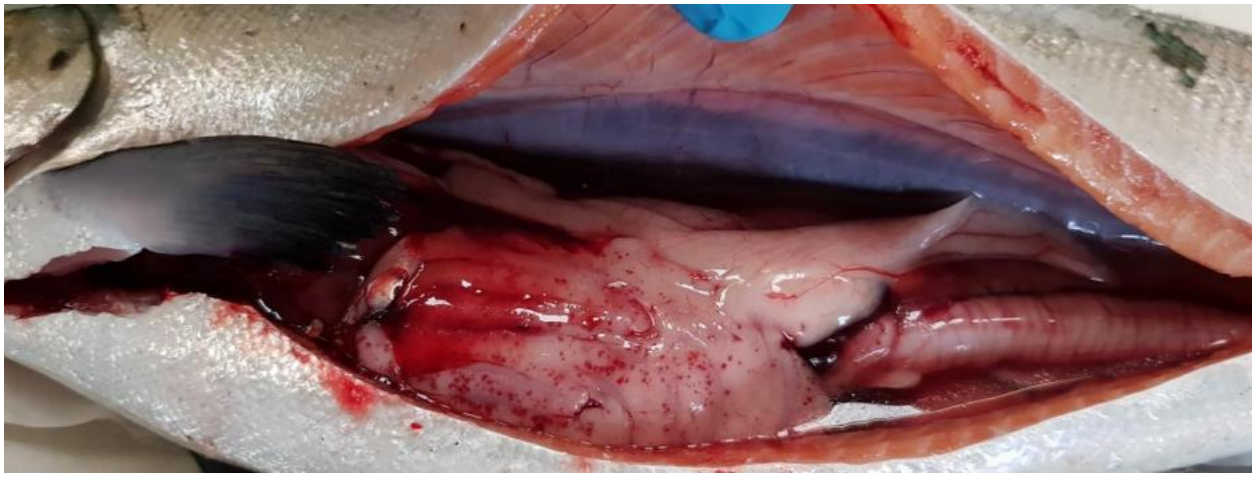
Lesions observed on fish during December - January, attributed to winter sores, predominantly affecting undersized fish/failed smolts. Lesions no longer observed on fish, but grumbling mortality attributed to PD/HSMI has been ongoing since start of year.
Several moribund fish observed in cages 3 and 4. 5 fish taken for diagnostic sampling, no lesions on fish observed.

Results of Surveillance	
1. Has any animal health surveillance been carried out by, or on behalf of, the business?	Y
2. If yes, are results available for inspection?	Y
3. Any significant results?	Y
If yes, detail (if not detailed under recent disease problems).	HSMI and PD detected

Yet even though surveillance carried out by, or on behalf of, Cooke Aquaculture detected HSMI there was no testing for PRV/HSMI by the Scottish Government inspectors.

Case No:	2019-0121			Date of visit:	19/03/2019		
Site No:	FS0054			Inspector:	[redacted]		
Results Summary	Freq.	Date of Notification					
		Database	Insp	Phone	Insp	Writing	Insp
MG_IHN	0/1	26/03/2019	[redacted]	26/03/2019	[redacted]	18/04/2019	[redacted]
MG_IPN	0/1	26/03/2019	[redacted]	26/03/2019	[redacted]	18/04/2019	[redacted]
MG_ISA	0/1	26/03/2019	[redacted]	26/03/2019	[redacted]	18/04/2019	[redacted]
MG_SAV	1/1	26/03/2019	[redacted]	26/03/2019	[redacted]	18/04/2019	[redacted]
MG_VHS	0/1	26/03/2019	[redacted]	26/03/2019	[redacted]	18/04/2019	[redacted]
HIST_ADHE	1/5	28/03/2019	[redacted]	28/03/2019	[redacted]	18/04/2019	[redacted]
HIST_AMGD	2/5	28/03/2019	[redacted]	28/03/2019	[redacted]	18/04/2019	[redacted]
HIST_GPAT	3/5	28/03/2019	[redacted]	28/03/2019	[redacted]	18/04/2019	[redacted]
HIST_SALH	5/5	28/03/2019	[redacted]	28/03/2019	[redacted]	18/04/2019	[redacted]
HIST_IPAT	5/5	28/03/2019	[redacted]	28/03/2019	[redacted]	18/04/2019	[redacted]

At least the Scottish Government inspectors took photos of Cooke's virus-laden farmed salmon:



A [Fish Health Inspectorate report for February 2019] illustrates how imported ova slip through the testing net – with the Scottish Government only checking shipment boxes and health certificates at Aberdeen Airport rather than taking samples of ova for disease screening:

Case No:	2019-0015								Date of visit:	17/01/2019	
Time spent on site:	1 Hour							Main Inspector:		WJM	
Site No:	FS0614	Site Name:	Holywood Salmon Farm								
Business No:	FB0572	Business Name:	AquaGen Scotland Ltd								
Case Types:	1 IMP	2		3		4		5		6	
Water Temp (°C):		Thermometer No:						FHI 045 completed			
Observations:		Region:	DG		Water type:	F		CoGP MA:			
Dead/weak/abnormally behaving fish present?	N/A	If yes, see additional information/clinical score sheet.									
Clinical signs of disease observed?	N/A	If yes, see additional information/clinical score sheet.									
Gross pathology observed?	N/A	If yes, see additional information/clinical score sheet.									
	N/A										

Additional Case Information:

Import inspection conducted at Aberdeen Airport.

Two box shipment of 42,000 Atlantic Salmon ova from Norway was inspected and original health certificates (intra.no.2019.0000131 (no-0028399)) were found to be included and satisfactory.

No issues raised.

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Scottish Government
Riaghaltas na h-Alba
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[redacted]
AquaGen Scotland Ltd
BETA Centre Unit 16A
Stirling University Innovation Park
Stirling
FK9 4NF
[redacted]

FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

BUSINESS NO	FB0572	**DATE OF VISIT**	17/01/2019
SITE NO	FS0614	**SITE NAME**	Holywood Salmon Farm
INSPECTOR	Warren Murray & Nicole Little	**CASE NO**	20190015

Inspection of a consignment introduced into Scotland

An inspection was conducted at Aberdeen Airport on a consignment of 42,000 Atlantic salmon ova introduced into Scotland from AquaGen, Norway.

The accompanying health certificate met the requirements of the Aquatic Animal Health (Scotland) Regulations 2009 and the Trade in Animals and Related Products (Scotland) Regulations 2012.

The consignee must retain the original health certificate for at least 3 years.

A [Fish Health Inspectorate report for August 2022] detailed a positive test for PRV at [Loch Duart's RSPCA Assured Loch Laxford salmon farm]:

Case No:	2022-0368			Date of visit:	31/08/2022
Time spent on site:	3.5 hours			Main Inspector:	[redacted]
Site No:	FS0065	Site Name:	Loch Laxford		
Business No:	FB0398	Business Name:	Loch Duart Ltd		
Case Types:	1 DIA	2 REP	3	4	5 6
Water Temp (°C):	13.9	Thermometer No:	T173	FHI 045 completed	
Observations:		Region:	HI	Water type: S	CoGP MA: M-3

Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.
Clinical signs of disease observed?	Y	If yes, see additional information/clinical score sheet.
Gross pathology observed?	Y	If yes, see additional information/clinical score sheet.
Diagnostic samples taken?	Y	

Case No:	2022-0368	Date of visit:	31/08/2022
Site No:	FS0065	Inspector:	[redacted]

Results Summary	Freq.	Date of Notification						
		Database	Insp	Phone	Insp	Writing	Insp	2nd Insp
Salmon Gillpox	5/5	06/09/2022	[redacted]	06/09/2022	[redacted]	11/10/2022	[redacted]	
Paranucleospora theridion	5/5	06/09/2022		06/09/2022		11/10/2022		
MG AGD	5/5	06/09/2022		13/09/2022		11/10/2022		
MG PRV	1/1	09/09/2022		13/09/2022		11/10/2022		
MG IHN	0/4	07/09/2022		13/09/2022		11/10/2022		
MG IPN	0/4	07/09/2022		13/09/2022		11/10/2022		
MG ISA	0/4	07/09/2022		13/09/2022		11/10/2022		
MG SAV	1/4	07/09/2022		13/09/2022		11/10/2022		
MG VHS	0/4	07/09/2022		13/09/2022		11/10/2022		
PRVH	1/5	16/09/2022		30/09/2022		11/10/2022		
GPAT	5/5	22/09/2022		30/09/2022		11/10/2022		
HPAT	4/5	22/09/2022		30/09/2022		11/10/2022		
SKIN	1/5	22/09/2022		30/09/2022		11/10/2022		
MPAT	1/5	22/09/2022		30/09/2022		11/10/2022		
MG_PMCV	0/4	07/09/2022		05/10/2022		11/10/2022		
Moritella Viscosa - VVIS	1/5	16/09/2022		30/09/2022		11/10/2022		

Piscine reovirus (PRVP)

Fish Number	Endogenous control CP value	Cp Values			Reported Result
2	19.66	24.18	24.12	24.11	POSITIVE

A [letter to Loch Duart from the Scottish Government dated 11 October 2022] detailed the positive test for PRV following pathology identified as heart and skeletal inflammation (HSMI) – and [attached a photo of disease-ridden Loch Duart salmon]:

FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

Business No	FB0398	**Date of Visit**	31/08/2022
Site No	FS0065	**Site Name**	Loch Laxford
Case No	20220368	**Inspector**	[redacted]

Section 1: Summary

The above site was inspected following reports of increased mortality by the farm operator. During the physical inspection of all pens, five fish were removed for diagnostic sampling.

Histopathology examination revealed hyperplasic branchitis, vascular disturbance and haemorrhage. Bacterial dermatitis in F1. F2 displayed pathology features resembling heart and skeletal inflammation (HSMI), confirmed by a positive QPCR for piscine orthoreovirus.

Moritella viscosa was identified on plates taken from lesion material of F1. The level and purity of growth would suggest that although *Moritella viscosa* would be implicated as the primary source of the lesion it would not be implicated as the primary source of morbidity overall.

All five fish tested positive for Salmon gill poxvirus, *Paranucleospora theridion* and *Neoparamoeba perurans* (amoebic gill disease (AGD)). F4 tested positive for salmonid alphavirus (SAV).

A [Fish Health Inspectorate report for August 2022] detailed PRV at The Scottish Salmon Company's East Tarbert Bay salmon farm off the Isle of Gigha (The Scottish Salmon Company was [renamed Bakkafrost in June 2022]):

Case No:	2022-0342						Date of visit:	17/08/2022	
Time spent on site:	2hours						Main Inspector:	[redacted]	
Site No:	FS1010	Site Name:	East Tarbert Bay						
Business No:	FB0169	Business Name:	The Scottish Salmon Company						
Case Types:	1 REP	2 SLA	3 DIA	4	5	6			
Water Temp (°C):	14.8	Thermometer No:	T308				FHI 045 completed		
Observations:		Region:	ST	Water type:	S		CoGP MA:	M-46	
Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.							
Clinical signs of disease observed?	Y	If yes, see additional information/clinical score sheet.							
Gross pathology observed?	Y	If yes, see additional information/clinical score sheet.							
Diagnostic samples taken?	Y								

From health surveillance conducted on site, 2 pens (1 and 7) were confirmed to have PRV. No clinical changes were observed and is currently not the primary suggested cause of increased mortality on site.

Recent (last 4 wks) disease problems?	Y	Any escapes (since last visit)?	N
If yes, detail:	Increased mortality for past 3 weeks. PRV confirmed on site. Osmoregulatory issues and poor water quality due to micro jellies and lion's mane jellyfish. Caligus burden high on site for 4 weeks.		

Results of Surveillance	
1. Has any animal health surveillance been carried out by, or on behalf of, the business?	Y
2. If yes, are results available for inspection?	Y
3. Any significant results?	Y
If yes, detail (if not detailed under recent disease problems).	PRV confirmed on site in two pens. Failed smolts.

Testing by the Scottish Government detected PRV in 5 out of 5 samples:

Case No:	2022-0342	Date of visit:	17/08/2022
Site No:	FS1010	Inspector:	[redacted]

Results Summary	Freq.	Date of Notification						
		Database	Insp	Phone	Insp	Writing	Insp	2nd Insp
VSPE	3/5	30/08/2022	[redacted]	01/09/2022	[redacted]	02/09/2022	[redacted]	[redacted]
VSPE	2/5	30/08/2022	[redacted]	01/09/2022	[redacted]	02/09/2022	[redacted]	[redacted]
AERO	1/5	30/08/2022	[redacted]	01/09/2022	[redacted]	02/09/2022	[redacted]	[redacted]
MG_AGDQ	5/5	30/08/2022	[redacted]	23/08/2022	[redacted]	02/09/2022	[redacted]	[redacted]
MG_VHS	0/5	30/08/2022	[redacted]	23/08/2022	[redacted]	02/09/2022	[redacted]	[redacted]
MG_IHN	0/5	30/08/2022	[redacted]	23/08/2022	[redacted]	02/09/2022	[redacted]	[redacted]
MG_IPN	5/5	30/08/2022	[redacted]	23/08/2022	[redacted]	02/09/2022	[redacted]	[redacted]
MG_ISA	0/5	30/08/2022	[redacted]	23/08/2022	[redacted]	02/09/2022	[redacted]	[redacted]
MG_PARA_THER_Q	4/5	30/08/2022	[redacted]	23/08/2022	[redacted]	02/09/2022	[redacted]	[redacted]
MG_PMCV	0/5	30/08/2022	[redacted]	23/08/2022	[redacted]	02/09/2022	[redacted]	[redacted]
MG_PRV	5/5	30/08/2022	[redacted]	23/08/2022	[redacted]	02/09/2022	[redacted]	[redacted]

Piscine reovirus

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	16.74	28.31	28.28	28	POSITIVE
F2	18.04	29.59	29.7	29.64	POSITIVE
F3	17.54	27.11	27.36	27.09	POSITIVE
F4	17.61	26.58	26.58	26.55	POSITIVE
F5	17.16	29.17	29.48	29.57	POSITIVE

The Fish Health Inspectorate Visit Report dated 29 August 2022 included photos of PRV-laden farmed salmon:

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FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

BUSINESS NO FB0169
SITE NO FS1010
CASE NO 20220342

DATE OF VISIT 17/08/2022
SITE NAME East Tarbert Bay
INSPECTOR [redacted]

Section 1: Summary

The above site was inspected following reports of increased mortality by the farm operator. During the physical inspection of all pens, five fish were removed for diagnostic sampling.

Histopathology examination revealed pathology consistent with mild amoebic gill disease (AGD) in all fish (confirmed by qPCR) and bacterial ulcerative dermatitis in F4. In addition, very mild myocardial myositis, splenitis, nephritis and moderate peritonitis was observed. Lastly, some of the lesions may have been the cause of osmoregulatory imbalance.

An *Aeromonas* sp. was identified in heavy, almost pure growth on plates taken from lesion material in F4. The level of purity of growth would suggest that it would be implicated as the source of the lesion in this case. This *Aeromonas* sp. was also observed at a very low level on the plate taken from kidney material of F1. Two *Vibrio* sp. isolates were identified on plates from kidney material of F1, F3 and F5. The level and purity of the growth on the plates would not suggest that these *Vibrio* spp. Would be implicated as the primary source of overall morbidity in the population. However, the level of growth on F5 was significant.

Four fish tested positive for *Paranucleospora theridion* by qPCR. In addition, all fish sampled tested positive for salmon gill pox virus, piscine reovirus and infectious pancreatic necrosis by qPCR.

Fish 4: Externally, scaling again was seen. The fish also had three lesions (one on the left side and two on the right; bacteriology sample taken of lesion as well as histology). Swollen vent was observed. Internally, yellow pseudofaeces was present.

Figure 2 Closer view of external observations of fish 1, 2, 3. Scaling is evident on all the fish. Evidence of physical damage on pectoral fins on fish 2 and fish 3.

A Fish Health Inspectorate report for July 2022 reported PRV/HSMI in Loch Creran at Scottish Sea Farms (the Scottish Government inspection was triggered by a welfare complaint filed by $camon $cotland following secret filming) – yet inspectors failed to test for PRV/HSMI:

Case No:	2022-0262							Date of visit:	18/07/2022
Time spent on site:	4.5 hours						Main Inspector:		[redacted]
Site No:	FS1047	Site Name:	Loch Creran (D)						
Business No:	FB0125	Business Name:	Scottish Sea Farms Ltd						
Case Types:	1 REP	2 DIA	3 WEL	4	5	6			
Water Temp (°C):	13.55	Thermometer No:	T308				FHI 045 completed		
Observations:		Region:	ST		Water type:	S	CoGP MA:		M-36
Dead/weak/abnormally behaving fish present?				Y	If yes, see additional information/clinical score sheet.				
Clinical signs of disease observed?				Y	If yes, see additional information/clinical score sheet.				
Gross pathology observed?				Y	If yes, see additional information/clinical score sheet.				
Diagnostic samples taken?				Y					

Timeline of recent disease:
Routine vet visit conducted in week 9, confirmed PRV +ve results for the whole site (100%), but no increased mortality associated with it seen on site. In Wk 14, histology again confirmed PRV +ve site with moderate levels, and slight increase in mortality seen but still below reporting threshold. Skin lesions seen on site were tested and were found to be a result of secondary bacterial infection; bad weather earlier in the year had affected the fish previously. P. skyensis was tested for during diagnostic taken in Wk 15 but result were negative and mortality remained below reporting threshold until wk 18. Wk 19 samples were positive for furunculosis (5/5). No moribunds were seen at vet visit in Wk 21. As mortality increased from Wk 24 present, PCR samples continued to be positive for furunculosis in Wk 25. As a result, decision to remove leading mort pens through harvest, and as of 18/07/2022 site is potentially fallowing within next 3 weeks. Next pens to harvest out are pen 7, 9 and 11. Site has been using diet with supplementary health ingredients called Assit Skin with Resist Lice from 5th to 25th May. Presently, fish are on Resist lice diet.

Observations on site:
From the first pen, moribunds were observed exhibiting exothalmia and lethargy. Two pens in particular were observed to have the highest mortality; pen 9 and 11, with ~20 moribunds seen upon pen inspection. Fish removed from pen 1 for diagnostic purpose were observed to have enlarged atriums of the heart, and some moderate petechial haemorrhaging on the liver too. Raised scales or 'furuncle-like' bubbles were also seen in sampled fish from pen 1 and 9. Upon observation of pens 4 and 6, fish were seen with more such skin lesions/boils, none of which were observed to be open or ruptured. Lastly, a few fish were observed to be belly up approx. 3-4m below the water surface hanging on the side of the net.

Recent (last 4 wks) disease problems?	Y	Any escapes (since last visit)?	N
If yes, detail:	PRV, HSMI, Furunculosis (clinical signs in the pens seen first time today)		

5. Evidence of recent increased/atypical mortalities?	Y
If yes, facility nos/no mortality per facility/no stock per facility/reason:	
Pen 5, 9, 11; HSMI and furunculosis	

Observations

Following 3 weeks of notifications of increased mortality above the reporting threshold a site inspection was conducted. The inspection was also conducted as a response a welfare complaint. On site, a high number of lethargic and moribund fish were observed in all pens. Some fish were observed to exhibit exophthalmia. Two pens in particular were observed to have the highest mortality and approximately 20 moribunds were seen on pen inspection in each pen.

All fish sampled were lethargic and moribund. A few fish were observed to be belly up approximately 3-4m below the water surface, on the side of the nets. Raised scales or furuncles were also seen in some sampled fish from pen 1 and 9. These were also observed in pens 4 and 6. The gills of all fish were zoned and in F3 and F5 were pale.

Internally, all fish displayed enlarged spleens and yellow pseudo faeces was present within the hind gut. In F2-F5 bloody ascites were observed. Some petechial haemorrhaging in F2 on the liver and in F3 on the pyloric caeca.

Figure 7 Internal picture of fish 2. Note the petechial haemorrhaging on liver. Bloody ascites observed in the cavity of the fish.

Read more via:
[Scottish Scamon: Piscine Reovirus, skin lesions/boils & "hanging" salmon in Loch Creran (sold by M&S as "responsibly sourced" & certified via RSPCA Assured)!]

A [Fish Health Inspectorate report for February 2022] details HSMI at [Mowi's RSPCA Assured Loch Greshornish salmon farm] off the Isle of Skye (the salmon were sourced from Stofnfiskur/Benchmark in Iceland via Loch Lochy) – but the Scottish Government failed to test any salmon for PRV/HSMI:

Case No:	2022-0020								Date of visit:	09/02/2022	
Time spent on site:	4hrs							Main Inspector:	[redacted]		
Site No:	FS0015	Site Name:	Loch Greshornish								
Business No:	FB0119	Business Name:	Mowi Scotland Ltd								
Case Types:	1 ECI	2 CNI	3 SLI	4 VMD	5	6					
Water Temp (°C):	8.3	Thermometer No:	T148				FHI 045 completed				
Observations:		Region:	HI	Water type:	S		CoGP MA	M-24			
Dead/weak/abnormally behaving fish present?				Y	If yes, see additional information/clinical score sheet.						

SAL - Loch Lochy, Stofnfiskur

On-going mortalities over the 1% threshold since October 2021 attributed to AGD, freshwater treatment loss and HSMI. Pasteurella skyensis was also detected in pen 6 in 2 out of 15 fish, this was followed by a Florocol treatment for the whole site. The latest health report showed the site still has complex gill issues and some AGD but the Pasteurella skyensis and HSMI are no longer being detected. No wrasse left on site due to freshwater treatments (44,000 fish lost) - site staff mentioned they did not have equipment to remove cleanerfish during FW treatments, issue raised with FHI senior management.

Site inspection and VMD sampling carried out by [redacted], supervised by [redacted] on 09/02/2022. The main population was deep in the water column and difficult to observe due to weather conditions. An average of 3 lethargic fish per pen were observed, mostly runts. Six of these fish were examined and no clinical signs were found internally. Externally, the fish showed signs of poor gills. The fish sampled for the VMD appeared healthy and had been feeding well.

Recent (last 4 wks) disease problems?	Y	Any escapes (since last visit)?	N
If yes, detail:	HMSI, Pasteurella skyensis (treated with Florocol), Complex gill issues, AGD		

5. Evidence of recent increased/atypical mortalities?	Y
If yes, facility nos/no mortality per facility/no stock per facility/reason:	
P. skyensis detected in Cage 6, AGD and HSMI also confirmed on site.	

Another Fish Health Inspectorate report for January 2022 at Mowi's Loch Greshornish salmon farm cited a PatoGen report for HSMI and how opened up morts were "seeing gross pathology consistent with HSMI" – but again the Scottish Government failed to test any salmon for PRV/HSMI:

Additional Case Information:

On-going mortality reports over the threshold since w/b 4/10/2021 attributed to AGD, treatment loss (FW) and with time HSMI. Most recent weeks attributed to complex gill disease with AGD and HSMI.

Looking to stock LUM in the next 2 months. Used to have WRS but with all the FW treatments these have perished.

PatoGen report: HSMI, 2/15 positive for P. skyensis from pen 6, since that result have stepped up morting multiple times per day and very proactive at taking out lethargic fish as soon as possible. Also increased use of footbaths and disinfectant sprayers. 9.2C Water temperature. Still up at about 10C about a week ago. Another heath visit scheduled for next week, to see if P. skyensis is in more pens, as only one pen samples before. Morts get opened up frequently and mostly seeing gross pathology consistent with HSMI.

Current site manager in place since November 2021, since then have done short 3-4h FW treatments more frequently to knock Amoeba (AGD). Will switch to low dose peroxide tarp treatment over the weekend/ next week. Have seen some Moritella as well. After peroxide looking to use Florocol next week for 10 days. Feeding has been poor. Reduced pellet size again so this has seemed to increase feeding again. Will start feeding organic diet as a trial as well for 3 weeks to see if there is a difference.

Stofnfiskur stock.

Mortality Information		
1. Any recent increased or atypical mortalities? (last 4 weeks).		Y
If yes, detail:	wk50 - 6.93% (37,454)- reported; wk51 - 2.67% (13,451)- reported; wk 52 - 3.64% (17,178) Cause: HSMI, other bacterial infection; 2022 wk1 - (Mon-Wed only) 1.76% (6,138) highest pen was pen3 Cause: HSMI, other bacterial infection.	

Health status and Results of Surveillance		
1. Any disease on site? (since last inspection)		Y
If yes, detail:	HSMI, secondary bacterial infection (result for P. skyensis from pen 6, some Moritella), see additional info	
2. Has any animal health surveillance been carried out by, or on behalf of, the business?		Y
3. Any significant results?		Y
If yes, detail	See additional info.	

A Fish Health Inspectorate report for November 2021 detailed HSMI at the Bloody Bay salmon farm operated by Scottish Sea Farms (Norskott Havbruk) off the Isle of Mull – with the farmed salmon sourced from Stofnfiskur in Iceland (via Barcaldine Hatchery):

Case No:	2021-0479			Date of visit:	10/11/2021
Time spent on site:	5hrs			Main Inspector:	[redacted]
Site No:	FS0964	Site Name:	Bloody Bay		
Business No:	FB0125	Business Name:	Scottish Sea Farms Ltd		
Case Types:	1 ECI	2 CNI	3 SLI	4 VMD	5 DIA	6
Water Temp (°C):	12.3	Thermometer No:	T152	FHI 045 completed	
Observations:		Region:	ST	Water type: S	CoGP MA: M-34

Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.
Clinical signs of disease observed?	Y	If yes, see additional information/clinical score sheet.
Gross pathology observed?	Y	If yes, see additional information/clinical score sheet.
Diagnostic samples taken?	Y	

Additional Case Information:

Fish came on from Barcaldine Smolt Unit and originated from Stofnfiskur.

Mortalities started increasing in wk33 and have remained above 1% across the site since. Samples taken by Pharmaq in September 21 confirmed the presence of AGD, HSMI and SGPV.

Recent (last 4 wks) disease problems?	Y
If yes, detail:	AGD, HSMI, SGPV

Results of Surveillance	
1. Has any animal health surveillance been carried out by, or on behalf of, the business?	Y
2. If yes, are results available for inspection?	Y
3. Any significant results?	Y
If yes, detail (if not detailed under recent disease problems).	AGD, HSMI and SGPV

The Scottish Government inspectors sampled only one pooled sample of farmed salmon for PRV – with positive results:

Case No:	2021-0479	Date of visit:	10/11/2021
Site No:	FS0964	Inspector:	[redacted]

Results Summary	Freq.	Date of Notification						
		Database	Insp	Phone	Insp	Writing	Insp	2nd Insp
MG_SAV	0/1	12/11/2021	[redacted]	12/11/2021	[redacted]		[redacted]	
MG_ISA	0/1	12/11/2021	[redacted]	12/11/2021	[redacted]		[redacted]	
MG_IHNQ	0/1	12/11/2021	[redacted]	12/11/2021	[redacted]		[redacted]	
MG_VHS	0/1	12/11/2021	[redacted]	12/11/2021	[redacted]		[redacted]	
MG_IPN	0/1	12/11/2021	[redacted]	12/11/2021	[redacted]		[redacted]	
MG_PARA_THER_Q	5/5	12/11/2021	[redacted]	12/11/2021	[redacted]		[redacted]	
MG_SAL_POX	4/5	12/11/2021	[redacted]	12/11/2021	[redacted]		[redacted]	
MG_AGDQ	5/5	12/11/2021	[redacted]	12/11/2021	[redacted]		[redacted]	
MG_PRV	1/1	17/11/2021	[redacted]	17/11/2021	[redacted]		[redacted]	

The Fish Health Inspectorate Visit Report dated 3 December 2021 detailed PRV/HSMI – detected by "molecular genetic analysis":

marinescotland science

Scottish Government
Riaghaltas na h-Alba
gov.scot

FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

Business No	FB0125	**Date of Visit**	10/11/2021
Site No	FS0964	**Site Name**	Bloody Bay
Case No	20210479	**Inspector**	[redacted]

Section 1: Summary

The site was visited following continued reports of elevated mortality levels. During the inspection, several moribund fish were observed across the site. Five fish were removed for further examination and subsequent diagnostic sampling.

Histopathology examination revealed mild, multifactorial, non-specific proliferative branchitis. Pathology was also consistent with the presence of epithelyocists (likely *Candidatus* Branchiomonas cysticola) and amoebic gill disease (AGD), confirmed by qPCR. Two fish also exhibited pathology consistent with cardiomyopathy syndrome (CMS), also confirmed by qPCR. Two displayed periportal hepatic necrosis and one fish also exhibited nephritis.

Molecular genetic analysis also detected the presence of *Paranucleospora theridion*, Salmon gill poxvirus (SGPV) and Piscine reovirus (HSMI).

Observations

The site was inspected following continued reports of elevated mortality levels and to carry out a routine inspection. Increased mortalities had been attributed to gill health, AGD, HSMI and SGPV. Three mortalities and eight moribunds were observed across the site. Five moribund fish were removed for diagnostic sampling.

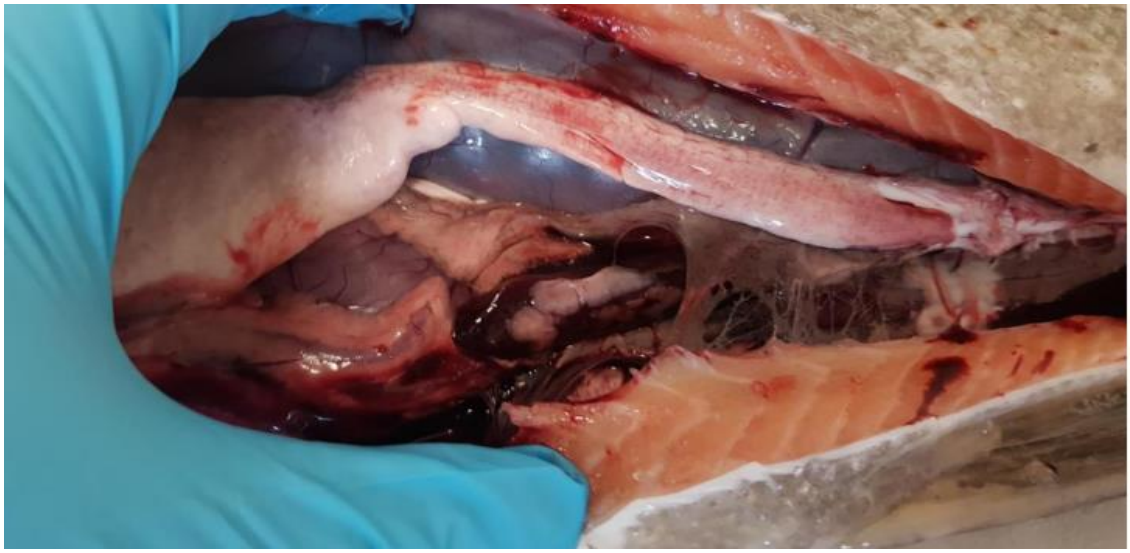
Externally, F1 had a darkened body and F1 and F5 were anorexic. The opercula on F5 was shortened and the eyes of F5 were also haemorrhagic. All fish had pale gills with zoning also noted on the gills of F2 and F5. Lice loads on all the fish sampled were <5.

Internally, all fish had pale/anaemic hearts and F2, 3 and 5 also had enlarged livers. There was a notable lack of fat on the pyloric caeca of F1, 3 and 5. The spleen of F4-5 were enlarged and there was yellow pseudo-faeces present in the gut of all five fish.

Piscine reovirus (HSMI)

Pool Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
P1	20.12	30.83	30.69	30.79	POSITIVE

Here’s photos published by the Scottish Government of the PRV/HSMI-infected farmed salmon at Bloody Bay (Scottish Sea Farms) in November 2021:



In addition to the Scottish Government's 'Case Information' highlighted above, PRV/HSMI is cited via 58 'Mortality Event Reports' published by the Scottish Government's Fish Health Inspectorate on 1 November 2022 – detailed below in chronological order (latest cases first):

Event #	Company	Site Name	Date reported	Explained reasons	Mort #s	Action taken by FHI
MRT03251	The Scottish Salmon Co	Lamlash	19/09/2022	Gill-Health Related	35108	FW treatment scheduled for wk 38/39. FHI to monitor. Update 22/09/2022 AZM: waterbourne insult from premused microjellies 4 weeks ago. AGD escalated quickly since then with necrosis on gills. Trial pens treated with 6hr FW and settled mortality and amoeba reduced. Therefore all pens on site treated with FW. Weekly health visits have occurred since insult began. Low level PRV on site but not clinically expressed. Some physical wounds from handling and low level Tenacibaculum diagnosed. Histology has not revealed any bacterial infection.
MRT03086	The Scottish Salmon Company	East Tarbert Bay	08/08/2022	Environment (Water Quality); Sea Lice related (Post-bath treatment)	105355	Business correspondent contacted. Caligus levels very high on site. To minimize effects of lice burden, 2 bath treatments were conducted in quick succession. Fish are from Applecross and Girlsta and are considered soft fish with reduce mucus layer. With the water quality at input not being favourable and the subsequent handling events have been cause of mortalities. PRV has been confirmed at moderate/high level across site, as well as minimal AGD. Site minimizing handling as well as will split fish via freshwater transfers into Druimyeon Bay to reduce biomass and allow SLICE treatment to commence. FHI inspection scheduled for 17/08/2022. FHI to monitor.

Event #	Company	Site Name	Date reported	Explained reasons	Mort #s	Additional information
MRT03092	Scottish Sea Farms Ltd	Loch Creran (B)	11/08/2022	Virus disease; Bacterial disease	13134	HSMI, bacterial disease; harvesting, site fallow on 10.08.22
MRT03074	Scottish Sea Farms Ltd	Loch Creran (D)	04/08/2022	Virus disease; Bacterial disease	8461	HSMI, bacterial disease; harvesting to fallow
MRT03054	Scottish Sea Farms Ltd	Loch Creran (D)	28/07/2022	Virus disease; Bacterial disease	22782	HSMI, Bacterial disease; harvesting to fallow
MRT03044	Scottish Sea Farms Ltd	Loch Creran (D)	21/07/2022	Virus disease; Bacterial disease	23180	HSMI, Bacterial disease; harvesting to fallow
MRT03027	Scottish Sea Farms Ltd	Loch Creran (D)	13/07/2022	Viral Disease	14441	HSMI, Physical treatment in week, destocking through harvest
MRT03020	Scottish Sea Farms Ltd	Loch Creran (D)	06/07/2022	Viral Disease	6826	HSMI confrimed
MRT03021	Scottish Sea Farms Ltd	Loch Creran (D)	06/07/2022	Viral Disease	8175	HSMI, increased mortality removal
MRT03022	Scottish Sea Farms Ltd	Loch Creran (D)	06/07/2022	Viral Disease	15943	HSMI, destocking through harvest

Event #	Company	Site Name	Date reported	Explained reasons	Mort #s	Action taken by FHI
MRT02867	SSF Shetland Ltd	Bight of Foraness	24/02/2022	Viral Disease / Sea Lice Related	21379	Mortality related to HSMI and physical lesions from recent hydrolicer treatments. FHI to monitor, site being visited 7/3/22
MRT02849	Mowi Scotland Ltd	Loch Greshornish	16/02/2022	Complex gill diseases / Pasteurella Skyensis infection / Treatment losses	6,063	Site visited 09/02/2022. HMSI, CGD, AGD and Pasturella skyensis were confirmed on site. P. skyensis was treated with Florocol and latest health report confirmed that P.skyensis and HMSI are no longer being detected in the stock. Six moribund fish were removed during the inspection. No clinical signs of disease were observed internally, but poor gill health was noted on all the fish examined. Mortalities reduced the following week. FHI to monitor.
MRT02847	Mowi Scotland Ltd	Loch Greshornish	15/02/2022	Complex gill disease issues ongoing on site causing significant mortality.	4,344	Site visited 09/02/2022. HMSI, CGD, AGD and Pasturella skyensis were confirmed on site. P. skyensis was treated with Florocol and latest health report confirmed that P.skyensis and HMSI are no longer being detected in the stock. Six moribund fish were removed during the inspection. No clinical signs of disease were observed internally, but poor gill health was noted on all the fish examined. Mortalities have reduced from previous week. FHI to monitor.
MRT02843	The Scottish Salmon Company	Taranaish	14/02/2022	Gill Health Related	1,543	Site inspected on 7/12/2021 (2021-0553), diagnostic samples collected. IPNv identified, recent issues reported onsite include AGD, PRV, SAV, Tenacibaculum. Site was partially treated with FW in Wk5. Last remaining cages are being FW treated this week. FHI to monitor.
MRT02835	Mowi Scotland Ltd	Loch Greshornish	04/02/2022	Pasteurella Skyensis / HSMI	6760	Site to be visited w/b 07/02/22.
MRT02833	SSF Shetland Ltd	Bight of Foraness	03/02/2022	Viral Disease / Sea Lice Related	6,916	Clinical HSMI has been diagnosed on the site, with histology results indicating impaired heart function likely during peak output. Recent thermolicer treatments have exacerbated mortality at the site. Treatment strategy has been reviewed by business and site is moving towards less intensive methods (tarp/wellboat) to treat remaining cages. First mortality notification received this year. FHI to monitor.
MRT02818	The Scottish Salmon Company	Taranaish	24/01/2022	Gill Health Related	2153	Site inspected on 7/12/2021 (2021-0553), diagnostic samples collected. IPNv identified, recent issues reported onsite include AGD, PRV, SAV, Tenacibaculum. Freshwater treatment planned for week 4. FHI to monitor.
MRT02779	Mowi Scotland Ltd	Loch Greshornish	17/01/2022	Complex gill diseases with AGD and HSMI.	27079	Mortality increased considerably in week following (WB10/01/2022) to 8.73%. PSI conducted on 07/01/2022. Florifenicol treatment ongoing to adress Moritella and P.Skyensis. Site to be contacted later this week to assess situation. FHI to monitor.
MRT02785	The Scottish Salmon Company	Taranaish	17/01/2022	Gill Health Related	1928	Site inspected on 7/12/2021 (2021-0553), diagnostic samples collected. IPNv identified, recent issues reported onsite include AGD, PRV, SAV, Tenacibaculum. Morality has reduced. Freshwater treatment completed. FHI to monitor.
MRT02763	Mowi Scotland Ltd	Loch Greshornish	10/01/2022	Complex gill diseases with AGD and HSMI.	17178	PSI conducted on 07/01/2022. Ongoing mortality with increased mortality observed for whole week (w/c 03/01/2022) with 5.74% (not officially reported). Secondary infection picked up in PSI; moritella and P.skyensis. Florfenicol treatment planned to treat Moritella and P.skyensis. FHI to monitor and see if mortality numbers decreased post antibiotic treatment.
MRT02768	The Scottish Salmon Company	Taranaish	10/01/2022	Gill Health Related	7,168	Company correspondent contacted. Site inspected on 7/12/2021 (2021-0553), diagnostic samples collected. IPNv identified, recent issues reported onsite include AGD, PRV, SAV, Tenacibaculum. On-going mortality with decrease in mortality since previous week. Freshwater treatment conducted in w/c 03/01/2022. FH to monitor
MRT02748	Mowi Scotland Ltd	Loch Greshornish	03/01/2022	Complex gill disease with AGD and HSMI.	13,451	On-going mortality event since October 2021. Mortality more than halved to previous week. Not officially reported, but following week (w/b 27/12) at 3.13% (full week). PSI required.
MRT02755	The Scottish Salmon Company	Taranaish	03/01/2022	Gill Health Related	8,125	Site inspected on 7/12/2021 (2021-0553), diagnostic samples collected. IPNv identified, recent issues reported onsite include AGD, PRV, SAV, Tenacibaculum. On-going mortality on downward trajectory, figures down from previous week.
MRT02736	The Scottish Salmon Company	Taranaish	27/12/2021	Gill Health Related	22,884	Site inspected on 7/12/2021 (2021-0553), diagnostic samples collected. IPNv identified, recent issues reported onsite include AGD, PRV, SAV, Tenacibaculum. On-going mortality on downward trajectory, figures down from previous week.
MRT02725	Mowi Scotland Ltd	Loch Greshornish	23/12/2021	Complex gill diseases with AGD and HSMI.	37454	This weeks mortalities have increased however week 51has seen a big reduction 1.51% for the first three days. FHI to monitor to ensure morts continue to decrease.

Event #	Company	Site Name	Date reported	Explained reasons	Mort #s	Action taken by FHI
MRT02716	The Scottish Salmon Company	Taranaish	20/12/2021	Gill Health Related	66,000	Site inspected on the 7/12/2021 with diagnostioc samples taken, IPNv identified, recent issues reported onsite include AGD, PRV, SAV, Tenacibaculum. 6 hour FW treatment has been administered which has had a positive effect on AGD. Fish behaviour is reported to be returning to normal and starting to show a feeding response. Mortality rates reducing to ~15% for following week. Mechanical treatment planned and looking for another FW treatment next year.
MRT02708	Mowi Scotland Ltd	Loch Greshornish	16/12/2021	Complex gill diseases with AGD and HSMI.	20909	Mortality spiking due to freshwater treatment (Wk50). Next freshwater treatment planned in January.
MRT02694	Mowi Scotland Ltd	Loch Greshornish	11/12/2021	Gill Disease, HSMI	11117	SIte manager contacted for further information. Slight reduction in following week (wk49).(1.62%) Site is currently treating with freshwater. Seeing spike in mortality after treatment, but after spike mortality has reduced to back ground levels in pens already treated.Second round of freashwater planned for january FHI to monitor.
MRT02668	Mowi Scotland Ltd	Loch Greshornish	06/12/2021	Gill Disease, HSMI and acute losses Salmosan Treatment	5941	Company contacted for further info. Complex gill disease and HSMI. Mortalities in week 48 increased due to Salmosan treatment to 1.9% but seem to be decreasing in week 49. FHI to monitor.
MRT02655	Scottish Sea Farms Ltd	Bloody bay	29/11/2021	Gill Health	1363	FHI visited site 10/11/2021 and diagnostic samples taken. P.theridion, SGPV and AGD positive. PCR was also positive for HSMI and CMS. Site is expected to be fallow by the end of 2021/beginning of 2022
MRT02619	Mowi Scotland Ltd	Loch Alsh (Sron)	19/11/2021	Jellyfish bloom and HSMI	23,459	Mortality has returned to below the reporting threshold in following week (0.39%). First mortality report this cycle. FHI to monitor.
MRT02620	Mowi Scotland Ltd	Loch Greshornish	19/11/2021	Acute Treatment loss (FW treatments) - HSMI	15,222	Mortality has reduced significantly in following week to 0.32%. FHI action TBC.
MRT02627	Scottish Sea Farms Ltd	Bloody bay	19/11/2021	Gill Health	2,164	FHI visited site 10/11/2021 and diagnostic samples taken. P.theridion, SGPV and AGD positive. PCR was also positive for HSMI and CMS. Site is expected to be fallow by the end of 2021/beginning of 2022.
MRT02607	Mowi Scotland Ltd	Loch Greshornish	11/11/2021	Acute Treatment loss (FW treatments) - HSMI	8197	Mortality has reduced slightly from last week, so far this week was below 1% but only for 3 days. Current losses attributed to FW treatmemts - FHI to continue to monitor, note to scheduler as visit may need conducted at end of month if morts rise.
MRT02581	Mowi Scotland Ltd	Loch Greshornish	08/11/2021	Acute Treatment loss (FW treatments) - HSMI	10199	Mortality has reduced down to 0.57% wb 01/11/2021. Visit may be arranged at end of november if mortality picks up again when inspectors are in Skye. FW treatments being carried out currently. FHI to monitor
MRT02328	The Scottish Salmon Company	Portree	30/08/2021	Viral Diseases, Gill Health Related, Sea Lice Related (treatment)	8947	Previously positive for PRV (wk28). Site has now been found to be positive for CMS. PGD and anaemia prevalent. Mortalities exacerbated by mechanical treatments. Reduced mortality in wk34. FHI to monitor.
MRT02257	The Scottish Salmon Company	Aird	09/08/2021	Viral Diseases, Sea Lice Related	5567	Increased mortality following reduction in week 29. Business correspondant detailed that CMS is still present on site. Mortality is related to viral disease (positive for PRV and CMS wk 28) and exacberated by post treatment handling (mechnical). Previously mentioned that Aird fish are on harvest plan. FHI to monitor. Treatment mortality figures will be monitored to see if they drop post treatment
MRT02238	The Scottish Salmon Company	Maragay Mor	26/07/2021	Handling (Pumping/Grading), Sea Lice Related	9064	Company contacted for additional information. The Fish at Maragay have required grading, freshwater treatment and lice treatment within relatively quick succession in order to treat the presence of AGD and elevated lice in recent weeks. Increased sensitivity in the stocked fish to handling events is a result of the population being positive for PRV. Biomass at the site has been reduced through fish transfers and harvests. Mortality reduced below the threshold in week 29. FHI to monitor.
MRT02240	The Scottish Salmon Company	Aird	26/07/2021	Viral Diseases	4536	company contacted for additonal information. Aird has tested positive during cycle for PRV and CMS. CMS has been the cause of the mortality observed in week 28. Aird fish are on harvest plan. Mortality reduced below reporting thresehold in week following (week 29) FHI to monitor

Event #	Company	Site Name	Date reported	Explained reasons	Mort #s	Action taken by FHI
MRT02241	The Scottish Salmon Company	Portree Outer	26/07/2021	Handling (Pumping/Grading), Sea Lice Related	7917	Company contacted for additional information. Portree Outer has required mechanical treatments for lice intervention. The mortality observed has been post-treatment. Portree is positive for PRV which explains increased sensitivity to handling events during the mechanical treatments. Lice levels on site are now well below intervention criteria. Intervention type going forward will consider fish tolerance for handling, with minimal stress options prioritised. Mortality dropped below reporting thresehold in week following (week 29) FHI to monitor
MRT02188	The Scottish Salmon Company	Aird	29/06/2021	Sea Lice Related, Viral Diseases	5530	Contacted business correspondent. CMS main cause of mortality , although also had positive results for PRV and SAV. Site has undergone a hydrolicer treatment. FHI to monitor mortality reports post treatment.
MRT02121	The Scottish Salmon Company	Aird	10/05/2021	Viral Diseases, Predation, Gill Health Related	5548	CMS, PRV and SAV. Site underwent a FW treatment. Monitor figures post treatment
MRT02120	The Scottish Salmon Company	Sgeir Dughall	03/05/2021	Viral diseases, predation, plankton	4655	CMS, PRV, SAV. ADD tones altered and Sealpro nets will be installed. FHI inspecting this week (6/5/21)
MRT02112	The Scottish Salmon Company	Reibinish	26/04/2021	Viral Diseases, Predation	2193	CMS, PRV, SAV. ADD tones altered and Sealpro nets will be installed. Currently fallow.
MRT02113	The Scottish Salmon Company	Scadabay	26/04/2021	Viral Diseases, Predation	1026	CMS, PRV, SAV. ADD tones altered and Sealpro nets will be installed. To be fallowed soon.
MRT02114	The Scottish Salmon Company	Sgeir Dughall	26/04/2021	Viral Diseases, Predation	4608	CMS, PRV, SAV. ADD tones altered and Sealpro nets will be installed. FHI to visit WB 03/05/21.
MRT02115	The Scottish Salmon Company	Aird	26/04/2021	Viral Diseases, Predation	9569	CMS, PRV, SAV. ADD tones altered and Sealpro nets will be installed.
MRT02109	The Scottish Salmon Company	Sgeir Dughall	19/04/2021	Viral Diseases, Predation	6574	Contacted company biologist, targeted harvesting of most affected pens is ongoing. Seal pro nets and an adjustment to the ADD on site has had a positive impact on seal numbers and mortalities are expected to reduce the following week. CMS and HSMI has been detected in the stock. Mechanical sea lice treatments had been used, a FW treatment is planned. FHI to be on site w/b 3/5/2021
MRT02110	The Scottish Salmon Company	Aird	19/04/2021	Viral Diseases, Predation	8209	Contacted company biologist, increase in seal activity around the site,causing some stress. Sgeir Dughall has had seal pro nets installed and the ADD has been adjusted this has caused the seals to migrate to Aird. FW treatment is planned. CMS, PD and PRV has been detected. FHI to monitor.
MRT02103	The Scottish Salmon Company	Scadabay	12/04/2021	Predation, Viral diseases	1401	FHI contacted company biologist for further information. PMCV/CMS and PRV/HSMI have been detected on site via PCR. Site to be fallow by end of may and mortality appears to have reduced below threshold the week following. FHI to monitor
MRT02102	The Scottish Salmon Company	Sgeir Dughall	06/04/2021	CMS/HSMI/Predator	9821	Site will be fallow by Q3 at the latest, most likely earlier. FHI are due to visit the site for inspection first week in may. FHI to monitor.
MRT02096	The Scottish Salmon Company	Sgeir Dughall	29/03/2021	CMS, HSMI, Predator	9868	Mechanical treatment for lice and fw treatment for gills administered previous week. Mortalities have returned to below reporting threshold in week 12, FHI will monitor.
MRT02089	The Scottish Salmon Company	Sgeir Dughall	19/03/2021	Gill Health related (FW treatment), viral diseases (CMS, HSMI)	18637	FHI contacted company biologist. Mortality levels for the following week around 1.3%, final numbers to be confirmed and notification submitted. Increase in mortality compared to previous notification of 1.1%, attributed it to post trematment losses. Further mechanical treatments taking place this week on targeted pens. FHI to monitor.
MRT02082	The Scottish Salmon Company	Sgeir Dughall	09/03/2021	post treatment, CMS, HSMI	4281	Mortality on site remained elevated (4.76%) in wk9 as mechanical and FW treatments continued. Mortality was compounded by CMS and some predtion on site. Treatments have now been completed. FHI to monitor over coming weeks.
MRT01683	Grieg Seafood Shetland Ltd	Leinish	02/07/2020	HSMI/Treatment Losses	11197	PSI to be conducted.

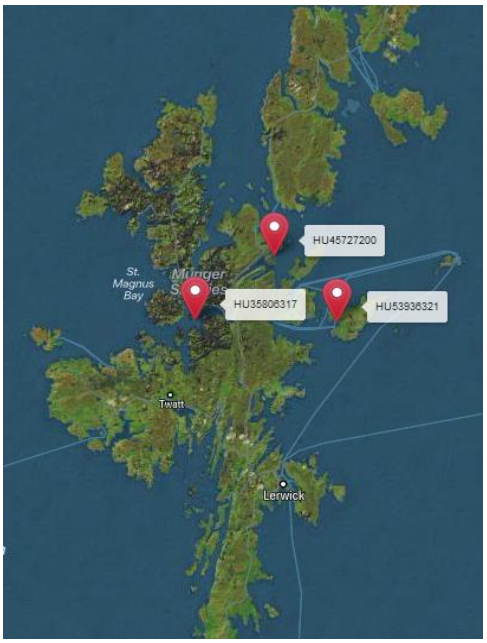
Event #	Company	Site Name	Date reported	Explained reasons	Mort #s	Additional information
MRT01619	Grieg Seafood Shetland Ltd	North Voe	28/04/2020	Handling/HSMI	3473	Handling damage a result of net changing (pen 6 and 7) leading to scrubbing damage of fish. Net changing process reviewed and subsequent net change at pen 5 has resulted in very low mortality levels. HSMI first detected on site February 2020
MRT00535	Marine Harvest (Scotland) Ltd	Ardintoul	22/11/2017	CMS, Complex gill issues	51592	Observed a decrease in appetite prior to increase in mortality levels. Combination of factors - fish have tested positive to CMS, PRV and complex gill issues. Cause recorded as anaemia by company
MRT00536	Marine Harvest (Scotland) Ltd	Ardintoul	22/11/2017	CMS, Complex gill issues	22330	Observed a decrease in appetite prior to increase in mortality levels. Combination of factors - fish have tested positive to CMS, PRV and complex gill issues. Cause recorded as anaemia by company
MRT00537	Marine Harvest (Scotland) Ltd	Ardintoul	22/11/2017	CMS, Complex gill issues	11822	Observed a decrease in appetite prior to increase in mortality levels. Combination of factors - fish have tested positive to CMS, PRV and complex gill issues. Cause recorded as anaemia by company
MRT00538	Marine Harvest (Scotland) Ltd	Ardintoul	22/11/2017	CMS, Complex gill issues	12502	Observed a decrease in appetite prior to increase in mortality levels. Combination of factors - fish have tested positive to CMS, PRV and complex gill issues. Cause recorded as anaemia by company

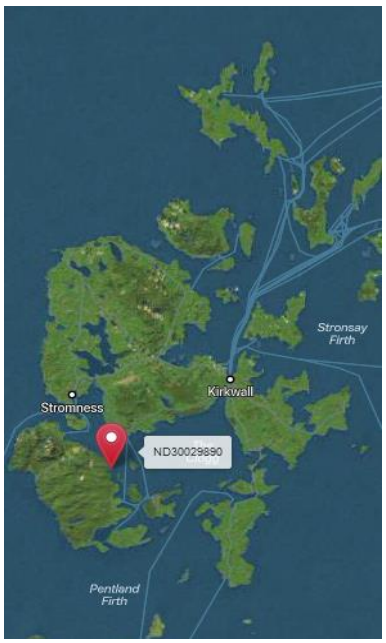
In summary, the PRV/HSMI positive cases reported by the Scottish Government's Fish Health Inspectorate (via 'Case Information' and via 'Mortality Event Reports') since November 2017 include 14 sites operated by Bakkafrost/The Scottish Salmon Company; 10 Mowi; 6 Scottish Sea Farms; 4 Grieg Seafood, 2 Loch Duart and 1 Cooke Aquaculture site (37 in total):

Bakkafrost/ The Scottish Salmon Company (Aird in Loch Sheildaig/Torridon)
Bakkafrost/ The Scottish Salmon Company (Ardcastle Bay in Loch Fyne)
Bakkafrost/ The Scottish Salmon Company (East Tarbert Bay in the Sound of Gigha)
Bakkafrost/ The Scottish Salmon Company (Lamlash Bay/St Molios, Isle of Arran)
Bakkafrost/ The Scottish Salmon Company (Loch Odhairn/Gravir, Isle of Lewis)
Bakkafrost/ The Scottish Salmon Company (Maragay Mor in Loch Uiskevagh, Uists)
Bakkafrost/ The Scottish Salmon Company (Portree/Torvaig in Sound of Raasay, Isle of Skye)
Bakkafrost/ The Scottish Salmon Company (Portree Outer in Sound of Raasay, Isle of Skye)
Bakkafrost/ The Scottish Salmon Company (Plocrapol in East Loch Tarbert, Isle of Harris)
Bakkafrost/ The Scottish Salmon Company (Reibinish in East Loch Tarbert, Isle of Harris)
Bakkafrost/ The Scottish Salmon Company (Scadabay in Loch Grosebay, Isle of Harris)
Bakkafrost/ The Scottish Salmon Company (Sgeir Dughall in Loch Torridon)
Bakkafrost/ The Scottish Salmon Company (Taranaish in Loch Roag, Isle of Lewis)

Bakkafrost/ The Scottish Salmon Company (Tarbert South in Loch Fyne)
Cooke Aquaculture (Lyrawa Bay in Scapa Flow, Orkney Islands)
Grieg Seafood (Cole Deep in Gon Firth, Shetland)
Grieg Seafood (Gob Na Hoe in Loch Dunvegan, Isle of Skye)
Grieg Seafood (Leinish Bay in Loch Dunvegan, Isle of Skye)
Grieg Seafood (North Voe in Linga Sound, Shetland)
Loch Duart (Loch Laxford, Sutherland)
Loch Duart (Lochmaddy, North Uist)
Mowi (Ardintoul in Loch Alsh)
Mowi (Cairidh in Loch Ainort, Isle of Skye)
Mowi (Eilean Grianain/Carradale in Kilbrannan Sound)
Mowi (Greshornish in Loch Snizort, Isle of Skye)
Mowi (Kingairloch in Loch a Choire/Loch Linnhe)
Mowi (North Shore in Loch Erisort, Isle of Lewis)
Mowi (Sconser Quarry in Caol Mor, Isle of Skye)
Mowi (Sron in Loch Alsh)
Mowi (Stulaigh in Loch Eynort, South Uist)
Mowi (Tabhaigh in Loch Erisort, Isle of Lewis)
Scottish Sea Farms (Bight of Foraness in Swinnister Voe, Shetland)
Scottish Sea Farms (Bloody Bay in the Sound of Mull, Isle of Mull)
Scottish Sea Farms (Loch Creran)
Scottish Sea Farms (Lismore North, Loch Linnhe)
Scottish Sea Farms (Nevis C in Loch Nevis)
Scottish Sea Farms (Shuna in Loch Linnhe)

Here are maps showing the locations of PRV/HSMI cases – from the Shetland Isles and the Orkney Islands in the far North of Scotland:





To the Outer Hebrides, the North West of Scotland, the Isle of Skye and down to Loch Nevis:

Down to the Isle of Mull and Loch Linnhe:

And then down to the Isle of Gigha, Loch Fyne and the Isle of Arran in the South of Scotland:

In other words: everywhere that salmon farms operate in the Highlands & Islands!

Note that a more thorough analysis of the Scottish Government's 'Case Information' database – the archive goes back to 2013 – will dredge up even more cases of PRV and HSMI. For example, an 'organic' salmon farm in Loch Harport on the Isle of Skye operated by Marine Harvest (since renamed Mowi) was diagnosed with HSMI in August 2013 (as detailed via a Fish Health Inspectorate report for December 2013):

Case No:	2013-0463					Date of visit:	14/10/2013
Time spent on site:	5 hours					Main Inspector:	JMS
Site No:	fs0247		Site Name:	Loch Harport			
Business No:	FB0119		Business Name:	Marine Harvest (Scotland) Ltd			
Case Types:	1 DIA	2	3	4	5	6	
Water Temp (°C):	12.9		Thermometer No:	T152		FHI 045 completed	

Observations:

Dead/weak/abnormally behaving fish present?	Y	If yes, detail below or on clinical score sheet.
Clinical signs of disease observed?	Y	If yes, detail below or on clinical score sheet.
Gross pathology observed?	Y	If yes, detail below or on clinical score sheet.
Diagnostic samples taken?	Y	

Additional comments

Six fish were taken for diagnostics. Very few moribund fish observed on the site but lethargic fish were observed in all cages. Severe gill damage was observed and the site had experienced large mortalities due to gill damage from algal blooms in September (kerinia and Chaetoceros). The site was also diagnosed with HSMI in August 2013. Fish Vet Group diagnosed AGD on site in September 2013.

4. Recent mortality (last 4 wks):	99422/ site/ 14/09/13 to 14/10/13. the majority of the losses were attributed to: Algal Bloom = 94597/site, HSMI = 2896/site, Harvest dead (died in well

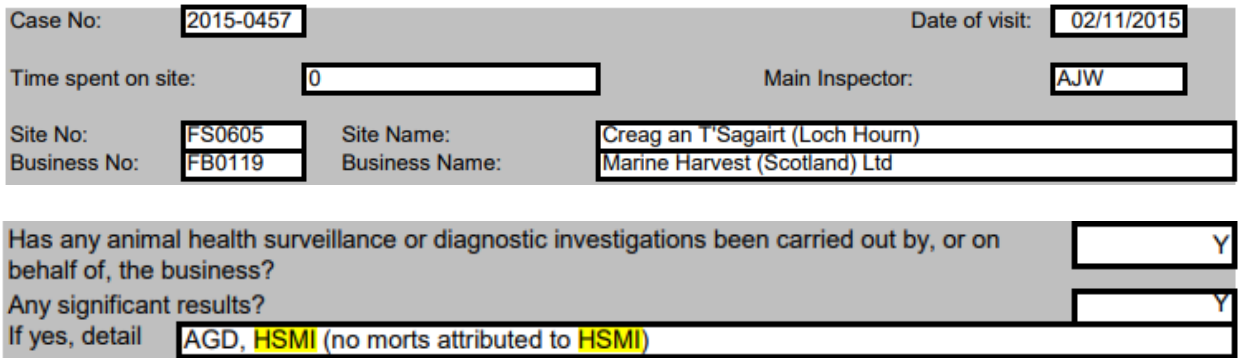
6. Any other peaks in mortality during period checked?	Y
11/7/13 - 11/8/13 Poor doer = 1737, Seal = 241, HSMI = 859	

Another Marine Harvest (Mowi) salmon farm in Loch Seaforth on the Isle of Lewis was diagnosed with HSMI in 2014 (as detailed via a Fish Health Inspectorate report for November 2014):

Case No:	2014-0603			Date of visit:	26/11/2014
Time spent on site:	0hrs			Main Inspector:	AJW
Site No:	FS1042	Site Name:	Seaforth		
Business No:	FB0119	Business Name:	Marine Harvest (Scotland) Ltd		

Any disease on site? (since last inspection)	Y
If yes, detail:	HSMI diagnosed 4-5 wks ago and lice
Has any animal health surveillance or diagnostic investigations been carried out by, or on behalf of, the business?	Y
Any significant results?	Y
If yes, detail	HSMI

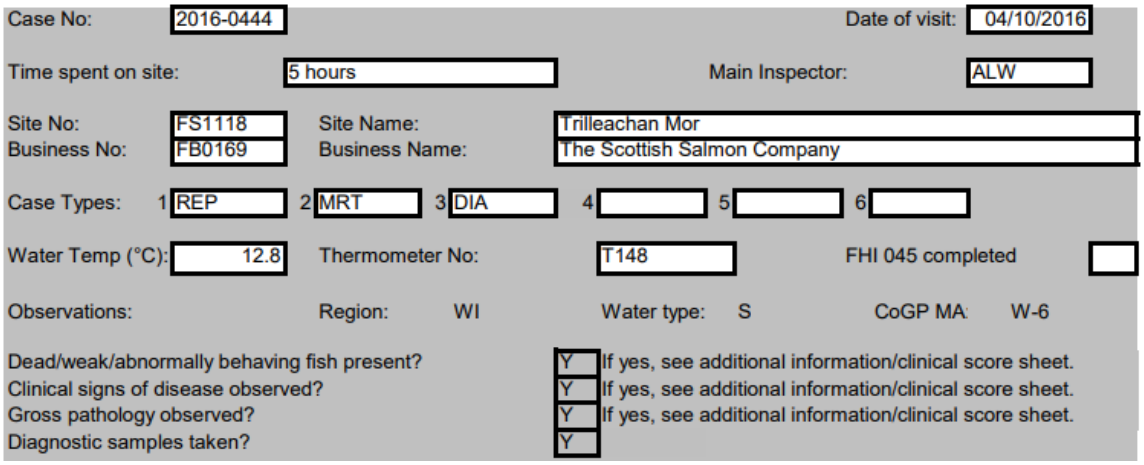
A Fish Health Inspectorate report for November 2015 identified HSMI at a salmon farm operated by Marine Harvest (Mowi) at Creag an T'Sagairt in Loch Hourn:



Case No:	2015-0457	Date of visit:	02/11/2015
Time spent on site:	0	Main Inspector:	AJW
Site No:	FS0605	Site Name:	Creag an T'Sagairt (Loch Hourn)
Business No:	FB0119	Business Name:	Marine Harvest (Scotland) Ltd

Has any animal health surveillance or diagnostic investigations been carried out by, or on behalf of, the business?	Y
Any significant results?	Y
If yes, detail	AGD, HSMI (no morts attributed to HSMI)

A Fish Health Inspectorate report for October 2016 identified PRV at The Scottish Salmon Company (since renamed Bakkafrost Scotland) at their Trilleachan Mor salmon farm (since taken over by Mowi):



Case No:	2016-0444	Date of visit:	04/10/2016
Time spent on site:	5 hours	Main Inspector:	ALW
Site No:	FS1118	Site Name:	Trilleachan Mor
Business No:	FB0169	Business Name:	The Scottish Salmon Company

Case Types: 1 REP 2 MRT 3 DIA 4 5 6

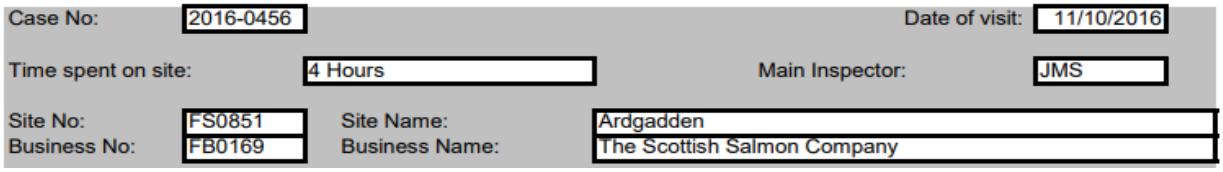
Water Temp (°C): 12.8 Thermometer No: T148 FHI 045 completed

Observations: Region: WI Water type: S CoGP MA: W-6

Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.
Clinical signs of disease observed?	Y	If yes, see additional information/clinical score sheet.
Gross pathology observed?	Y	If yes, see additional information/clinical score sheet.
Diagnostic samples taken?	Y	

AGD pathology was identified as branchiomonas (clinically significant) and Desmozoon lepeoptherii. Samples have also tested positive for PRV and pox. Moritella was also suspected earlier in the year. Tests for SAV were negative.

Another Fish Health Inspectorate report for October 2016 for a salmon farm operated by The Scottish Salmon Company at Ardgadden in Loch Fyne detailed: "health surveillance carried out by business revealed site positive for PRV":



Case No:	2016-0456	Date of visit:	11/10/2016
Time spent on site:	4 Hours	Main Inspector:	JMS
Site No:	FS0851	Site Name:	Ardgadden
Business No:	FB0169	Business Name:	The Scottish Salmon Company

Additional Case Information:

Health surveillance carried out by business revealed site positive for PRV

A Fish Health Inspectorate report for October 2017 detailed positive PCR tests for PRV at the Knock Hatchery operated by Scottish Sea Farms on the Isle of Mull (Landcatch's Ormsary Hatchery – where ISA was detected last year - was also cited in the report):

Case No:	2017-0455			Date of visit:	10/10/2017
Time spent on site:	5h			Main Inspector:	DJT
Site No:	fs0254	Site Name:	Knock		
Business No:	FB0125	Business Name:	Scottish Sea Farms Ltd		

16 May 2017 testing for PRV on two tanks following positive results on sea site post transfer, PCR tests on site were positive for PRV but there was no clinical expression however fungus was evident these fish were culled out on site.

6. Any other peaks in mortality during period checked?	Y
If yes, detail:	w/b 8/5/2017 tank E17, post transfer from Ormsary 29478 (fish were post yolk sack fry but were not feeding)

This is the first time that $camon $cotland has seen a positive test for PRV in a hatchery and raises fears that hatchery-reared salmon are spreading PRV/HSMI to sea cage sites up and down the coasts of Scotland.

Another Fish Health Inspectorate report for November 2017 cited PRV at the Caolas A Deas salmon farm operated by Marine Harvest (Mowi) in Loch Shell – with reference to on-growing of fish via other sites at Seaforth and Tabhaigh (i.e. farmed salmon are moved between sites):

Case No:	2017-0506							Date of visit:	07/11/2017		
Time spent on site:	5.5 hours							Main Inspector:	ALW		
Site No:	FS1291	Site Name:	Caolas A Deas								
Business No:	FB0119	Business Name:	Marine Harvest (Scotland) Ltd								
Case Types:	1 REP	2 ECI	3 CNI	4 SLI	5 VMD	6					
Water Temp (°C):	12.2	Thermometer No:	T148			FHI 045 completed					
Observations:		Region:	WI	Water type:	S	CoGP MA:	W-5				
Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.									

Due to finish harvest in a couple of weeks. Will then restock after 4 week fallow with ~450,000 part grown stock from Seaforth for approx 6 months. Next input after that will be late Q3/Q4s smolts in 2018.
CMS, PRV and PD have been confirmed on site. PGD is main cause of mortalities, particularly during treatments. Recent tests for AGD have been negative.
Fish were transferred to site from Tabhaigh and received a freshwater treatment in the wellboat during transfer. While on site fish have had treatments with Salmosan (June, August & September), Slice (July), freshwater (October) and the thermolicer (one cage only in August). Elevated mortality levels after treatment with thermolicer so no other cages treated. Recent freshwater treatment carried out on Intercaledonia. Fish treated on boat for 11 hours and some elevated mortality levels occurred due to PGD. Also experienced increased mortality levels in lumpfish during the treatment as they could not be removed from the pens prior to the treatment. Estimate approx 1,500-2,000 per pen.

A Fish Health Inspectorate report for February 2017 reported HSMI at Slocka Ronas Voe salmon farm in Shetland (the diagnostic investigation was carried out by, or on behalf of, Scottish Sea Farms) – with reference to the fish on site sourced from Knock, Ormsary and Loch Frisa:

Case No:	2017-0017			Date of visit:	28/02/2017
Time spent on site:	0			Main Inspector:	AJW
Site No:	FS1018	Site Name:	Slocka Ronas Voe		
Business No:	FB0125	Business Name:	Scottish Sea Farms Ltd		

Additional Case Information:

Fish currently on site from Knock, Ormsary and Loch Frisa put onto site at end of February. These origins reported to be doing well. Fish were also transferred onto site from Couldoran but of the 193,000 fish, 160,00 died either during transport or on discharge. The remaining fish from this input were culled.

Any disease on site? (since last inspection)	Y
If yes, detail:	HSMI, Paranucleospora theridion and lice in previous cycle
Has any animal health surveillance or diagnostic investigations been carried out by, or on behalf of, the business?	Y
Any significant results?	Y
If yes, detail	HSMI, Paranucleospora theridion

Another Scottish Sea Farms site in Loch Nevis reported HSMI and PRV via a Fish Health Inspectorate report for April 2017 – with 4,129 morts following a Thermolicer treatment where it was "thought to be fish weakened by HSMI":

Case No:	2017-0130			Date of visit:	04/04/2017
Time spent on site:	7 hrs			Main Inspector:	SAE
Site No:	FS0430	Site Name:	Nevis A		
Business No:	FB0125	Business Name:	Scottish Sea Farms Ltd		

Recent (last 4 wks) disease problems?	Y
If yes, detail:	HSMI not causing mortalities

3. Any significant results?	Y
If yes, detail (if not detailed under recent disease problems).	failed smolts, gill issues, HSMI
23/7/16 failed smolts, concussion, 18/11/16 AGD & PGD, 30/1/17 PCR positive PRV (HSMI) fairly low CT values	

Start date:	End date: (if applicable)	Total mortality during event (if available):	Additional information (e.g. action taken by company):
20/02/2017	26/02/2017	4,129	Losses following Thermolicer treatment. Thought to be fish weakend by HSMI.

Another Scottish Sea Farms site in Loch Kishorn – sourced with smolts from Ormsary and Loch Damph – cited a "low grade HSMI previously diagnosed" by FVG (Fish Vet Group) via a Fish Health Inspectorate report for September 2017:

Case No:	2017-0398								Date of visit:	05/09/2017	
Time spent on site:	5 hours								Main Inspector:	JMS	
Site No:	FS1274	Site Name:	Kishorn West								
Business No:	FB0125	Business Name:	Scottish Sea Farms Ltd								
Case Types:	1 ECI	2 CNI	3 SLI	4 VMD	5 DIA	6 REP					
Water Temp (°C):	13.9	Thermometer No:	T152						FHI 045 completed		
Observations:		Region:	HI		Water type:	S			CoGP MA:	M-19	
Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.									
Clinical signs of disease observed?	Y	If yes, see additional information/clinical score sheet.									
Gross pathology observed?	Y	If yes, see additional information/clinical score sheet.									
Diagnostic samples taken?	Y										

FVG report 30/7/17 - mortality improved post H202 but appetite still low. Low grade HSMI previously diagnosed, lamellar aneurisms (bleeding) and AGD. Mentions symptoms associated with water borne irritant but water samples have not identified any blooms.

Additional comments:

All fish had very pale gills with evidence of haemorrhaging. All fish had pale livers and pale hearts. F2 and F5 had deformed hearts which were difficult to cut. F1 had fluid round the heart.

Observations

The above site was inspected following a report from the business of increased mortality in the Atlantic salmon stocked on the site. At the time of the inspection the site was stocked with 277,466 2016 S0 Atlantic salmon at an average weight of 3.3kg and 2300 mixed year class wrasse at an average weight of 50g. Mortality started to increase at the beginning of July 2017 accompanied with a drop in appetite. The odd numbered cages located to the east of the feed barge were worst affected, with mortality peaking in week 34 at 19.61% in cage 3. Complex gill issues and low grade heart and skeletal muscle inflammation (HSMI) had been diagnosed at the site by Fish Vet Group. Five lethargic Atlantic salmon were sampled for diagnostic purposes.

External: All fish were lethargic and had pale gills with evidence of haemorrhaging. Lice (*Lepeophtheirus salmonis*) were also observed on all fish.

A Fish Health Inspectorate report for January 2016 cited HSMI and PRV at Cooke Aquaculture's Vee Taing salmon farm in Shetland – including a positive test for PRV following sampling by Scottish Government inspectors and HSMI infection detected via a "vet report":

Case No:	2016-0036						Date of visit:	27/01/2016	
Time spent on site:	6.5 hours						Main Inspector:	KLL	
Site No:	FS1057	Site Name:	Vee Taing						
Business No:	FB0095	Business Name:	Cooke Aquaculture Scotland Ltd						
Case Types:	1 ECI	2 CNI	3 SLI	4 VMD	5 DIA	6			
Water Temp (°C)	8	Thermometer No:	Site				FHI 045 completed		
Observations:		Region:	SH	Water type:	S		CoGP MA:	S-2	

Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.
Clinical signs of disease observed?	Y	If yes, see additional information/clinical score sheet.
Gross pathology observed?	Y	If yes, see additional information/clinical score sheet.
Diagnostic samples taken?	Y	

Most recent vet report in October suggested a water bourne irritant was causing gill damage, which was leading to elevated mortality. Also reported was some evidence of either PD or HSMI infection earlier in the cycle. A new feed is being trialled that is reported to increase mucous production on the gills, which is supposed to help combat AGD.

3. Any significant results?	Y
If yes, detail (if not detailed under recent disease problems).	
mild and chronic gill pathology caused by water bourne irritant. Post clinical symptoms of PD or HSMI observed in heart and skeletal muscle (end of October)	

In this case, Scottish Government inspectors did test for PRV/HSMI with positive results:

Case No:	2016-0036	Date of visit:	27/01/2016
Site No:	FS1057	Inspector:	KLL

Results Summary	Freq.	Date of Notification						
		Database	Insp	Phone	Insp	Writing	Insp	2nd Insp
SAV PCR	0/1	03/02/2016	KLL	N/A	KLL	04/03/2016	KLL	AJW
IPNv	1/1	04/02/2016	KLL	04/02/2016	KLL	04/03/2016	KLL	AJW
CMS (histo)	1/3	10/02/2016	KLL	10/02/2016	KLL	04/03/2016	KLL	AJW
IPN (histo)	1/3	10/02/2016	KLL	10/02/2016	KLL	04/03/2016	KLL	AJW
AGD (histo)	1/3	10/02/2016	KLL	10/02/2016	KLL	04/03/2016	KLL	AJW
Moritella viscosa (bact)	2/3	10/02/2016	KLL	10/02/2016	KLL	04/03/2016	KLL	AJW
VHS	0/1	25/02/2016	KLL	N/A	KLL	04/03/2016	KLL	AJW
IHN	0/1	25/02/2016	KLL	N/A	KLL	04/03/2016	KLL	AJW
ISA	0/1	25/02/2016	KLL	N/A	KLL	04/03/2016	KLL	AJW
PMVP (CMS PCR)	1/1	25/02/2016	KLL	25/02/2016	KLL	04/03/2016	KLL	AJW
PRV (HSMI PCR)	1/1	25/02/2016	KLL	25/02/2016	KLL	04/03/2016	KLL	AJW

Molecular Genetics: Tissue samples were tested for segments of RNA indicative of the presence of infectious salmon anaemia virus (ISAv) and salmonid alphavirus (SAV) using real-time PCR (QPCR). Further tests were conducted for piscine myocarditis virus (PMV) and piscine reovirus (PRV).

Pool 1 was positive for PMV and PRV.

A Fish Health Inspectorate report for September 2016 detailed "HSMI virus thought to be present" at Grieg Seafood's East Voe Laxfirth salmon farm in Shetland:

Case No:	2016-0418			Date of visit:	23/09/2016
Time spent on site:	0			Main Inspector:	PMM
Site No:	FS0333	Site Name:	East Voe Laxfirth		
Business No:	FB0440	Business Name:	Grieg Seafood Shetland Ltd		

Additional Case Information:

Notification received from Production manager regarding 1.81% mortality at East Voe Laxfirth. Diagnostic sample had been taken 2016-0393 on 13/09/16

HSMI virus thought to be present although GSS suspect from the livers that the fish have also suffered from toxic algal poisoning from Psuedo-nitzschia - to be confirmed by histology. Began emergency harvesting. If there is no improvement in the fish condition, expect to depopulate the site within the next two weeks

Reference was made to "diagnostic sampling" being conducted but no samples were taken by Scottish Government inspectors for testing:

Start date:	End date: (if applicable)	Size of fish:	Average weight of affected population:	Species:	Yearclass:	Timescale	Mortality rate recorded(%):	Explained/ unexplained:	If explained, select reason(s):
19/09/2016	23/09/2016	≥750g	2.5 kg	SAL	2015 S0	Weekly	1.81	Explained	HSMI

Additional information (e.g. action taken by company):	Action taken by FHI (include case no where applicable):
HSMI virus to be present although GSS suspect from the livers that the fish have also suffered from toxic algal poisoning from Psuedo-nitzschia - to be confirmed by histology. Began emergency harvesting. If there is no improvement in the fish's condition GSS expect to depopulate the site within the next two weeks	Site was inspected wk37 and diagnostic sampling conducted.

Both PRV and HSMI were reported at a salmon farm operated by Marine Harvest (Mowi) in Loch Torridon via the Fish Health Inspectorate in May 2016:

Case No:	2016-0175								Date of visit:	11/05/2016	
Time spent on site:	4 hours								Main Inspector:	JMS	
Site No:	FS0234	Site Name:	Torridon								
Business No:	FB0119	Business Name:	Marine Harvest (Scotland) Ltd								
Case Types:	1 ECI	2 CNI	3 SLI	4 VMD	5 MRT	6					
Water Temp (°C):	9	Thermometer No:	T152						FHI 045 completed		
Observations:		Region:	HI		Water type:	S			CoGP MA:	M-17	
Dead/weak/abnormally behaving fish present?				Y	If yes, see additional information/clinical score sheet.						
Clinical signs of disease observed?				Y	If yes, see additional information/clinical score sheet.						

Salmon - 18/11/15 - pen 4 - 9%, pen 6 - 5.8% - fungus, fish from Glenfinnan - Fish moved under veterinary supervision as treatment for fungus.
Salmon - 3/11/15- 30/11/15 - pen 4 29095 for period, pen 6 14564 total morts for period
Salmon - 50971 morts/site total for November 2015
Salmon - 5907 morts/site for December
Salmon - March 2016 - ~2% for site - some seal mortality, one seal dispatched
Piscine riovirus (CMS) positive result - 26/04/16

Recent (last 4 wks) disease problems?	Y	Any escapes (since last visit)?	N
If yes, detail:	PRV positive, some suspect bacterial infection in lumpfish		

The positive PRV test was carried out by, or on behalf of, Marine Harvest (Mowi).

1. Has any animal health surveillance been carried out by, or on behalf of, the business?	Y
2. If yes, are results available for inspection?	Y
3. Any significant results?	Y
If yes, detail (if not detailed under recent disease problems).	
Fungus at start of cycle, PRV positive 20/4/16, samples taken from lumpfish for bacteriology 10/5/16 - no results yet	

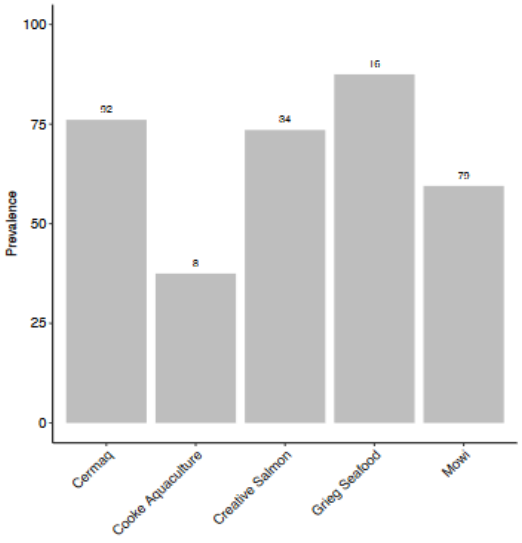
However, no samples were taken by the Scottish Government inspector:

> All epidemiological units were inspected. On this occasion no samples were taken for disease analysis. The Inspector did not observe any clinical signs associated with the listed diseases as described in the Aquatic Animal Health (Scotland) Regulations 2009.

When Scottish Salmon Watch visited Mowi's Loch Torridon salmon farm in September 2020 we observed a skip full of disease-ridden dead salmon:

Access to disease data held by salmon farming companies and diagnostic testing companies is required to produce a graph detailing prevalence of positive PRV detections in Scotland by company (Mowi, Scottish Sea Farms/Grieg Seafood, The Scottish Salmon Company/Bakkafrost, Loch Duart, Cooke Aquaculture and Organic Sea Harvest) – as [reported by the Canadian Journal of Fisheries and Aquatic Sciences (18 November 2022) for Cermaq, Cooke Aquaculture, Creative Salmon, Grieg Seafood and Mowi](#).

Figure S3 Prevalence (%) of positive detections in each company. Numbers show the total number of samples tested for each company (n).



In addition to testing in sea cages (it does not appear that the Scottish Government conduct PRV/HSMI testing in freshwater cages or hatcheries or processing plants – at least the testing results are not publicly available), the Scottish Government has tested wild salmon for PRV.

In a [case reported by the Scottish Government for June 2021](#), the Fish Health Inspectorate tested 90 juvenile wild salmon from the River Forss for PRV and all were negative.

Case No:	2021-0167						Date of visit:	08/06/2021	
Time spent on site:	3 working days					Main Inspector:			
Site No:	FS1240	Site Name:	Highland						
Business No:	FB0544	Business Name:	Scotland						
Case Types:	1 STS	2 DIA	3 OTH	4	5	6			
Water Temp (°C):	17.5	Thermometer No:	T173			FHI 045 completed			
Observations:		Region:	HI		Water type:	B	CoGP MA		
Dead/weak/abnormally behaving fish present?	Y	If yes, see additional information/clinical score sheet.							
Clinical signs of disease observed?	Y	If yes, see additional information/clinical score sheet.							
Gross pathology observed?	Y	If yes, see additional information/clinical score sheet.							
Diagnostic samples taken?	Y								

Screening of 150 juvenile salmon from the River Forss for pathogens following reports of a collapse of recruitment last year. 150 fish were caught by electro fishing over two days, 8th and 9th of June 2021 (ND058639).

Case No:	2021-0167	Date of visit:	08/06/2021
Site No:	FS1240	Inspector:	[redacted]

Results Summary	Freq.	Date of Notification						
		Database	Insp	Phone	Insp	Writing	Insp	2nd Insp
MG - Piscine myocarditis virus	0/90		[redacted]	23/06/2021	[redacted]	29/09/2021	[redacted]	[redacted]
MG - piscine Reovirus	0/90			23/06/2021		29/09/2021		
MG - Salmonid alphavirus	0/92			23/06/2021		29/09/2021		

Samples tested negative for infectious haematopoietic necrosis virus (IHNV), infectious pancreatic necrosis virus (IPNV), salmonid alphavirus (SAV) and viral haemorrhagic septicemia virus (VHSV), piscine reovirus (PRV), and piscine myocarditis virus (PMCV).

A further five wild salmon tested negative for PRV in May 2022 – as detailed in a Fish Health Inspectorate report for the River Divie (a tributary of the River Findhorn):

Case No:	2022-0167	Date of visit:	19/05/2022
Site No:	FS1240	Inspector:	[redacted]

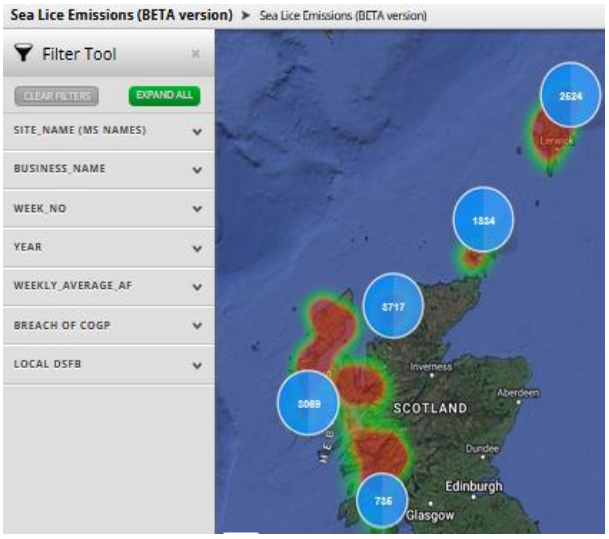
Results Summary	Freq.	Date of Notification						
		Database	Insp	Phone	Insp	Writing	Insp	2nd Insp
MG_AGDQ	0/5	24/05/2022	[redacted]	24/05/2022	[redacted]		[redacted]	[redacted]
MG_PARA_THER_Q	0/5	24/05/2022		24/05/2022				
MG_SAL_POX	5/5	24/05/2022		24/05/2022				
GPAT	5/5	02/06/2022		02/06/2022				
SAPR (histo)	3/5	02/06/2022		02/06/2022				
GPAR	3/5	02/06/2022		02/06/2022				
CEST	1/5	02/06/2022		02/06/2022				
SPVH	1/5	02/06/2022		02/06/2022				
SKIN	3/5	02/06/2022		02/06/2022				
SPAT	1/5	02/06/2022		02/06/2022				
ANIP	5/5	08/06/2022		23/06/2022				
HEPA	1/5	08/06/2022		23/06/2022				
SAPR bact & molgen	4/5	23/06/2022		23/06/2022				
YRUK	5/5	23/06/2022		23/06/2022				
LACT	5/5	23/06/2022		23/06/2022				
AERO	5/5	23/06/2022		23/06/2022				
MG-IHN	0/5	23/06/2022		23/06/2022				
MG-VHS	0/5	23/06/2022		23/06/2022				
MG-ISA	0/5	23/06/2022		23/06/2022				
MG-IPN	0/5	23/06/2022		23/06/2022				
MG-PMCV	0/5	23/06/2022		23/06/2022				
MG-PRV	0/5	23/06/2022		23/06/2022				

The spread of PRV – and other diseases such as Infectious Salmon Anaemia (reported last year at Landcatch's Ormsary Hatchery and at Scottish Sea Farms in Loch Spelve) – to wild fish is an all too real risk.

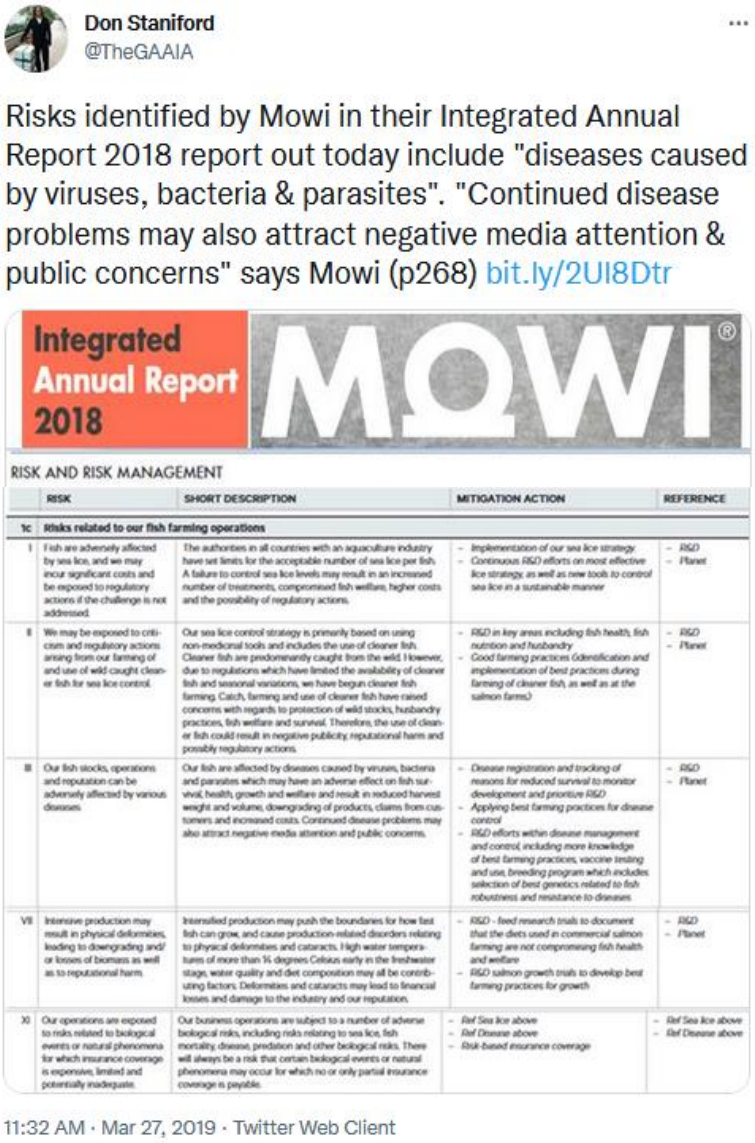
In September 2019, Scottish Salmon Watch published photos of disease-ridden wild salmon – tested by Scottish Government inspectors for infectious diseases – and asked: "Are Farms Spreading Infectious Diseases, Pathogens & Viruses to Wild Fish?"

Further [reports by the Scottish Government Fish Health Inspectorate] of wild salmon affected by diseases, parasites, pathogens and viruses associated with salmon farms raises alarm bells.

The scientific paper [‘Detection and phylogenetic assessment of PRV-1 via sampling of biological materials released from salmon farms in British Columbia’] (18 November 2022) raises the stakes even higher – and points to sea lice as a vector for the spread of PRV ([science certainly points to how lice-infested salmon are more susceptible to the spread of ISA]). Lice data [published by the Scottish Government] – and [presented via WildFish’s sea lice mapping tool] – illustrates the scale of Scottish salmon’s parasite problem.



The risks of spreading infectious diseases, viruses, pathogens and bacteria has certainly been red-flagged by salmon farming companies such as Mowi:



Don Staniford
@TheGAAIA

Risks identified by Mowi in their Integrated Annual Report 2018 report out today include "diseases caused by viruses, bacteria & parasites". "Continued disease problems may also attract negative media attention & public concerns" says Mowi (p268) bit.ly/2UI8Dtr

Integrated Annual Report 2018

MOWI®

RISK AND RISK MANAGEMENT

	RISK	SHORT DESCRIPTION	MITIGATION ACTION	REFERENCE
1c	**Risks related to our fish farming operations**			
I	Fish are adversely affected by sea lice, and we may incur significant costs and be exposed to regulatory actions if the challenge is not addressed.	The authorities in all countries with an aquaculture industry have set limits for the acceptable number of sea lice per fish. A failure to control sea lice levels may result in an increased number of treatments, compromised fish welfare, higher costs and the possibility of regulatory actions.	– Implementation of our sea lice strategy – Continuous R&D efforts on most effective lice strategy, as well as new tools to control sea lice in a sustainable manner	– R&D – Planet
II	We may be exposed to criticism and regulatory actions arising from our farming of and use of wild caught cleaner fish for sea lice control.	Our sea lice control strategy is primarily based on using non-medicinal tools and includes the use of cleaner fish. Cleaner fish are predominantly caught from the wild. However, due to regulations which have limited the availability of cleaner fish and seasonal variations, we have begun cleaner fish farming. Catch, farming and use of cleaner fish have raised concerns with regards to protection of wild stocks, husbandry practices, fish welfare and survival. Therefore, the use of cleaner fish could result in negative publicity, reputational harm and possibly regulatory actions.	– R&D in key areas including fish health, fish nutrition and husbandry – Good farming practices (identification and implementation of best practices during farming of cleaner fish, as well as at the salmon farms)	– R&D – Planet
III	Our fish stocks, operations and reputation can be adversely affected by various diseases.	Our fish are affected by diseases caused by viruses, bacteria and parasites which may have an adverse effect on fish survival, health, growth and welfare and result in reduced harvest weight and volume, downgrading of products, claims from customers and increased costs. Continued disease problems may also attract negative media attention and public concerns.	– Disease registration and tracking of reasons for reduced survival to monitor development and prioritize R&D – Applying best farming practices for disease control – R&D efforts within disease management and control, including more knowledge of best farming practices, vaccine testing and use, breeding program which includes selection of best genetics related to fish robustness and resistance to diseases	– R&D – Planet
VII	Intensive production may result in physical deformities, leading to downgrading and/or losses of biomass as well as to reputational harm.	Intensified production may push the boundaries for how fast fish can grow, and cause production-related disorders relating to physical deformities and cataracts. High water temperatures of more than 16 degrees Celsius early in the freshwater stage, water quality and diet composition may all be contributing factors. Deformities and cataracts may lead to financial losses and damage to the industry and our reputation.	– R&D - feed research trials to document that the diets used in commercial salmon farming are not compromising fish health and welfare – R&D salmon growth trials to develop best farming practices for growth	– R&D – Planet
XI	Our operations are exposed to risks related to biological events or natural phenomena for which insurance coverage is expensive, limited and potentially inadequate.	Our business operations are subject to a number of adverse biological risks, including risks relating to sea lice, fish mortality, disease, predation and other biological risks. There will always be a risk that certain biological events or natural phenomena may occur for which no or only partial insurance coverage is payable.	– Ref Sea lice above – Ref Disease above – Risk-based insurance coverage	– Ref Sea lice above – Ref Disease above

11:32 AM · Mar 27, 2019 · Twitter Web Client

The role of imported ova – a vector for the spread of ISA and other diseases, viruses and pathogens – has been repeatedly raised as a risk by Scottish Salmon Watch (renamed $camon $cotland in February 2022). The Scottish Government told Scottish Salmon Watch in January 2022 (via a FOI disclosure dated 10 January 2022) that "Marine Scotland Science does not undertake routine testing on ova to screen for the presence of aquatic animal pathogens" and "We do not hold any information on the number of imported ova, from Aquagen, screened for ISA and PRV. As confirmed above, MSS does not undertake routine testing on ova to screen for the presence of aquatic animal pathogens".

1. Is Marine Scotland Science being hired privately by salmon farming companies to test ova for ISA, PRV and other viruses, pathogens, bacteria and diseases?

Marine Scotland Science (MSS) does not undertake routine testing on ova to screen for the presence of aquatic animal pathogens.

2. How many of these imported ova [from AquaGen] were screened for ISA and PRV?

We do not hold any information on the number of imported ova, from Aquagen, screened for ISA and PRV. As confirmed above, MSS does not undertake routine testing on ova to screen for the presence of aquatic animal pathogens.

A FOI disclosure by the Scottish Government in April 2020 reiterated the woeful lack of testing:

1. Howmany salmon eggs imported into Scotland were tested for PRV and other viruses, pathogens and infectious diseases such as ISA?

No testing of salmon eggs, imported into Scotland, has been undertaken by Marine Scotland Science in relation to the pathogens and diseases you specify.

2. Has Marine Scotland Science conducted screenings of ova for PRV as an extra risk measure to avoid vertical transmission?

No screening of ova for PRV has been undertaken by Marine Scotland Science.

3. What % of ova used by 'Scottish' salmon farms are infected with PRV, ISA and other diseases, pathogens and viruses?

We hold no information on the percentage of ova, used by 'Scottish' salmon farms, which are infected with PRV, ISA and other diseases, pathogens and viruses.

4. What % of imported ova were screened prior to entry into Scotland for infectious diseases, pathogens and viruses?

Marine Scotland holds no information on the screening of ova (testing for the presence of pathogens) in relation to ova imported into Scotland.

5. Howmuch of domestically produced ova is sourced from genetic material (ova, broodstock or smolts) sourced from overseas (e.g. Norway, Iceland and Ireland)?

We do not hold information on the genetic variability of the stocks used in Scotland for farming purposes to allow us to answer this question. While we do not hold this specific information, Section 2 of the Finfish Farm Production Survey provides some detail of the origin of ova laid down for farming in Scotland.

https://www.gov.scot/publications/scottish-fish-farm-production-survey-2018/pages/4/

6. What % of domestically produced ova has been screened for infectious diseases, pathogens and viruses such as PRV and ISA?

Screening of ova (testing for the presence of pathogens) is not currently undertaken by Marine Scotland Science in relation to domestically produced ova within Scotland.

Further on in your request you posed an additional question:

What percentage of farmed salmon are infected with PRV, ISA and other diseases, pathogens and viruses?

Marine Scotland Science does not hold information that allows us to answer that question because we don't test all farmed fish in Scotland. Scottish Ministers are informed of the presence on Scottish fish farms of any listed diseases in order that controls may be imposed where needed. Presently, within Scotland no fish farms farming Atlantic salmon are under restriction for any of the listed diseases.

The lack of screening and testing of tens of millions of ova imported into Scottish salmon farms is a disease disaster waiting to happen (or more appropriately, already happening on salmon farms across Scotland). Scottish Salmon Watch called on Scottish Ministers in January 2022 to close the borders!

FOI 2021-00259890 details 93 million salmon ova (eggs) imported into salmon farms in Scotland between January 2020 and 10 November 2021 via 69 shipments from Iceland (55.8 million in 45 shipments from Benchmark Genetics Iceland/Stofnfiskur in Stadarbergi and Vogavik), the Republic of Ireland (37 million in 22 million shipments from Mowi Ireland in Kindrum and Lough Altan) and Norway (220,000 in 2 shipments from AquaGen in Rimstad):

Date consignment due	Destination site name	Destination business name (Site operator)	Numbe	Source Counti	Import consignor
10/11/2021	Ormsary Hatchery	Landcatch Natural Selection Ltd	650,000	Iceland	Benchmark Genetics
10/11/2021	Ormsary Hatchery	Landcatch Natural Selection Ltd	252,000	Iceland	Benchmark Genetics
10/11/2021	Inverkerry Hatchery	Landcatch Natural Selection Ltd	598,000	Iceland	Benchmark Genetics
10/11/2021	Ormsary Hatchery	Landcatch Natural Selection Ltd	900,000	Iceland	Benchmark Genetics
26/10/2021	Appleburn Hatchery	The Scottish Salmon Company	1,650,000	Iceland	Benchmark Genetics
27/07/2021	Inchmore	Mowi Scotland Ltd	280,000	Iceland	Benchmark Genetics
12/04/2021	Lochailort Recirculation	Mowi Scotland Ltd	1,600,000	Republic of Ireland	Mowi Ireland
12/04/2021	Inchmore	Mowi Scotland Ltd	2,100,000	Republic of Ireland	Mowi Ireland
31/03/2021	Cairndow Hatchery	Cooke Aquaculture (Freshwater)	500,000	Iceland	Benchmark Genetics
30/03/2021	Inverpolly	Finfish Ltd	2,160,000	Republic of Ireland	Mowi Ireland
24/03/2021	Barcaldine Hatchery Inc	Scottish Sea Farms Ltd	1,000,000	Republic of Ireland	Mowi Ireland
24/03/2021	Lochailort Recirculation	Mowi Scotland Ltd	2,160,000	Republic of Ireland	Mowi Ireland
09/03/2021	Ardtaraig Hatchery	Cooke Aquaculture (Freshwater)	350,000	Iceland	Benchmark Genetics
17/02/2021	Inchmore	Mowi Scotland Ltd	2,053,400	Republic of Ireland	Mowi Ireland

In December 2021, Scottish Salmon Watch wrote to Scottish Ministers - including:

> In conclusion, Scottish Salmon Watch urges the Scottish Government to take immediate action to stop the spread of ISA, PRV and other diseases, viruses and pathogens via imported ova. In practical terms, that means closing down the border to ova imports and screening domestically produced ova, smolts and farmed salmon for (which are predominantly sourced from imported ova from Norway, Iceland and Ireland) for ISA, PRV and other diseases, viruses and pathogens.

> From data disclosed by the Scottish Government via FOI we know that the Barcaldine Hatchery has imported ova from AquaGen in Norway, Mowi Ireland and Stofnfiskur in Iceland via 18 shipments since November 2018 totalling 23.4 million.

Date consignment due	Destination site name	Destination business name	Number in consignment	Source Country	Import consignor
27/11/2018	Barcaldine Hatchery Incubation 1	Scottish Sea Farms	1,250,000	Norway	AquaGen AS
27/11/2018	Barcaldine Hatchery Incubation 3	Scottish Sea Farms	1,250,000	Norway	AquaGen AS
16/01/2020	Barcaldine Hatchery Incubation 1	Scottish Sea Farms	1481480	Republic of Ireland	Mowi Ireland
21/03/2019	Barcaldine Hatchery Incubation 1	Scottish Sea Farms	1,500,000	Republic of Ireland	Mowi Ireland
19/03/2020	Barcaldine Hatchery Incubation 2	Scottish Sea Farms	1500000	Republic of Ireland	Mowi Ireland
10/01/2019	Barcaldine Hatchery Incubation 2	Scottish Sea Farms	1,500,000	Republic of Ireland	Mowi Ireland
19/03/2020	Barcaldine Hatchery Incubation 3	Scottish Sea Farms	1500000	Republic of Ireland	Mowi Ireland
21/03/2019	Barcaldine Hatchery Incubation 3	Scottish Sea Farms	1,500,000	Republic of Ireland	Mowi Ireland
16/01/2020	Barcaldine Hatchery Incubation 4	Scottish Sea Farms	1018520	Republic of Ireland	Mowi Ireland
10/01/2019	Barcaldine Hatchery Incubation 4	Scottish Sea Farms	1,500,000	Republic of Ireland	Mowi Ireland
13/01/2021	Barcaldine Hatchery Incubation 3	Scottish Sea Farms	1000000	Republic_of_Ireland	Mowi_Ireland
13/01/2021	Barcaldine Hatchery Incubation 4	Scottish Sea Farms	1000000	Republic_of_Ireland	Mowi_Ireland
29/10/2019	Barcaldine Hatchery Incubation 2	Scottish Sea Farms	1125000	Iceland	Stofnfiskur Hf.
30/07/2019	Barcaldine Hatchery Incubation 2	Scottish Sea Farms	1200000	Iceland	Stofnfiskur Hf.
29/10/2019	Barcaldine Hatchery Incubation 3	Scottish Sea Farms	1125000	Iceland	Stofnfiskur Hf.
30/07/2019	Barcaldine Hatchery Incubation 3	Scottish Sea Farms	1200000	Iceland	Stofnfiskur Hf.
02/07/2020	Barcaldine Hatchery Incubation 4	Scottish Sea Farms	1200000	Iceland	Stofnfiskur Hf.
14/10/2020	Barcaldine Hatchery Incubation 4	Scottish Sea Farms	1560000	Iceland	Stofnfiskur_Hf.

> How many of these imported ova were screened for ISA and PRV?

Scottish Ministers ignore the disease risks at their peril. The Seattle Times reported in December 2018 how PRV had been imported into Washington in the United States by Cooke Aquaculture via infected eggs from Stofnfiskur (rebranded as Benchmark Iceland in 2021):

The Seattle Times

Environment

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Agriculture | Environment

Fish farmer destroys 800,000 juvenile Atlantic salmon due to disease; second purge in past year

Originally published December 18, 2018 at 7:11 pm | Updated December 18, 2018 at 7:38 pm

The Washington Department of Fish and Wildlife considers the exotic strain of PRV to be an unacceptable risk to native stocks of Pacific salmon. Under the conditions of its permit, Cooke Aquaculture Pacific was required to destroy the fish.

By Lynda V. Mapes

Seattle Times environment reporter

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For the second time, Cooke Aquaculture Pacific has destroyed 800,000 juvenile Atlantic salmon after testing required by the Washington Department of Fish and Wildlife (WDFW) determined the fish were infected with an exotic strain of Piscine Orthoreovirus (PRV.)

The strain is essentially the same strain of virus found at the Iceland hatchery from which Cooke receives Atlantic salmon eggs.

Cooke had a similar problem last May. Tests on the most current batch recently came back, said Amy Windrope, Region 4 director for WDFW. Two of Cooke's last three batches of Atlantic salmon in the past year have tested positive for PRV, Windrope said. The third was clean.

Scottish Salmon Watch's letter to Scottish Ministers in April 2019 cited the Seattle Times article and an article published by Salmon Business in December 2018 which referred to an "optional service of screening against PRV that our customers may choose as an extra risk measure to avoid vertical transmission":

Egg supplier responds to Washington PRV salmon cull

News by **Owen Evans** - 20 December 2018

Benchmark Genetics, which supplies eggs to Cooke Aquaculture Pacific, has responded to reports a US salmon cull was due to an 'exotic' strain of Piscine Orthoreovirus (PRV).

As reported on SalmonBusiness yesterday, the salmon farmer Cooke Aquaculture Pacific had to cull 800,000 fish.

The Icelandic company StofnFiskur – a subsidiary of Benchmark Genetics – supplied the eggs to Cooke.

Divisional marketing director Birgitte Sørheim wrote in an email to SalmonBusiness that: "PRV is not a classified disease but a virus commonly found in Atlantic salmon. Fish that carry the virus are not sick but can, under certain circumstances (weak health status/gill status and other factors) develop heart and skeletal muscle inflammation and will then be diagnosed as sick. This was not the case with the juveniles that had to be destroyed in the US. These fish were healthy but were required to be destroyed by the WDFW."

Cooke's hatchery near Rochester tested positive for a form of the fish PRV *piscine orthoreovirus* virus that the WDFW (The Washington Department of Fish and Wildlife) classifies it as "exotic."

Sørheim added that "the total number of fish destroyed was 800,000. PRV was detected by routine sampling in April, and the entire batch of fish was required to be culled."

"The PRV at Cooke may have originated from the ova delivered from Iceland. We have, however, an optional service of screening against PRV that our customers may choose as an extra risk measure to avoid vertical transmission."

"PRV is found in both farmed and wild salmon and is not described as exotic in Europe. The virus is also not listed by OIE or European authorities," she wrote.

In other words, salmon farming companies can cut costs by not screening imported ova for diseases and viruses. Coupled with a woeful lack of government testing, this means that millions of potentially virus-laden ova may be flooding into salmon farms all over the world. The New York Times reported back in 2011:

The New York Times

Norwegians Concede a Role in Chilean Salmon Virus

Give this article

By Alexei Barrionuevo
July 27, 2011

SÃO PAULO, Brazil — A virus that has killed millions of salmon in Chile and ravaged the fish farming industry there was probably brought over from Norway, a major salmon producer has acknowledged.

Cermaq, a state-controlled Norwegian aquaculture company that has become one of the principal exporters of salmon from Chile, has endorsed a scientific study concluding that salmon eggs shipped from Norway to Chile are the "likely reason" for the outbreak of the virus in 2007, according to Lise Bergan, a company spokeswoman.

The disease dangers of importing ova – whether they are sourced from Norway, Iceland or Ireland – represents all too real a risk for wild fish and it beggars belief that imported ova remains untested for PRV, ISA and other viruses, pathogens and diseases.

Data published by the Scottish Government in October 2022 via the 'Fish Farm Production Survey 2021' revealed that imports of ova from Norway and Iceland were declining but imports from Ireland were increasing:

Imports and Exports

Table 22a: Source and number (000's) of salmon ova, fry, parr and smolts imported during 2012-2021 derived from health certificates

Import Year	Ova				Fry, Parr and Smolts		
	Iceland	Norway	Republic of Ireland	Total	Norway	Republic of Ireland	Total
2012	0	23,849	10,134	33,983	0	0	0
2013	2,719	35,044	10,700	48,463	0	55	55
2014	3,813	49,831	5,218	58,862	1,748	1,602	3,350
2015	8,978	45,926	4,815	59,719	365	2,118	2,483
2016	5,324	38,602	5,444	49,370	0	1,956	1,956
2017	13,883	37,025	7,000	57,908	0	2,012	2,012
2018	10,116	48,430	7,250	65,796	0	1,700	1,700
2019	26,352	23,673	10,184	60,209	0	297	297
2020	41,756	220	15,296	57,272	0	1,130	1,130
2021	31,276	160	19,260	50,696	0	300	300

The numbers of ova imported decreased by 11% in 2021. The number of fry, parr and smolts imported also decreased, with 300,000 fish imported from the Republic of Ireland during 2021.

The 'Fish Farm Production Survey 2021' also revealed that imports of foreign ova had declined markedly with 'out-sourced GB broodstock' increasing significantly.

Table 18: Source, number (000's), previous year's estimate of ova laid down to hatch during 2012-2021 and projected production for 2022

Year	In-house broodstock	Out-sourced GB broodstock	GB wild broodstock	Foreign ova	Total	Previous year's estimate
2012	18,556	9,981	0	34,700	63,237	55,723
2013	16,996	8,263	0	41,315	66,573	49,249
2014	14,418	2,725	10	53,684	70,837	48,149
2015	6,479	223	10	61,463	68,175	65,284
2016	5,884	4	0	58,458	64,346	59,604
2017	6,228	360	0	59,158	65,746	60,673
2018	8,780	200	0	61,499	70,479	67,374
2019	5,516	1,724	75	63,931	71,246	71,571
2020	5,195	4,480	258	68,685	78,618	70,598
2021	6,383	22,581	124	43,707	72,795	68,588
2022						77,306

Whether ova is imported from Iceland, Norway or Ireland or is 'out-sourced GB broodstock', $camon $cotland urges Scottish Ministers to screen and test the millions of ova (72.8 million in 2021 and 77.3 estimated in 2022) for PRV, ISA and other diseases, viruses and pathogens.

The exact prevalence of PRV inside salmon farms, hatcheries and processing plants in Scotland is unclear but the recent revelation of 70% prevalence in British Columbia - where many of the same Norwegian-owned companies operate – demands a routine and rigorous testing regime across the salmon farming sector.

A FOI disclosure by the Scottish Government in June 2019 detailed how over 50% of farmed salmon tested by Marine Scotland Science were positive for PRV:

Date of Testing	Pathogen	Test	Result (Positive)
29/11/2018	PRV	QPCR	19 of 19
29/11/2018	PRV	QPCR	13 of 13
10/01/2018	PRV	QPCR	10 of 11
19/12/2018	PRV	QPCR	10 of 10
18/09/2018	PRV	QPCR	10 of 10
27/02/2018	PRV	QPCR	10 of 10
18/09/2018	PRV	QPCR	7 of 7
13/07/2018	PRV	QPCR	7 of 7
10/04/2018	PRV	QPCR	7 of 7
29/11/2018	PRV	QPCR	6 of 6
13/11/2018	PRV	QPCR	6 of 6

Date of Testing	Pathogen	Test	Result (Positive)
19/02/2019	PRV	QPCR	10 of 10
21/05/2019	PRV	QPCR	9 of 9
25/04/2019	PRV	QPCR	6 of 7
21/05/2019	PRV	QPCR	6 of 6
12/02/2019	PRV	QPCR	6 of 6
22/01/2019	PRV	QPCR	6 of 6
08/01/2019	PRV	QPCR	6 of 6
16/04/2019	PRV	QPCR	5 of 9
12/02/2019	PRV	QPCR	5 of 6
25/04/2019	PRV	QPCR	5 of 5
05/02/2019	PRV	QPCR	5 of 5
01/05/2019	PRV	QPCR	4 of 5
03/05/2019	PRV	QPCR	4 of 4
03/04/2019	PRV	QPCR	4 of 4
12/02/2019	PRV	QPCR	4 of 4
11/01/2019	PRV	QPCR	4 of 4

Scottish Salmon Watch reported in June 2019:

> Data disclosed via FOI/19/00882 reveals that during 2018 and 2019 there were 399 positive samples out of 774 samples tested (i.e. 52% of farmed salmon samples tested positive for PRV) **[1]** - including 63 tests out of 113 with 100% positive results:

According to the Scottish Government's FOI reply to Scottish Salmon Watch dated 3 June, the results relate to Marine Scotland Science's "commercial testing service on behalf of third parties" and "the sources of these samples will relate to aquaculture sites both within and out with Scotland" but "from the records held by Marine Scotland Science they cannot be linked to any particular source." Scottish Salmon Watch today filed a further FOI request for more specific details.

PRV is highly contagious, causes fatal heart and skeletal muscle inflammation in salmon and a scientific study published in 2018 linked it to an equally deadly type of anemia in at least one species of wild salmon.

Shamefully, Scotland's Aquatic Animal Health surveillance programme does not routinely test for Piscine Reovirus (also called Piscine orthoreovirus) and Heart & Skeletal Muscle Inflammation (HSMI). "Sampling for PRV is restricted to those inspections involving diagnostic investigations and only in such cases where histopathological analysis is indicative of pathology associated with PRV infection," explained the Scottish Government in a letter dated 3 June.

The Scottish Government's FOI reply in June 2019 on PRV testing – or more appropriately, the lack of it – is worth repeating:

> You also asked *'How many samples of farmed salmon and water samples have been tested for Piscine Reovirus (PRV) and Heart & Skeletal Muscle Inflammation (HSMI)'.* As explained above, Marine Scotland does not analyse water samples for aquatic animal pathogens as part of our statutory sampling programme. You can find details on the number of fish sampled as part of the statutory surveillance programme within the case information released through our active publication plan. For your information, sampling for PRV is restricted to those inspections involving diagnostic investigations and only in such cases where histopathological analysis is indicative of pathology associated with PRV infection. In those circumstances further screening using the molecular genetics method RT-PCR is undertaken. In general, tissues from several fish (usually between 1-5 animals) are pooled together for testing. You can calculate the number of fish sampled by analysing the sample sheet associated with the case which will detail the number of fish per pool and the tests associated with those samples taken.

Subsequent requests for information on the PRV testing conducted by Marine Scotland Science were denied due to "commercial confidentiality". Here's FOI refusal by the Scottish Government in July 2019:

Response to your request

As was explained in our email of 7 June 2019 requesting clarification of your request, the clients who use Marine Scotland's commercial testing service are usually commercial veterinary companies and not salmon farming companies themselves. Therefore, strictly speaking, we hold little, if any, information relevant to your request. However, we understand that you would like results of testing carried out by Marine Scotland on behalf of salmon farming companies, and are dealing with your request on that basis.

While our aim is to provide information whenever possible, in this instance we are unable to provide the information you have requested because an exception under regulation 10(5)(e) (substantial prejudice to confidentiality of commercial or industrial information) of the EIRs applies to that information. The reasons why that exception applies are explained in the Annex to this letter.

The Scottish Government's expanded reasons for non-disclosure of PRV testing data carried out by Marine Scotland Science are detailed in this Annex:

ANNEX

REASONS FOR NOT PROVIDING INFORMATION

An exception applies

An exception under regulation 10(5)(e) of the EIRs (substantial prejudice to confidentiality of commercial information) applies to the information you have requested. This exception applies because disclosure of this particular information would, or would be likely to, prejudice substantially the confidentiality of commercial information relating to the companies who have provided the samples, and thus cause substantial harm to their commercial interests. As explained above, and in our email of 7 June, the companies who use our commercial testing service are most usually commercial veterinary companies. We also carry out some contract work for overseas interests, again not salmon farming companies themselves. Disclosing the results of samples submitted to us for analysis, with the expectation that results would be confidential, is likely to lead to the loss of clients for the commercial companies using our service. Their clients are likely to be a) extremely disappointed that this information was disclosed and b) concerned that any future use of their diagnostic services may be disclosed. Release of the information is therefore likely to cause substantial harm to their interests. Further, substantial harm is likely to be caused by the release of this information to the salmon farming companies themselves. Again as explained in our email of 7 June, some of the commercial work that we carry out relates to experimental trials, and does not have any relevance to the status of farmed fish. We are unable to separate out any such results from data originatingfrom farmed fish samples. In addition, the testing is done to confirm the presence of pathogens, and results do not necessarily indicate the presence of disease. Disease diagnosis is not made from sample analysis, and pathogens are often present in clinically healthy fish. Any data from our commercial sampling activities cannot, therefore, provide a picture of the fish health status of the Scottish aquaculture industry, but has the potential to provide a misleading picture of the industry in Scotland because we are unable to provide any context to explain the results. This is likely to cause substantial harm to the aquaculture companies involved in Scotland.

This exception is subject to the 'public interest test'. Therefore, taking account of all the circumstances of this case, we have considered if the public interest in disclosing the information outweighs the public interest in applying the exception. We have found that, on balance, the public interest lies in favour of upholding the exception. We recognise that there is a public interest in disclosing information as part of open and transparent government, and that there is a strong public interest in providing information about salmon farming and fish health. However, there is a greater public interest in protecting the commercial interests of companies that help to ensure that Scottish farmed fish are as healthy as possible. There is also a public interest in allowing such analysis to be carried out by Marine Scotland scientists. This builds capacity and ensures best use of publicly funded diagnostic facilities, meaning that Marine Scotland are able to respond to emerging diseases in aquaculture and deal effectively with any disease outbreaks. The loss of this work to Marine Scotland, which is what would happen either through commercial veterinary companies losing clients or those same companies choosing to get future samples analysed elsewhere (probably outwith Scotland), is not in the public interest. Further, the limitations of the information for building a picture of the health status of the aquaculture industry in Scotland, are such that there is a limited public interest in that information on its own merits.

Scottish Salmon Watch filed a FOI appeal following another refusal in April 2020 by the Scottish Government to provide information on PRV testing (which was a reply to a FOI request filed by Scottish Salmon Watch in February 2020), The FOI appeal in April 2020 included:

> To repeat from Scottish Salmon Watch's FOI request of 28 February 2020:
>
> Scottish Salmon Watch fully understands that (as FOI/19/00882 explained):
>
> "Commercial testing results relate to samples submitted from third parties and from the records held by Marine Scotland Science they cannot be linked to any particular source. The sources of these samples will relate to aquaculture sites both within and out with Scotland. The results will also include samples from transmission trials concerning experimental animals and facilities. Therefore, there are severe limitations with this data in terms of how it can be interpreted and portrayed. In summary the commercial testing data represents a number of test results from a number of samples which relate to a multitude of unidentifiable sources all of which have been submitted by third parties."
>
> However, records submitted from third parties held by Marine Scotland Science are clearly available and are formally requested since 1 January 2019. If the Scottish Government
>
> refuses to provide copies of the full records - citing 'commercial confidentiality' for example - Scottish Salmon Watch asks that the names of the third parties are at least provided.
>
> As the Scottish Government explained via their review of FOI/19/00882 dated 20 June and published on 5 July 2019:
>
> "In the original response, to your request for information, it was stipulated that commercial testing results related to samples submitted from third parties and from the records held by Marine Scotland Science they cannot be linked to any particular source. This comment was made in relation to PRV samples, and whilst it is true in the main it does not relate to two of the sample submissions made. In this case, two of the samples were received directly from The Scottish Salmon Company. In all of the cases, we are unable to identify sites or specific sources of the samples received."

Scottish Salmon Watch's FOI review request in April 2020 concluded:

> Scottish Salmon Watch strongly argues that any discussion of the tests clearly adds to the context and public understanding of the presence of diseases or pathogens on Scottish salmon farms. The public surely have a right to know what type of testing and consequently what level of data on diseases, pathogens and viruses in Scottish public waters is planned by the Scottish Government. Transparency is the hallmark of democracy.
>
> It is the opinion of Scottish Salmon Watch that the Scottish Government is deliberately avoiding testing for various diseases, pathogens and viruses; tailoring the testing regime to systematically avoid unwanted results; and/or privately fencing off commercial testing via Marine Scotland Science rather than the Fish Health Inspectorate which publishes the damning disease data via 'Case Information' thereby disseminating the data to the general public and informing public debate.
>
> Commercial interests of predominantly Norwegian-owned multinationals which control ca. two thirds of the 'Scottish' salmon farming industry should not be placed ahead of the national interests of protecting Scotland's pristine waters; European-protected species and habitats; and iconic wild Scottish salmon.

The [presence of PRV in over 50% of farmed salmon tested by Marine Scotland Science] could therefore represent the tip of a very large iceberg indeed.

In addition to the lack of PRV testing in hatcheries and freshwater smolt farms, the lack of government testing in processing plants represents a glaring omission. A [letter to Scottish Ministers by Scottish Salmon Watch in April 2019] cited a Scottish Government admission in August 2018 that fish processing effluent and land based farm flow through was not tested for pathogens:

> In a letter dated 21 August 2018, the Scottish Government admitted that fish processing effluents or land based farm flow through were not tested for pathogens:
>
> The Scottish Government does not test fish processing effluent or land based farm flow through for fish pathogens. Many fish pathogens are present within the wider aquatic environment and it is important that any risks identified are proportionately managed.
>
> As has been outlined previously, CAR licences do not control for fish pathogens. Processing plants may pose a risk of concentrating fish pathogens in the environment and these risks can be mitigated by biosecurity protocols.

A [letter to Scottish Salmon Watch from the Scottish Government in February 2018] claimed that "Scottish Government will continue to consider best available evidence to ensure that the interactions of wild and farmed fish are appropriately managed":

With regards to fish disease, Piscine Orthoreovirus (PRV) and processing plant effluent, the Scottish Government does not conduct testing of processing effluent for fish pathogens. Many infections which can be carried by farmed fish are present naturally within the wider environment. Scottish Government will continue to consider best available evidence to ensure that the interactions of wild and farmed fish are appropriately managed. Processing plants may pose a risk of concentrating fish pathogens in the environment and these risks can be mitigated by biosecurity protocols. As you are aware, the Code of Good Practice for Scottish Finfish Aquaculture contains a chapter on processing sites and states that drainage from areas where effluent and fish by-products are generated should feed into a disinfection facility, with subsequent treatment and discharge in accordance with CAR license conditions. Scottish Government's fish health inspectorate produced disinfection guidance in 2006 which should be regarded as best practice at fish farm sites and processing plants. The guide can be found online; http://www.gov.scot/Topics/marine/Fish-Shellfish/FHI/healthpractice A copy is also available as an annex to the Code (Annex 4).

Please be assured that processing plants handling fish culled for disease control purposes, (for example fish culled for the control of infectious salmon anaemia) must be authorised by Scottish Government's Fish Health Inspectorate under the Aquatic Animal Health (Scotland) Regulations 2009. This will be done where Scottish Ministers are satisfied that the operation and biosecurity of the establishment will not lead to an unacceptable risk of spreading disease. In addition, where a listed disease occurs the fish health inspectorate will consider the sampling of wild fish as part of any epidemiological investigation. This provides information on the state of the environment in terms of the presence of the pathogen in relation to susceptible wild species.

However, over four years later the situation is still unsatisfactory. As $camon $cotland reported last month:

The Scottish Government's Fish Health Inspectorate recently slipped out interesting 'Case Information' detailing 'improvement' and 'further investigation' required following inspections of processing plants operated by Mowi in Fort William and Loch Duart in Dingwall earlier this year. The Fish Health Inspectorate sent Mowi a letter in June 2022 detailing "further investigation and improvement" to be implemented in order for the Blar Mhor processing plant in Fort William to be considered "satisfactory" (i.e. current biosecurity systems were unsatisfactory to deal with disease risks):

marinescotland science

Scottish Government
Riaghaltas na h-Alba
gov.scot

FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

Business No	FB0544	**Date of Visit**	23/05/2022
Site No	FS1240	**Site Name**	Blar Mhor
Case No	20220165	**Inspector**	[redacted]

PROCESSING FACILITY INSPECTION

An inspection of the above facility was made in accordance with the Aquatic Animal Health (Scotland) Regulations 2009 to assess the measures in place for the processing of fish harvested from aquaculture sites subject to control measures for bacterial kidney disease.

An inspection of all work areas was conducted. The operation of the facility will be deemed satisfactory for the routine processing of fish from aquaculture sites subject to control measures for bacterial kidney disease (BKD) when the following measures have been implemented:

- To prevent cross-contamination, harvest bins containing or which have contained fish from sites subject to disease control measures should be cleaned and disinfected in an area that is separate from harvest bins which have already been cleaned and disinfected and are being stored prior to dispatch to farm sites;

- Disposable liners from the harvest bins received from sites subject to disease control measures should be disposed of in a bio-secure manner e.g. cleaning and disinfection or incineration. If transported off the site, they should be transported in sealed containers to prevent any pathogen escaping into the wider environment.

Additional improvements would also be required prior to the facility being authorised to process fish subject to disease control measures for other listed diseases as required by regulation 7 of the Aquatic Animal Health (Scotland) Regulations 2009 (the 2009 Regs). Prior to authorisation as a processing establishment by the competent authority under the 2009 Regs, for the site to process fish subject to disease control measures (for listed diseases, other than BKD), the following areas require further investigation and improvement:

- Contingency plans to deal with a breach of the biosecurity systems at the processing establishment will need to be developed and followed;
- Procedures for the immediate notification of the Scottish Ministers in the event of a breach in biosecurity at the processing facility are not currently in place and will need to be developed and followed;
- The disinfectant used on any effluent wastewater must be effective against listed pathogens and auditable records of their use should be maintained;
- Biosecurity of vehicles entering the facility including disinfection should be implemented and auditable records of this should be maintained;
- Harvest bins from sites subject to disease control measures that have been cleaned and disinfected should be easily identifiable and stored in a designated area that is separate from the storage area for bins that have arrived from sites not subject to any disease control measures;
- Staff training in the recognition of clinical signs of listed diseases.

R10

Marine Laboratory, 375 Victoria Road, Aberdeen, AB11 9DB
Tel - 0131 244 3498 Fax - 0131 244 0944 Email - ms.fishhealth@gov.scot
Website - www.gov.scot/Topics/marine/science

Details of the process of applying for authorisation with Marine Scotland are available at: Aquaculture Processing Establishment (APE): forms and guidance - gov.scot (www.gov.scot). Should Mowi wish to seek authorisation for the Blar Mhor processing facility in accordance with the Aquatic Animal Health Regulations 2009, please contact the Fish Health Inspectorate.

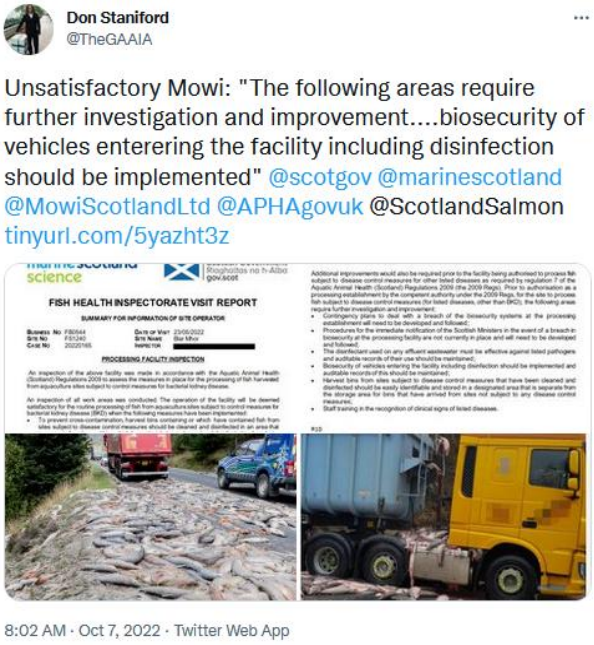
Please contact myself or the duty inspector should you require any further information or have any queries regarding this report.

Signed: [redacted] Date: 23/06/2022

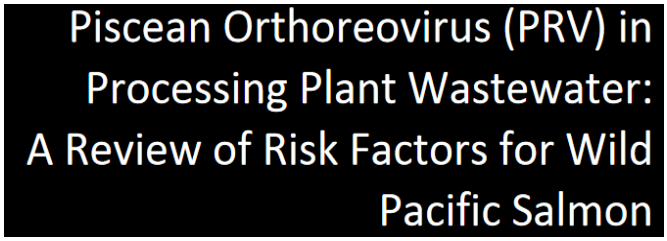
Fish Health Inspector

The Fish Health Inspectorate Service Charter detailing standards of service is available on the Marine Scotland website at www.gov.scot/Topics/marine/Fish-Shellfish/FHI/charter

The lack of testing for PRV/HSMI – and ISA for that matter – at processing plants across Scotland is unacceptable in view of the disease risks highlighted in British Columbia and the recent scientific paper published in the Canadian Journal of Fisheries and Aquatic Sciences (18 November 2022).



In March 2018, a report published by BC CAHS and the University of British Columbia reviewed the risks of processing plants following shocking video footage of bloodwater effluent:



The BC CAHS and University of British Columbia report (March 2018) included:

Executive Summary

Recent detection of Piscine Orthoreovirus (PRV) in seawater near a salmon processing plant increased concerns that wild salmon in BC are at risk of harm by being exposed to and infected by live PRV. The virus is recognized as a causative factor to the disease Heart and Skeletal Muscle Inflammation (HSMI) in Norwegian salmon. This report reviews scientific studies on PRV and HSMI that pertain specifically to the strain of PRV identified in BC salmon to a) assess the potential risk PRV poses to the health of exposed wild salmon in BC, b) identify significant data gaps in making such an assessment, and c) add context to the finding of PRV in seawater around fish processing plants.

PRV is the only marine virus among the Orthoreovirus genus. As a group, the Orthoreoviruses are non-enveloped viruses that are resilient in the environment compared to other marine viruses. After infection, PRV concentrates in the blood, where it replicates by forming viral factories inside the red blood cells. Real time based PCR tests are well established for detecting PRV RNA sequences in blood or other fish tissues. Even so, knowledge of PRV and methods to detect it are relatively new to science and do not extend back to the start of commercial salmon farming in BC.

The difficulty is that PRV-infected fish may not show disease signs, including HSMI. While studies on Norwegian salmon established that HSMI develops in salmon either deliberately injected with purified PRV, PRV-infected blood or cohabited with donor PRV-infected fish, not all fish develop HSMI. This is despite all fish becoming PRV positive and all fish with HSMI being PRV-positive.

$camon $cotland therefore asks what scientific research – including any risk assessments of impacts of wild fish – and sampling is being conducted by the Scottish Government with respect to PRV/HSMI in processing plant effluents and bloodwater? What safeguards are in place in Scotland to stop the spread of PRV/HSMI via processing plants and harvesting stations?

PRV/HSMI contamination in salmon farming is clearly a public interest issue – only amplified by the recent science from Canada and media coverage in The Globe & Mail via "Ottawa accused of suppressing research on fish-farm virus in B.C. despite warnings it could harm wild salmon" (21 November 2022). In April 2018, BBC News reported:

BBC Your account Home News

Scottish salmon farming petition signed by 30,500

21 April 2018

Campaigners want to see waste water tested as a matter of routine

By Ewan Murrie
BBC Scotland news website

More than 30,500 people have signed a petition urging the Scottish government to routinely test effluent from salmon processing plants for diseases.

Campaigners claimed that some polluted waste water contained pathogens that could "threaten" wild salmon stocks.

Last year **footage was released** that showed treated "blood water" being released from a fish processing plant into Canadian waters where wild salmon spawn.

The discharge later tested positive for pathogens potentially harmful to fish: PRV and Piscirickettsia salmonis bacteria.

Scottish Salmon Watch director Don Staniford said: "In view of the recent results of positive tests for viruses in effluent water in Canada it is incumbent upon the Scottish government and Sepa to follow suit.

"It is shockingly irresponsible that the Scottish government does not even test for any pathogens in processing plant or salmon farm effluent."

The National [reported in May 2018]:

THE NATIONAL

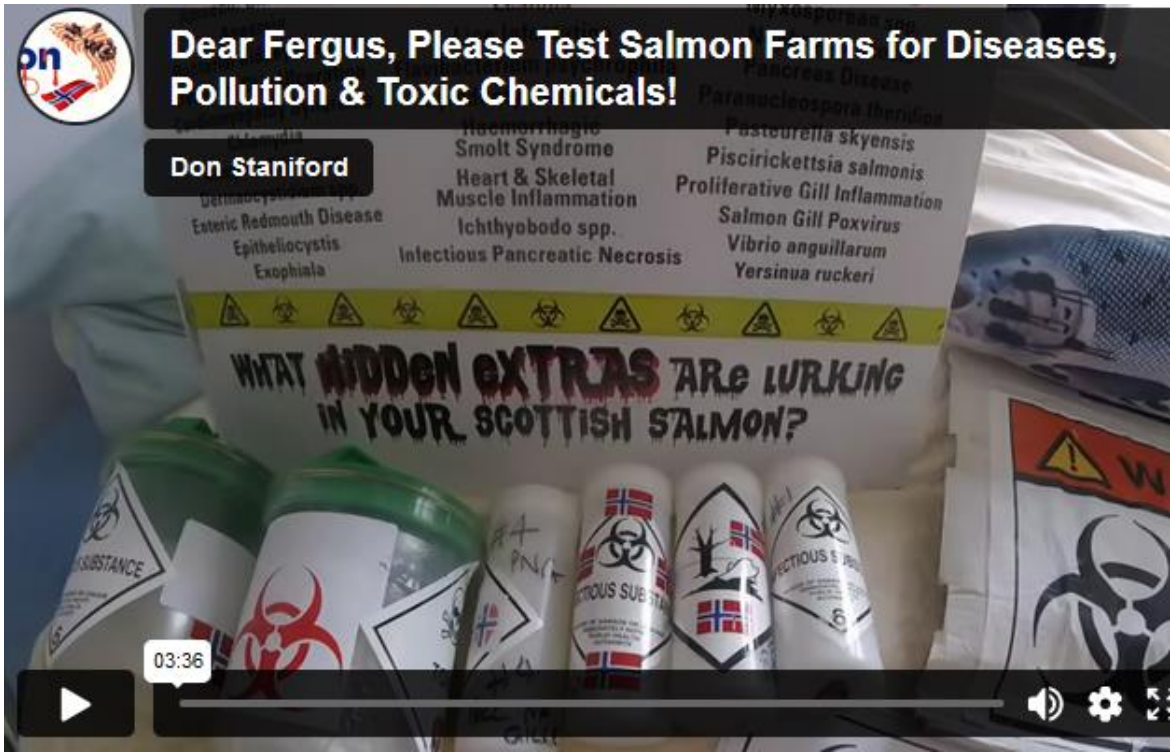
42,000 sign petition for tougher Scottish salmon farm testing

9th May 2018

There are claims a lack of effluent testing could allow parasites and chemical waste into open waters

In May 2018, Scottish Salmon Watch [delivered a 42,000 signature petition to Scottish Ministers]:

In September 2019, samples of untreated sewage effluent taken by Scottish Salmon Watch at Mowi's salmon farms around the Island of Shuna in Argyll were [denied entry to the Scottish Parliament who deemed it a "biosecurity risk"] and [Marine Scotland Science refused to test the samples for PRV].



In January 2018, BBC News reported:

BBC Your account Home News

Shetland salmon packing factory leaks 'blood water' into sea

25 January 2018

By Ewan Murrie

BBC Scotland news website

A Shetland salmon packing factory leaked "bloody" sewage into the sea, BBC Scotland has been told.

People had complained of an "offensive odour" coming from the Cooke Aquaculture's Mid Yell Plant.

It led to a Scottish Environment Protection Agency (Sepa) investigation in 2017 - which uncovered "significant" breaches of environmental conditions.

A Freedom of Information request has revealed that Sepa was contacted by a member of the public in August 2017, who reported "weekly offensive smell complaints from locals, the school and tourists".

It led to the environmental regulator visiting the site on the island of Yell - which, according to the inspector's report, uncovered untreated overflow from blood water tanks discharging into Mid Yell Voe.

Sepa identified one "gross" and two "significant" breaches of Environmental Limit Conditions related to this activity - but it is reported that only "small quantities" of blood water were leaked into the sea.

Scottish government advice says untreated effluent from processing plants risks spreading infectious salmon anaemia.

The incident has prompted an environmental campaigner to call on the Scottish Salmon Producers Organisation to expel Cooke Aquaculture due to breaches of the industry's code of practice relating to the spread of infectious diseases.

More on this story

Bloody sewage 'threatens' wild salmon

29 November 2017

In conclusion, $camon $cotland calls on Scottish Ministers to read and take heed of the recent scientific paper: 'Detection and phylogenetic assessment of PRV-1 via sampling of biological materials released from salmon farms in British Columbia'. Government surveillance of PRV/HSMI inside sea cages, freshwater smolt farms, hatcheries and processing plants (including waste effluents and waste biological material) must close the net on the disease-ridden, virus-laden and lice-infested salmon farming sector in Scotland.

Moreover, the protection of commercial confidentiality and the business interests of foreign-owned companies (who control 99% of 'Scottish' salmon farming production) cannot be allowed to take precedence over Scotland's iconic wild salmon. A forensic examination of the data publicly available on PRV/HSMI reported by the Scottish Government's Fish Health Inspectorate (via 'Case Information' and via 'Mortality Event Reports') – as presented above - shows that private companies such as Norwegian-owned Patogen and the Inverness-based Fish Vet Group/Pharmaq (formerly owned by Benchmark but bought by Zoetis-owned Pharmaq in 2020) are conducting commercial testing for PRV/HSMI: the results of which are not available to the public and not disclosed by the Scottish Government via FOI.

Consequently, the prevalence of PRV/HSMI in salmon farming in Scotland cannot be gauged accurately although PRV testing of farmed salmon by Marine Scotland Science in 2018/2019 – when 52% of samples tested positive for PRV – is alarming. If the prevalence of PRV in Scottish farmed salmon is anything like the 70% PRV prevalence reported by scientists in farmed salmon tested in British Columbia then there are serious concerns and very real risks to wild fish across Scotland.

The mass escape of nearly 50,000 farmed salmon from Mowi's salmon farm at Carradale in August 2020 – a site where Patogen reported 12/12 samples positive for PRV-1 (via a Fish Health Inspectorate report for August 2020) – illustrates how sea cage salmon farms can be vectors for the spread of diseases and viruses. And the fact that Mowi, and other companies, move salmon between sites without any government testing for PRV/HSMI is a recipe for disease disaster. Has the Scottish Government not learned from the lessons of the spread of ISA – which reared its ugly head again last year - which cost the salmon farming industry £100 million and 200 jobs back in the late 1990s?

The fact is - judged by the data reported by the Scottish Government's Fish Health Inspectorate via 'Case Information' - that more wild salmon (96) have been tested by the Scottish Government than farmed salmon. It is difficult to put an exact figure on it due to the fragmented and user-unfriendly nature of the Scottish Government database (a sceptic might conclude that the Scottish Government is deliberately trying to conceal the data) but the number of farmed salmon sampled for PRV appears to be less than 10 per year.

$camon $cotland vehemently opposes the current regime where the screening of imported ova for infectious diseases, viruses and pathogens is an optional service which some egg companies such as Benchmark/Stofnfiskur offers to salmon farming companies. Instead of allowing an open border and permitting millions of imported ova to flood untested into Scottish salmon farms, the Scottish Government should introduce mandatory and statutory testing of imported ova and smolts for PRV/HSMI (the results for which are routinely published).

There is a strong suspicion that farmed salmon in freshwater lochs, hatcheries, harvest stations, well-boats and processing plants are not tested for PRV/HSMI at all. If there is testing for PRV/HSMI then it is not yet in the public domain and $camon $cotland would like access.

$camon $cotland therefore challenges Scottish Ministers to come clean on the testing and sampling regime for PRV/HSMI in farmed salmon (including imported ova; hatchery reared smolts; freshwater smolts and sea cages) and wild fish (including salmon, sea trout, cleaner fish and herring).

Please consider this a formal request for information under the relevant FOI and Environmental Information regulations:

How many wild fish have been tested by the Scottish Government (including Marine Scotland Science) for PRV/HSMI since 1 January 2019?

How many farmed salmon in sea cages, freshwater lochs, hatcheries, harvesting stations and processing plants have been tested by the Scottish Government (including Marine Scotland Science) for PRV/HSMI since 1 January 2019?

Please provide an annual breakdown and provide documents (including photos) detailing testing, sampling, data analysis, scientific studies and any information pertaining to PRV/HSMI. Please provide copies of any Cabinet Briefings, internal memos, letters, correspondence with salmon farming companies and diagnostic testing companies and emails.

Please provide any information held by the Scottish Government on testing of farmed salmon and wild fish for PRV/HSMI – including any commercial testing carried out by salmon farming companies such as Mowi, Bakkafrost/The Scottish Salmon Company, Scottish Sea Farms (Norskott Havbruk), Grieg Seafood, Cooke Aquaculture, Loch Duart, Kames and Organic Sea Harvest as well as private diagnostic testing by companies such as Patogen and the Fish Vet Group.

In light of the recent science on PRV/HSMI from Canada, $camon $cotland urges the Scottish Government to reconsider and reverse previous refusals to disclose data on PRV/HSMI testing of farmed salmon.

Please provide the information electronically and please provide a receipt for this FOI request.

A formal reply to the concerns raised in this letter from Scottish Ministers would also be much appreciated.

Yours sincerely,

Don Staniford

Director, Scamon Scotland

More background on this issue is published via:

[Piscine Reovirus Ravages Scottish Salmon Farms - please follow the science in Canada & investigate the risks to wild fish in Scotland!]
[Going Down the Drain: Photos of Mowi's blood water treatment at "highly offensive & polluting" processing plant in Fort William]
[Unsatisfactory Biosecurity: Disease Control 'Improvement' & 'Further Investigation' Required at Processing Plants Operated by Mowi & Loch Duart]
[Heart & Pancreas Disease Ravage Scottish Salmon (according to new Marine Scotland Science report)]
[FOI Reveals Virus-Laden Salmon Slip Net & Into Scottish Waters]
[Virus-Laden Farmed Salmon - FOI reveals over half of samples test positive for Piscine Reovirus]