Scottish Salmon Watch, 28 May 2018

Hard Evidence: Fast-Tracking Disease-Ridden Scottish Salmon

- Data reveals a shortening of production cycle from 20 to 16 months in last decade
- Deaths due to disease 'masked' via early harvest claim Scottish Parliament
- 'Masked' is an inappropriate word argues Marine Harvest
- "The increased ability to grow larger smolts provides the opportunity to reduce the marine grow out phase of farmed salmon, thus reducing the time spent in sea and the length of exposure to marine challenges such as sea lice," claims 'Scotland's 10 Year Farmed Fish Health Framework'

A data analysis by Scottish Salmon Watch (see Appendix 1**)** backs up a claim by the Scottish Parliament's Environment, Climate Change and Land Reform Committee in March that salmon farmers in Scotland are harvesting early due to lice, disease and mortality problems.

Data accessed via Scotland's Aquaculture web-site reveals that the average production cycle for Scottish salmon farms is currently 16.5 months (sourced from 2013-2017 data - sadly monthly biomass data is only available up to December 2017). This compares to 20.1 months a decade ago (sourced from 2002-2007 data - monthly biomass data is only available from 2002).

Whilst operators in the period 2002 to 2007 all reported production cycles around 20 months (the shortest was Grieg Seafood at 19.4 months and the longest was Marine Harvest at 20.5 months) there was significant fluctuations for the current period (2013-2017). Loch Duart and Cooke Aquaculture reported the shortest production cycle at 13.2 months and 13.5 months respectively with Marine Harvest reporting 16.2 months; both Scottish Sea Farms and The Scottish Salmon Company reporting 18 months and Grieg Seafood the longest at 19.1 months.

Sites operated by Cooke Aquaculture shortened their production cycle by 6.8 months; Loch Duart sites by 6.7 months; Marine Harvest sites by 4.3 months; Scottish Sea Farms sites by 2.3 months and Grieg Seafood by 0.1 month (Kames Fish Farming and Wester Ross Fisheries were not included due to the small sample size and the Scottish Salmon Company only analysed in relation to the current period as it did not exist in 2002-2007).

Background:

The Rural Economy & Connectivity Committee's oral evidence on 2 May 2018, as part of the Scottish Parliament's salmon farming inquiry, included a discussion on 'early harvesting':

John Finnie: I will quote from the ECCLR Committee report:

"The overall number of deaths as result of disease, ill health and stress may be masked by the early harvesting of fish with disease or life threatening conditions."

Is that the case and, if so, how widespread is the practice?

Grant Cumming: I will give you a bit of my background. I am quite new to my job of managing director, and prior to that I was in salmon farming. The subject is very close to my heart. Like any farmer, salmon farmers hate it when our stock is not healthy: welfare is our number 1 priority, just as it is in agriculture. If our fish are not healthy, we consider the possibility of harvesting them, which is sometimes a better option than treating them. If we left all the fish in the sea and never harvested them, eventually all the fish would die.

Yes—there has been early harvesting, but if we had not harvested early, mortality rates could have been higher, so I do not think that it is a bad thing to have taken action to harvest early.

Craig Anderson: My company also takes such decisions very seriously, and we take advice from a third-party veterinary group. If fish health has deteriorated a great deal, we will decide to harvest, but it is a serious decision that is not taken lightly.

John Finnie: The telling word in the quote that I read out was "masked". What is your reaction to that? Is it all open and transparent, or is early harvesting avoiding exposure to a wider issue?

Ben Hadfield: I hope that you will forgive me for saying that I think that "masked" was a bad choice of word. We are very knowledgeable about the health status of our fish and the challenges that we face. It is part of our business to be at the top of our game on that.

Also, we are busy people, but I accept that communicating such information in an open and transparent way is something that we have done badly. The information is sometimes complex, but we have to explain it. The SSPO has recently published sea lice data and proposes to publish mortality data, and Marine Harvest has published that data by site since 2016. Those examples are the direction in which the industry in our nation needs to go in order to get a proper buy-in to a culture of quality growth in the right circumstances. I hope that that is a good answer.

I do not think that the use of the word "masked" in the report was appropriate.

In March, as part of the Environment, Climate Change & Land Reform (ECCLR) Committee's inquiry into the environmental impacts of salmon farming, the ECCLR Committee published a report on the environmental impacts of salmon farming which included:

Management solutions

85. The Committee heard while mortality rates have gone up the availability of specialised fish veterinary advice has expanded massively. The Committee also heard there are solutions for dealing with the challenge of gill health and the industry is investing in the treatment of fish with fresh water in well boats or other contained units and when gill health deteriorates beyond the point at which the industry considers it is sensible to keep those fish in the sea they are harvested early and then go into the food chain.

View of the Committee

94. The Committee understands with any livestock production there will be health challenges and the aquaculture industry is no different in that regard. However the levels of mortality have been increasing and the Committee is of the view that the figures suggest the industry has a significant problem with fish deaths. The overall number of deaths as result of disease, ill health and stress may be masked by the early harvesting of fish with disease or life threatening conditions. This activity warrants further review.

'Scotland's 10 Year Farmed Fish Health Framework' published on 23 May 2018 claimed: "The increased ability to grow larger smolts provides the opportunity to reduce the marine grow out phase of farmed salmon, thus reducing the time spent in sea and the length of exposure to marine challenges such as sea lice."

Work Stream 5: Production Cycle and on-Farm Management

Industry and research have improved fish farming cycles to allow for growth to an acceptable harvest weight and include good fish health and husbandry techniques such as fallowing. The increased ability to grow larger smolts provides the opportunity to reduce the marine grow out phase of farmed salmon, thus reducing the time spent in sea and the length of exposure to marine challenges such as sea lice. Reduction in time spent at sea may also in turn reduce treatment requirement, thereby extending the shelf life of sea lice medicines and slow down the build-up of chemical resistance within sea lice. Reduced time spent in the sea also has corresponding benefits in reducing environmental impacts, including those in the water column and sea bed.

Fallowing allows for a break in sea lice and other pathogen biological life cycles and could be done more frequently under shorter farming cycles. Contiguous area fallowing would also provide benefit for rainbow trout fish health and welfare, a concept which is yet to be explored fully.

The activities under this work stream aim to explore the potential mechanisms to optimise farmed salmonid health and welfare. This includes supporting the use appropriate and effective use of Acoustic Deterrent Devices on Scottish fish farms.

Activities

- Review evidence to support the potential environmental and health benefits arising from input of larger smolts (and associated decrease in marine phase) and increased fallow frequency
- Recommend best-practice to maximise smolt survival in the first 30 days at sea and the ability to shorten the marine phase of the production cycle.
- Review rainbow trout production methods (inc. continuous stocking) and identify areas where the industry could support the move to contiguous fallowing if evidentially justified
- Review how the regulatory framework can better encourage deployment of larger smolts, increased fallowing and improved health for salmon and rainbow trout.
- Develop standards for the use of Acoustic Deterrent Devices (ADDs) or alternatives on marine salmon farms.
- Identify where support to fish farming companies is necessary and assist industry to prioritise robust ova selected for disease resistance to maintain and enhance Scotland's good health status.
- Revise the recommendations of the Code of Good Practice with regards to ova selection.

Fish Farming Expert [reported in March 2018]:

Anglers call for 'early harvest' sanction for salmon farmers

From left: Jon Gibb, Alan Wells, Richard Luxmoore and Guy Linley-Adams give evidence at Holyrood.

Angling pressure group Salmon and Trout Conservation Scotland (S&TCS) has suggested a "three-strikes-and-you're-out" approach that would force salmon farmers to harvest fish early if lice numbers exceeded trigger levels on three consecutive counts.

By Gareth Moore

Guy Linley-Adams: Suggested that fish farmers should be forced to harvest early if lice limits are exceeded.

S&TCS representative Guy Linley-Adams put forward the idea while giving evidence to a Scottish Parliamentary committee inquiry into Scottish salmon farming yesterday.

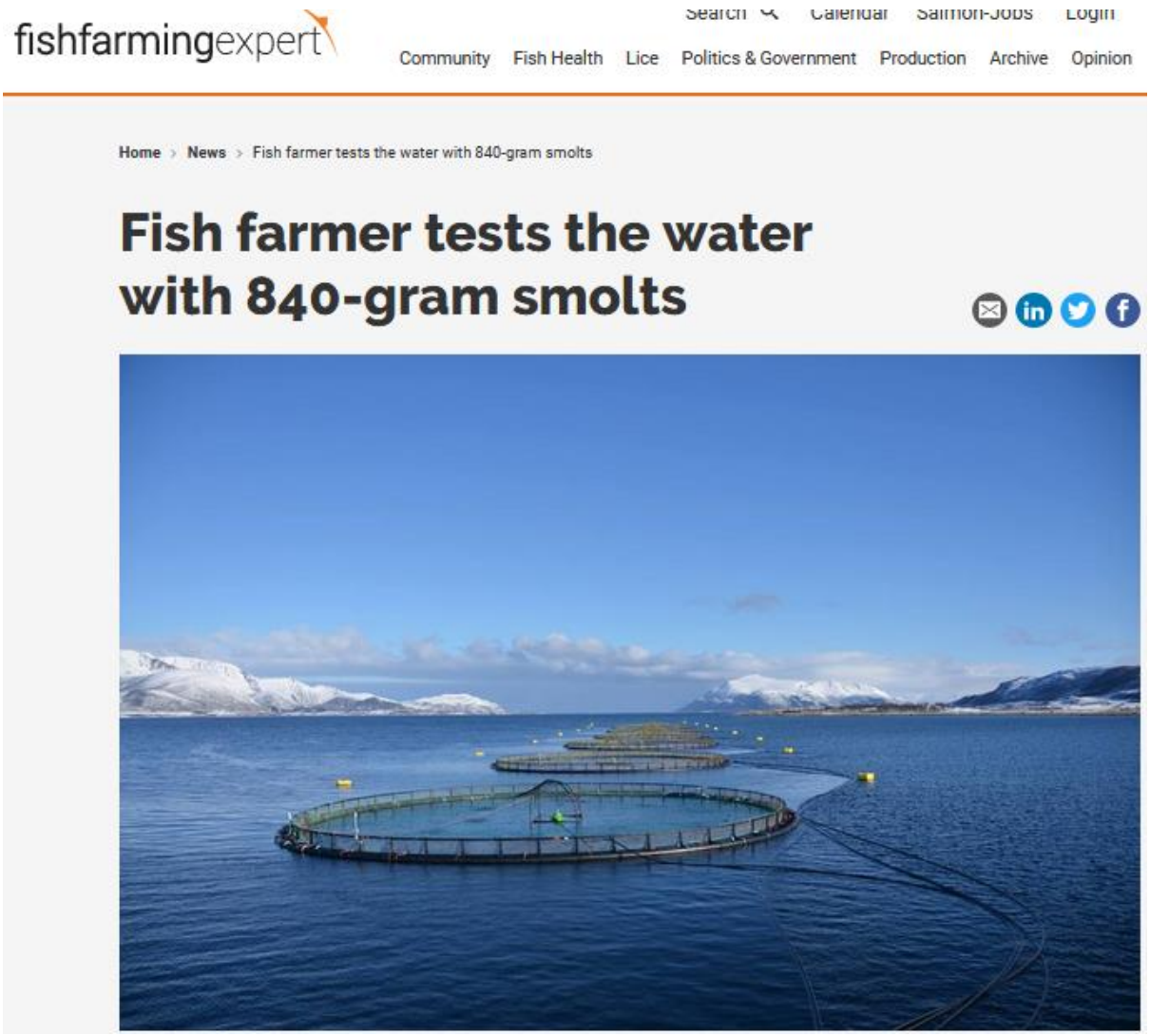
Linley-Adams appeared as a witness in front of the Rural Economy and Connectivity (REC) Committee inquiry alongside Jon Gibb, clerk of Lochaber District Salmon Fishery Board; Dr Alan Wells, chief executive of Fisheries Management Scotland (FMS); and Dr Richard Luxmoore, senior nature conservation adviser at the National Trust for Scotland, appearing on behalf of Scottish Environment LINK.

Linley-Adams, Gibb and Luxmoore also said salmon farming should move to closed containment in the medium-to-long term, something that they said would both help solve the industry's problems with disease and mortality and protect wild fish from lice larvae released from fish farms.

Here's the [transcript from the Scottish Parliament's meeting on 14 March 2018]:

> **Guy Linley-Adams:** On the various trigger levels, I noticed that the ECCLR Committee suggested that the level of 0.5 lice per fish in the code of good practice should be mandatory. That is with the proviso that the number of lice per fish is not a good measure; it should be the number of lice per farm, as my colleagues have suggested. It would be sensible to put in a ceiling above which farms should not operate and should be required to harvest early in order to remove the fish.

Fish Farming Expert [reported in May 2018]:



There's an increasing trend for salmon farmers to set out ever-larger smolts, but few will have taken the practice as far as Eidsfjord Sjøfarm.

By Therese Soltveit

The Norwegian company has set out its biggest smolts ever, weighing a mighty 840 grams, which will considerably shorten the production time at sea. The fish Eidsfjord Sjøfarm set out at the beginning of this month can be harvested before the end of the year.

Eidsfjord CEO Roger Simonsen and production manager Rolf-Arne Reinholdtsen both agree that huge smolts are the way forward and are excited about how the 840-gram smolts will survive in the next few months. Photo: Eidsfjord Sjøfarm.

The company, together with smolt supplier Sisomar, has had a conscious strategy to shorten the time its salmon spend in the sea.

Chief executive Roger Simonsen said that Eidsfjord recently set out the salmon at its Reinsnesøya site, located in Sortlandsundet in Sortland municipality.

"We have put out 100,000 salmon of up to 840 grams. We have done that in a single cage," he said.

The location of Reinsnesøya, located in Sortlandsundet in the municipality of Sortland, where Eidsfjord Sjøfarm has set out smolts of over 800 grams. Photo: Eidsfjord Sjøfarm.

Milestone

Simonsen says he doesn't know any other farmers who have set out such big smolts before, and thinks this will be an exciting time for the company.

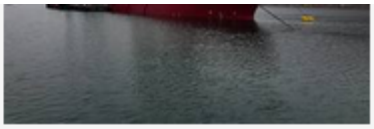
"This is the first time we've set out smolts this big and it is something new for us. So, it was a historic day for us in Eidsfjord Sjøfarm. There will be some trial and error in the future, but we are looking forward to it."

Production manager Rolf-Arne Reinholdtsen added that it's a milestone for the company to set out such big smolts.

"These smolts can take our production to a whole new level and is another way to grow the fish. We have previously put out 400-gram smolts and have had good experiences with them, and are looking forward to experiencing more about large-smolt in-sea production."

The article also included:

Conscious strategy



The wellboat Novatrans took care of the transport of 840-grams smolts delivered to Eidsfjord Sjøfarm. Here you see loading at Sisomar. Photo: Sisomar.

Eidfjord Sjøfarm, together with smolt producer Sisomar, has for several years had a conscious strategy to increase the size of the smolts and shorten the production time in the sea.

"This is a clear commitment we have made with Sisomar, who have created a large-smolt division at their facility. They have come a long way with the production of large-scale smolt and do a great job of delivering bigger and bigger smolts of good quality to us," said Simonsen, adding that the companies are now seeing the results of the good effort that has been put in over several years.

Reinholdtsen states that they are looking for a production period of 6-8 months, which indicates that the fish that were released on May 1 will be ready for harvest at the end of 2018.

Data published by the Scottish Government's annual fish farm surveys shows weights of farmed salmon inputted as smolts into the sea and final weights at harvest - revealing a trend of increasing mean weight at harvest in year 0 (1.8 kg in 2006 compared to 2.9 kg in 2016) but comparable weights for harvest in year 1 and year 2:

Table 25: Number (000s), production (tonnes) of salmon harvested and mean fish weight (kg) per year class during 2006-2016

	Year of smolt input	Year of harvest	Number (000s)	Production (tonnes)	Mean weight at harvest (kg)
Harvest in year 0 (i.e. in year of input)	2006	2006	115	211	1.8
	2007	2007	23	40	1.7
	2008	2008	116	216	1.9
	2009	2009	81	178	2.2
	2010	2010	128	268	2.1
	2011	2011	109	307	2.8
	2012	2012	127	301	2.4
	2013	2013	0	0	-
	2014	2014	286	720	2.5
	2015	2015	223	626	2.8
	2016	2016	114	333	2.9

Harvest in year 1	2005	2006	14,036	64,099	4.6
	2006	2007	13,787	60,890	4.4
	2007	2008	13,011	54,759	4.2
	2008	2009	16,338	77,621	4.7
	2009	2010	18,266	85,826	4.7
	2010	2011	18,694	91,105	4.9
	2011	2012	21,502	97,744	4.5
	2012	2013	21,264	106,161	5.0
	2013	2014	20,316	101,997	5.0
	2014	2015	24,038	114,112	4.7
	2015	2016	24,633	111,163	4.5
Harvest in year 2	2004	2006	14,237	67,537	4.7
	2005	2007	14,999	69,000	4.6
	2006	2008	15,881	73,631	4.6
	2007	2009	14,132	66,448	4.7
	2008	2010	13,666	68,070	5.0
	2009	2011	13,772	66,606	4.8
	2010	2012	13,053	64,178	4.9
	2011	2013	11,283	57,073	5.1
	2012	2014	13,712	76,305	5.6
	2013	2015	10,910	56,984	5.2
	2014	2016	10,940	51,321	4.7

The weight of grisle and pre-salmon harvest during 2006-2016 increased up to 2013 but 2016 weights are on a par with 2006 weights.

Table 26: Number (000s) and production (tonnes) of grilse and pre-salmon harvested during 2006-2016

Year	Grilse (January-August)			Pre-salmon (September-December)		
	Number	Tonnes	Average weight (kg)	Number	Tonnes	Average weight (kg)
2006	4,357	18,162	4.2	9,679	45,937	4.7
2007	3,823	15,811	4.1	9,964	45,079	4.5
2008	3,716	15,296	4.1	9,295	39,463	4.2
2009	5,631	23,857	4.2	10,707	53,764	5.0
2010	6,877	29,733	4.3	11,389	56,093	4.9
2011	7,604	35,146	4.6	11,090	55,959	5.0
2012	11,337	53,216	4.7	10,165	44,528	4.4
2013	9,618	47,496	4.9	11,646	58,665	5.0
2014	9,048	46,686	5.2	11,268	55,311	4.9
2015	11,243	53,930	4.8	12,795	60,182	4.7
2016	13,463	59,853	4.4	11,170	51,310	4.6

The latest fish farm survey (published in September 2017) shows that the mean weight of smolts in 1999 is on a par with the latest weights. In fact, the weight of smolts in 2000 (3.5 kg) for harvest year 0 is higher than any year since.

Survival and Production in Smolt Year Classes

Table 28: Survival and production in smolt year classes during 1999-2016

		Harvest year 0				Harvest year 1				Harvest year 2		
Year of smolt input	Smolt input (000s)	Number (000s)	Weight (tonnes)	Mean weight (kg)	% harvest	Number (000s)	Weight (tonnes)	Mean weight (kg)	% harvest	Number (000s)	Weight (tonnes)	Mean weight (kg)
1999	41,106	1,000	2,763	2.8	2.4	23,077	89,963	3.9	56.1	9,096	40,754	4.5
2000	45,185	765	2,673	3.5	1.7	22,726	96,539	4.2	50.3	11,354	53,535	4.7
2001	48,643	557	1,227	2.2	1.1	23,528	90,230	3.8	48.4	15,619	73,255	4.7
2002	50,086	272	824	3.0	0.5	22,602	96,205	4.3	45.1	15,555	71,988	4.6
2003	43,083	82	276	3.4	0.2	19,596	85,792	4.4	45.5	13,920	61,850	4.4
2004	39,041	168	319	1.9	0.4	15,075	67,738	4.5	38.6	14,237	67,537	4.7
2005	37,168	0	-	-	0	14,036	64,099	4.6	37.8	14,999	69,000	4.6
2006	41,091	115	211	1.8	0.3	13,787	60,890	4.4	33.5	15,881	73,631	4.6
2007	37,853	23	40	1.7	0.06	13,011	54,759	4.2	34.4	14,133	66,448	4.7
2008	36,662	116	216	1.9	0.3	16,338	77,621	4.7	44.6	13,666	68,070	5.0
2009	38,548	81	178	2.2	0.2	18,266	85,826	4.7	47.4	13,772	66,606	4.8
2010	38,490	128	268	2.1	0.3	18,694	91,105	4.9	48.6	13,053	64,178	4.9
2011	42,733	109	307	2.8	0.3	21,502	97,744	4.5	50.3	11,283	57,073	5.1
2012	41,094	127	301	2.4	0.3	21,264	106,161	5.0	51.7	13,712	76,305	5.6
2013	40,936	0	-	-	0	20,316	101,997	5.0	49.6	10,910	56,984	5.2
2014	48,112	286	720	2.5	0.6	24,038	114,112	4.7	50.0	10,940	51,321	4.7
2015	45,465	223	626	2.8	0.5	24,633	111,163	4.5	54.2			
2016	42,957	114	333	2.9	0.3							

The current lack of up-to-date site-specific information on infectious diseases, lice infestation and mortalities does not make it easy to categorically link early harvesting at certain salmon farms with particular problems. However, disclosures via Freedom of Information and Case Information published by the Scottish Government has made some useful information available which can be cross-referenced with production time-lines.

For example, a FOI disclosure by the Scottish Government revealed that Marine Harvest, Scottish Sea Farms and the Scottish Salmon Company experienced serious problems are various sites in 2017. The top twenty mortality events reported by Marine Harvest in 2017 (up to November) were:

Site Name	Start date	End date	Size of fish	Average weight of affected population	Mortality rate recorded (%)	If explained, select reason(s)	If unexplained, select observations:	Total mortality during event (if applicable)	Additional information (e.g. action taken)
Ardintoul	23/10/2017	29/10/2017	≥750g	2Kg	5.63	CMS, Complex gill issues	General Anaemia	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
Soay	09/10/2017	15/10/2017	<750g	0.4Kg	5.7	Treatment		31705	Disease samples taken, but all negative. Oxygen saturation issue on wellboat during freshwater treatment
Port Na Cro	30/10/2017	05/11/2017	≥750g	4kg	29.66	Complex gill issues, Gill issues, Anemia		24400	Site harvested out 6/11/17
MacLean's Nose	27/02/2017	05/03/2017	≥750g	1128.6g	3.86	CMS		22774	Monitoring situation closely. Health personnel on site frequently.
Ardintoul	30/10/2017	05/11/2017	≥750g	2Kg	2.58	CMS, Complex gill issues	General Anaemia	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
MacLean's Nose	06/03/2017	12/03/2017	≥750g	1199.1g	2.7	CMS		21460	Monitoring situation closely. Health personnel on site frequently.
MacLean's Nose	20/02/2017	26/02/2017	≥750g	1059.9g	3.4	CMS		20801	Monitoring situation closely. Health personnel on site frequently.
MacLean's Nose	13/03/2017	19/03/2017	≥750g	1255.1	2.7	CMS		20249	Monitoring situation closely. Health personnel on site frequently.
Poll Na Gille	23/10/2017	29/10/2017	≥750g	3.3kg	3.2	Complex gill issues, Gill issues,		20053	Harvesting worst affected cages.
Creag an T'Sagairt (Loch	26/06/2017	02/07/2017	≥750g	2.75Kg	2.31	Treatment		19633	Salmosan treatment
MacLean's Nose	22/03/2017	26/03/2017	≥750g	1323.9g	2.61	CMS		19056	Monitoring situation closely. Health personnel on site frequently.
MacLean's Nose	13/02/2017	19/02/2017	≥750g	992.7g	2.97	CMS		18740	Monitoring situation closely. Health personnel on site frequently.
Port Na Cro	23/10/2017	29/10/2017	≥750g	4kg	8.15	Complex gill issues, Gill issues, Anemia		17651	Site harvested out 6/11/17
MacLean's Nose	06/02/2017	12/02/2017	≥750g	922.0g	2.69	CMS		17428	Monitoring situation closely. Health personnel on site frequently.
Poll Na Gille	16/10/2017	22/10/2017	≥750g	3.3kg	2.6	Complex gill issues, Gill issues, Anemia		15861	Harvesting worst affected cages.
MacLean's Nose	27/03/2017	02/04/2017	≥750g	1393.7g	2.07	CMS		14719	Monitoring situation closely. Health personnel on site frequently.
Poll Na Gille	30/10/2017	05/11/2017	≥750g	3.3kg	2.7	Complex gill issues, Gill issues, Anemia		13830	Harvesting worst affected cages.
Loch Alsh (Sron)	23/10/2017	29/10/2017	≥750g	3.6 kg	2.44	CMS, Handling (harvest and treatment - salmosan)		12680	Site has begun harvesting, company vet monitoring mortality levels. Salmosan treatment conducted, increase in mortality due to backlog of mort removal during previous week due to logistics issues.
Ardintoul	13/11/2017	19/11/2017	≥750g	2Kg	1.5	CMS, Complex gill issues	General Anaemia	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
Creag an T'Sagairt (Loch Hourn)	12/06/2017	18/06/2017	≥750g	2.75Kg	1.39	Treatment		12082	Freshwater treatment on wellboat

"Harvesting worst affected cages" reported Marine Harvest for Poll Na Gille in November 2017 and "Harvested worst affected cages first" reported Marine Harvest for Linnhe in June 2017. Download the Excel spreadsheet online here.

The top ten mortality events reported by Scottish Sea Farms in 2017 (up to November) included several farms which were described as "site is harvesting early":

Site Name	Start date:	End date:	Mortality rate recorded (%):	If explained, select reason(s):	Total mortality during event	Additional information (e.g. action taken):
Kishorn B (North)	02/10/2017	08/10/2017	6.44	Gill pathology, anaemia	24345	Site is harvesting early.
South Sound	26/12/2016	08/01/2017	4.58	Physical damage	23657	Visit from fish vet group and samples showed no further action required. Attributed to bad weather.
Kishorn A (South)	18/09/2017	24/09/2017	6.27	Gill pathology, anaemia, CMS	18854	Site to begin harvesting early
Kishorn B (North)	09/10/2017	15/10/2017	5.35	Gill pathology, anaemia	16300	Site is harvesting early.
Kishorn A (South)	02/10/2017	08/10/2017	6.02	Gill pathology, anaemia, CMS	15490	Site is harvesting early.
Kishorn B (North)	16/10/2017	22/10/2017	4.58	Gill pathology, anaemia	13050	Site is harvesting early.
Kishorn West	02/10/2017	08/10/2017	6.35	Gill pathology, anaemia	12500	Site is harvesting early.
Loura Voe	02/01/2017	15/01/2017	1.41	Physical damage, Seal damage	11450	Light were turned off as thought on this occasion that it was attracting seals. Physical damage also attributed to bad weather.
Kishorn B (North)	24/07/2017	30/07/2017	2.63	AGD, PGD, Treatment	11442	H2O2 treatment (wellboat) carried out during week 30. Mortalities attributed to post-treatment losses and underlying gill pathology, likely exacerbated due to the additional handling when using the wellboat for treatment. Treatments are now being conducted using tarps and mortalities have fallen below 1%. Vets have attended site.
Kishorn West	11/09/2017	17/09/2017	4.09	Gill pathology, anaemia	11314	Ongoing losses at site. Site being harvested to reduce risk Site was visited by FHI on 05/06/2017. Diagnostic results showed fish were positive for gill pathology including Salmon Gill poxvirus, Paranucleospora theridion and AGD.

"Harvesting is underway at affected cages to reduce risk"; "Five affected cages to be harvested out, harvesting underway" and "Site being harvested to reduce risk" reported Scottish Sea Farms in relation to Kishorn West. "Site to begin harvesting early" reported Scottish Sea Farms in relation to Kishorn A (South) and Kishorn B (North). "Site is harvesting early" reported Scottish Sea Farms in relation to Kishorn B (North), Kishorn West and Kishorn B (South). Download the Excel spreadsheet online here.

The top ten mortality events reported by the Scottish Salmon Company in 2017 (up to November) included Loch Tuath which was described as "worst effected cages (sic) harvested and reducing biomass":

Site Name	Start date:	End date:	Mortality rate recorded(%):	If explained, select reason(s):	Total mortality during event	Additional information (e.g. action taken):
Vuiabeag	04/09/2017	10/09/2017	10.37	AGD, PD, Treatment	97534	
Loch Odhairn(Gravir)	24/07/2017	30/07/2017	9.64	AGD, Complex gill issues, Treatment	64872	Severe gill issues with high levels of AGD present. H2O2 treatment at end of week 29. FW treatment planned for 12/08/17. Vet has been attending weekly and will attend FW treatment.
Loch Odhairn(Gravir)	24/07/2017	30/07/2017	9.64	AGD, Complex gill issues, Treatment	64872	Severe gill issues with high levels of AGD present. H2O2 treatment at end of week 29. FW treatment planned for 12/08/17. Vet has been attending weekly and will attend FW treatment.
Druimyeon Bay	13/11/2017	19/11/2017	8.69	post treatment hydrolicer losses,	45089	further hydroliser treatment planned, fish on functional feed, harvesting.
Russel Burn	17/07/2017	27/07/2017	4.42	Fungus	40873	Mortality event attributed to fungus post vaccination. Affected stock were treated with formalin and numbers have dropped.
Strone Point	23/10/2017	29/10/2017	6.27	Ongoing bacterial challenge. Vibrio anguillarum identified as primary pathogen	38,694	FVG Visited site and provided advise on increasing biosecurity. Awaiting antibiotic sensitivity results.
Loch Odhairn(Gravir)	31/07/2017	04/08/2017	6.34	AGD, Complex gill issues, Treatment	38530	Severe gill issues with high levels of AGD present. H2O2 treatment at end of week 29. FW treatment planned for 12/08/17. Vet has been attending weekly and will attend FW treatment.
Loch Odhairn(Gravir)	31/07/2017	04/08/2017	6.34	AGD, Complex gill issues, Treatment	38530	Severe gill issues with high levels of AGD present. H2O2 treatment at end of week 29. FW treatment planned for 12/08/17. Vet has been attending weekly and will attend FW treatment.
Loch Tuath	04/09/2017	10/09/2017	14.2	AGD, Algal bloom, Complex gill issues, Jellyfish	36422	FHI informed, company biologists notified. Worst effected cages harvested and reducing biomass
Vuia Mor	11/09/2017	17/09/2017	4.13	AGD, Complex gill issues, Treatment	32487	

"Site partially harvested to remove worst affected fish - remainder of site due to fallow by end of January 2018" and "Harvesting to reduce biomass" reported the Scottish Salmon Company in relation to Druimyeon Bay. "Planning to harvest out soon" reported the Scottish Salmon Company in relation to Loch Tuath. "Accelerated harvests"; "Biomass has been lowered but gill issues continuing" and "Site has harvested largest grade cages to lower biomass, gill health issues ongoing" reported the Scottish Salmon Company in relation to Loch Odhairn/Gravir. "Hoping to grade out poor doers to reduce biomass" reported the Scottish Salmon Company in relation to Inch Kenneth. Download an Excel spreadsheet online here.

The FOI data also reveals over 135,000 dead salmon due to mechanical treatments with the Thermolicer killing 45,000 and the Hydrolicer killing 90,000 fish:

- Mortality events reported by Marine Harvest in 2017 include three cases (in Creag an T'Sagairt, Cairidh & Caolas A Deas) involving over 20,000 dead salmon due to using a Thermolicer.

- Mortality events reported by Scottish Sea Farms in 2017 include six cases (in Nevis C, Nevis B, Nevis A & South Sound) involving over 25,000 dead salmon due to using a Thermolicer.

- Mortality events reported by the Scottish Salmon Company in 2017 include eight cases (Driumyeon Bay, Sgian Dubh, Sgeir Dughall, North Uiskevagh, Kenmore & Inch Kenneth) involving 90,000 dead salmon due to using a Hydrolicer.

An email [obtained via FOI from the Scottish Government] revealed that Marine Harvest was experiencing increases in mortality from nine sites in late October 2017 citing "Anaemia issues", "CMS" and "complex gill issue" which "are being managed through harvesting and treatment". "Some fish treated with antibiotics with some positive effect, plan to harvest out ASAP once below MRL," reported Marine Harvest in relation to North Shore (Loch Erisort).

From: [redacted]
Sent: 30 October 2017 10:42
To: [redacted]
Cc: [redacted]

[redacted]
Subject: Mortality and sea lice issues, Marine Harvest

[redacted]

I received an update on Friday lunchtime last week from [redacted] at Marine Harvest concerning sea lice and mortality issues at a number of their sites.

In terms of sea lice, the latest figures have been sent to you. The company has gone from usually having 2-3 sites to report to 9 sites, three of these are sitting just below an average of 8 and are being managed through harvesting and treatment. All the details should be within the file submitted to [redacted]

From a mortality perspective, increases have been noted from a number of sites in the last week. Anaemia issues have been of concern, not suspected to be linked to ISA or any evidence of obvious haemorrhage, but may be a consequence of the complex gill issue. Mortality has also been attributed to CMS, but in many cases there are multifactorial causes. Many of these cases will need a follow up and I suggest contacting the site manager for further details as required.

- Invasion Bay – mortality >1% per week for weeks of 2nd, 9th, 16th October – attributed to CMS
- MacLean's Nose – historic CMS issues, but now fine that Q4s are out (Q1s only remaining on site)
- Loch Alsh – escalating morts in October up to 1% per week attributed to CMS
- Caolas A Deas (Loch Shell) – Last week 2.5% loss and 0.7% loss on east and west parts of site respectively, attributed to CMS
- Poll Na Gille – presently losing 1-2.1% per week (attributed to CMS, sea lice, anaemia)
- Soay (WLT) treatment (FW) associated mortality – 5.7% week of 9th October
- Loch Hourn (Creag an T'Sagairt) – anaemia since July but no mortality issues. Sea lice control through cleaner fish. Week of 18 September >1% mortality, last week 0.8% mortality
- Ardintoul – levels of anaemia in some pens, testing undertaken suggest no infective cause. Sea lice at 3.5 average for farm. Treatment underway but likely to result in mortality
- North Shore – over the last 4 weeks 2% mortality per week, on north shore east 3.9, 2.5, 4.1% mortality for the last 3 weeks. Some fish treated with antibiotics with some positive effect, plan to harvest out ASAP once below MRL. Extreme presentation of regenerative anaemia. Histology evidence of low grade challenge relating to the gills. No evidence of infectious cause (with respect to anaemia). Site also suffered/ suffering from AGD, PD and Pasturella.
- Port Na Cro – 1% mortality 25 September. Last week 6% mortality. Sea lice and anaemia listed as attributing factors

- BDNC – one week in October 1% mortality

The company are trying to harvest appropriate stocks as quickly as possible. It was reported that there is no capacity to increase harvest rate within the company or across the wider industry.

Actions – we need to follow up on both the mortality reports for our records (I would suggest this would be best done through site managers) and agree on a strategy of visits going forward, where required, we have visited a number of these sites recently and are due to visit some in the near future.

Other data published monthly by Marine Harvest indicates that Cardiomyopathy Syndrome (CMS) started causing mortality problems at MacLean's Nose in February 2017 (10.79% mortality) with problems continuing in March 2017 (11.17% mortality - with 4.02% mortality also reported at Loch Alsh); April 2017 (12.6% and 3.79% at Loch Alsh); May 2017 (13.96%); June 2017 (9.77%) and July 2017 (4.07%).

FOI data obtained from SEPA reveals that the ten biggest monthly losses at Marine Harvest salmon farms during 2017 (up to September) were as follows:

149,949 at Colonsay in August (reported via Scotland's Aquaculture as 12,439kg)
97,235 at MacLeans Nose in March (reported via Scotland's Aquaculture as 107,760 kg)
87,914 at MacLeans Nose in April (reported via Scotland's Aquaculture as 135,641kg)
85,147 at MacLeans Nose in May (reported via Scotland's Aquaculture as 156,754kg)
76,913 at Tabhaigh in August (reported via Scotland's Aquaculture as 265,069kg)
70,627 at MacLeans Nose in February (reported via Scotland's Aquaculture as 67,757kg)
62,747 at Erisort (North Shore East) in September (reported via Scotland's Aquaculture as 214,813kg)
48,620 at Soay Sound in August (reported via Scotland's Aquaculture as 3,645kg)
41,946 at Creag an Sagairt West in June (reported via Scotland's Aquaculture as 116,536kg)
41,615 at Ardintoul in February (reported via Scotland's Aquaculture as 4599kg)

Read more via:
"Data on Mortalities & Diseases at Scottish Salmon Farms"
"Scottish Salmon's Mort Mountain Leaps Over 10 Million - FOI reveals 2.3 million dead salmon at Marine Harvest farms in 2017".
"Hard Evidence: Dossier of Data on Lice, Diseases & Mortalities at Scottish Salmon Farms"

A FOI reply by the Scottish Parliament in April 2018 (search for # 603922) - cites health problems at Marine Harvest's sites during 2018 in Loch Greshornish and Loch Duich:

From: Julie Edgar[redacted]
Sent: 09 March 2018 12:24
To: Goldsmith JM (Jenny)
Subject: Committee Visit to Marine Harvest
Attachments: GF Lice and mortality kgs 2018.xlsx

Dear Jenny

Good to talk to you just now. As per our conversation, Ben Hadfield, MD of Marine Harvest Scotland, would be happy to host a Committee visit and in principle this could be to any MH farm. Given the specific information that the Committee would like to explore he is suggesting Loch Duich and/or Greshornish – perhaps depending on the severity of the health challenges that exist on the chosen date. At the moment, the management issues at each site are as follows:

Loch Duich – Challenging site to manage sea lice, sealice infection and treatment ongoing, history of gill health challenges, fish around 3.5 Kg

Loch Greshornish – Complex gill health and severe anemia leading to mortality in February, but situation improving gradually.

Ben has also supplied sea lice and mortality data for all the MH farms in Scotland (attached). Mortality is in total kilos and it is important to remember that it is from a standing biomass in the sea of around 26,000 tonnes. The lice figures are provided as Gravid Female Lice.

Regarding dates, Ben would want to be involved in the Committee visit and can be available until he travels to Canada from the 24th April to the 1st May.

Look forward to hearing from you re possible dates etc.

Kind regards
Julie

Julie Edgar
Head of News and PR
Scottish Salmon

Monthly data on lice levels and mortalities was also disclosed by Marine Harvest to the Scottish Parliament:

Operation	Marine Scotland
Generation	All
Lice Type	Lep female gravid

Avg Lice Count	Year	Week									Grand Total
	2018										
Area	2018w01	2018w02	2018w03	2018w04	2018w05	2018w06	2018w07	2018w08	2018w09	2018w10	
Ardintoul	0.84	0.04	0.01	0.09	0.09	0.06	0.07	0.08	0.03	0.22	0.13
Ardnish	0.09	0.00	0.00	0.00	1.25						0.08
Bagh Dail nan Cean	0.13	0.40	0.69	0.50	1.43	1.85					0.90
Caol Mor							0.00	0.00	0.00	0.00	0.00
Carradale	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.01	0.00
Cheese Bay	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.01
Colonsay	0.34	0.45	0.30	0.28	0.72	0.64		0.63	0.97		0.56
Duich	0.64	0.54	0.78	1.54	1.81	0.07	0.17	0.25	0.24	0.19	0.55
Gorsten	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Greshornish	0.08	0.43	0.29	0.23	0.70	0.56	0.60	0.74	1.00	1.01	0.56
Harport									0.00	0.00	0.00
Invasion Bay	0.36	1.07	1.01	1.19	1.58	1.74	1.77	1.41	1.24	0.53	1.22
Laga Bay	0.20	0.17	0.10	0.25	0.58	0.72	0.44	0.77	0.70	0.49	0.43
Leven								0.00			0.00
Linnhe										0.00	0.00
Loch Alsh		0.13	0.13	0.26	0.36	0.13	0.33	0.16	0.09	0.25	0.17
Loch Boisdale	0.02	0.03	0.01	0.01	0.02	0.00	0.02	0.00			0.01
Loch Erisort	1.27	1.74	2.79	4.38	1.77	1.48	1.15	1.67		1.57	2.20
Loch Ewe	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.01	0.01	0.02	0.01
Loch Hourn	1.02	0.51	0.49								0.78
Loch Shell	0.21	0.13	0.19	0.24	0.13	0.14	0.14	0.22	0.25	0.35	0.19
MacLean's Nose	0.15	0.28	0.43	0.17	0.08	0.36	0.58	0.80	0.58	0.85	0.45
Muck	1.85		1.78	1.68	1.43		1.27	1.35	0.70		1.59
North Harris	0.67	0.68	0.72	0.18	0.11	0.14	0.38	0.43	0.37	0.35	0.36
Poll na Gille	0.79	0.13	0.48	0.19	0.50	0.50	0.31	0.47	0.33	0.50	0.40
Skipport	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.03	0.02	0.01
South Harris	0.06	0.11	0.07	0.14	0.20	0.10	0.11	0.15	0.21	0.36	0.14
South West Shuna	0.16	0.02	0.41	0.20	0.03	0.06	0.15	0.13	0.22	0.22	0.18
Stulaigh	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00			0.00
Torridon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
WL Tarbert	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
Grand Total	**0.30**	**0.34**	**0.33**	**0.35**	**0.41**	**0.28**	**0.24**	**0.25**	**0.22**	**0.20**	**0.30**

Operation	Marine Scotland
Generation	All

Mort Biomass (Kg)	Year	Week									Grand Total
	2018										
Area	2018w01	2018w02	2018w03	2018w04	2018w05	2018w06	2018w07	2018w08	2018w09	2018w10	
Ardintoul	9,907	9,972	12,195	1,732	2,405	2,776	3,871	2,258	3,138	1,464	49,720
Ardnish	211	25	7								242
Bagh Dail nan Cean	3,429	2,551	1,814	1,659	2,357	3,092	2,624	294			17,819
Caol Mor					1,897	1,149	255	108	690	748	4,848
Carradale	1,469	855	663	937	1,037	590	668	416	1,677	3,317	11,629
Cheese Bay	2,069	1,192	3,791	2,657	2,472	1,908	2,000	2,227	1,977		20,294
Colonsay	128	85	66	73	63	68	139	40	300	111	1,073
Duich	1,919	5,134	3,899	2,060	2,430	17,822	3,601	2,419	3,807	2,853	45,944
Gorsten	7	5	25	14	14	16	17	1,096	1,405	23	2,623
Greshornish	12,533	11,785	38,952	15,132	13,264	16,963	21,441	21,323	15,994	6,592	173,979
Harport						2,247	443	232	54	8	2,986
Hellisay	299										299
Invasion Bay	8,935	22,708	7,971	9,440	5,832	6,063	4,650	4,367	5,263	3,674	78,902
Laga Bay	3,099	3,485	3,187	3,502	2,655	3,100	2,533	3,316	3,278	994	29,149
Leven							1,848	242	55	16	2,161
Linnhe							1,747	1,286	919	51	4,004
Loch Alsh		12,262	7,378	4,298	4,645	3,770	4,492	3,585	4,770	4,760	49,960
Loch Boisdale	112	61	94	129	203	115	169	135	56		1,074
Loch Erisort	4,936	3,947	4,408	3,326	3,746	3,337	4,708	4,160	940	527	34,035
Loch Ewe	188	457	722	1,107	832	789	551	243	605	183	5,676
Loch Hourn	1,438	1,152	1,168	372							4,130
Loch Shell	2,797	831	614	1,095	2,522	1,072	700	675	426	218	10,948
MacLean's Nose	2,264	2,969	3,372	2,839	2,325	1,476	1,492	5,106	2,928	1,127	25,898
Muck	3,701	107	2,856	2,230	1,747	3,201	3,513	2,608	1,336		21,300
North Harris	12,857	19,131	5,791	9,027	13,274	4,577	3,241	3,729	14,326	6,596	92,549
Poll na Gille	3,220	4,844	3,900	7,055	3,227	728	1,070	967	1,077	926	27,013
Skipport	291	630	716	596	770	962	887	1,568	4,043	955	11,417
South Harris	1,903	1,113	1,115	1,025	1,225	1,013	1,162	897	1,402	610	11,466
South West Shuna	1,847	3,202	1,478	2,315	5,114	1,692	2,004	1,902	2,118	258	21,931
Stulaigh	128	57	184	564	339	257	248	175	122	254	2,326
Torridon	90	125	159	181	246	416	396	395	462	232	2,702
WL Tarbert	75	46	156	70	103	132	116	166	216	92	1,172
Grand Total	**79,853**	**108,730**	**106,681**	**73,434**	**74,744**	**79,332**	**70,587**	**65,937**	**73,383**	**36,590**	**769,272**

Download as a PDF online here

Read more via "Media Backgrounder: Marine Harmfest Scotland"

Other 'Case Information' is published via the Scottish Government's Fish Health Inspectorate which currently holds data for 2013; 2014; 2015; 2016 and 2017.

The latest Case Information (October to December 2017) detail Cases 20170340-20170460 which includes reference to a "decision taken quickly to empty site" following a rapid rise in mortality reported as due to "gill issues, anaemia" at Marine Harvest's Port Na Cro salmon farm in November 2017. "Issues with gills and anaemia have lead to decision to harvest," concluded the Fish Health Inspectorate report.

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Case No:	2017-0431			Date of visit:	06/11/2017
Time spent on site:	5hrs			Main Inspector:	SAE
Site No:	FS0859	Site Name:	Port Na Cro		
Business No:	FB0119	Business Name:	Marine Harvest (Scotland) Ltd		

Case Types: 1 REP 2 DIA 3 4 5 6

Water Temp (°C):	12.3	Thermometer No:	Site	FHI 045 completed	

Observations: Region: ST Water type: S CoGP MA M-40

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	

UNI/REG only - if unable to carry out intended visit detail reason below:

FHI 059, Version 11 Issued by: FHI Date of issue: 12/09/2017

Additional Case Information:

Site harvested out on day of inspection. 5 fish diagnostic taken of fish kept back from last cage.

Mortality shot up from below 1% to 4.11% in wk 42. (see details on mort reports) Decision taken quickly to empty site.

9/10 October Peroxide for AGD

Recent (last 4 wks) disease problems?
If yes, detail: gill issues, anaemia

Mortality Records

1. Mortality records available for inspection?	Y
2. How are mortalities disposed of?	Whole fish - Dundas Chemicals
If other detail:	and some ensiled
3. Mortality records complete and correctly entered?	Y
4. Recent mortality (last 4 wks):	Pen 4 worst; see mort event report
5. Evidence of recent increased/atypical mortalities?	Y
If yes, facility nos/no mortality per facility/no stock per facility/reason:	
see mort event reports	
6. Any other peaks in mortality during period checked?	N
If yes, detail:	
7. Have increased (unexplained) mortalities been reported to vet or FHI?	Y
If yes, detail action:	site harvested out
8. Have 'mortality events' been reported to FHI? If no, add MRT case and enter on mortality events sheet.	Y

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?	N
3. Any significant results?	Y
If yes, detail (if not detailed under recent disease problems).	gill issues
site has not received reports from last samples sent off and last two health visits but issues with gills and anaemia have lead to decision to harvest	

Records checked between: 11/10/2017 - 06/11/2017

Mortality due to "complex gill issues" at Marine Harvest's Port Na Cro salmon farm was recorded as high as 29.66% in October 2017:

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Case No: 2017-0431 Site No: FS0859 Date of visit: 06/11/2017

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):
16/10/17	22/10/2017	≥750g	4kg	SAL	2016 Q4	Weekly	4.11	Explained	Complex gill issues, Gill issues
23/10/17	29/10/2017	≥750g	4kg	SAL	2016 Q4	Weekly	8.15	Explained	Complex gill issues, Gill issues
30/10/17	05/11/2017	≥750g	4kg	SAL	2016 Q4	Weekly	29.66	Explained	Complex gill issues, Gill issues

Over 50,000 morts were reported citing "General Anaemia":

If unexplained, select observations:	Total mortality during event (if available):	Additional information (e.g. action taken by company):	Action taken by FHI (include case no where applicable):
General Anaemia	9,280	Site harvested out 6/11/17	Site visit 6/11/17
General Anaemia	17,651	Site harvested out 6/11/17	Site visit 6/11/17
General Anaemia	24400	Site harvested out 6/11/17	Site visit 6/11/17

The Scottish Government reported in a letter to Marine Harvest positive tests for proliferative gill pathology with lesions consistent with amoebic gill disease (AGD), epitheliocysts, Piscine myocarditis virus (PMCV) consistent with mild cardiomyopathy syndrome (CMS), Paranucleospora theridon and salmon gill poxvirus (SGPV).

marinescotland science

The Scottish Government
Riaghaltas na h-Alba

[redacted]
Marine Harvest (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	06/11/2017
SITE NO	FS0859	SITE NAME	Port Na Cro
INSPECTOR	Svenja Elwenn	CASE NO	20170431

Section 1: Summary

A report of increased mortality at the site was received from the operator. Five fish were removed for diagnostic sampling.

Histopathology examination revealed mild to moderate proliferative gill pathology with lesions consistent with amoebic gill disease (AGD) which was confirmed by QPCR, and presence of epitheliocysts. Pathology consistent with mild cardiomyopathy syndrome (CMS) was noted which was confirmed by QPCR positive result for Piscine myocarditis virus (PMCV).

Due to gill health issues observed on site samples were screened for *Paranucleospora theridion* (syn. *Desmozoon lepeophtherii*) and salmon gill poxvirus (SGPV) by QPCR and tested positive for both pathogens.

Another FHI visit report dated October 2017 for The Scottish Salmon Company's Loch Tuath salmon farm "revealed complex gill pathology including the presence of amoebic cells suggestive of amoebic gill disease and evidence of gill poxvirus"; "Epitheliocystis were noted and tested positive to Canditus Branchiomonas cysticola" and "Vascular damage and mid hepatic necrosis was also noted". Farmed salmon also tested positive for Parvicapsula pseudobranchicola and Paranucleospora theridon.

marinescotland science

The Scottish Government
Riaghaltas na h-Alba

[redacted]
The Scottish Salmon Company
1 Smithy Lane
Lochgilphead
Argyll
PA31 8TA
[redacted]

FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

BUSINESS NO	FB0169	DATE OF VISIT	11/10/2017
SITE NO	FS0617	SITE NAME	Loch Tuath
INSPECTOR	David Tomlinson	CASE NO	20170458

Section 1: Summary

Five lethargic Atlantic salmon (*Salmo salar*) were sampled for diagnostic purposes. Histopathology examination revealed complex gill pathology including the presence of amoebic cells suggestive of amoebic gill disease and evidence of salmon gill poxvirus. Both pathogens were confirmed by QPCR. Epitheliocystis were noted and tested positive to *Candidatus* Branchiomonas cysticola by QPCR. Vascular damage and mild hepatic necrosis was also noted.

Due to the gill health issues on site, samples were screened for *Parvicapsula pseudobranchicola* and *Paranucleospora theridion* by QPCR. Samples tested **positive** for both pathogens.

A FHI visit report from October 2017 reported disease problems:

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Case No:	2017-0467							Date of visit:	17/10/2017		
Time spent on site:	4 hours							Main Inspector:	SJD		
Site No:	FS0411	Site Name:	Vuiabeag								
Business No:	FB0169	Business Name:	The Scottish Salmon Company								
Case Types:	1 REP	2 DIA	3		4		5		6		
Water Temp (°C):	12.5	Thermometer No:	Site					FHI 045 completed			
Observations:		Region:	WI		Water type:	S		CoGP MA	W-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										

The report for The Scottish Salmon Company's salmon farm at Vuia Beag in Loch Roag detailed "complex disease issues" including "AGD, Para Ther, Salmon gill pox, Microsporidia, SAV and epitheliocystis" with "plans to move all fish to Eughlam in December":

FHI 059, Version 11 Issued by: FHI Date of issue: 12/09/2017

Additional Case Information:

Complex gill issues on site - AGD, Para Ther & Salmon gill pox. Microsporidia, SAV, epitheliocystis positive - by PCR from FVG.
This is the last cycle of fish for Vuia Beag - no plans to restock.
Morts started to rise in week 29 - 5002/site/wk.
Wk 30 - 14182, wk 31 - 14284, wk 32 - 14894, wk 33 - 13,974, wk 34 - 14861, wk 35 - 17449, wk 36 - 97524. First few weeks just below the reporting level of 1.5%.

Morts dropped again over last few weeks - wk 37 - 2061, wk 38 - 905, wk 39 - 1342, wk 40 - 2176, wk 41 - 2704, wk 42 - 1853.
Morts attributed to complex gill issues and associated treatments - H2O2.
Slice treatment - 25/09 -01/10 latest. 4 slice treatments since input. Lice levels low - <0.1.
No movements since last inspection. Plan to move all fish to Eughlam in December. Will wait until after move to stock with cleaner fish.

The report also detailed "deformed spine":

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Additional comments:

F1 - deformed spine.

As well as a "strong presence" of moribund, anorexic and lethargic farmed salmon in addition to lesions on the flank and a "medium presence" of necrotic gills.

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Case no: 2017-0467 Site No: FS0411 Method of killing:

Date of visit: 17/10/2017 Inspector(s): SJD Sheet Relevant: Y

S for strong presence: **M** for medium presence: **W** for weak presence

Fish Number		1	2	3	4	5					
Time sampled after death (if > 45 minutes)				50	60	70					
External Signs											
Behaviour	Moribund	S	S	S	S	S					
	Lethargic	S	S	S	S	S					
	Hanging vertical										
	Spiralling										
	Flashing										
	Loss of equilibrium										
Body	Dark										
	Distended abdomen										
	Anorexic	W	S	S	S	W					
Gills	Pale										
	Zoned										
	Necrotic	M	M	M	M	M					
Lesions	Flank		S	W							

Marine Scotland Science's FHI visit report dated October 2017 included:

marinescotland science

The Scottish Government
Riaghaltas na h-Alba

[redacted]
The Scottish Salmon Company
1 Smithy Lane
Lochgilphead
Argyll
PA31 8TA
[redacted]

FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

Business No	FB0169	**Date of Visit**	19/10/2017
Site No	FS0411	**Site Name**	Vuiabeag
Inspector	Sonia Duguid	**Case No**	20170467

Section 1: Summary

A report was received from the operator of increased mortality levels at the site due to complex gill issues. Five fish were selected for diagnostic sampling.

Histopathology examination revealed complex gill issues with pathology consistent with amoebic gill disease (AGD) which was confirmed by QPCR and evidence of salmon poxvirus which was also confirmed by QPCR. Epitheliocystis were also noted in fish 3 and 5 and tested positive for *Candidatus* Branchiomonas cysticola and *Candidatus* Syngnamydia salmonis by QPCR. Mild hepatic necrosis was also noted, likely associated with hypoxia. Fish 3 also showed a skin lesion which in association with gill issues may impact on osmotic balance.

Due to gill health issues observed on site samples were screened for *Paranucleospora theridion* (syn. *Desmozoon lepeophtherii*) by QPCR and tested positive.

Mortality levels had begun to rise in July 2017, peaking at 10.37% in week 36 following a hydrogen peroxide treatment. Mortality had reduced below the reporting level of 1.5% the following week and the week prior to the visit was at approximately 0.2%. Health surveillance carried out by the company reported complex gill issues (AGD, *Paranucleospora theridion,* salmon gillpox and epitheliocystis). PCR results were also positive for salmonid alphavirus. A number of moribund salmon were observed across the site and five were sampled for diagnostic purposes.

Results

Bacteriology: Kidney and gill material from fish 1-5 and lesion material from fish 2 and 3 were inoculated onto appropriate media for the isolation of bacteria. The following bacteria were isolated:

Moritella viscosa – fish 3 (lesion material)
Vibrio spp. – 2 separate isolates from fish 1-4 (kidney and gill material)

Moritella viscosa is a known fish pathogen and it was present at very high levels in the lesion of Fish 3.

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

Candidatus Branchiomonas cysticola

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F3	22.96	29.27	29.23	29.33	POSITIVE
F5	23.26	25.05	25.22	25.00	POSITIVE

Candidatus Syngnamydia salmonis

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F3	22.96	27.33	27.57	27.48	POSITIVE
F5	23.26	27.58	27.55	27.41	POSITIVE

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

Infectious pancreatic necrosis virus (IPNV)

Pool Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
P1	19.65	36.26	36.76	36.71	POSITIVE

Salmonid alphavirus (SAV)

Pool Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
P1	19.65	36.08	35.76	36.11	POSITIVE

Salmon gill poxvirus (SGPV)

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	23.23	31.87	31.96	32.00	POSITIVE
F2	23.29	25.56	25.48	25.52	POSITIVE
F3	23.05	26.21	26.09	26.05	POSITIVE
F4	22.71	35.25	35.12	35.28	POSITIVE
F5	23.27	26.31	26.28	26.28	POSITIVE

The samples tested negative for infectious haematopoietic necrosis virus (IHNV), infectious salmon anaemia virus (ISAV) and viral haemorrhagic septicemia virus (VHSV).

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

Neoparamoeba perurans (AGD)

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	23.23	28.57	28.62	28.67	POSITIVE
F2	23.29	26.11	26.06	26.08	POSITIVE
F3	23.05	27.21	27.17	27.18	POSITIVE
F4	22.71	27.22	27.04	27.06	POSITIVE
F5	23.27	27.18	27.19	27.10	POSITIVE

Paranucleospora theridion

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	23.23	29.54	29.40	29.51	POSITIVE
F2	23.29	26.41	26.35	26.36	POSITIVE
F3	23.05	29.46	29.28	29.38	POSITIVE
F4	22.71	32.94	33.18	33.11	POSITIVE
F5	23.27	28.23	28.31	28.31	POSITIVE

R09

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A FHI visit report from October 2017 for The Scottish Salmon Company's salmon farm at Vuia Mor in Loch Roag detailed a total mortality since input of 30.23% with 32,487 morts. Recent disease issues cited were PGD, AGD, Para Ther, Sal Gill pox, PD, HSMI, microsporidia and epitheliocystis.

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Additional Case Information:

Site contact to be updated - confirm with business correspondent.
Just started stocking with lumpfish - first load arrived yesterday.
Recent issues - PGD, AGD, Para Ther, Sal Gill pox, PD, HSMI, microsporidia, epitheliocystis
Stocked in January 2017.
Mortality since input - generally 0.08%-0.7% per week.
Recent mortality - wk 42 - 366, wk 41 - 577, wk 40 - 31536 (6.24%), 39 - 67435 (11.91%)
Total 30.23% mortality since input.
Ongoing Slice treatment.
Site specific sea lice strategy.
Check with biologist regarding harvest plans.

If unexplained, select observations:	Total mortality during event (if available):	Additional information (e.g. action taken by company):	Action taken by FHI (include case no where applicable):
	32487		

A FHI visit report from October 2017 for Marine Harvest's salmon farm at North Shore in Loch Erisort detailed a "presumptive Pasteurella skyensis diagnosis" and "pathology consistent with previous Pasteurella infections" as well as "some cadiomyopathy", Pancreas Disease, AGD (Amoebic Gill Disease), Salmon gill pox and ParaTher (Paranucleospora theridon):

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Case No:	2017-0469					Date of visit:	18/10/2017
Time spent on site:	5 hours					Main Inspector:	SJD
Site No:	FS1033	Site Name:	North Shore				
Business No:	FB0119	Business Name:	Marine Harvest (Scotland) Ltd				
Case Types:	1 REP	2 ESC	3 DIA	4	5	6	
Water Temp (°C):	11.5	Thermometer No:	Site			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	

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Additional Case Information:

Presumptive Pasteurella skyensis diagnosis - based on histology results from FVG. Gram -ve bacteria seen in sections and pathology consistent with previous Pasteurella infections. Also, isolate submitted via FVG to MS for sequencing.
Samples sent off to Ridgeway for isolation and confirmation - results expected at start of next week.
Pen 16 worst affected.
Samples from end of September showed some cardiomyopathy - FVG.
PD diagnosed at end of May (sub-type 5) - recent blood PCRs negative, no longer active infection. Don't think contributing to current mortality event. However, additional PCRs positive from Patogen tests at end of September. Patogen also had positive PCRs for CMS in one fish. Salmon gill pox and ParaTher also positive.
Stocked with lumpfish but extended FW treatments killed majority - close to 100% mortality.
PGD on site at present but not gross AGD lesions. PGD scores of 2-3 on moribunds but similar in un-affected fish.
Site vet reported - fluid being seen in pericardium - from clear to 'milky white'. Fluid in peritoneal cavity - blood tinged. Also some fluid on swim bladder. Mottled spleen in some with nodules. Adhesions present.

Original site plans to fallow in May/June 18 - but likely to be earlier now.
North Shore West - 287905@ 4.1kg
North Shore East - 289462 @ 3.9kg
Morts removed in tubs - collected by Gogar and transferred to Energen biogas.
NSW - morts started rising in August. Prior to this approx. 200/8 cages/ every few days. Now 43-201/c/day.
49608 across NSW since 28/06/17.
NSE - 95762 total mortality since 28/06/17. Similar to NSW - started rising in August. Now 12-311/c/day.
Morts have dropped again over last few days - peaked at 7500 across NSE/day on 28 September, now 741/site/day.
Staggered treatment with antibiotics (Florocol) - limited availability of antibiotic. 7 cages treated.
Morts also above reporting levels at Tabhaigh - weeks 32 -34
Escape investigation
Seal spotted in pen, disappeared before action taken to remove. Divers on site within 2 hours - found and repaired hole net. Due to size of hole not thought to be caused by seal, but by hat of uplift system.
Site manager in discussion with production manager regarding modifications to uplift system which may be possible to prevent re-currence.
Cage currently being treated with Florocol. Decision to be made following withdrawal period - either to harvest cage or carry out lice treatment. Fish will be counted at this time - don't want handling at present due to treatment.

Multiple moribund fish seen in cages 16, 17 and 2. 5 sampled for diagnostic purposes. Didn't see as much gross pathology or clinical signs as had been seen by vet.

Deformities such as a "shortened upper jaw" and "eyes damaged" were also reported:

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Additional comments:

F2 - shortened upper jaw, thickened membrane over kidney - gelatinous, adhesions.
F3 - shortened upper jaw, both eyes damaged, adhesions.
F4 - grilse
F5 - shortened upper jaw.

The FHI visit report for Marine Harvest's salmon farm at North Shore in Loch Erisort detailed:

marinescotland science

The Scottish Government
Riaghaltas na h-Alba

[redacted]
Marine Harvest (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	18/10/2017
SITE NO	FS1033	SITE NAME	North Shore
INSPECTOR	Sonia Duguid	CASE NO	20170469

Section 1: Summary

A report was received from the operator of increased mortality levels at the site due to infection with *Pasteurella skyensis*. Recent samples submitted to the Fish Vet Group had also shown some cardiomyopathy. Proliferative gill disease was also being observed on site. The site was inspected and five fish were removed for diagnostic sampling.

Histopathology examination revealed mild gill pathology, mainly lamellar capillary disturbances/damage. Some of the lesions are commonly seen as background levels. Fish 3 showed mild pathology resembling Pasteurella-like infections and gram negative bacteria were observed in sections of fish 4. Myositis and mild myocardial inflammation were also noted in fish 1, fish 2 and fish 3.

Pasteurella skyensis was isolated, this is a known fish pathogen and the purity and growth level suggest it is likely to be implicated in morbidity.

Pasteurella skyensis was isolated, this is a known fish pathogen and the purity and growth level suggest it is likely to be implicated in morbidity.

Due to gill health issues observed on site, samples were screened for *Neoparamoeba perurans* (AGD), *Paranucleospora theridion* (syn. *Desmozoon lepeophtherii*) and salmon gill poxvirus by QPCR and tested positive for all three pathogens. Results for individual fish are detailed below.

Mortality levels had begun to rise in August 2017, peaking at 4.9% in week 39. Mortality had reduced to 2.65% the week prior to the inspection. Seven cages were being treated with Florocol as insufficient antibiotic was available to treat the whole site. The most recent health surveillance carried out by the company reported a *Pasteurella skyensis* infection. PCR results at the end of September 2017 were positive for salmonid alphavirus, piscine myocardiopathic virus (1 fish), salmon gill poxvirus and *Paranucleospora theridion*. A number of moribund salmon were observed across the site and five were sampled for diagnostic purposes.

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

R09

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Website - www.gov.scot/Topics/marine/science

Piscine reovirus (PRV)

Pool Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
P1	19.37	37.09	36.76	36.95	POSITIVE

Salmon gill poxvirus (SGPV)

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	22.87	37.15	36.93	38.29	POSITIVE
F2	23.27	38.34	37.99	37.99	POSITIVE
F4	23.38	29.71	29.62	29.75	POSITIVE
F5	23.05	36.83	36.48	36.93	POSITIVE

Fish 3 tested negative for SGPV.

Parasitology:

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

Neoparamoeba perurans (AGD)

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F2	23.27	32.09	32.49	32.26	POSITIVE
F3	23.15	32.61	32.58	32.61	POSITIVE
F4	23.38	33.92	33.90	34.27	POSITIVE

Fish 1 and 5 tested negative for AGD.

Paranucleospora theridion

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	22.87	33.22	33.38	33.07	POSITIVE
F3	23.15	35.17	35.05	35.50	POSITIVE
F5	23.05	32.06	32.12	32.01	POSITIVE

"About 125,000 salmon have died due to a disease outbreak at two fish farms on the Isle of Lewis," reported BBC Scotland in October 2017. "Marine Harvest confirmed that the sites in Loch Erisort have been hit by the bacterium Pasturella Skyensis". "Macleans Nose in Loch Sunart, where salmon have also been exposed to AGD, is believed to be infected by Pasteurella skyensis, too," reported Fish Update in October 2017.

"A staggering 177,000 were hauled out of one loch [Erisort] last autumn," reported The Daily Mail in January 2018.

Thousands of fish thrown in a truck – and troubling new questions for salmon farms

A staggering 177,000 were hauled out of one loch last autumn but that's a fraction of the 10m diseased salmon binned by the industry in a single year

SPECIAL INVESTIGATION
by Gavin Madeley

Download high res images via [Photo Gallery: Dead Salmon from Scotland's Disease-Ridden Salmon Farms]

A [FHI visit report from October 2017] for a salmon farm in Loch Kishorn (Kishorn A) operated by Scottish Sea Farms detailed disease problems including AGD, sea lice damage to the heads of farmed salmon, Paranucleospora theridon, salmon gillpox, Branchiomonas, lamellar bleeding of the gills, CMS and HSMI like pathology:

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Case No:	2017-0496							Date of visit:	25/10/2017		
Time spent on site:	4 hours							Main Inspector:	ALW		
Site No:	FS0709	Site Name:	Kishorn A (South)								
Business No:	FB0125	Business Name:	Scottish Sea Farms Ltd								
Case Types:	1 REP	2 DIA	3 VMD	4		5		6			
Water Temp (°C):	13.8	Thermometer No:	T148					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	

Recent (last 4 wks) disease problems?		Y	Any escapes (since last visit)?
If yes, detail:	CMS, AGD, Paranucleospora theridion, salmon gillpox and Branchiomonas		

FHI 059, Version 11 Issued by: FHI Date of issue: 12/09/2017

Additional comments:

Fish 2-5 sea lice damage to head

FHI 059, Version 11 Issued by: FHI Date of issue: 12/09/2017

Additional Case Information:

Ongoing health issue on site. Company reported weekly mortality levels above 1%.

Tests positive for presence of AGD, Paranucleospora theridion, salmon gillpox and Branchiomonas. Also observed lamellar bleeding of the gills. CMS was detected earlier in the cycle (fish ~500g) and HSMI like pathology in more recent tests.
Advice from vets to accelerate harvests and not to attempt mechanical delousing in worst affected cages, bath only. Sea lice levels have increased (Most recent count on 27/9/17 - 5.67. No recent counts as harvesting out site). Treated all cages with Azamethiphos at end of Sept/early October.
Harvesting worst affected cages first and site should be empty over the weekend.

Mortalities being sent to Dundas for disposal. Due to volume of fish using a dedicated workboat operated by Fergusons Transport (Carly) who are organising the removal. Mortalities removed using uplift, transferred to tubs on site workboat and then pumped into sealed skips on boat. Boat moors at Kyle of Lochalsh each day and morts are collection by Billy Bowie.
A number of fish seen on site with lice damage to the head (estimate ~100 per cage visible). Removed 4 moribund fish and one apparently healthy fish for VMD. The gills of the fish removed for VMD had numerous pale patches so was included in the diagnostic sample. The four moribund fish had extensive lice damage to their heads, but gills appeared ok. Internally the heart of fish four was pale. Photos attached.

The FHI visit report clearly states "harvesting out site, advised to avoid crowding" as an action response to increased mortalities:

7. Have increased (unexplained) mortalities been reported to vet or FHI?		Y
If yes, detail action:	Harvesting out site, advised to avoid crowding	
8. Have 'mortality events' been reported to FHI? If no, add MRT case and enter on mortality events sheet.		Y

Marine Scotland Science detailed in their FHI Visit Report for October 2017 "complex gill issues" - including pathology consistent with epitheliocystis, amoebic gill disease (AGD), evidence of salmon gill poxvirus, mild hepatic necrosis, mild cardiomyopathy, Paranucleospora theridon, Vibrio sp. and Pseudomonas fluorsecens:

marinescotland science

The Scottish Government
Riaghaltas na h-Alba

[redacted]
Scottish Sea Farms Ltd
Laurel House
Laurelhill Business Park
Polmaise Road Stirling
FK7 9JQ
[redacted]

FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

Business No	FB0125	**Date of Visit**	25/10/2017
Site No	FS0709	**Site Name**	Kishorn A (South)
Inspector	Andrea Warwick	**Case No**	20170496

Section 1: Summary

A report was received from the operator of increased mortality levels at the site due to complex gill issues. Five fish were removed for diagnostic sampling.

Histopathology examination revealed complex gill issues. There was pathology consistent with epitheliocystis, amoebic gill disease (AGD) which was confirmed by QPCR and evidence of salmon gill poxvirus which was confirmed by QPCR. Mild hepatic necrosis was noted, likely associated with hypoxia. Mild cardiomyopathy noted in all individuals.

Due to gill health issues observed on site samples were screened for *Paranucleospora theridion* (syn. *Desmozoon lepeophtherii*) by QPCR and tested positive.

A *Vibrio* sp. and *Pseudomonas fluorescens* were isolated but are not thought to be the primary source of morbidity.

Section 2: Case Detail

Observations

The above site was inspected following a report from the operator of increased mortality in the Atlantic salmon stocked on the site. At the time of the inspection the site was stocked with 59,933 2016 S0 Atlantic salmon at an average weight of 3.38Kg.

Mortality levels had begun to rise at the start of September 2017, peaking at 6.27% in week 38 and were at 2% the week previous to the inspection. Harvesting was ongoing and the site was due to fallow by the end of the month. Health surveillance carried out by the business reported R09

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Website - www.gov.scot/Topics/marine/science

complex gill issues (AGD, *Branchiomonas*, *Paranucleospora theridion* and salmon gill poxvirus) with lamellar bleeding of the gills. A number of lethargic salmon were observed across the site and four were sampled for diagnostic purposes along with a fish that appeared to be healthy.

Fish 1 had pale gills and fish 2-5 had sea lice damage to their heads. Internally the heart of fish 4 was pale, there was no food in the guts of fish 3, 4 and 5 and there was yellow pseudo-faeces present in the gut of fish 2.

Results

Bacteriology: Kidney and gill material from fish 1-5 was inoculated onto appropriate media for the isolation of bacteria.

The following bacteria were isolated from fish 1-5:

- *Pseudomonas fluorescens* (gill material from fish 1-5)
- *Vibrio* sp. (kidney material from fish 2 and 5)

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

Salmon gill poxvirus

Fish Number	F1	F2	F3	F4	F5
Endogenous control Cp value	23.03	24.28	24.85	24.09	23.34
Cp Values	38.79	29.98	33.47	28.86	32.90
	38.34	29.83	33.37	27.92	31.01
	>40	29.82	33.28	27.92	33.09
Reported Result (PCR)	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE

The samples tested negative for infectious haematopoietic necrosis virus (IHNV), infectious pancreatic necrosis virus (IPNV), infectious salmon anaemia virus (ISAV), salmonid alphavirus (SAV) and viral haemorrhagic septicemia virus (VHSV).

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

Neoparamoeba perurans (AGD)

Fish Number	F3	F4	F5
Endogenous control Cp value	24.85	24.09	23.34
Cp Values	>35	31.82	31.72
	>35	32.15	31.82
	>35	31.91	31.67
Reported Result	POSITIVE	POSITIVE	POSITIVE

Paranucleospora theridion

Fish Number	F1	F3	F4	F5
Endogenous control Cp value	23.03	24.85	24.09	23.34
Cp Values	32.86	30.95	31.07	35.00
	33.14	31.01	31.60	35.35
	33.73	30.93	31.00	35.38
Reported Result	POSITIVE	POSITIVE	POSITIVE	POSITIVE

Histology: Tissue samples of gill, skin and skeletal muscle, heart, pyloric caeca, pancreas, hind gut, liver, spleen and kidney were taken from fish 1-5. The tissue samples were fixed in 10% neutral buffered formalin.

Histopathological examination revealed the following:

Gill: Mild to moderate multifocal interlamellar hyperplasia with occasional spaces (lacunae) filled now and then with cell debris, mainly distally, and lamellar fusion were noted in all individuals and several amoebic cells resembling *Neoparamoeba perurans* noted in all individuals. Diffuse irregular lamellar epithelial surface, diffuse displacement and hypertrophy of chloride cells, epithelial cell hypertrophy and prominent goblet cells noted in all individuals and few detaching apoptotic epithelial cells noted in fish 2, 3 and 4. Some gill filament bluntness also noted in fish 1 and 4. Occasional epithelial basophilic inclusions (epitheliocystis) noted in fish 1 and 3. One aneurysmal dilation/telangiectasia (fish 4) and focal lamellar epithelial lifting filled with proteinaceous fluid (fish 4).

The FHI visit report from October 2017 for another salmon farm in Loch Kishorn (Kishorn B) operated by Scottish Sea Farms detailed similar disease problems including AGD, Paranucleospora theridon, salmon gillpox and Branchiomonas, lamellar bleeding of the gills and sea lice damage to the heads of farmed salmon.

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Case No:	2017-0497					Date of visit:	25/10/2017		
Time spent on site:	4.5 hours					Main Inspector:	ALW		
Site No:	FS0804	Site Name:	Kishorn B (North)						
Business No:	FB0125	Business Name:	Scottish Sea Farms Ltd						
Case Types:	1 REP	2 DIA	3 VMD	4	5	6			
Water Temp (°C):	13.8	Thermometer No:	T148			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								
Recent (last 4 wks) disease problems?		Y	Any escapes (since last visit)?						
If yes, detail:	AGD, Paranucleospora theridion, salmon gillpox and Branchiomonas								

The FHI visit report (October 2017) for the Kishorn B (North) salmon farm operated by Scottish Sea Farms in Loch Kishorn stated: "Harvesting worst affected cages first and site should be empty in next six weeks".

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Additional Case Information:

Ongoing health issue on site. Company reported weekly mortality levels above 1%.
Tests positive for presence of AGD, Paranucleospora theridion, salmon gillpox and Branchiomonas. Also observed lamellar bleeding of the gills.
Advice from vets to accelerate harvests and not to attempt mechanical delousing in worst affected cages, bath only. Sea lice levels have increased (Most recent count on 16/10/17 - 5.95. No recent counts as harvesting out site). Treated 5 cages with Azamethiphos at end of Sept/early October, but high mortality level in two cages so did not continue treatment of remaining cages. May use thermolicer or hydolicer.
Harvesting worst affected cages first and site should be empty in next six weeks.
Mortalities being sent to Dundas for disposal. Due to volume of fish using a dedicated workboat operated by Fergusons Transport (Carly) who are organising the removal. Mortalities removed using uplift, transferred to tubs on site workboat and then pumped into sealed skips on boat. Boat moors at Kyle of Lochalsh each day and morts are pumped from the skip into containers for collection by Billy Bowie.
A number of fish observed with sea lice damage to their heads (estimate 30-50 per cage). Removed 5 lethargic fish for diagnostic sampling. Two had slightly pale gills, no white patches. Fish sampled for VMD appeared healthy.

"Advised to accelerate harvest" stated the FHI visit report for October 2017:

Mortality Records		
1. Mortality records available for inspection?		Y
2. How are mortalities disposed of?	Whole fish - Dundas Chemicals	
If other detail:	Normally incinerate at shorebase	
3. Mortality records complete and correctly entered?		Y
4. Recent mortality (last 4 wks):	wk 39 - 4,550 (1.17%), wk 40 - 24,345 (6.44%), wk 41 - 16,300 (5.35%), wk 42 - 13,050 (4.58%)	
5. Evidence of recent increased/atypical mortalities?		Y
If yes, facility nos/no mortality per facility/no stock per facility/reason:		
Across site due to gill issues		
6. Any other peaks in mortality during period checked?		N
If yes, detail:		
7. Have increased (unexplained) mortalities been reported to vet or FHI?		Y
If yes, detail action:	Advised to accelerate harvest	
8. Have 'mortality events' been reported to FHI? If no, add MRT case and enter on mortality events sheet.		Y

Marine Scotland Science detailed in their FHI Visit Report for October 2017 "complex gill issues" - including pathology consistent with amoebic gill disease (AGD), evidence of salmon gill poxvirus, epitheliocystis, hepatic necrosis, Paranucleospora theridon, Vibrio sp, Branchiomonas cysticola and Candidatus Syngamydia salmonis:

marinescotland science

The Scottish Government
Riaghaltas na h-Alba

[redacted]
Scottish Sea Farms Ltd
Laurel House
Laurelhill Business Park
Polmaise Road Stirling
FK7 9JQ
[redacted]

FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

Business No	FB0125	**Date of Visit**	25/10/2017
Site No	FS0804	**Site Name**	Kishorn B (North)
Inspector	Andrea Warwick	**Case No**	20170497

Section 1: Summary

A report was received from the operator of increased mortality levels at the site due to complex gill issues. Five moribund fish were removed for diagnostic sampling.

Histopathology examination revealed complex gill issues. There was pathology consistent with amoebic gill disease (AGD) which was confirmed by QPCR, evidence of salmon gillpox virus which was confirmed by QPCR and epitheliocystis which tested positive for *Candidatus* Branchiomonas cysticola and *Candidatus* Syngnamydia salmonis by PCR. Hepatic necrosis was also noted, likely associated with hypoxia.

Due to gill health issues observed on site samples were screened for *Paranucleospora theridion* (syn. *Desmozoon lepeophtherii*) by QPCR and tested positive.

A *Vibrio* species was also isolated, but due to light growth it is not thought to be the primary source of morbidity.

Section 2: Case Detail

Observations

The above site was inspected following a report from the operator of increased mortality in the Atlantic salmon stocked on the site. At the time of the inspection the site was stocked with 169,887 2016 S0 Atlantic salmon at an average weight of 3.9Kg, ~5,000 wrasse of mixed age and ~5,000 lumpsuckers of mixed age.

Marine Laboratory, 375 Victoria Road, Aberdeen, AB11 9DB
Tel - 0131 244 3498 Fax - 01224 295620 Email - ms.fishhealth@gov.scot
Website - www.gov.scot/Topics/marine/science

Mortality levels had begun to rise at the end of September 2017, peaking at 6.44% in week 40 and were at 4.58% the week previous to the inspection. Harvesting was ongoing and the site was due to fallow by the end of the year. Health surveillance carried out by the business reported complex gill issues (AGD, *Branchiomonas*, *Paranucleospora theridion* and salmon gill poxvirus) with lamellar bleeding of the gills. A number of lethargic salmon were observed across the site and five were sampled for diagnostic purposes.

Fish 2 and 4 had pale gills and there was evidence of sea lice damage to heads of fish 3 & 4. Internally the hearts of fish 2 and 5 were pale, there was no food in the guts of fish 1, 2 and 3 and there was yellow pseudo-faeces present in the guts of fish 4 and 5.

Results

Bacteriology: Kidney and gill material from fish 1-5 was inoculated onto appropriate media for the isolation of bacteria.

The following bacterium was isolated from fish 2-5:

- *Vibrio* species (kidney material from fish 2-5 and gill material from fish 2 and 3)

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

Candidatus Branchiomonas cysticola

Fish Number	F3	F4
Endogenous control Cp value	23.61	23.10
Cp Values	24.70	28.76
	24.77	28.97
	24.79	29.12
Reported Result	POSITIVE	POSITIVE

Candidatus Syngnamydia salmonis

Fish Number	F3	F4
Endogenous control Cp value	23.61	23.10
Cp Values	33.48	33.60
	33.62	33.71
	33.69	34.60
Reported Result	POSITIVE	POSITIVE

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

Salmon gill poxvirus

Fish Number	F1	F2	F3	F4	F5
Endogenous control Cp value	22.33	23.58	23.94	23.58	24.18
Cp Values	32.38	31.53	31.79	31.80	35.10
	32.07	31.66	32.06	31.73	35.48
	32.01	31.63	31.79	31.84	35.13
Reported Result (PCR)	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE

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

Neoparamoeba perurans (AGD)

Fish Number	F1	F2	F3	F4	F5
Endogenous control Cp value	22.33	23.58	23.94	23.58	24.18
Cp Values	34.87	32.70	33.91	30.20	31.05
	34.31	32.46	33.91	34.26	31.17
	35.00	32.69	34.32	34.45	31.30
Reported Result	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE

Paranucleospora theridion

Fish Number	F1	F2	F3	F4	F5
Endogenous control Cp value	22.33	23.58	23.94	23.58	24.18
Cp Values	39.24	30.01	27.85	28.63	31.02
	40.00	29.98	28.02	28.52	31.19
	39.19	30.08	28.35	29.94	33.87
Reported Result	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE

Read more about Candidatus Syngnamydia salmonis via:

Characterization of '*Candidatus* Syngnamydia salmonis' (*Chlamydiales, Simkaniaceae*), a bacterium associated with epitheliocystis in Atlantic salmon (*Salmo salar* L.)
Genotyping of Candidatus Syngnamydia salmonis (chlamydiales; Simkaniaceae) co-cultured in Paramoeba perurans (amoebozoa; Paramoebidae)

Information on other diseases reported on Scottish salmon farms was reported via "Scottish Salmon's Mort Mountain Leaps Over 10 Million - FOI reveals 2.3 million dead salmon at Marine Harvest farms in 2017" in February 2018 - including:

Amoebic Gill Disease (AGD), Proliferative Gill Disease (PGD), Chlamydia and other conditions listed as "complex gill issues" and "gill pathology" have decimated Scottish salmon farming over the last decade (read more via "Gill Diseases: Scottish Salmon's Dirty Big Secret"; "Chlamydia and gill disease ravage Scottish salmon: GAAIA"; "Fit for the Queen - Loch Duart's Chlamydia-Contaminated Salmon?"; "Characterization of "*Candidatus* Piscichlamydia salmonis" (Order *Chlamydiales*), a Chlamydia-Like Bacterium Associated With Epitheliocystis in Farmed Atlantic Salmon (*Salmo salar*)"; "Characteristics of chlamydia-like organisms pathogenic to fish" and "Characterization of '*Candidatus* Syngnamydia salmonis' (*Chlamydiales, Simkaniaceae*), a bacterium associated with epitheliocystis in Atlantic salmon (*Salmo salar* L.)").

Pasturella skyensis was first reported on Scottish salmon farms in 2002 with another scientific paper co-authored by scientists at the University of Glasgow published in 2015. Read more on Pasteurella skyensis via: "125,000 salmon die in disease outbreak at Lewis fish farms"; "Disease kills 125,000 salmon on Lewis fish farm"; "Campaigners say 'no more salmon farms' after disease on Lewis kills 125,000 fish"; "Pasteurella skyensis sp. nov., isolated from Atlantic salmon (Salmo salar L.)" and "Characterization of two groups of *Pasteurella skyensis* isolates from Atlantic salmon, *Salmo salar* L., based on serotype and 16S rRNA and rpoB gene partial sequences".

Cardomyopathy Syndrome (CMS) was first reported on Scottish salmon farms in 2000 with Scottish Quality Salmon (the forerunner to the Scottish Salmon Producers Organisation) claiming "there is no cause for concern" in an interview with The Independent newspaper

Further data on diseases is presented via Scottish Salmon Watch's written submission to the Scottish Parliament's salmon farming inquiry: "Hard Evidence: Dossier of Data on Lice, Diseases & Mortalities at Scottish Salmon Farms" (March 2018).

Another FHI Fish Visit report dated October 2017 for the Kishorn West salmon farm operated by Scottish Sea Farms in Loch Kishorn included: "Advice from vets to accelerate harvests and not to attempted mechanical delousing in worst affected cages"; "Harvested out

worst affected cages and should be empty within six weeks" and "Company may look at using Thermolicer/Hydrolicer to reduce lice levels while harvesting ongoing":

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Additional Case Information:

Visit to collect information for ongoing gill issue which has lead to increased mortality levels. Site inspected by FHI last month. Tests positive for presence of AGD, Paranucleospora theridion, salmon gillpox and Branchiomonas. Also observed lamellar bleeding of the gills. HSMI like pathology in more recent tests.
Advice from vets to accelerate harvests and not to attempt mechanical delousing in worst affected cages, bath only. Sea lice levels have increased (Most recent count on 17/10/17 - 5.62. Previous counts below Average Adult Female level of 3). Treated 3 cages with Azamethiphos at end of Sept/early October.
Harvested out worst affected cages and should be empty within six weeks. Company may look at using thermolicer/hydrolicer to reduce lice levels while harvesting ongoing.
Mortalities being sent to Dundas for disposal. Due to volume of fish using a dedicated workboat operated by Fergusons Transport (Carly) who are organising the removal. Mortalities removed using uplift, transferred to tubs on site workboat and then pumped into sealed skips on boat. Boat moors at Kyle of Lochalsh each day for collection by Billy Bowie.

Recent (last 4 wks) disease problems?		Y	Any escapes (s
If yes, detail:	AGD, Paranucleospora theridion, salmon gillpox and Branchiomonas		

Mortality Records		
1. Mortality records available for inspection?		Y
2. How are mortalities disposed of?	Whole fish - Dundas Chemicals	
If other detail:	Normally incinerate at shorebase	
3. Mortality records complete and correctly entered?		Y
4. Recent mortality (last 4 wks):	wk 39 - 8,739 (4.17%), wk 40 - 12,500 (6.35%), wk 41 - 2,370 (1.34%), wk 42 - 5,360 (3.06%)	
5. Evidence of recent increased/atypical mortalities?		Y
If yes, facility nos/no mortality per facility/no stock per facility/reason:		
Across site due to gill issues		
6. Any other peaks in mortality during period checked?		N
If yes, detail:		
7. Have increased (unexplained) mortalities been reported to vet or FHI?		Y
If yes, detail action:	Advised to accelarate harvest	
8. Have 'mortality events' been reported to FHI? If no, add MRT case and enter on mortality events sheet.		Y

A FHI Fish Visit report dated November 2017 for Marine Harvest's salmon farm at Caolas A Deas in Loch Shell detailed disease problems including PGD (Proliferatitve Gill Disease), CMS (Cardiomyopathy Syndrome), PRV (Piscine Reovirus) and PD (Pancreas Disease).

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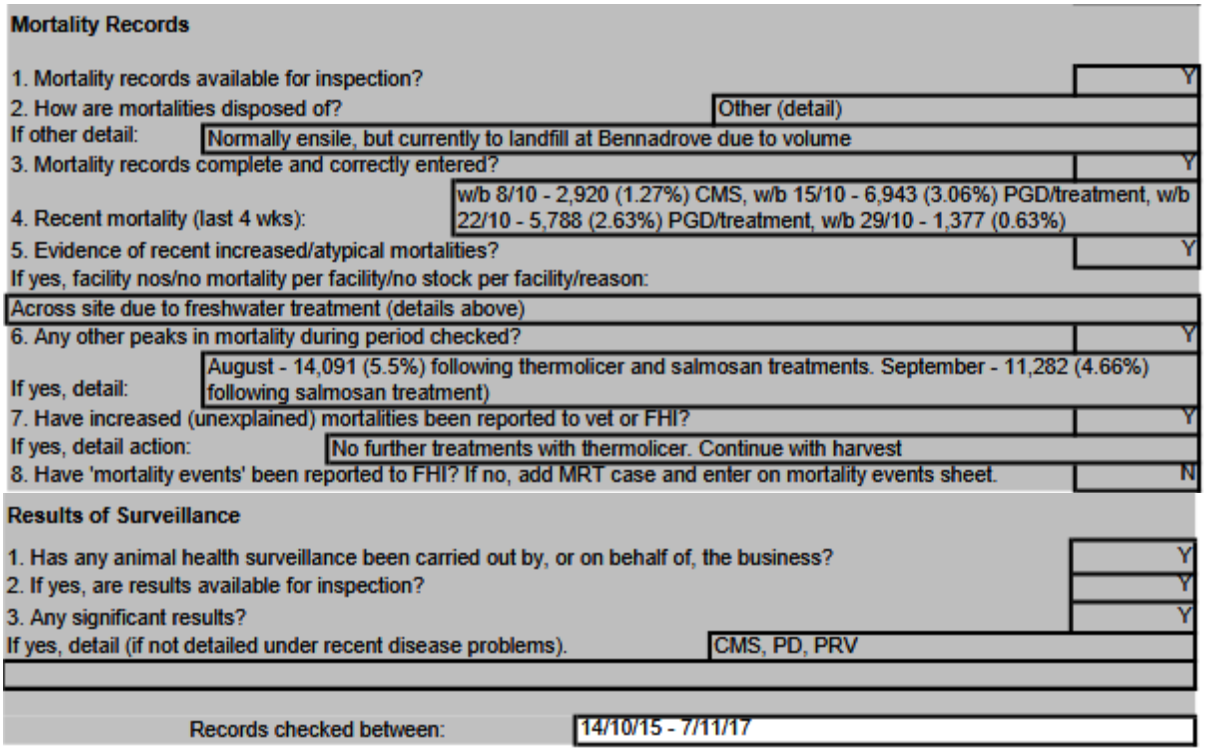
Additional Case Information:

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.
Lumpfish worked well at controlling lice initially, but less so as they have grown. Also have sea lice skirts on all cages.
Fish on site feeding very deep and difficult to catch. Fish sampled for VMD appeared healthy. Only one lethargic fish removed for examination, but no gross pathology seen and no samples taken.



Mortality Records	
1. Mortality records available for inspection?	Y
2. How are mortalities disposed of?	Other (detail)
If other detail:	Normally ensile, but currently to landfill at Bennadrove due to volume
3. Mortality records complete and correctly entered?	Y
4. Recent mortality (last 4 wks):	w/b 8/10 - 2,920 (1.27%) CMS, w/b 15/10 - 6,943 (3.06%) PGD/treatment, w/b 22/10 - 5,788 (2.63%) PGD/treatment, w/b 29/10 - 1,377 (0.63%)
5. Evidence of recent increased/atypical mortalities?	Y
If yes, facility nos/no mortality per facility/no stock per facility/reason:	
Across site due to freshwater treatment (details above)	
6. Any other peaks in mortality during period checked?	Y
If yes, detail:	August - 14,091 (5.5%) following thermolicer and salmosan treatments. September - 11,282 (4.66%) following salmosan treatment)
7. Have increased (unexplained) mortalities been reported to vet or FHI?	Y
If yes, detail action:	No further treatments with thermolicer. Continue with harvest
8. Have 'mortality events' been reported to FHI? If no, add MRT case and enter on mortality events sheet.	N

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, PRV
Records checked between:	14/10/15 - 7/11/17

PRV (Piscine Reovirus) - which is linked to Heart & Skeletal Muscle Inflammation (HSMI) - has attracted significant media attention in Canada following the discovery in both wild and farmed salmon. "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," reported a scientific paper published by PLOS in December 2017. "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."

PRV has affected salmon farms in Norway, Chile, Ireland, Canada, United States and Scotland.

Read more via:
"Piscine Reovirus (PRV): An Underestimated Pathogen in the Scottish Salmon Industry?"
"The effect of exposure to farmed salmon on piscine orthoreovirus infection and fitness in wild Pacific salmon in British Columbia, Canada"
"Piscine Orthoreovirus (PRV) and Heart and Skeletal Muscle Inflammation (HSMI)"
"A novel Totivirus and Piscine Reovirus (PRV) in Atlantic Salmon (Salmo salar) with Cardiomyopathy Syndrome (CMS)"
"First description of clinical presentation of piscine orthoreovirus (PRV) infections in salmonid aquaculture in Chile and identification of a second genotype (Genotype II) of PRV"
"An outbreak of disease resembling Heart and Skeletal Muscle Inflammation in Scottish farmed salmon, Salmo salar L., with observations on myocardial regeneration"
"Piscine orthoreovirus (PRV) infects Atlantic salmon erythrocytes"
"Piscine reovirus (PRV) in wild Atlantic salmon, *Salmo salar* L., and sea-trout, *Salmo trutta* L., in Norway"

The Fish Site reported in 2015:

> **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.
>
> There have been reports of increased downgrades due to discoloured fillet marks in batches of fish subsequent to elevated serum levels of the enzyme creatine kinase (CK). This enzyme can indicate muscle damage and is known to increase during HSMI infection. It is suspected that PRV infection may have been responsible for these elevated CK levels and fillet discolouration however this has not been conclusively established.

A FHI Fish Visit report dated November 2017 detailed disease problems at Cooke Aquaculture's salmon farm in the Stead of Aithness (Aith Voe) in Shetland.

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Case No:	2017-0533	Date of visit:	08/11/2017
Time spent on site:	5 hrs	Main Inspector:	ASM
Site No:	FS0637	Site Name:	Stead of Aithness
Business No:	FB0095	Business Name:	Cooke Aquaculture Scotland Ltd

Case Types: 1 REP 2 DIA 3 4 5 6

Water Temp (°C): N/A Thermometer No: T172 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	

"Harvest has been accelerated by 1 months (sic) due to increased morts," detailed FHI Fish Visit report dated November 2017. "Top sweep is being harvest first (sic) from the worst affected cages."

"During the inspection of the stock on site there were many fish high in the water column," continued the FHI Fish Visit report dated November 2017. "Many fish were moribund and about 20-30 fish over the site were observed dead on the surface of the water."

FHI 059, Version 11 Issued by: FHI Date of issue: 12/09/2017

Additional Case Information:

Morts removed daily using mort socks
Waste collected by TWMA. They can cope with the volume produced.
Site stocked with lumpsuckers but these have died. This occurred shortly after the lumpsuckers were input in July. 15,000 input. Company biologist took samples and sent to FVG. Mortality attributed to a bacterial infection.
Lice skirts used on site. Skirts are 6m deep. These are thought to be effective against lice.
Cages aerated using compressed air.
Harvest has been accelerated by 1 months due to increased morts. Top sweep is being harvest first from the worst affected cages.
FVG have been contacted and have conducted two site visit. Last report observed, another report is expected soon. The site representative agreed to contact ASM once the report has been received.
Site staff did not directly observe macroscopic jellyfish, however, FVG did suggest mortality was consistent with harmful microscopic zooplankton, either Muggiaea or Solmaris.
AGD treatments carried out earlier in 2017. Treated on 22/09/17, 09/08/17, 11/07/17. All treatments were reportedly successful.
SLICE treatments conducted on 23/06/17, 22/02/17 and 02/11/16. These were taken after very slight rises in lice numbers. All treatments were reportedly successful.
Lice numbers have been on the rise in the past weeks leading up to the inspection (thought to be related to the increase in immunocompromised fish on site), especially numbers of pre-adult males. Still under 3 adult females per fish.

Updated by SJD 19/12/17 - mortality percentage in Mortality events sheet updated to same as on master sheet. Master sheet entry was updated following a phone call on 24/11/17 as percentage recorded was incorrect.
Updated by ASM 21/12/17 - During the inspection of the stock on site there were many fish high in the water column. Many fish were moribund and about 20-30 fish over the site were observed dead on the surface of the water.

The mortality rate was reported as 11.52%.

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):
30/10/17	05/11/2017	≥750g	3.5kg	SAL	2016 S0	Weekly	11.52	Explained	Complex gill issues

With total mortality of 58,590 farmed salmon.

Total mortality during event (if available):	Additional information (e.g. action taken by company):	Action taken by FHI (include case no where applicable):
58590	Additional samples submitted to FVG	Inspection undertaken (2017-0533)

Marine Scotland Science detailed in their FHI Visit Report for November 2017 "pathology consistent with amoebic gill disease, presence of epitheliocystis and some features resembling salmon poxvirus" as well as mild hepatic necrosis and minor cardiomyopathy.

marinescotland science

The Scottish Government
Riaghaltas na h-Alba

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[redacted]

FINAL FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

BUSINESS NO	FB0095	**DATE OF VISIT**	08/11/2017
SITE NO	FS0637	**SITE NAME**	Stead of Aithness
INSPECTOR	Andy Mayes	**CASE NO**	20170533

Section 1: Summary

The fish health inspectorate were contacted by a representative for the above site during a mortality event. A site inspection was organised. During the inspection five fish were removed for diagnostic sampling.

Histopathology examination revealed complex gill issues with pathology consistent with amoebic gill disease, presence of epitheliocystis and some features resembling salmon poxvirus. Mild hepatic necrosis, likely associated with hypoxia, marked lamellar capillary disturbances or damage and minor cardiomyopathy were also noted.

Section 2: Case Detail

Observations

The fish health inspectorate were contacted on 31/10/17 regarding an increase in mortality over the level of reporting criteria. The mortality event started on 09/10/17 with a mortality rate of 1.9% (11,932 fish) over the week. This mortality rate peaked at 13.69% (81,698 fish) per week two weeks after the start of the event. The mortality event was attributed to complex gill issues by the business representative. A veterinarian had been called and samples had been taken.

During the inspection the preliminary results of the veterinarian investigation were observed. The pathology observed by the veterinarian was consistent with harmful microscopic zooplankton, most likely from the genus *Muggiaea* or *Solmaris*. Inspection of the treatment records showed the fish were treated three times for amoebic gill disease (AGD) since input starting on 11/07/17, 09/08/17 and 22/09/17. All treatments were reportedly successful. Three successful SLICE treatments were also carried out starting on 02/11/16, 22/02/17 and 23/06/17. These were

Marine Laboratory, 375 Victoria Road, Aberdeen, AB11 9DB
Tel - 0131 244 3498 Fax - 01224 295620 Email - ms.fishhealth@gov.scot
Website - www.gov.scot/Topics/marine/science

reportedly successful. Lice numbers the week before the inspection were increasing (thought to be related to the increase in the immunocompromised fish on site). The levels were below 3 adult female lice per fish.

During the inspection of the stock on site there were many fish high in the water column. Many fish were moribund and about 20-30 fish over the site were observed dead on the surface of the water. Five live fish were removed for diagnostic sampling.

All fish removed were lethargic and moribund, while fish 3 also had a cataract in one eye. The gills of fish 3-5 were pale, and in fish 4 and 5, were necrotic. All fish had a high lice burden, between 9 and 16 (all life stages). Internally all fish had yellow pseudo-faeces, fish 2, 4 and 5 had bloody ascites. Fish 2 and 4 also had a slightly grey kidney and fish 4 and 5 had a slightly swollen heart atrium.

A FHI Fish Visit report dated November 2017 detailed disease problems at Marine Harvest's salmon farm at Ardintoul in Loch Alsh (a Special Area of Conservation protected via the EC Habitats Directive) - including CMS, PRV, AGD, Branchiomonas, Paranucleospora theridon and salmon gill poxvirus.

FHI 059, Version 11 Issued by: FHI Date of issue: 12/09/2017

Case No:	2017-0542							Date of visit:	22/11/2017		
Time spent on site:	5 hours							Main Inspector:	ALW		
Site No:	FS0245	Site Name:	Ardintoul								
Business No:	FB0119	Business Name:	Marine Harvest (Scotland) Ltd								
Case Types:	1 REP	2 DIA	3	4	5	6					
Water Temp (°C):	11.5	Thermometer No:	T148					FHI 045 completed			
Observations:		Region:	HI		Water type:	S		CoGP MA	M-21		
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										

FHI 059, Version 11 Issued by: FHI Date of issue: 12/09/2017

Additional Case Information:

Report received from company of increased mortality with observed anaemia. Details recorded on mortality events sheet. Increase in mortality observed following decrease in appetite 5 weeks ago. Daily feed dropped from 16 tonnes per day to 8 tonnes per day. Fish feeding deep in cages.
Regular samples how shown a decrease in packed cell volume in sampled fish. In August samples were 20% of fish at 1-20% PCV, 5% at 21-30% PCV, 45% at 31-40% PCV, 20% at 41-50% PCV and 10% at 50+% PCV. In September samples were 25% at 1-20% PCV, 25% at 21-30% PCV and 50% at 31-40% PCV. In October samples were 55% at 1-20% PCV, 20% at 21-30% PCV and 25% at 31-40% PCV.
Samples have tested positive for CMS, PRV, AGD, Branchiomonas, Paranucleospora theridion and salmon gill poxvirus, but negative for PD and piscichlamydia.
Site has wrasse stocked at 4.5%, lumpfish stocked at 11% and sea lice skirts in place to control lice. Company criteria for treatment is 0.5 average adult female lice per fish. Site has had regular treatments for lice and gills.
July - Slice and salmosan, August - hydrolicer, September - salmosan, hydrogen peroxide and hydrolicer, October - hydrolicer, November - hydrolicer and hydrogen peroxide. Due to use hydrolicer next week.
Very few lethargic fish observed, but five removed for diagnostic sampling. One had bilateral exophthalmia and one had very pale gills. See comments on 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).	
Recent tests positive for CMS, AGD, PRV, Branchiomonas, Paranucleospora and salmon gill poxvirus	
Records checked between:	7/6/17 - 22/11/17

The [FHI Fish Visit report dated November 2017] detailed a mortality rate of 5.63% and over 90,000 mortalities between late October 2017 and mid November 2017:

FHI 059, Version 11 Issued by: FHI Date of issue: 12/09/2017

Case No: 2017-0542 Site No: FS0245 Date of visit: 22/11/2017

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):
23/10/17	29/10/2017	≥750g	2Kg	SAL	2017 Q1	Weekly	5.63	Explained	CMS, Complex gill issues
30/10/17	05/11/2017	≥750g	2Kg	SAL	2017 Q1	Weekly	2.58	Explained	CMS, Complex gill issues
06/11/17	12/11/2017	≥750g	2Kg	SAL	2017 Q1	Weekly	1.40	Explained	CMS, Complex gill issues
13/11/17	19/11/2017	≥750g	2Kg	SAL	2017 Q1	Weekly	1.50	Explained	CMS, Complex gill issues

If unexplained, select observations:	Total mortality during event (if available):	Additional information (e.g. action taken by company):	Action taken by FHI (include case no where applicable):
General Anaemia	51,592	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	Site visited 22/11/17 and diagnostic samples taken
General Anaemia	22,330	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	Site visited 22/11/17 and diagnostic samples taken
General Anaemia	11,822	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	Site visited 22/11/17 and diagnostic samples taken
General Anaemia	12,502	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	Site visited 22/11/17 and diagnostic samples taken

Marine Scotland Science detailed in their [FHI Visit Report for November 2017] "complex gill issues with mild proliferative gill pathology" and stated: "Lesions were consistent with amoebic gill disease (AGD) and mid salmon poxvirus pathology". Epitheliocystis, Candidatus Branchiomonas cysticola and Candidatus Syngnamydia salmonis were noted along with "pathology consistent with mild cardiomyopathy syndrome (DMS)", piscine myocarditis virus, piscine reovirus (PRV), hepatic necrosis, granulomatous inflammation and Paranucleospora theridon.

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FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

BUSINESS NO	FB0119	**DATE OF VISIT**	22/11/2017
SITE NO	FS0245	**SITE NAME**	Ardintoul
INSPECTOR	Andrea Warwick	**CASE NO**	20170542

Section 1: Summary

A report was received from the operator of increased mortality levels at the site. Five fish were removed for diagnostic sampling.

Histopathology examination revealed complex gill issues with mild proliferative gill pathology. Lesions were consistent with amoebic gill disease (AGD) and mild salmon poxvirus pathology. The presence of both pathogens was confirmed by QPCR. Epitheliocystis were noted. QPCR tests for *Candidatus* Branchiomonas cysticola and *Candidatus* Syngnamydia salmonis were positive. There was also pathology consistent with mild cardiomyopathy syndrome (CMS) and the QPCR test for piscine myocarditis virus was positive. The QPCR test for piscine reovirus (PRV) was positive, but there was no histopathology consistent with heart and skeletal muscle inflammation (HSMI). Hepatic necrosis (likely associated with hypoxia) and granulomatous inflammation was also noted.

Due to gill health issues observed on site samples were screened for *Paranucleospora theridion* (syn. *Desmozoon lepeophtherii*) by QPCR and tested positive.

Section 2: Case Detail

Observations

The above site was inspected following a report from the operator of increased mortality in the Atlantic salmon stocked on the site. At the time of the inspection the site was stocked with 817,600 2017 Q1 Atlantic salmon at an average weight of 2kg, ~47,000 wrasse of mixed age and ~70,000 lumpsuckers of mixed age.

R09
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Website - www.gov.scot/Topics/marine/science

Mortality levels had risen sharply at the end of October 2017 from 0.9% in week 42 to 5.63% in week 43, but had decreased to 1.5% in the week previous to the inspection (week 46). Health surveillance carried out by the business reported complex gill issues (AGD, *Branchiomonas*, *Paranucleospora theridion* and salmon gill poxvirus), CMS and PRV. Anaemia had been observed with an increase in the proportion of fish with low packed cell volume from August through to October. Five lethargic or moribund salmon were observed across the site and were sampled for diagnostic purposes.

Fish 1, 2 and 4 were lethargic, fish 3 was moribund and unable to maintain equilibrium and fish 5 was anorexic. Fish 1 had severe bilateral exophthalmia, the opercula of fish 2 were shortened and fish 4 had pale gills.

Fish 4 had a pale heart. Fish 2, 4 and 5 had yellow pseudo-faeces present in their guts and there was no food in the gut of fish 1. There was a lack of fat around the pyloric caeca of fish 5 and the swim bladder of fish 2 was filled with fluid.

Candidatus Branchiomonas cysticola

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	23.30	27.20	27.12	27.05	POSITIVE
F2	23.71	29.70	29.36	29.49	POSITIVE
F3	22.73	29.95	29.60	29.84	POSITIVE
F4	23.28	26.05	26.04	25.89	POSITIVE
F5	22.29	23.31	23.48	23.54	POSITIVE

Candidatus Syngnamydia salmonis

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	23.30	36.31	36.52	39.26	POSITIVE
F2	23.71	34.76	34.61	35.32	POSITIVE
F3	22.73	31.55	31.54	31.79	POSITIVE
F4	23.28	34.50	34.17	34.97	POSITIVE
F5	22.29	33.00	33.12	32.89	POSITIVE

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

Salmon gill poxvirus

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	23.34	24.53	24.62	24.68	POSITIVE
F2	23.80	25.33	25.50	25.38	POSITIVE
F3	23.10	30.11	29.86	29.91	POSITIVE
F4	23.21	32.04	31.91	31.89	POSITIVE
F5	22.62	24.24	24.18	24.08	POSITIVE

Piscine reovirus

Pool Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
P1	17.28	32.68	32.66	32.66	POSITIVE

Piscine myocarditis virus

Pool Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
P1	17.28	21.31	21.23	21.10	POSITIVE

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

Neoparamoeba perurans (AGD)

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	23.34	35.98	35.90	35.71	POSITIVE
F2	23.80	35.07	35.26	35.44	POSITIVE
F3	23.10	32.21	32.28	32.23	POSITIVE
F4	23.21	33.96	34.68	33.96	POSITIVE
F5	22.62	32.45	32.63	32.50	POSITIVE

Paranucleospora theridion

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	23.34	30.09	30.03	30.04	POSITIVE
F2	23.80	31.55	31.53	31.28	POSITIVE
F3	23.10	31.40	31.43	31.40	POSITIVE
F4	23.21	28.57	28.44	28.33	POSITIVE
F5	22.62	23.95	23.83	24.01	POSITIVE

Histology: Tissue samples of gill, skin and skeletal muscle, heart, pyloric caeca, pancreas, hind gut, liver, spleen and kidney were taken from fish 1-5. The tissue samples were fixed in 10% neutral buffered formalin.

Histopathological examination revealed the following:

Gill: Mild multifocal hyperplasia and lamellar fusion noted in F3 and F5 and mainly distally in F1, some spongiosis noted in F3 and F5, small foci of necrosis on the hyperplasic plaque. Several amoebic cells resembling *Neoparamoeba perurans* were noted F3 and F5, diffuse irregular epithelium with prominent goblet cells in all individuals and mild cell infiltration in F1. Some nuclei karyorrhexis, some detaching apoptotic epithelial cells and some chloride cells displacement were also present. Occasional/few basophilic epithelial inclusions (epitheliocystis), few aneurysmal dilation/telangiectasia and lamellae thrombi noted in all individuals.

A FHI Fish Visit report dated November 2017 detailed disease problems at Cooke Aquaculture's Bow Hascosay salmon farm in Shetland - including AGD, PD, CMS and lice infestation.

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Case No:	2017-0544						Date of visit:	07/11/2017	
Time spent on site:	4.5 hours					Main Inspector:		SJD	
Site No:	FS0477	Site Name:	Bow of Hascosay						
Business No:	FB0095	Business Name:	Cooke Aquaculture Scotland Ltd						
Case Types:	1 ECI	2 CNI	3 SLI	4 REP	5 VMD	6 DIA			
Water Temp (°C):	10.6	Thermometer No:		Site		FHI 045 completed			
Observations:		Region:	SH	Water type:	S	CoGP MA	S-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	

FHI 059, Version 11 Issued by: FHI Date of issue: 12/09/2017

Additional Case Information:

PD early in cycle. Started in YoM fish - mainly stopped feeding, but no major mortality. Report available from FVG - August 2016.
Mortality - 123,261 total since input.
Latest health visit - 15/09/17 - CMS diagnosed by FVG.
AGD diagnosed by FVG in March 17.
Morts last month - 6519 - attributed to runts (2135) and production (CMS - 4384)

Lice treatments since input - Salmosan - June 17. H202 - May 17. Hydrolicer - March 17. H202 - January 17. Slice - Dec 16.
Lice levels above criteria for treatment since end of September - last count 2/11/17 - 1.55 average adult female. Site due to fallow in next few weeks.
Sea lice management plan not available - currently being drafted.

Lice levels above 3 at end of 2016 and start of 2017 - don't appear to have been reported to FHI.

Very few moribunds seen, although a few fish with physical damage.

Updated 16/01/18 SJD - Sea lice management plan submitted and meets current requirements. Company advised that plan may require updating in future once further guidance issued.

Marine Scotland Science's FHI Visit Report for November 2017 detailed "complex gill issues", cardiomyopathy syndrome, mild enteropathy and Tenacibaculum sp.

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FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

BUSINESS NO	FB0095	DATE OF VISIT	07/11/2017
SITE NO	FS0477	SITE NAME	Bow of Hascosay
INSPECTOR	Sonia Duguid	CASE NO	20170544

Section 1: Summary

A report was received from the operator of increased mortality levels at the site due to complex gill issues, environmental issues and cardiomyopathy syndrome (CMS). Two fish were selected for diagnostic sampling.

Histopathology examination revealed pathology consistent with CMS, which was confirmed by QPCR. Mild gill pathology and mild enteropathy with presence of bacteria were also observed. The gill pathology may have been functionally insignificant and some features are within commonly seen background levels.

Tenacibaculum sp was isolated. The level and purity of growth may be significant however this can be hard to estimate as this bacterium is not easily cultured.

The following points were raised with the site representative with regards to parasites (sea lice) during the inspection:

On this occasion the site was found to have had average adult female *Lepeophtheirus salmonis* ('sea lice') per fish counts of 3 or above between week 48, 2016 and week 7, 2017. These counts had not been reported to the Fish Health Inspectorate as part of the required measures to demonstrate that satisfactory measures are in place for the control of sea lice. Where the average adult female sea lice per fish count reaches 3 or above this must be reported to the Fish Health Inspectorate within seven days of the date of the count. Please ensure that future counts that exceed the reporting level are reported to the Fish Health Inspectorate. It is noted however, that the site has been below the reporting level since week 8 2017 and that the company has implemented the reporting requirement on other sites. No further action is required in relation to these counts.

A FHI Fish Visit report dated November 2017 detailed disease problems at another Cooke Aquaculture salmon farm at East of Holm Heogland in Shetland - including "variable complex gill disease including PGD and lowlevel AGD"; "Low level HSMI type pathology" as well as Costia and branchiomonas.

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Case No:	2017-0546								Date of visit:	08/11/2017	
Time spent on site:	2 hours							Main Inspector:		SJD	
Site No:	FS0960	Site Name:	East of Holm Heogland (Burkwell)								
Business No:	FB0095	Business Name:	Cooke Aquaculture Scotland Ltd								
Case Types:	1 REP	2 DIA	3	4	5	6					
Water Temp (°C):	10.6	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										

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Additional Case Information:

Morts - October - 28,096 (7.14%) across site - Higher in cages 2 (4573 - 16.03%) and 3 (4310 - 15.35%).
9/10 - total 6675, 16/10 - total 5373 - to add to previously reported mortality events.
Week 30/10 - 1895 (0.52%) - below reporting levels.

FVG report - samples 11/09 - variable complex gill disease including PGD and low-level AGD. Low level HSMI type pathology.
FVG report - read date 26/10 - acute waterborne irritant, AGD, Costia, branchiomonas.

The FHI Fish Visit report dated November 2017 noted a pale/anaemic spleen and stated that the "heart lost shape when removed".

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Additional comments:

F2 spleen pale/anaemic, pale mustard coloured liver. Heart lost shape when removed.

The FHI Fish Visit report dated November 2017 noted positive tests for Salmon gill poxvirus (SGPV), Piscine myocarditis virus (PMCV), Neoparamoeba perurans (AGD) and Paranucleospora theridon:

Salmon gill poxvirus (SGPV)

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	23.00	33.26	33.11	33.03	POSITIVE
F2	24.12	29.70	30.26	30.12	POSITIVE

Piscine myocarditis virus (PMCV)

Pool Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
P1	18.40	26.91	27.15	27.19	POSITIVE

Neoparamoeba perurans (AGD)

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	23.00	>35	>35	>35	POSITIVE
F2	24.12	29.02	28.84	28.63	POSITIVE

Paranucleospora theridion

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	23.00	37.25	38.74	39.03	POSITIVE
F2	24.12	32.80	32.53	32.86	POSITIVE

A FHI Fish Visit report for November 2017 detailed disease problems at another Cooke Aquaculture salmon farm at Winna Ness in Shetland - with over 30% mortality and "acute gill pathology".

FHI 059, Version 11 Issued by: FHI Date of issue: 12/09/2017

Case No: 2017-0550 Date of visit: 08/11/2017

Time spent on site: 2.5 hours Main Inspector: SJD

Site No: FS0871 Site Name: Winna Ness

Business No: FB0095 Business Name: Cooke Aquaculture Scotland Ltd

Case Types: 1 REP 2 DIA 3 4 5 6

Water Temp (°C): 10.6 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

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Additional Case Information:

Morts - October- 36028 (10.11%) across site. Higher in cages 7 (5798 - 16.85%), 8(7869 - 26.31%) & 9 (8353 - 30.96%). Week 23/10 - below reporting level - 3109 morts (0.96%).

FVG report - sampled 09/10 - acute gill pathology - waterborne irritant such as plankton. Mild AGD.
Weather poor during visit - focussed on cages with higher mortality. Only two moribunds in cages 8 & 9 - both sampled.
Movement records not checked - ECI last month.

Updated 14/11/17 - SJD - mortality events for weeks 40, 41 & 42 had previously been reported - number of fish during mortality event confirmed.

The FHI Fish Visit report for November 2017 detailed "complex gill issues", "pathology consistent with cardiomyopathy syndrome (CMS) and mild amoebic gill disease", "multifocal hepatic necrosis (likely associated with hypoxia)" and positive tests for Paranucleospora theridon (syn. Desmozoon lepeophtheri) and salmon gill poxvirus (SGPV).

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FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

BUSINESS NO	FB0095	DATE OF VISIT	08/11/2017
SITE NO	FS0871	SITE NAME	Winna Ness
INSPECTOR	Sonia Duguid	CASE NO	20170550

Section 1: Summary

A report was received from the operator of increased mortality levels at the site being attributed to complex gill issues and environmental issues. Two fish were selected for diagnostic sampling.

Histopathology examination revealed pathology consistent with cardiomyopathy syndrome (CMS) and mild amoebic gill disease (AGD), both of which were confirmed by QPCR. Multifocal hepatic necrosis (likely associated with hypoxia) was also noted.

Due to gill health issues observed on site samples were screened for *Paranucleospora theridion* (syn. *Desmozoon lepeophtherii*) and salmon gill poxvirus (SGPV) by QPCR and fish 2 tested positive for both pathogens.

Section 2: Case Detail

Observations

The above site was inspected following a report from the operator of increased mortality in the Atlantic salmon stocked on the site. At the time of the inspection the site was stocked with 315,647 2016 S0 Atlantic salmon at an average weight of 4kg.

Mortality levels had begun to rise in August 2017 and continued to be elevated during September and October. A total mortality of 36,028 (10.11%) was reported across the site for the month of October. Mortality was higher in cages 7 (16.85%), 8 (26.31%) and 9 (30.96%) during October. Weekly mortality percentage had peaked at 4.73% across the site in week 40. Mortality had reduced prior to the visit to 0.96% in week 43 and 1.51% in week 44.

R09

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Tel - 0131 244 3498 Fax - 01224 295620 Email - ms.fishhealth@gov.scot
Website - www.gov.scot/Topics/marine/science

Health surveillance carried out in October 2017 reported acute gill pathology attributed to a waterborne irritant. Mild AGD was also observed. Due to adverse weather conditions the inspection focussed on cages 7, 8 and 9, where only 2 moribund fish were observed. Both were sampled for diagnostic purposes.

Both fish were lethargic and had areas of necrosis on the gills. The gills of fish 1 were pale and zoned. Fish 2 had extensive haemorrhaging across the ventrum, throat and base of fins, an inflamed vent and areas of scale oedema. Fish 2 also had shortened opercula.

Internally, fish 1 was generally anaemic with a pale liver. Fish 2 had bloody ascites and a deformed heart with a large blood clot present in the pericardial cavity. Petechial haemorrhaging was observed on pyloric caeca, liver and swim bladder of fish 2.

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

Salmon gill poxvirus (SGPV)

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F2	24.66	30.51	30.51	30.30	POSITIVE

F1 tested negative for salmon gill poxvirus.

Piscine myocarditis virus (PMCV)

Pool Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
P1	19.91	20.48	20.68	20.70	POSITIVE

Neoparamoeba perurans (AGD)

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	23.27	29.61	29.45	29.68	POSITIVE
F2	24.66	27.65	29.08	29.04	POSITIVE

Paranucleospora theridion

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F2	24.66	39.42	>40	39.00	POSITIVE

A FHI Fish Visit report dated November 2017 detailed disease problems at the Scottish Salmon Company's salmon farm at Portree on the Isle of Skye - including "complex gill issues", "anorexic and moribund fish", AGD, poxvirus and Desmozooan.

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Case No:	2017-0555								Date of visit:	07/11/2017	
Time spent on site:	7.5 hr							Main Inspector:		RJS	
Site No:	FS0708	Site Name:	Portree								
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):	12.6	Thermometer No:	T213				FHI 045 completed				
Observations:		Region:	HI	Water type:	S		CoGP MA:	M-26			

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	

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Additional Case Information:

The site has been suffering from complex gill issues this cycle. This is thought to have been exacerbated by an algal bloom recently. No problems this cycle with predation, lice or jellyfish. Morts are removed by lift-up systems, although one is out of action currently. Morts are incinerated on site when the fish are small but have been getting transferred for storage at Kenmore, Loch Torridon as larger fish have been getting lost. The morts are taken by boat to Kenmore and are then sent to Dundas Bros using Billy Bowie. This activity has resulted in the sites inspection frequency increasing. The BMP and FMS both require updating with regard to mortality disposal. Fish are normally harvested live through Stornoway. Due to the recent elevated number of mortalities there were signs of decomposed mortalities at the surface in 4 cages. Hydrolicer used successfully on site on some cages in May 2017. A number of anorexic and moribund fish were observed in most cages. The fish were active when trying to catch them however. 4 moribund fish caught, one of which was anorexic. 4 other fish also caught for VMD sampling. Diagnostic samples were taken. Of the 5 fish sampled for diagnostic tests, 2 had zoned gills and 3 had pale gills. The moribund fish has not been feeding. Diagnostic surveillance by veterinary services has identified AGD, poxvirus and Desmozooan. A FW treatment is to be conducted to combat the effects on the gills.

The FHI Fish Visit report for November 2017 detailed "complex gill issues with pathology consistent with amoebic gill disease, epitheliocystis, capillary disturbances and some evidences of salmon gill poxvirus" as well as positive tests for Neoparamoeba perurans, Paranucleospora theridon and salmon gill poxvirus.

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FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

BUSINESS NO	FB0169	DATE OF VISIT	07/11/2017
SITE NO	FS0708	SITE NAME	Portree
INSPECTOR	Ron Smith	CASE NO	20170555

Section 1: Summary

During a routine inspection of the above site, a number of moribund and lethargic fish were observed. Five fish were removed for further examination and subsequent diagnostic sampling.

Histopathology examination revealed complex gill issues with pathology consistent with amoebic gill disease, epitheliocystis, capillary disturbances and some evidences of salmon gill poxvirus in F3. F1 is a poor doing fish.

Due to gill health issues observed on site, samples were also screened for *Neoparamoeba perurans*, *Paranucleospora theridion* (syn. *Desmozoon lepeophtherii*) and salmon gill poxvirus by QPCR and tested positive.

A FHI Fish Visit report dated November 2017 detailed disease problems at Marine Harvest's salmon farm in Loch Greshornish on the Isle of Skye - including 20-30 Caligus (sea lice) with farmed salmon reported as "belly up as if concussed from banging":

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Case No:	2017-0558							Date of visit:	09/11/2017		
Time spent on site:	9 hr							Main Inspector:	RJS		
Site No:	FS0015	Site Name:	Loch Greshornish								
Business No:	FB0119	Business Name:	Marine Harvest (Scotland) Ltd								
Case Types:	1 ECI	2 CNA	3 SLI	4 VMD	5 DIA	6					
Water Temp (°C):	12.5	Thermometer No:	T213					FHI 045 completed	N/A		
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.
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	

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Additional comments:

All fish had ~20-30 Caligus on the body. Fish 1, 2 and 5 were belly up as if concussed from banging 2ry equipment in cage. Fish 1 and 2 had white plaques on the gills. Fish 3 had a slightly flaccid heart muscle.

Marine Scotland Science's FHI Visit Report for November 2017 detailed "moribund and lethargic fish", "mild proliferative gill pathology with features consistent with amoebic gill disease (AGD), epitheliocystis, "anorexic poor-doing indivuduals" and positive tests for Neoparamoeba perurans, Paranucleospora theriodon (syn. Desmozoon lepeophtheri) and salmon gill poxvirus.

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FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

BUSINESS NO	FB0119	DATE OF VISIT	09/11/2017
SITE NO	FS0015	SITE NAME	Loch Greshornish
INSPECTOR	Ron Smith	CASE NO	20170558

Section 1: Summary

During a routine inspection of the above site, a number of moribund and lethargic fish were observed. Five fish were removed for further examination and subsequent diagnostic sampling.

Histopathology examination revealed marked to mild proliferative gill pathology with features consistent with amoebic gill disease (AGD). Epitheliocystis were also noted in F2. F3 and F4 were anorexic poor-doing individuals.

Due to gill health issues observed on site, samples were also screened for *Neoparamoeba perurans*, *Paranucleospora theridion* (syn. *Desmozoon lepeophtherii*) and salmon gill poxvirus by QPCR and tested positive.

For more background on Desmozoon lepeophtheri read:
"A case study of Desmozoon lepeophtherii infection in farmed Atlantic salmon associated with gill disease, peritonitis, intestinal infection, stunted growth, and increased mortality"
"Gill pathology in Scottish farmed Atlantic salmon, *Salmo salar* L., associated with the microsporidian *Desmozoon lepeophtherii*"

The report identified farmed salmon with cataracts and anorexia.

Section 2: Case Detail

Observations

During a routine inspection, a number of lethargic and moribund fish were observed. Five moribund and lethargic fish were caught for examination and diagnostic sampling.

External examination of the fish showed zonation in the gills of fish 1 – 5, cataracts and anorexia in fish 3 and 4.

Internal examination showed inflammation in the tubules of the pyloric caeca and no food in the gut of fish 3 & 4. Yellow pseudo-faeces was observed in the gut of fish 3 & 4, along with a lack of fat on the pyloric caeca. The heart of fish 3 also appeared to be slightly flaccid.

R09

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As well as positive tests for SGPV, AGD and Paranucleospora Theridon:

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

Salmon gill poxvirus (SGPV)

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
1	23.24	36.71	37.81	36.70	POSITIVE
2	25.11	25.62	26.05	26.19	POSITIVE
3	21.91	39.22	39.26	38.81	POSITIVE
4	24.07	36.72	38.72	37.60	POSITIVE
5	22.74	36.81	37.95	36.21	POSITIVE

The samples tested negative for infectious haematopoietic necrosis virus (IHNV), infectious pancreatic necrosis virus (IPNV), infectious salmon anaemia virus (ISAV), salmonid alphavirus (SAV) and viral haemorrhagic septicemia virus (VHSV).

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

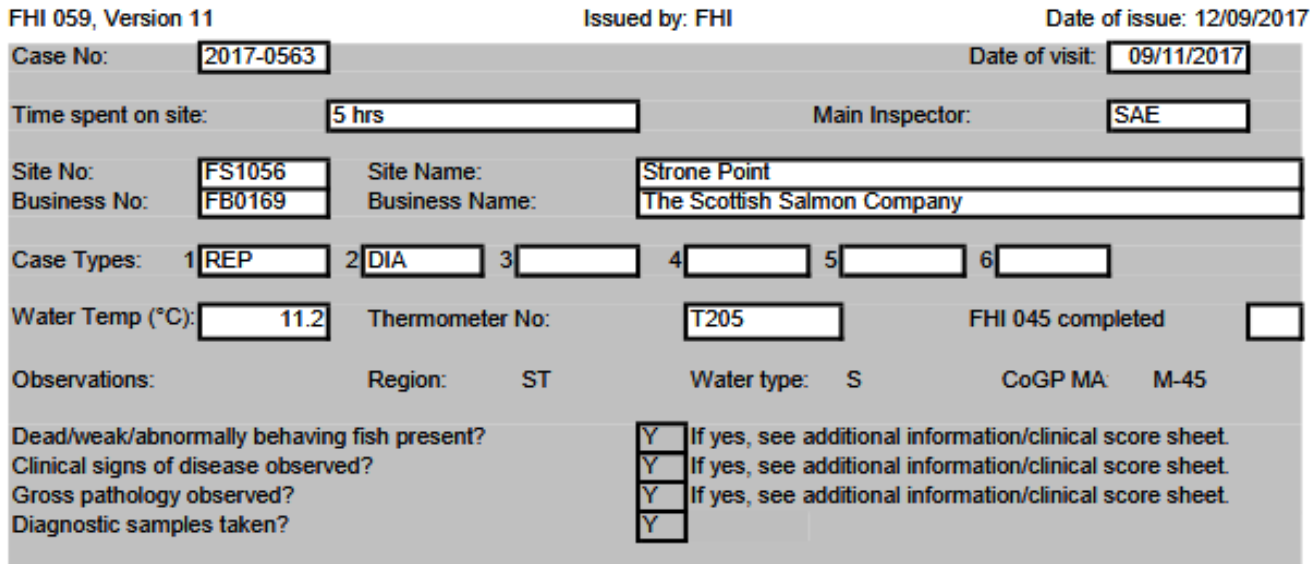
Neoparamoeba perurans (AGD)

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
1	23.24	27.93	28.00	27.89	POSITIVE
2	25.11	28.02	27.66	27.62	POSITIVE
3	21.91	27.96	28.06	28.25	POSITIVE
4	24.07	28.38	28.18	28.50	POSITIVE
5	22.74	28.90	28.69	28.84	POSITIVE

Paranucleospora Theridion

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
1	23.24	30.41	30.41	30.57	POSITIVE
2	25.11	31.92	31.89	31.91	POSITIVE
3	21.91	34.13	33.93	33.63	POSITIVE
4	24.07	32.45	32.41	32.12	POSITIVE
5	22.74	27.66	27.15	27.68	POSITIVE

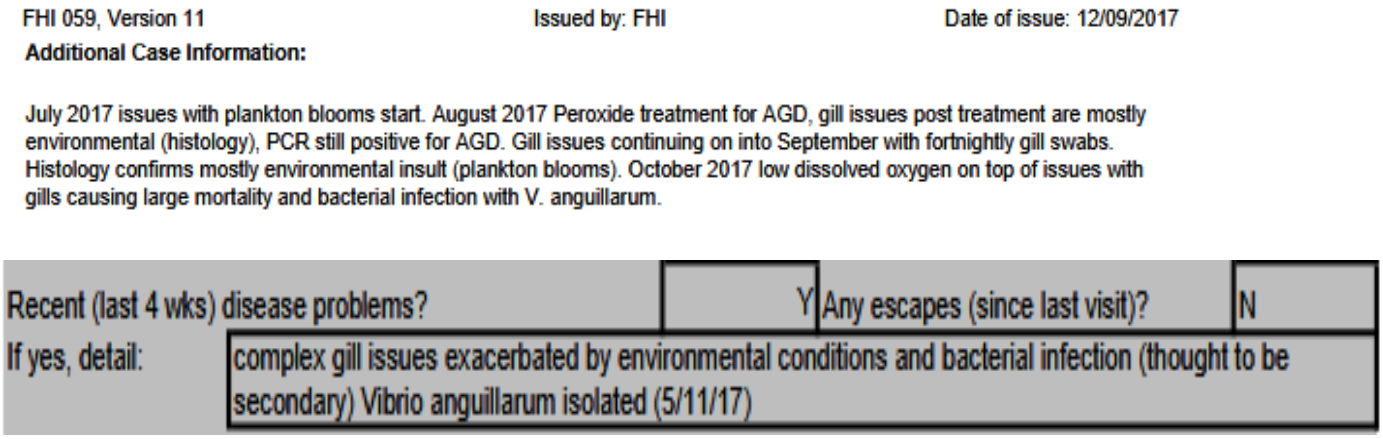
A FHI Fish Visit report dated November 2017 detailed disease problems at The Scottish Salmon Company's salmon farm at Strome Point in Loch Fyne - including AGD, gill issues and "large mortality" and "bacterial infection with V. anguillarum":



FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Case No:	2017-0563							Date of visit:	09/11/2017		
Time spent on site:	5 hrs							Main Inspector:	SAE		
Site No:	FS1056	Site Name:	Strone Point								
Business No:	FB0169	Business Name:	The Scottish Salmon Company								
Case Types:	1 REP	2 DIA	3	4	5	6					
Water Temp (°C):	11.2	Thermometer No:	T205				FHI 045 completed				
Observations:		Region:	ST	Water type:	S		CoGP MA:	M-45			

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	



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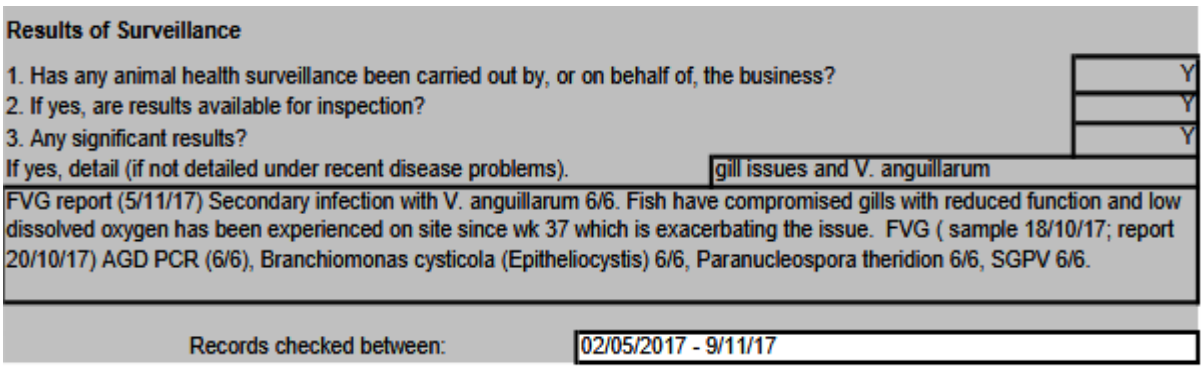
Additional Case Information:

July 2017 issues with plankton blooms start. August 2017 Peroxide treatment for AGD, gill issues post treatment are mostly environmental (histology), PCR still positive for AGD. Gill issues continuing on into September with fortnightly gill swabs. Histology confirms mostly environmental insult (plankton blooms). October 2017 low dissolved oxygen on top of issues with gills causing large mortality and bacterial infection with V. anguillarum.

Recent (last 4 wks) disease problems?	Y	Any escapes (since last visit)?	N
If yes, detail:	complex gill issues exacerbated by environmental conditions and bacterial infection (thought to be secondary) Vibrio anguillarum isolated (5/11/17)		



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).	gill issues and V. anguillarum

FVG report (5/11/17) Secondary infection with V. anguillarum 6/6. Fish have compromised gills with reduced function and low dissolved oxygen has been experienced on site since wk 37 which is exacerbating the issue. FVG (sample 18/10/17; report 20/10/17) AGD PCR (6/6), Branchiomonas cysticola (Epitheliocystis) 6/6, Paranucleospora theridion 6/6, SGPV 6/6.

Records checked between: 02/05/2017 - 9/11/17

Read more about Vibrio anguillarum via:
"Clinical Vibrio anguillarum infection in lumpsucker Cyclopterus lumpus in Scotland"
"Vibrio anguillarum as a fish pathogen: virulence factors, diagnosis and prevention"
"Vibriophages and Their Interactions with the Fish Pathogen Vibrio anguillarum"

In terms of mortalities, The Scottish Salmon Company reported for Strome Point in Loch Fyne that "mortalities start to increase in the beginning of October" with 20-70 morts per day per cage and 3,000 - 6,000 per day per site:

Mortality Records

1. Mortality records available for inspection?	Y
2. How are mortalities disposed of?	Whole fish - Dundas Chemicals
If other detail:	
3. Mortality records complete and correctly entered?	Y
4. Recent mortality (last 4 wks):	Mortalities start to increase in the beginning of October, some cages worse affected than others. Environmental issues with plankton blooms in October and some low dips in dissolved oxygen in mid October. Fish unable to cope with compromised gills and low oxygen. Some of the lower mort cages 20-70 morts per day per cage.
5. Evidence of recent increased/atypical mortalities?	Y
If yes, facility nos/no mortality per facility/no stock per facility/reason:	
3000 - 6000 per day per site	
6. Any other peaks in mortality during period checked?	Y
If yes, detail:	August 2017 2.66% for the month for the entire site some issues with AGD. AGD continuing on into September with numbers slightly decreasing.
7. Have increased (unexplained) mortalities been reported to vet or FHI?	Y
If yes, detail action:	Weekly reports are made to FHI, site visit was triggered by these reports.
8. Have 'mortality events' been reported to FHI? If no, add MRT case and enter on mortality events sheet.	Y

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Additional comments:

F3 black spherical objects observed on the gills (see photos) and haemorrage/ damage in the muscle tissue on the ventral surface internally (sample collected for histology).

F4 kidney unusual (see photos).

The FHI Fish Visit report dated November 2017 revealed "complex gill issues and some circulatory disturbance". "Pathology was consistent with mid amoebic gill disease and showed evidences of salmon poxvirus," continued the report. Epitheliocystis and confirmed via a positive test for Candidatus Branchiomonas cysticola as well as positives for Paranucleaspora theridon and Vibrio anguillarum. Read more about Candidatus Branchiomonas cysticola via:

'Candidatus Branchiomonas cysticola' is a common agent of epitheliocysts in seawater-farmed Atlantic salmon Salmo salar in Norway and Ireland
Temporal changes in infections with some pathogens associated with gill disease in farmed Atlantic salmon (Salmo salar L)
Ca. Branchiomonas cysticola, Ca. Piscichlamydia salmonis and Salmon Gill Pox Virus transmit horizontally in Atlantic salmon held in fresh water
AGD: a practical guide, part 1

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FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

BUSINESS NO	FB0169	DATE OF VISIT	09/11/2017
SITE NO	FS1056	SITE NAME	Strone Point
INSPECTOR	Svenja Elwenn	CASE NO	20170563

Section 1: Summary

A report of increased mortality at the site was received from the operator. Five fish were removed for diagnostic sampling.

Histopathology examination revealed complex gill issues and some circulatory disturbance. Pathology was consistent with mild amoebic gill disease and showed evidences of salmon poxvirus, both pathogens were confirmed by QPCR. Epitheliocysts were noted and confirmed by positive QPCR for *Candidatus* Branchiomonas cysticola. The skeletal muscle necrosis noted in F3 was likely associated with a lesion.

Due to gill health issues observed on site samples were screened for *Paranucleospora theridion* (syn. *Desmozoon lepeophtherii*) by QPCR and tested positive.

Vibrio anguillarum was identified from three fish, with the level and purity of growth from the kidney material of F5 deemed significant.

The FHI Fish Visit report dated November 2017 reported positive for the following:

Candidatus Branchiomonas cysticola

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F3	23.15	28.21	28.47	28.47	POSITIVE
F4	23.78	25.77	25.75	25.78	POSITIVE
F5	22.69	25.15	25.13	25.06	POSITIVE

F1 and F2 were not tested.

Salmon gill poxvirus

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	22.82	38.16	38.64	38.71	POSITIVE
F2	24.00	34.81	34.77	34.94	POSITIVE
F3	23.15	27.23	27.37	27.50	POSITIVE
F4	23.78	31.10	31.24	30.69	POSITIVE
F5	22.69	30.15	30.17	30.14	POSITIVE

Neoparamoeba perurans (AGD)

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F2	24.00	30.71	30.91	30.90	POSITIVE
F3	23.15	30.01	30.21	30.14	POSITIVE
F4	23.78	30.87	30.93	30.66	POSITIVE
F5	22.69	29.88	30.02	30.14	POSITIVE

F1 tested negative for *Neoparamoeba perurans*.

Paranucleospora theridion

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	22.82	34.97	34.64	34.67	POSITIVE
F2	24.00	31.32	31.41	31.24	POSITIVE
F3	23.15	31.57	31.22	31.24	POSITIVE
F4	23.78	29.21	29.53	29.31	POSITIVE
F5	22.69	29.04	28.87	29.35	POSITIVE

A FHI Fish Visit report dated November 2017 detailed disease problems at Marine Harvest's salmon farm at Poll Na Gille in the Sound of Jura - including "complex gill issues", anaemia, "severe PGD pathology and extensive haemorrhaging":

FHI 059, Version 11 Issued by: FHI Date of issue: 12/09/2017

Case No: 2017-0603 Date of visit: 29/11/2017

Time spent on site: 4 hrs Main Inspector: PMM

Site No: FS0629 Site Name: Poll Na Gille

Business No: FB0119 Business Name: Marine Harvest (Scotland) Ltd

Case Types: 1 REP 2 DIA 3 4 5 6

Water Temp (°C): 11.4 Thermometer No: T155 FHI 045 completed

Observations: Region: ST Water type: S CoGP MA M-40

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	

FHI 059, Version 11 Issued by: FHI Date of issue: 12/09/2017

Additional Case Information:

Site inspected following increased mortalities above reporting level. Mortalities had been attributed to complex gill issues and anaemia. Site has harvested the worst affected stock. The remaining cages have been passive graded and fish split down, resulting in approx 20,000 fish per cage. Harvests have been a combination of live haul and dead haul. Dead haul have been conducted by the Viking Caledonia with loads being transferred to tankers in Oban.

Intercaledonia was on site conducting freshwater treatments, targeted treatments were conducted on cage 1 (16 hour treatment) and cage 16 (15 hour treatment). No issues observed or reported in cage 16. However, 3 fish hanging vertically removed from cage 1 and sampled.

Visibility excellent at time of inspection >6m, all cages fitted with 5m deep sea lice skirts. Majority of fish observed shoaling normally, 5 -10 lethargic fish per cage observed deeper in the water.

Health report 19/10/17 - pen 12 F1 - moderate PGD, P& - F1 - no signs of anaemia. P16 F5 & F6 - moribund severe anaemia presented in pale gills with moderate to severe PGD pathology and extensive haemorrhaging. Sampled blood was watery and measured haematocrit levels was at 6.5 and 5.1%. Histology reporting liver necrosis in both fish likely due to hypoxia caused by anaemia.

The mortality records stated that Marine Harvest had "harvested worse cages, reducing biomass":

Mortality Records

1. Mortality records available for inspection?	Y
2. How are mortalities disposed of?	Whole fish - Dundas Chemicals
If other detail:	
3. Mortality records complete and correctly entered?	Y
4. Recent mortality (last 4 wks):	wk 45 - 20,309 (~2.6%) (4,463 attributed to CMS and 15,846 attribited to anaemia), wk 46 - 8,129 (~2.1%) (3,212 attributed to CMS and 4,917 attributed to anaemia), wk 47 - 1,751 (~0.66%) (1,570 attributed to CMS and 181 attribited to hydrolicer treatment)
5. Evidence of recent increased/atypical mortalities?	Y
If yes, facility nos/no mortality per facility/no stock per facility/reason:	
week 45 for site 4,463 attributed to CMS and 15,846 attributed to anaemia.	
6. Any other peaks in mortality during period checked?	N
If yes, detail:	
7. Have increased (unexplained) mortalities been reported to vet or FHI?	Y
If yes, detail action:	Harvested worst cages, reducing biomass and passive graded remaining cages, split fish to 13 cages stocked at approx 20,000 per cage.
8. Have 'mortality events' been reported to FHI? If no, add MRT case and enter on mortality events sheet.	Y

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).	

Pen 12 - f1 - moderate PGD, P7 - F1 - no signs of anaemia, P16 F5 +6 - moribund severe anaemia presented in pale gils with moderate to severe PGD pathology and extensive haemorrhaging. Sampled blood was watery and measured haematocrit levels was at 6.5 and 5.1%. Histology reporting liver necrosis in both fish likely due to hypoxia caused by anaemia.

Records checked between: 06/11/17 to 29/11/17

The FHI Fish Visit report for November 2017 detailed "complex gill issues and anaemia", "mild cardiomyopathy with features resembling cardiomyopathy syndrome (CMS) and the presence of the causative agent, piscine myocarditis virus (PMCV)" and reported a positive test for Paranucleospora theridon (syn. Desmozoon lepeophtheri). Over 60,000 mortalities were reported in a four-week period (Week 33 to 36).

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[redacted]

FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

BUSINESS NO	FB0119	**DATE OF VISIT**	29/11/2017
SITE NO	FS0629	**SITE NAME**	Poll Na Gille
INSPECTOR	Paul McKay	**CASE NO**	20170603

Section 1: Summary

A report was received from the operator of increased mortality levels at the site due to complex gill issues and anaemia. Three moribund fish were removed for diagnostic sampling.

Histopathological examination revealed mild cardiomyopathy with features resembling cardiomyopathy syndrome (CMS) and the presence of the causative agent, piscine myocarditis virus (PMCV), was confirmed by real-time PCR (QPCR). Mild gill pathology was also noted.

Due to gill health issues observed on site samples were screened for *Paranucleospora theridion* (syn. *Desmozoon lepeophtherii*) by QPCR and tested positive.

Section 2: Case Detail

Observations

The above site was inspected following a report from the operator of increased mortality in the Atlantic salmon stocked on the site. At the time of the inspection the site was stocked with 265, 453 2016 S0 Atlantic salmon at an average weight of 4.4 Kg and ~17,500 wrasse of mixed age.

Mortality levels began to rise at the end of October 2017, peaking at 3.2% (20,053 Atlantic salmon) in week 43 and remained elevated during weeks 44 – 2.7% (13,830 Atlantic salmon), week 45 – 2.6% (20,309 Atlantic salmon) and week 46 – 2.1% (8,129 Atlantic salon). Mortality levels decreased to 0.66% (1,751 Atlantic salmon) during week 47.

The worst affected cages have been harvested and the remaining stock has been passive graded and biomass reduced across the remaining cages. Health surveillance carried out by the R09

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Website - www.gov.scot/Topics/marine/science

business reported complex gill issues and severe anaemia presented in pale gills. A number of lethargic salmon were observed across the site and three were sampled for diagnostic purposes.

All three fish were observed hanging vertically in the water. The gills of F1 and F2 were pale. Internally F1 and F3 presented clear ascites and F2 presented bloody ascites. All three fish displayed enlarged spleens. Cage one had undergone a freshwater treatment the day prior to the site inspection.

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 myocarditis virus (PMCV)

Pool Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
P1	17.92	30.35	30.25	30.33	Positive

The samples tested negative for infectious haematopoietic necrosis virus (IHNV), infectious pancreatic necrosis virus (IPNV), infectious salmon anaemia virus (ISAV), salmonid alphavirus (SAV),viral haemorrhagic septicemia virus (VHSV) and salmon gill poxvirus.

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

Paranucleospora theridion

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	22.07	30.59	30.50	30.55	Positive
F2	22.12	35.2	35.62	34.81	Positive
F3	22.38	32.55	32.55	32.55	Positive

The FHI Fish Visit report signed off by stating that histopathological examination had found "some evidence of erthrophagocytosis" in the spleen, "mild diffuse hepatocyte vacuolation" in the liver, "mild pericarditis" in the heart and "lamellar congestion" in the gills.

Histopathological examination revealed the following:

Gill: Minor interlamellar basal hyperplasia (F1) and small foci of epithelial hyperplasia, lamellar fusion and lamellar congestion and some lamellar thickness noted in F3. Few aneurysmal dilation/telangiectasia were also noted in F3.

Skin & Muscle: Within the normal range.

Heart: Small foci of myofibre degeneration and cell infiltration noted in F2 and F3, mild pericarditis noted in F2.

Gut and pyloric caeca: Within the normal range.

Pancreas: Within the normal range.

Liver: Mild diffuse hepatocyte vacuolation (F1 & F2).

Kidney: Within the normal range.

Spleen: Some evidence of erythrophagocytosis (F3).

[redacted]

Signed: Date: 21/12/17

Fish Health Inspector

A FHI Fish Visit report for November 2017 detailed disease problems at Kames Fish Farming's salmon farm at Shuna SW (Rubh'an Trilleachain) in Shuna Sound stating that: "Biomass has been reduced with worst affected stock having been harvested. Harvest have been both live haul to Mallaig and dead haul."

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Case No:	2017-0604			Date of visit:	29/11/2017
Time spent on site:	4 hrs			Main Inspector:	PMM
Site No:	FS1290	Site Name:	Shuna SW (Rubh'an Trilleachain)		
Business No:	FB0134	Business Name:	Kames Fish Farming Ltd		
Case Types:	1 REP	2 DIA	3	4	5	6
Water Temp (°C):	11.5	Thermometer No:	T155	FHI 045 completed	
Observations:		Region: ST	Water type: S	CoGP MA: M-40	

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	

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Additional Case Information:

Site inspected after FHI identified increased mortalities above the reporting threshold during site inspections. 4 fish diagnostic sampling conducted. Fish were sitting deeper in the water column. Appeared to be shoaling normally, observed on camera system on barge. 1 fresh dead and 3 lethargic moribund fish removed from site for sampling. Fish one displayed some sea lice grazing damage

Thermolicer on site at time of inspection, reported that can treat up to 60 tonnes of fish an hour. Visible difference observed in sea lice load between pre and post thermolicer treated fish. Site manager reported that clearances are usually >90% and system is very effective. During treatment sea lice counts are conduct pre -treatment, multiple counts are conducted in the crowded fish during treatment and a post treatment count is conducted.

All top net supports have padding installed around the base of the support which is designed to eliminate fish concussing themselves, this has reportedly been very effective. Mortalities removed using uplift system. All cages have sea lice skirts installed, these are 5m deep

Biomass has been reduced with worst affected stock having been harvested. Harvests have been both live haul to Mallaig and dead haul. Dead haul has been conducted by the Viking Caledonia (Johnson Marine) and have been unloading in Oban for transport to Blar Mhor.

Recent (last 4 wks) disease problems?	Y
If yes, detail:	Complex gill issues and anaemia

Mortality Records

1. Mortality records available for inspection?	Y
2. How are mortalities disposed of?	Whole fish - Dundas Chemicals
If other detail:	
3. Mortality records complete and correctly entered?	Y
4. Recent mortality (last 4 wks):	wk 45 - 6,184 (~1.7%) (80 to physical damage, 3,826 attributed to hydrolicer treatment and 2,278 attributed to anaemia), wk 46 - 3,303 (0.93%) (110 attributed to poor doers, 1,572 attributed to physical damage, 1,603 attributed to hydrolicer treatment and 18 attributed to anaemia) and wk 47 - 1,130 (0.32%) (1,130 attributed to physical damage)
5. Evidence of recent increased/atypical mortalities?	N
If yes, facility nos/no mortality per facility/no stock per facility/reason:	
6. Any other peaks in mortality during period checked?	N
If yes, detail:	
7. Have increased (unexplained) mortalities been reported to vet or FHI?	Y
If yes, detail action:	worst effected stock has been harvested.
8. Have 'mortality events' been reported to FHI? If no, add MRT case and enter on mortality events sheet.	Y

The FHI Fish Visit report for November 2017 detailed "complex gill issues and anaemia", "features resembling salmon gill poxvirus", "epitheliocystis and mild peritonitis", "mild cardiomyopathy with features resembling cardiomyopathy syndrome", piscine myocarditis virus (PMVC), Paranucleospora theridon and Neoparamoeba perurans (AGD).

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FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

BUSINESS NO	FB0134	**DATE OF VISIT**	29/11/2017
SITE NO	FS1290	**SITE NAME**	Shuna SW (Rubh'an Trilleachain)
INSPECTOR	Paul McKay	**CASE NO**	20170604

Section 1: Summary

A report was received from the operator of increased mortality levels at the site due to complex gill issues and anaemia. One moribund and three lethargic fish were removed for diagnostic sampling.

Histopathology examination revealed complex gill issues with low levels of proliferative lesions and features resembling salmon gill poxvirus and the presence of the virus was confirmed by real-time PCR (QPCR). Epitheliocystis and mild peritonitis were also observed. Mild cardiomyopathy with features resembling cardiomyopathy syndrome, the presence of piscine myocarditis virus (PMCV) confirmed by QPCR, (F1) were also noted.

Due to gill health issues observed on site, samples were screened for *Paranucleospora theridion* (syn. *Desmozoon lepeophtherii*) and *Neoparamoeba perurans* (AGD) by QPCR and tested positive.

Section 2: Case Detail

Observations

The above site was inspected following a report from the operator of increased mortality in the Atlantic salmon stocked on the site. At the time of the inspection the site was stocked with 351,165 2016 S0 Atlantic salmon at an average weight of 3.9 Kg, 22,672 wrasse of mixed age and 21,588 lumpsuckers of mixed age.

Mortality levels began to rise at the end of October 2017, peaking at 1.7% (6,184 Atlantic salmon) in week 45 and experienced elevated levels during weeks 43 – 1.2% (5,653 Atlantic salmon) and

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Website - www.gov.scot/Topics/marine/science

44 – 1.2% (5,364 Atlantic salmon). Mortalities dropped to 0.93% (3,303 Atlantic salmon) during week 46 and further in week 47 – 0.32%(1,130 Atlantic salmon).

The worst affected cages have been harvested. Health surveillance carried out by the business reported complex gill issues and severe anaemia presented in pale gills. A number of lethargic salmon were observed across the site and five were sampled for diagnostic purposes.

Four fish were removed for diagnostic sampling. F1 was moribund. Whilst F2 to F4 were lethargic. F2 and F4 were anorexic with pale gills. F3 displayed pale necrotic gills. Internally F1, F2 and F4 presented bloody ascites and F3 presented clear ascites. F3 displayed a pale heart. F1, F2 and F3 displayed enlarged spleens, lack of food in the gut and yellow pseudo-faeces.

Bacteriology isolated Vibrio species and Moritella viscosa (the causative agent of Winter ulcer):

Bacteriology: Kidney and gill material from F1 to F4 was inoculated onto appropriate media for the isolation of bacteria.

The following bacteria were isolated:
- *Vibrio* species (kidney material from three fish and gill material from four fish)
- *Moritella viscosa* (kidney material from three fish and gill material from one fish)

Although *Moritella viscosa* is a known fish pathogen the level and purity of growth would not suggest that it or the *Vibrio* sp. isolated would be implicated in morbidity in this case.

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

Salmon gill poxvirus QPCR

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	23.55	29.73	29.21	29.69	POSITIVE
F2	22.31	35.39	35.54	36.13	POSITIVE
F3	23.20				NEGATIVE
F4	22.76				NEGATIVE

Piscine myocarditis virus QPCR

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
P1	17.94	31.23	31.13	31.26	POSITIVE

Parasitology: Tissue samples were tested for segments of nucleic acid indicative o of the parasites specified below using real-time PCR (QPCR).

Neoparamoeba perurans (AGD)

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	23.55	28.14	28.19	28.22	POSITIVE
F2	22.31	31.49	31.37	31.55	POSITIVE
F3	23.20	35.02	34.69	34.72	POSITIVE
F4	22.76	33.78	33.62	33.68	POSITIVE

Paranucleospora theridion

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	23.55	28.12	28.16	28.21	POSITIVE
F2	22.31	33.35	33.33	33.56	POSITIVE
F3	23.20	37.35	37.64	37.74	POSITIVE
F4	22.76	31.31	31.28	31.19	POSITIVE

A [FHI Fish Visit report for December 2017] detailed disease problems at The Scottish Salmon Company's salmon farm at Druimyeon Bay in the Sound of Gigha - including PGD, CMS and "sea lice grazing damage to heads".

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Case No:	2017-0606							Date of visit:	05/12/2017
Time spent on site:	3.5 hrs							Main Inspector:	PMM
Site No:	FS0336	Site Name:	Druimyeon Bay						
Business No:	FB0169	Business Name:	The Scottish Salmon Company						
Case Types:	1 REP	2 DIA	3 VMD	4	5	6			
Water Temp (°C):	11.2	Thermometer No:	T155				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	

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Additional Case Information:

Site inspected following mortalities reported above the weekly threshold. Mortalities have been attributed to PGD, and post hydrolicer losses. Recent vet report has identified CMS and this is now a factor in losses. 5 fish removed for diagnostic sampling, 6/9 cages are on the harvest forecast sheet and the site may be fallow by the end of the year.
Site is quite exposed and water was very choppy which affected visibility at times during the inspection. ~10 moribund fish observed per cage, some of which had sea lice grazing damage to heads.
It was reported that there was a higher than normal % of mature fish, this was estimated to be ~20%, half of moribund fish visible in the cages were maturing fish.

"Harvesting worst affected cages and accelerated harvest of site," [stated the FHI report].

Mortality Records

1. Mortality records available for inspection?	Y
2. How are mortalities disposed of?	Whole fish - Dundas Chemicals
If other detail:	
3. Mortality records complete and correctly entered?	Y
4. Recent mortality (last 4 wks):	06/11 - 25,607 (4.44%) attributed to post hydrolicer treatment, 13/11 - 45,089 (8.69%) attributed to post hydrolicer treatment, CMS and handling, 20/11 - 61,777 (14.12%) attributed to CMS and handling and 27/11 - 34,680 (10.12%) - attributed to CMS and handling
5. Evidence of recent increased/atypical mortalities?	N
If yes, facility nos/no mortality per facility/no stock per facility/reason:	
6. Any other peaks in mortality during period checked?	N
If yes, detail:	
7. Have increased (unexplained) mortalities been reported to vet or FHI?	Y
If yes, detail action:	Harvesting worst affected cages and accelerated harvest of site
8. Have 'mortality events' been reported to FHI? If no, add MRT case and enter on mortality events sheet.	Y

All five farmed salmon tested had a "strong presence" for moribund and lethargic behaviour.

FHI 059, Version 11 | Issued by: FHI | Date of issue: 12/09/2017

Case no:	2017-0606	Site No:	FS0336	Method of killing:	Percussive	
Date of visit:	05/12/2017	Inspector(s):	PMM	Sheet Relevant:	Y	

S for strong presence: M for medium presence: W for weak presence

Fish Number		1	2	3	4	5					
Time sampled after death (if > 45 minutes)											
External Signs											
Behaviour	Moribund	S	S	S	S	S					
	Lethargic	S	S	S	S	S					
	Hanging vertical		S								

The FHI Fish Visit report for December 2017 reports all the usual suspects with over 30,000 mortalities in Week 43 citing problems such as PGD, CMS, AGD and PMCV.

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FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

BUSINESS NO	FB0169	DATE OF VISIT	05/12/2017
SITE NO	FS0336	SITE NAME	Druimyeon Bay
INSPECTOR	Paul McKay	CASE NO	20170606

Section 1: Summary

Reports were received from the operator of ongoing increased mortality levels at the site attributed to a combination of proliferative gill disease (PGD), handling/grading and cardiomyopathy syndrome (CMS). Five fish were removed for diagnostic sampling.

Histopathology examination revealed marked cardiomyopathy consistent with CMS and the presence of the causative agent, piscine myocarditis virus (PMCV), was confirmed by real-time PCR (QPCR). Mild complex gill issues with lesions suggestive of amoebic gill disease (AGD) were observed and confirmed by QPCR. Multifocal hepatic necrosis and marked nephropathy noted in fish three.

Due to gill health issues observed on site, samples were also screened for *Paranucleospora theridion* (syn. *Desmozoon lepeophtherii*) and salmon gill poxvirus by QPCR and tested positive.

Section 2: Case Detail

Observations

The above site was inspected following a report from the operator of increased mortality in the Atlantic salmon stocked on the site. At the time of the inspection the site was stocked with 233,639 2016 S0 Atlantic salmon at an average weight of 3 Kg.

Mortality levels began to increase at the beginning of October 2017 (week 40), peaking at 2.81% (30,015 Atlantic salmon) in week 43. The worst affected cages had been harvested and the site was due to fallow by the end of 2017. Recent health surveillance conducted by the operator

R09

Marine Laboratory, 375 Victoria Road, Aberdeen, AB11 9DB
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Website - www.gov.scot/Topics/marine/science

reported CMS. A number of moribund fish were observed across the site and five were removed for diagnostic sampling.

All fish sampled were moribund and lethargic, with F2 hanging vertically. F5 was anorexic. Internally F5 had clear ascites whilst F1, F3 and F4 had bloody ascites. The heart of F3 was deformed. There was gross haemorrhaging on the liver in F3, F4 and F5. The spleens of fish F1, F2, F4 and F5 were enlarged. There was no food present in the guts of any fish sampled and all had yellow pseudo-faeces.

Positive tests included for Salmon gill poxvirus, Piscine myocarditis virus and Salmonid alphavirus.

Salmon gill poxvirus

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
F1	22.60	33.75	33.68	33.93	POSITIVE
F2	22.36	27.02	27.10	27.00	POSITIVE
F3	22.65	33.78	34.02	33.99	POSITIVE
F4	23.24				NEGATIVE
F5	22.15	30.57	30.78	30.53	POSITIVE

Piscine myocarditis virus

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
P1	17.14	19.31	19.31	19.11	POSITIVE

Salmonid alphavirus

Fish Number	Endogenous control Cp value	Cp Values			Reported Result (PCR)
P1	17.14	32.13	32.18	32.34	POSITIVE

Read more about Salmonid alphavirus (SAV) via:
Salmonid alphavirus (SAV)
Geographical distribution of salmonid alphavirus subtypes in marine farmed Atlantic salmon, Salmo salar L., in Scotland and Ireland
Prevalence of salmonid alphavirus in Scottish fish farms from 2006 to 2007

Case Information published by the Scottish Government's Fish Health Inspectorate for July to September 2017 includes a FHI visit report for Loch Duart's salmon farm in Badcall Bay.

FHI 059, Version 10 | Issued by: FHI | Date of issue: 12/02/2016

Case No:	2017-0183			Date of visit:	29/08/2017
Time spent on site:	4.5			Main Inspector:	JMS
Site No:	FS0067	Site Name:	Badcall Bay		
Business No:	FB0398	Business Name:	Loch Duart Ltd		
Case Types:	1 DIA	2 REP	3 VMD	4 ECI	5 CNI 6 SLI
Water Temp (°C):	13.8	Thermometer No:	T152	FHI 045 completed	
Observations:		Region:	HI	Water type: S	CoGP MA: M-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.
Gross pathology observed?	y	If yes, see additional information/clinical score sheet.
Diagnostic samples taken?	y	

The report details AGD lesions as well as "significant gill pathology (AGD, Branchiomonas, Desmazoon, SGPV), widespread inflammation and vascular damage". "Piscirickettsia suspected but not identified though staining (sic)" stated the report. Mortality rates for some of the worst cages were over 30%.

FHI 059, Version 10 | Issued by: FHI | Date of issue: 12/02/2016

Additional Case Information:

The site was inspected following a report from the business correspondent of increased mortality at the site since the end of July 2017. The mortality was attributed to complex gill issues and a potential water borne insult. Liver pathology had also been observed in samples taken by FVG. Summary of FVG findings: 4/8/17 - acute and chronic gill pathology, AGD lesions, evidence of water borne irritant, no clinical findings in external organs. AGD listed as a concern. 16/8/17 - mixed acute and chronic gill pathology, exposure to water borne irritant, liver pathology. 23/8/17 - Significant gill pathology (AGD, Branchiomonas, Desmazoon, SGPV) widespread inflammation and vascular damage, AGD ct values from PCR suggested a worse infection than was seen by histology. No evidence of SAV. Liver necrosis observed, Piscirickettsia suspected but not identified though staining.

One cage group currently stocked with ~80000 (between 6500 and 9500/pen) salmon of Landcatch origin. Fish were transferred from Outer Bay and Drumbeg in June 2017.

Site received a Salmosan Vet treatment between 29/6/17 and 1/7/17 post transfer. Site received a Paramove treatment for AGD between 5/7/17 and 10/7/17, scores reduced post treatment. Three pens were treated on 8/8/17 with Paramove for AGD, the whole site was not treated due to the reaction of the fish. Low 02 levels have been a problem and site has been using aeration to help this. Mortality is being removed by uplift, stored in a sealed skip and removed by DK waste to Gray Composting. Harvests are carried out by dead haul.

Mortality:
Week 29 - 3.75% for site, worst cages b11 29.35% and B12 18.75% issues with dosing equipment - human error in mixing
Week 30 0.2%
Week 31 0.78%
Week 32 4.79% site worst cage B10 31.32% post H202 - H202 treatment halted
Week 33 7.07% site worst cages B01 10.45% and B02 11.86% and B05 12.44% B06 10.59% - not associated with treatment
Week 34 4.18% (mid week) worst cage B6 15.84%
Monthly totals June 2017 0.12%, July 9.66%, August 15.69% (up until 15th August) mainly attributed to gills and post treatment.
Wk 33 487 lumpsucker morts in cage 9 post H202 treatment

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).	
Complex gill issues, AGD, liver pathology, branchiomonas, inflammation and vascular damage, desmazoon	

Records checked between: 12/11/14 - 29/8/17

The FHI visit report also described "no membrane between heart and liver" and "haemorrhaging at the base of the pelvic fins" in sampled farmed salmon.

FHI 059, Version 10	Issued by: FHI	Date of issue: 12/02/2016

Additional comments:

Hearts appeared flabby and were difficult to cut. Some atriums added to pots separately. F1 heart appeared flat. No membrane between heart and liver in F3. F1, 2, 5 had haemorrhaging at the base of the pelvic fins.

The FHI visit report for August 2017 detailed "severe complex gill issues with chronic and acute pathology", epitheliocystis, Candidatus Branchiomonas cysticola, Candidatus Syngnamydia salmonis, vascular damage, mild hepatic necrosis, Salmon gill poxvirus and Paranucleospora theridon.

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FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

BUSINESS NO	FB0398	DATE OF VISIT	29/08/2017
SITE NO	FS0067	SITE NAME	Badcall Bay
INSPECTOR	Jeanna Sandilands	CASE NO	20170183

Section 1: Summary

Five lethargic Atlantic salmon (*Salmo salar*) were sampled for diagnostic purposes following reports of increased mortality at the above site. Histopathology examination revealed severe complex gill issues with chronic and acute pathology. Amoebic cells suggestive of amoebic gill disease (AGD) were noted and confirmed by QPCR. Epitheliocystis observed by histopathology was confirmed by QPCR for *Candidatus* Branchiomonas cysticola and *Candidatus* Syngnamydia salmonis. Vascular damage and pathology associated with treatment or water borne insult were also observed. Mild hepatic necrosis was noted.

Due to the gill health issues observed on site, samples were screened for salmon gill poxvirus and *Paranucleospora theridion* (syn, *Desmozoon lepeophtherii*) by QPCR. Samples tested positive for both pathogens.

Candidatus Branchiomonas cysticola

Fish Number	F1	F2	F3	F4	F5
Endogenous control Cp value	23.72	23.76	22.85	22.69	21.87
Cp Values	22.81	22.34	23.25	20.99	20.56
	22.79	22.4	23.07	20.97	20.39
	22.77	22.08	23.08	20.97	20.39
Reported Result	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE

Candidatus Syngnamydia salmonis

Fish Number	F1	F2	F3	F4	F5
Endogenous control Cp value	23.72	23.76	22.85	22.69	21.87
Cp Values	31.97	28.81	30.31	30.38	31.13
	32.16	29.05	29.82	30.1	30.99
	31.96	28.91	30.26	30.13	31.5
Reported Result	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE

Salmon gill poxvirus

Fish Number	F1	F2	F3	F4	F5
Endogenous control Cp value	23.11	23.66	22.60	22.25	22.38
Cp Values	30.83	28.27	35.89	29.57	27.28
	30.66	28.02	35.95	29.25	27.20
	30.72	28.07	36.17	29.36	27.05
Reported Result (PCR)	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE

Neoparamoeba perurans (AGD)

Fish Number	F1	F2	F3	F4	F5
Endogenous control Cp value	23.11	23.66	22.60	22.25	22.38
Cp Values	28.55	29.82	31.51	32.87	30.59
	28.68	29.72	31.53	32.57	30.71
	28.58	30.12	31.43	32.78	30.64
Reported Result	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE

Paranucleospora theridion

Fish Number	F1	F2	F3	F4	F5
Endogenous control Cp value	23.11	23.66	22.60	22.25	22.38
Cp Values	25.32	26.67	26.01	32.94	24.75
	25.34	26.75	25.71	33.04	24.63
	25.37	26.72	25.80	33.16	24.54
Reported Result	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE

A FHI visit report for August 2017 for Loch Duart's salmon farm in Calva Bay detailed disease problems - including a mortality rate of 45.64% since input in some cages. "Worst affected will be harvested by next Monday (pens 22, 23, 25, 27, and 28 already harvested out)" stated the FHI visit report.

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FHI 059, Version 10 | Issued by: FHI | Date of issue: 12/02/2016

Case No:	2017-0188								Date of visit:	29/08/2017	
Time spent on site:	4.5h							Main Inspector:		JMS	
Site No:	FS0068	Site Name:	Calva Bay (Calbha Beag)								
Business No:	FB0398	Business Name:	Loch Duart Ltd								
Case Types:	1 MRT	2 REP	3 DIA	4 PSI	5	6					
Water Temp (°C):	13.8	Thermometer No:	T152				FHI 045 completed				
Observations:		Region:	HI	Water type:	S		CoGP MA:	M-5			

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	

FHI 059, Version 10 | Issued by: FHI | Date of issue: 12/02/2016

Additional Case Information:

The site was inspected following a report from the business correspondent of increased mortality at the site since the end of July 2017. The mortality was attributed to complex gill issues and potential water borne insult. Reduced feeding over weekend 22/23rd July prompted samples to be taken in week 30. Summary of FVG findings: 4/8/17 - Complex gill disease and AGD, Branchiomonas infection, liver pathology. 17/8/17 - Significant complex gill pathology, AGD, Branchiomonas and liver pathology. Possible toxic algal effect observed. 28/8/17 - Complex gill disease and liver pathology. Results are pending for samples taken for Piscirickettsia PCR (did not show up on staining) and further histology including brain tissue. Pale gills have been routinely noted. CT values for AGD PCR suggests a more extensive infection than the histology and gross gill appearance indicates.
Water sampling over the period showed background phytoplankton mainly Ceratium, although not at bloom levels. 02 levels on A walkway have been poor.

Two out of three cage groups currently stocked (A and G). Site is currently stocked with ~201000 (between 6500 and 10500 fish/pen) salmon of Landcatch origin. Fish were transferred from Outer Bay and Drumbeg in June 2017.
Mortality is being removed by uplift, stored in a sealed skip and removed by DK Waste to Gray Composting. Harvests are carried out dead haul.

A walkway received a Salmosan Vet treatment between 29/6/17 - 5/7/17 post transfer. A & G walkway treated with Paramove for AGD between 11/7/17 and 20/7/17 - AGD scores reduced. Further treatments not advised due to gill issues.

Morts A group - worst affected will be harvested by next Monday (pens 22,23,25,27 and 28 already harvested out)
Wk 29 1.39%
Wk 30 0.37%
Wk 31 1.3%
Wk 32 3.4%
Wk 33 25.31% - worst C21 28.28%, C23 72.5%, C22 45.96% - not related to treatment
Wk 34 15.57% - worst C16 31.55% (45.64% since input) C21 (42.76% since input)

Morts G group
Wk 29 0.37%
Wk 30 0.29%
Wk 31 0.35%
Wk 32 0.87%
Wk 33 4.02% - worst affected C31 7.14%, C39 9.43%
Wk 34 1.13%

Totals
Wk 29 0.86%, Wk 30 0.33%, wk 31 0.8%, wk 32 2.06%, wk 33 13.9%, Wk 34 6.62% (partial week)
34% loss across site (52% A walkway, 18% G walkway) 73020 in total from 30/7/17 until 25/8/17
June 2017 0.45%, July 2017 2.57%, August 2017 21.47%

FHI 059, Version 10 | Issued by: FHI | Date of issue: 12/02/2016

Additional comments:

All fish had mottled livers. Haemorrhaging at the base of the pelvic fins in F1,2,3,5. All fish had swollen atrium. F1 had fluid round the heart

The FHI visit report for August 2017 detailed AGD, Candidatus Branchiomonas cysticola, Candidatus Syngnamydia salmonis, Salmon gill poxvirus and Paranucleospora theridon.

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FISH HEALTH INSPECTORATE VISIT REPORT

SUMMARY FOR INFORMATION OF SITE OPERATOR

Business No	FB0398	**Date of Visit**	29/08/2017
Site No	FS0068	**Site Name**	Calva Bay (Calbha Beag)
Inspector	Jeanna Sandilands	**Case No**	20170188

Section 1: Summary

Five lethargic Atlantic salmon (*Salmo salar*) were sampled for diagnostic purposes following reports of increased mortality at the above site. Histopathology examination revealed complex gill issues with evidence of amoebic gill disease (AGD), which was confirmed by QPCR and epiotheliocystis also confirmed by QPCR for *Candidatus* Branchiomonas cysticola and *Candidatus* Syngnamydia salmonis. Pathology suggestive of potential treatment effects or water borne insult was observed. Mild to moderate hepatic necrosis and kidney pathology was also noted.

Due to the gill health issues observed on site, samples were screened for salmon gill poxvirus and *Paranucleospora theridion* (syn, *Desmozoon lepeophtherii*) by QPCR. Samples tested positive for both pathogens.

Candidatus Branchiomonas cysticola

Fish Number	F1	F2	F3	F4	F5
Endogenous control Cp value	23.72	23.76	22.85	22.69	21.87
Cp Values	22.81	22.34	23.25	20.99	20.56
	22.79	22.4	23.07	20.97	20.39
	22.77	22.08	23.08	20.98	20.73
Reported Result	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE

Candidatus Syngnamydia salmonis

Fish Number	F1	F2	F3	F4	F5
Endogenous control Cp value	23.72	23.76	22.85	22.69	21.87
Cp Values	31.97	28.81	30.31	30.38	31.13
	32.16	29.05	29.82	30.1	30.99
	31.96	28.91	30.26	30.13	31.5
Reported Result	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE

Salmon gill poxvirus

Fish Number	F1	F2	F3	F4	F5
Endogenous control Cp value	23.06	23.39	22.31	22.09	21.92
Cp Values	25.16	26.56	26.03	31.00	24.60
	25.24	26.50	26.10	31.14	24.47
	25.10	26.26	26.02	31.09	24.45
Reported Result (PCR)	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE

Neoparamoeba perurans (AGD)

Fish Number	F1	F2	F3	F4	F5
Endogenous control Cp value	23.06	23.39	22.31	22.09	21.92
Cp Values	31.83	29.85	30.61	30.89	31.16
	31.64	29.65	30.57	31.27	31.17
	21.81	29.69	30.66	31.09	31.25
Reported Result	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE

Paranucleospora theridion

Fish Number	F1	F2	F3	F4	F5
Endogenous control Cp value	23.06	23.39	22.31	22.09	21.92
Cp Values	27.71	26.00	28.58	25.51	29.86
	27.81	25.71	27.62	25.90	29.03
	27.49	25.94	28.38	25.44	30.09
Reported Result	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE

The FHI visit report for August 2017 also stated that the "worst affected cages are being harvested out":

FHI 059, Version 10 Issued by: FHI Date of issue: 12/02/2016

Case No: 2017-0189 Site No: FS0067 Date of visit: 29/08/2017

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):
30/07/2017		≥750g	2.2kg	SAL	2016 s0	Weekly	20.00	Explained	AGD, Algal bloom, Complex gill issues, O2 problems, Water quality
07/08/2017	13/08/2017	≥750g	2.2kg	SAL	2016 s0	Weekly	4.79	Explained	AGD, Algal bloom, Complex gill issues, O2 problems, Water quality
14/08/2017	20/08/2017	≥750g	2.2kg	SAL	2016 s0	Weekly	7.07	Explained	AGD, Algal bloom, Complex gill issues, O2 problems, Water quality
21/08/2017	27/08/2017	≥750g	2.2kg	SAL	2016 s0	Weekly	4.18	Explained	AGD, Algal bloom, Complex gill issues, O2 problems, Water quality

If unexplained, select observations:	Total mortality during event (if available):	Additional information (e.g. action taken by company):	Action taken by FHI (include case no where applicable):
	16958	Fish and water quality sampling carried out. FVG have sampled on three occasions through August, worst affected cages are being harvested out.	MRT case and diagnostic sampling
		Fish and water quality sampling carried out. FVG have sampled on three occasions through August, worst affected cages are being harvested out.	MRT case and diagnostic sampling
		Fish and water quality sampling carried out. FVG have sampled on three occasions through August, worst affected cages are being harvested out.	MRT case and diagnostic sampling
		Fish and water quality sampling carried out. FVG have sampled on three occasions through August, worst affected cages are being harvested out.	MRT case and diagnostic sampling

A FHI visit report for July 2017 reported "severe gill issues" at The Scottish Salmon Company's salmon farm in Loch Odhairn (Gravir).

FHI 059, Version 10 | Issued by: FHI | Date of issue: 12/02/2016

Case No:	2017-0312	Date of visit:	28/07/2017
Time spent on site:	0	Main Inspector:	PMM
Site No:	FS0242	Site Name:	Loch Odhairn(Gravir)
Business No:	FB0169	Business Name:	The Scottish Salmon Company

FHI 059, Version 10 | Issued by: FHI | Date of issue: 12/02/2016

Additional Case Information:

Severe gill issues with high levels of AGD present. Hydrogen peroxide treatment at end of week 29. FW treatment planned for 12/08/17. Vet has been attending weekly and will attend FW treatment.
Mortalities wk 30 - 9.64%
Mortalities wk 31 - 6.34 %

Mortalities were reported at over 110,000 in a two week period in July/August 2017.

FHI 059, Version 10 | Issued by: FHI | Date of issue: 12/02/2016

Case No: 2017-0312 Site No: FS0242 Date of visit: 28/07/2017

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):
17/07/2017	23/07/2017	≥750g	2kg	SAL	2016 S0	Weekly	2.33	Explained	AGD, Treatment
24/07/2017	30/07/2017	≥750g	2kg	SAL	2016 S0	Weekly	9.64	Explained	AGD, Complex gill issues, Treatment
31/07/2017	04/08/2017	≥750g	2kg	SAL	2016 S0	Weekly	6.34	Explained	AGD, Complex gill issues, Treatment

Total mortality during event (if available):	Additional information (e.g. action taken by company):	Action taken by FHI (include case no where applicable):
16,072	Post AGD treatment, low concentration H2O2 treatment.	Visit scheduled
64872	Severe gill issues with high levels of AGD present. H2O2 treatment at end of week 29. FW treatment planned for 12/08/17. Vet has been attending weekly and will attend FW treatment.	FHI to visit - planned for w/c 14/08/17.
38530	Severe gill issues with high levels of AGD present. H2O2 treatment at end of week 29. FW treatment planned for 12/08/17. Vet has been attending weekly and will attend FW treatment.	FHI to visit - planned for w/c 14/08/17.

A FHI visit report for August 2017 for The Scottish Salmon Company's salmon farm at Inch Kenneth in Loch na Keal on the Isle of Mull detailed "very skinny" fish including one "deformed with a bent spine" and three out of the five farmed salmon sampled had "deformed hearts".

FHI 059, Version 10 | Issued by: FHI | Date of issue: 12/02/2016

Case No:	2017-0350			Date of visit:	23/08/2017
Time spent on site:	3 hours			Main Inspector:	DJT
Site No:	fs0593	Site Name:	Inch Kenneth		
Business No:	FB0169	Business Name:	The Scottish Salmon Company		
Case Types:	1 REP	2 MRT	3 DIA	4	5 6
Water Temp (°C):	14.7	Thermometer No:	T173	FHI 045 completed	
Observations:		Region: ST	Water type: S	CoGP MA: M-37	

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	

FHI 059, Version 10 | Issued by: FHI | Date of issue: 12/02/2016

Additional comments:

All fish sampled were very skinny, fish three was deformed with a bent spine. One caligus observed.

Externally: All five fish were lethargic, anorexic with darkened bodies and pale gills.

Internally: All five fish had a lack of fat and splenomegaly, fish 3-5 had deformed hearts and yellow pseudo faeces was evident in fish 4 and 5. The kidney of fish 1 and 2 were slightly granular in appearance.

Disease problems included AGD, PD, Branchiomonas and microspoidean.

FHI 059, Version 10 | Issued by: FHI | Date of issue: 12/02/2016

Additional Case Information:

Mortality event started on the 10th July (reported to FHI) and has been ongoing since then. Site inspection triggered due to continued mortality event above reporting thresholds. Initial spike was due to treatment with hydrogen peroxide for AGD and sea lice however stocks had been through a clinical outbreak of PD so were immunosuppressed. AGD gill scores were rising so treatment was deemed necessary.

Due to weather conditions only three cages were treated on the 14th July and the remaining three cages were treated 4th August resulting in two spikes of mortality post treatments. These have all been reported to the FHI.

Mortality event was recorded for week 32 (7-13 Aug), 21.43% (23117 fish @1.7 kg).

Mortalities recorded for week 33 0.40%, 335 fish. Week 34 30 fish so far (0.04%)

Total mortalities since 10th July 44.09% or 62,634 fish in total.

Reports available from the FVG confirm clinical PD on site in February. Additional reports confirm clinical AGD, Branchiomonas, microsporidean. High gill scores for AGD recorded indicating treatment was required.

A FHI visit report for August 2017 for Cooke Aquaculture's salmon farm in the Bay of Vady in Orkney detailed early harvesting due to mortality problems. "Reports of increased mortality due to gill issues, site is being harvest out," stated the FHI report. "Reporting limit has been breached for five weeks."

FHI 059, Version 10 Issued by: FHI Date of issue: 12/02/2016

Case No:	2017-0390			Date of visit:	28/08/2017
Time spent on site:	0			Main Inspector:	DJT
Site No:	FS1020	Site Name:	Bay of Vady		
Business No:	FB0095	Business Name:	Cooke Aquaculture Scotland Ltd		

FHI 059, Version 10 Issued by: FHI Date of issue: 12/02/2016

Additional Case Information:

Reports of increased mortality due to gill issues, site is being harvested out. Reporting limit has been breached for five weeks

wk30, 1.33% (2398 @ 4.8kg)
wk31, 1.16% (1955 @ 4.9kg)
wk32 1.19% (1857 @ 5kg)
wk33, 2.45% (3,340 @ 4.8kg)
wk34, 1.27% (1497 @ 5kg)

Mortalities were over 10,000 for a four-week period in July/August 2017 with "ongoing monitoring and harvesting of stocks".

FHI 059, Version 10 Issued by: FHI Date of issue: 12/02/2016

Case No: 2017-0390 Site No: FS1020 Date of visit: 28/08/2017

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):
24/07/2017		≥750g	4.8	SAL	2016 s1	Weekly	1.33	Explained	Complex gill issues
31/07/2017		≥750g	4.9	SAL	2016 s1	Weekly	1.16	Explained	Complex gill issues
07/08/2017		≥750g	5	SAL	2016 s1	Weekly	1.19	Explained	Complex gill issues
14/08/2017		≥750g	4.88	SAL	2016 s1	Weekly	2.45	Explained	Complex gill issues
21/08/2017		≥750g	5	SAL	2016 s1	Weekly	1.27	Explained	Complex gill issues

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Total mortality during event (if available):	Additional information (e.g. action taken by company):	Action taken by FHI (include case no where applicable):
2398	ongoing monitoring and harvesting of stocks, site should be fallow end of September to the middle of October	Site visit to be arranged asap.
1955	ongoing monitoring and harvesting of stocks, site should be fallow end of September to the middle of October	Site visit to be arranged asap.
1857	ongoing monitoring and harvesting of stocks, site should be fallow end of September to the middle of October	Site visit to be arranged asap.
3340	ongoing monitoring and harvesting of stocks, site should be fallow end of September to the middle of October	Site visit to be arranged asap.
1497	ongoing monitoring and harvesting of stocks, site should be fallow end of September to the middle of October	Site visit to be arranged asap.

A FHI visit report for August 2017 for Cooke Aquaculture's salmon farm in Carness Bay in Orkney detailed over 20,000 mortalities in a six-week period. "Site is being harvested," stated the FHI report.

FHI 059, Version 10 | Issued by: FHI | Date of issue: 12/02/2016

Case No:	2017-0391			Date of visit:	28/08/2017
Time spent on site:	0			Main Inspector:	DJT
Site No:	fs0390	Site Name:	Carness Bay		
Business No:	FB0095	Business Name:	Cooke Aquaculture Scotland Ltd		

Mortality event reported on the 28/8/2017. Main cause is gill issues and also a treatment see mortality sheet for details.

wk28 1.4% (2332 @ 4.8kg)
wk29 1.15% (1877 @ 5kg)
wk31 1.23% (1984 @ 5.4kg)
wk32 1.97% (3123 @ 5.5kg)
wk33 1.94% (3025 @ 5.6kg)
wk34 5.63% (8604 @ 5.9kg)

Total mortality during event (if available):	Additional information (e.g. action taken by company):	Action taken by FHI (include case no where applicable):
2332	ongoing monitoring, treatment caused some of the mortalities recorded. Site is being harvested, due to be fallow late September to Mid October	site inspection to be arranged asap
1877	ongoing monitoring, treatment caused some of the mortalities recorded. Site is being harvested, due to be fallow late September to Mid October	site inspection to be arranged asap
1984	ongoing monitoring, treatment caused some of the mortalities recorded. Site is being harvested, due to be fallow late September to Mid October	site inspection to be arranged asap
3123	ongoing monitoring, treatment caused some of the mortalities recorded. Site is being harvested, due to be fallow late September to Mid October	site inspection to be arranged asap
3025	ongoing monitoring, treatment caused some of the mortalities recorded. Site is being harvested, due to be fallow late September to Mid October	site inspection to be arranged asap
8604	ongoing monitoring, treatment caused some of the mortalities recorded. Site is being harvested, due to be fallow late September to Mid October	site inspection to be arranged asap

Cooke Aquaculture is no stranger to disease issues - with PRV causing problems in the United States. Read more via:
Washington state finds virus in Cooke Atlantic salmon, plans expanded testing
Cooke banned from restocking at US farm site
19 salmon that escaped from Cooke pens had PRV, tests suggest
100% of Escaped Atlantic Salmon Sampled in Puget Sound Test Positive for Piscine Orthoreovirus (PRV)
Washington state finds PRV at Cooke farms, holds up transfer of 800,000 salmon

Case Information for 2016 included this reference to harvesting at The Scottish Salmon Company's farm at Furnace in Loch Fyne due to "gill pox issues" and rapidly rising mortality rates from 1.71% in Week 29 to 8.64% in Week 34 and 10.72% in Week 35:

FHI 059, Version 10 Issued by: FHI Date of issue: 12/02/2016

Additional Case Information:

FHI notified by company of increased mortality due to complex gill issues. Site has begun harvesting and aim to be complete by late September/ early October.
Samples screened by company vet and FVG stating gill issues, possibly gill pox. AGD scoring low.
Bulk of stock on site originate from Furnace which has a history of gill pox issues.
An H2O2 treatment was carried out on 17/07/2017 on 6 cages as a trial, mortality rate quickly increased in these 6 cages. No treatments have been performed since.

Morts:
Wk 29 - 1877 (1.71%)
Wk 30 - 0
Wk 31 - 1984 (1.84%)
Wk 32 - 3123 (2.95%)
Wk 33 - 3025 (2.95%)
Wk 34 - 8604 (8.64%)
Wk 35 - 9747 (10.72%)

Fish sampled for diagnostics originated from Furnace.

Thanks to the work of Salmon & Trout Conservation Scotland accessing sea lice data via FOI, Scotland's "liciest" have been named and shamed - including 61 salmon farms breaching lice limits between November 2016 and August 2017.

Ardcastle Bay	The Scottish Salmon Company
Badcall Bay	Loch Duart Ltd
Bagh Chlann Neill	The Scottish Salmon Company
Bastaness	Cooke Aquaculture Scotland Ltd
Cairidh	Marine Harvest (Scotland) Ltd
Clashnessie Bay	Loch Duart Ltd
Cloudin	Cooke Aquaculture Scotland Ltd
Corlarach	Grieg Seafood Shetland Ltd
Djubawick	Cooke Aquaculture Scotland Ltd
Dury Voe	Scottish Sea Farms Ltd
Eilean Grianain	Marine Harvest (Scotland) Ltd
Etive 4	Dawnfresh Farming Ltd
Foreholm	Scottish Sea Farms Ltd
Furnace Quarry	The Scottish Salmon Company
Geasgill	The Scottish Salmon Company
Gob a Bharra Loch Fyne	The Scottish Salmon Company
Gob na Hoe	Grieg Seafood Shetland Ltd
Greanamul	The Scottish Salmon Company
Groatay	Marine Harvest (Scotland) Ltd
Hellisay	Marine Harvest (Scotland) Ltd
Holms Geo	Scottish Sea Farms Ltd
Kempie Bay	Scottish Sea Farms Ltd
Kenmore Loch Torridon	The Scottish Salmon Company
Kilerivagh / Petersport	The Scottish Salmon Company
Kingairloch	Marine Harvest (Scotland) Ltd
Langa Isle (East)	Grieg Seafood Shetland Ltd
Leinish	Grieg Seafood Shetland Ltd
Linnhe	Marine Harvest (Scotland) Ltd
Loch Carnan	Loch Duart Ltd
Loch Laxford	Loch Duart Ltd
Loch Odhairn	The Scottish Salmon Company
Loura Voe	Scottish Sea Farms Ltd
Maol Ban	Marine Harvest (Scotland) Ltd
Maragay Mor	The Scottish Salmon Company
Meall Mhor Loch Fyne	The Scottish Salmon Company
Nevis B	Scottish Sea Farms Ltd
North Havra	Grieg Seafood Shetland Ltd
North Papa	Grieg Seafood Shetland Ltd
North Shore	Marine Harvest (Scotland) Ltd
North Uiskevagh	The Scottish Salmon Company
Ornish Island	Marine Harvest (Scotland) Ltd
Plocrapol	The Scottish Salmon Company
Quarry Point	The Scottish Salmon Company
Reibinish	The Scottish Salmon Company
Scadabay	The Scottish Salmon Company
Score Holms	Grieg Seafood Shetland Ltd
Sgeir Dughall	The Scottish Salmon Company
Shuna SW (Rubh'an Trilleachain)	Kames Fish Farming Ltd
Sian Bay	Scottish Sea Farms Ltd
Snaraness	Scottish Sea Farms Ltd
Soay	Marine Harvest (Scotland) Ltd
South Sound	Scottish Sea Farms Ltd
Spoose Holm	Grieg Seafood Shetland Ltd
Strome	The Scottish Salmon Company
Strondoir Bay	The Scottish Salmon Company
Stulaigh	Marine Harvest (Scotland) Ltd
Teisti Geo	Scottish Sea Farms Ltd
Turness	Cooke Aquaculture Scotland Ltd
Uyea Isle	Cooke Aquaculture Scotland Ltd
Vee Taing	Cooke Aquaculture Scotland Ltd
West of Burwick	Grieg Seafood Shetland Ltd
Wick of Belmont	Cooke Aquaculture Scotland Ltd

Read more via:
"Scotland's worst sea lice offenders: Full Farm List"
"Scottish salmon sold by a range of supermarkets in the UK has sea lice up to 20 times acceptable limit - Tesco, Sainsbury's and Co-op are among those who have stocked salmon from the worst affected farms"
"Scottish salmon farming's 'liciest' farms named and shamed"
"FOI Number Five – getting you the information they don't want you to see!"

Shamefully, SEPA stopped collecting data on the numbers of dead farmed salmon following lobbying from the SSPO in 2013 who claimed publication would be "commercially damaging". Read more via:
"Scottish watchdog labelled 'lapdog' after agreeing to keep fish farm deaths secret"
"Public denied info on full scale of salmon deaths"
"Environment watchdog 'gave in to industry' over dead salmon"
"Farmed salmon killed by disease leaps to 8.5 million"

Despite the industry's reluctance to divulge details on diseases and mortalities, there is the prospect of further data making it possible to directly link early harvest with particular disease problems at specific sites. In February 2018, the Scottish Salmon Producers Organisation publicly pledged in oral evidence to the Scottish Parliament's Environment, Climate Change & Land Reform Committee to publish site specific data on lice, mortalities and diseases:

David Sandison: It is fair to say that the aspects of fish health that are most important to success in growing our livestock are the core of our business. In that regard, we understand and acknowledge that there are gaps in the data. We could definitely enhance that further.

The industry has been chastened for a long time about the supply of information on sea lice numbers on the farms in Scotland. For the committee's benefit and for the wider public, I can confirm that, from here on and forthwith, we will publish all data on sea lice counts on farms in Scotland on a farm-by-farm basis. That will back up the decision that the SSPO board took in November last year, which is now in the public domain.

Dr Collin: It is welcome news that the industry will publish those data. However, we would like historical data to be published as well. We are talking about adaptive management and learning from impacts and the data that have been collected. It takes time to collect and monitor data, which will delay any conclusive results and action. If we have the historical data, we can begin with a wealth of data and start to make changes now.

The Convener: David Sandison is nodding his head. Will that historical data be available?

David Sandison: We are very happy to consider what we can provide that will help the debate. There is data available. It is not as though the industry has not been gathering and publishing the data; it has been published in regional format for the past five or six years in quite a bit of detail. We need to consider that data. Data is extremely important, and we need to know how to use it to the best advantage of all.

Mark Ruskell (Mid Scotland and Fife) (Green): Will the industry also publish data on salmon mortality, broken down by farm and with the reasons for those morts set out?

David Sandison: Yes. We will provide mortality data at farm level and will, from time to time, give a commentary on any disease issues that might be associated with that mortality.

Mark Ruskell: Will there be historical data alongside the data for sea lice?

David Sandison: Part of our commitment in establishing the fish health framework group, which is looking at the 10-year strategy, is the provision of five years of historical mortality data, which will be annualised and comparative year on year. At the moment, we have data up to 2015; we still have to complete the production cycles for 2016 and 2017.

Read more via "Victory for Freedom of Information"

Nevertheless, when the Scottish Salmon Producers Organisation finally published site specific sea lice data in May 2018 it was immediately criticised by Salmon & Trout Conservation Scotland:

Salmon farming industry's selective release of individual farm sea lice data falls far short of what is required

Salmon and Trout Conservation Scotland (S&TC Scotland) is dismayed that this week's publication by the Scottish Salmon Producers Organisation (SSPO) of sea lice data for January, on an individual farm basis (see http://scottishsalmon.co.uk/wp-content/uploads/2018/04/Lice-averages-Jan-2018.pdf), falls far short of what the Environment Climate Change and Land Reform Committee's Report in March, on the Environmental Impacts of Salmon Farming, demanded.

The ECCLR Committee's Report* stated clearly what was required from the industry (at para 58):

> *"The Committee believes the efforts of the industry have proven to be largely insufficient to address lice issues. The Committee welcomes the announcement by the SSPO that sea lice data will be published on a farm by farm basis. For that data to be most useful the Committee considers there should be no unreasonable delay in its publication.*
>
> *The industry should be required to publish it in real time. Data should be published in a consistent and comparable basis and should include numbers of fish and action taken in response.*
>
> *This information would advance the science and solutions available to the industry.*
>
> *The industry should also be required to publish consistent and comparable weekly historic data sets on sea lice figures on a farm by farm basis from the time records are available.*
>
> *There should be no delay in the industry publishing this information so this should initially be published on a voluntary basis by the end of April 2018."*

Andrew Graham-Stewart, Director of S&TC Scotland, said:

> *"The industry is clearly ignoring most of what the ECCLR Committee called for – with no good reason.*
>
> *Scottish Salmon Producers Organisation (SSPO) has unilaterally decided that it will publish data three months in arrears. Such a time lag for the release of individual farm sea lice data is unacceptable and unwarranted. There is no logical reason why the delay should be any more than a week or two."*

Guy Linley-Adams, Solicitor for S&TC Scotland, said:

> *"The publication of individual farm sea lice figures for January, which S&TC Scotland welcomes, is only a bare minimum first step.*
>
> *As to what the data says, it indicates that there are still major problems with sea lice control. Indeed 31 per cent of farms (a total of 39 out of 126 that were stocked for the whole of January) were above the Code of Good Practice threshold – in some cases seven times over."*

The SSPO's sea lice data for January 2018 details lice problems at the following sites (one lice per fish is the threshold):

January 2018

Company	Farm	Adult female lice
Scottish Salmon Company Ltd	Gravir Outer	7.11
Marine Harvest (Scotland) Ltd	Duich	2.29
Marine Harvest (Scotland) Ltd	Greshornish	1.26
Marine Harvest (Scotland) Ltd	Invasion Bay	2.80
Marine Harvest (Scotland) Ltd	Bagh Dail Nan Cean	2.03
Marine Harvest (Scotland) Ltd	Loch Hourn	1.07
Cooke Aquaculture (Scotland)	Winna Ness	1.34
Grieg Seafood Shetland Ltd	Bomlo	1.45
Cooke Aquaculture (Scotland)	Turness	2.90
Cooke Aquaculture (Scotland)	Uyea Isle	1.97
Cooke Aquaculture (Scotland)	North Sandwick	1.57
Marine Harvest (Scotland) Ltd	Muck	2.43
Marine Harvest (Scotland) Ltd	North Shore	3.49
Marine Harvest (Scotland) Ltd	North Shore East	4.37
Marine Harvest (Scotland) Ltd	Noster	1.05
Scottish Salmon Company Ltd	Strome	4.76
Grieg Seafood Shetland Ltd	Poseidon	1.43
Scottish Salmon Company Ltd	Trilleachan Mor	7.13
Grieg Seafood Shetland Ltd	Snizort East	2.06
Grieg Seafood Shetland Ltd	South of Linga	1.04

Grieg Seafood Shetland Ltd	Swining 3	1.59
Marine Harvest (Scotland) Ltd	Seaforth	1.18
Scottish Salmon Company Ltd	Ardyne	1.26
Scottish Salmon Company Ltd	Sgian Dubh	1.43
Scottish Salmon Company Ltd	Inch Kenneth	2.90
Scottish Salmon Company Ltd	Portree	2.52
Scottish Sea Farms Ltd	Bight of Bellister	2.37
Scottish Sea Farms Ltd	Fishnish (A)	1.30
Scottish Sea Farms Ltd	Fishnish (B)	1.53
Scottish Sea Farms Ltd	Fiunary	1.10
Scottish Sea Farms Ltd	Loch Spelve (B)	1.00
Scottish Sea Farms Ltd	Loura Voe	No count - Harvesting
Scottish Sea Farms Ltd	Mangaster	2.47
Scottish Sea Farms Ltd	Scallastle E	2.14
Scottish Sea Farms Ltd	Scallastle W	1.06
Scottish Sea Farms Ltd	Tanera A	2.03
Scottish Sea Farms Ltd	Tanera B	1.73
Scottish Sea Farms Ltd	Vidlin	1.46

The ECCLR report (5 March 2018) also recommended the publication of disease and mortality data:

> 59. The Committee also considers that the industry must be required to publish data on salmon mortality on a farm by farm basis and publish accompanying information on disease issues that might be associated with that mortality. The industry should also be required to publish consistent and comparable weekly historic data sets on salmon mortality on a farm by farm basis from the time records are available. There should be no delay in the industry publishing this information and so this should also initially be published on a voluntary basis by the end of April 2018.
>
> 60. This reporting should be a statutory obligation to ensure transparency and facilitate public access to information, particularly as not all salmon farmers are members of the SSPO.

What we know for sure is that the average size of Scottish salmon farms is increasing. The latest fish farm survey (published in September 2017) shows that 82.8% of Scottish salmon farming production comes from sites producing over 1,000 tonnes (up from 73.6% in 2006).

Scale of Production by Site

Table 33: Number of sites shown in relation to their production grouping and percentage share of production 2006-2016

Production grouping (tonnes)	0	1-50	51-100	101-200	201-500	501-1,000	>1,000	Total	
								Sites*	Tonnes
2006	95	10	10	16	29	30	62	252	131,847
2007	89	9	8	19	33	34	55	247	129,930
2008	118	7	9	15	22	29	57	257	128,606
2009	104	12	12	10	33	25	58	254	144,247
2010	109	5	6	10	33	22	64	249	154,164
2011	106	9	7	9	28	29	66	254	158,018
2012	115	3	5	9	25	33	67	257	162,223
2013	112	9	3	12	18	36	67	257	163,234
2014	117	8	1	9	26	29	70	260	179,022
2015	115	2	1	9	26	26	75	254	171,722
2016	117	3	3	9	22	26	73	253	162,817
2006	0	0.2	0.6	1.8	7.9	15.9	73.6	-	-
2007	0	0.2	0.4	2.3	8.3	19.0	69.8	-	-
2008	0	0.1	0.5	1.6	5.8	15.9	76	-	-
2009	0	0.2	0.6	1.0	7.7	13.0	77.5	-	-
2010	0	0.1	0.3	0.9	7.3	10.8	80.6	-	-
2011	0	0.2	0.3	0.8	6.4	13.4	78.9	-	-
2012	0	<0.1	0.2	0.9	5.0	15.0	78.8	-	-
2013	0	0.1	0.1	1.1	4.0	16.7	78.0	-	-
2014	0	0.1	<0.1	0.8	5.0	12.0	82.0	-	-
2015	0	<0.1	<0.1	0.9	5.0	11.6	82.4	-	-
2016	0	<0.1	0.1	0.8	4.6	11.7	82.8	-	-

*Includes farms stocked but having no production.

Read more via:
[Supersized McSalmon - I'm Lovin' It Sings Fergus!]
[Big McSalmon, Large Lice & Toxic Chemicals - Supersized Salmon Goes Global!]
[Sunday Times: "Supersizing salmon farms in Scotland 'will be a disaster'"]
[SEPA proposes lifting biomass cap for Scottish salmon farms]
[Industry: no imminent plans for super-sized salmon farm]
[Outrage over secret plans to base world's biggest salmon farm in Scotland]
[Super-sized Scottish Salmon - 8,000 tonnes of trouble on the horizon!]

Whether bigger salmon farm size means even [bigger lice, disease and mortality problems] remains to be seen. [Scottish Salmon Watch] will certainly be keeping a watching brief.

Earlier this month, Scottish Salmon Watch delivered a 42,000-strong petition to the Scottish Government calling for the testing of salmon farming operations for deadly diseases and viruses.

Read more via:
The National: "42,000 sign petition for tougher Scottish salmon farm testing"
Herald: "Salmon farms are turning Scotland's seas into an open sewer, claim campaigners"
SumOfUs: "Campaigners at Scottish Parliament call for wastewater testing at salmon farming operations to save wild fish"
Letter to Scottish Government re. Infectious Diseases in Salmon Farming Effluents
Risk of waterborne virus spread – review of survival of relevant fish and crustacean viruses in the aquatic environment and implications for control measures

BBC News reported (19 May 2018) trouble ahead for Scotland's disease-ridden salmon farming industry. "Last week, we learned the industry expects an 11% drop in output this year, as it struggles to get on top of sea lice and disease," reported BBC News (May 24 2018). "When either is found in a cage, salmon are harvested (or slaughtered, if you prefer) straight away, and much earlier than if they grew to their optimum marketable size."

Appendix 1: Production Cycles for Marine Cage Salmon Farms in Scotland

Data accessed via Scotland's Aquaculture web-site (via Monthly Biomass data) in May 2018 (data only available up to December 2017).

Please note that a harvest cycle of farmed salmon is taken from the first month biomass appears until the last month of active biomass (i.e. before the site is fallowed and there is zero biomass). Note also that this is not an exhaustive list of all production cycles in the periods listed - if a statistician with a great deal of time on their hands (or a PhD student) wished to analysis the data and carry out a year-by-year comparison all the data is publicly available online here.

Summary:

2013-2017 data: Overall Industry Average = 16.5 months

2002-2007 data: Overall Industry Average = 20.1 months

2013-2017 data:

Overall Industry Average = 16.5 months

Loch Duart: Average time at sea = 13.2 months
Cooke Aquaculture: Average time at sea = 13.5 months
Marine Harvest: Average time at sea = 16.2 months
The Scottish Salmon Company: Average time at sea = 18 months
Scottish Sea Farms: Average time at sea = 18 months
Grieg Seafood: Average time at sea = 19.1 months

Marine Harvest: Average time at sea = 16.2 months

Ardgour (Loch Linnhe): January 2016 to June 2017 (18 months)

Ardintoul (Loch Alsh): February 2015 to September 2016 (20 months)

Bagh Dail nan Ceann North and South (Sound of Jura): November 2015 to August 2016 (10 months)

Cairidh (Loch Ainort): March 2016 to September 2017 (17 months)

Callert (Loch Leven): January 2016 to September 2017 (19 months)

Camas an Leim (Torridon) (Loch Torridon): November 2015 to March 2017 (17 months)

Camus Glas (Loch Sunart): November 2014 to August 2016 (22 months)

Caolas a Deas East (Loch Shell): June 2015 to January 2016 (7 months)

Caolas a Deas West (Loch Shell): November 2014 to January 2016 (15 months)

Carradale (North) (Kilbrannan Sound): July 2016 to May 2017 (10 months)

Carradale (South) (Kilbrannan Sound): November 2015 to May 2017 (19 months)

Colonsay: September 2015 to April 2017 (20 months)

Creag an Sagairt West (Loch Hourn): August 2014 to February 2016 (19 months)

Duich (Loch Duich): February 2015 to August 2016 (19 months)

Erisort, North Shore East (Loch Erisort): May 2015 to June 2016 (14 months)

Erisort, North Shore West (Loch Erisort): December 2014 to June 2016 (19 months)

Gorsten (Loch Linnhe): November 2015 to June 2017 (20 months)

Greshornish (Loch Snizort): March 2015 to September 2016 (19 months)

Grey Horse Channel (Sound of Harris): October 2015 to February 2017 (17 months)

Groatay (Sound of Harris): May 2016 to May 2017 (13 months)

Hellisay (Sound of Hellisay): March 2014 to October 2015 (20 months)

Invasion Bay (Loch Sunart): November 2014 to May 2016 (19 months)

Isle of Ewe (Loch Ewe): September 2015 to March 2017 (19 months)

Kingairloch (Loch a Choire) (Loch Linnhe): May 2016 to July 2017 (15 months)

MacLeans Nose (Sound of Mull): August 2015 to May 2016 (10 months)

Maol Ban (Inner Sound): March 2016 to August 2017 (18 months)

Marulaig Bay (Loch Boisdale): February 2016 to August 2017 (19 months)

Noster (Loch Seaforth): April 2016 to October 2016 (7 months)

Poll na Gille (Sound of Jura): October 2014 to August 2016 (23 months)

Port na Cro (Shuna Sound): June 2017 to November 2017 (6 months)

Port na Moine Site 2 (North) (Loch Craignish): October 2015 to August 2017 (23 months)

Sconser (Sound of Raasay): February 2017 to June 2017 (5 months)

Seaforth (Loch Seaforth): April 2016 to October 2016 (7 months)

Skipport Outer (Ornish) (Loch Skipport): October 2015 to February 2017 (17 months)

Soay Sound (West Loch Tarbert): October 2015 to April 2017 (19 months)

Sron (Loch Alsh): February 2015 to June 2016 to (17 months)

Stulaigh Island (Loch Eynort): September 2015 to May 2017 (21 months)

Tabhaigh (Loch Erisort): August 2016 to November 2017 (16 months)

The Scottish Salmon Company: Average time at sea = 18 months

Aird Ardheslaig (Loch Sheildaig): January 2016 to October 2017 (22 months)

Ardcastle (Loch Fyne): December 2016 to June 2017 (19 months)

Ardgaddan (Loch Fyne): October 2015 to June 2017 (21 months)

Ardyne (Baigh au Sgairbh) (Loch Striven): February 2015 to September 2016 (20 months)

Druimyeon Bay (Sound of Gigha): October 2014 to April 2016 (19 months)

East Tarbert Bay (Sound of Gigha): March 2015 to January 2016 (11 months)

Eughlam North (Loch Roag): March 2015 to November 2016 (20 months)

Furnace (Loch Fyne): April 2016 to December 2016 (9 months)

Geasgill (Loch na Keal): September 2014 to March 2016 (19 months)

Glenan Bay (Loch Fyne): October 2015 to May 2017 (20 months)

Gob a Bharra (Loch Fyne): October 2015 to June 2017 (21 months)

Gometra (Loch Tuath): August 2014 to March 2016 (20 months)

Gousam (Loch Roag): April 2015 to November 2016 (20 months)

Gravir Outer (Loch Odhaim): October 2014 to April 2016 (19 months)

Greanamul (Sound of Greanamul): March 2016 to November 2017 (21 months)

Inch Kenneth (Loch na Keal): August 2014 to March 2016 (20 months)

Kenmore Bay (Loch a Chracaich) (Loch Torridon): January 2016 to August 2017 (20 months)

Kyles Vuia East (Loch Roag): February 2015 to August 2016 (19 months)

Loch Portree (Torvaig) (Sound of Raasay): September 2014 to February 2016 (18 months)

Maragay Mor (Loch Uiskevagh): October 2016 to November 2017 (14 months)

Meall Mhor (Loch Fyne): October 2015 to March 2017 (18 months)

Mid Strome (Loch Carron): September 2014 to December 2015 (16 months)

Petersport North (Loch a Laip): April 2016 to August 2017 (17 months)

Plocrapol (East Loch Tarbert): May 2016 to May 2017 (13 months)

Quarry Point (Loch Fyne): September 2015 to April 2017 (20 months)

Reibinish (East Loch Tarbert): September 2015 to June 2017 (22 months)

Rubha Stillaig (Loch Fyne): October 2015 to April 2017 (19 months)

Scadabay (Loch Grosebay): September 2015 to April 2017 (20 months)

Sgeir Dughall (Loch Torridon): November 2016 to August 2017 (10 months)

Sgian Dubh (Loch Striven): April 2015 to September 2016 (18 months)

St Molios (Lamlash Bay): February 2016 to September 2017 (20 months)

Strondoir Bay (Loch Fyne): September 2015 to April 2017 (20 months)

Strone Point (Loch Striven): March 2015 to September 2016 (19 months)

Taranaish (Loch Roag): March 2015 to October 2016 (20 months)

Tarbert South (Loch Fyne): September 2015 to May 2017 (21 months)

Trilleachan Mor (Loch Seaforth): October 2015 to November 2016 (14 months)

Tuath (Rubha na Gall) (Loch Tuath): October 2016 to October 2017 (13 months)

Uiskevagh North (Loch Uiskevagh): March 2016 to November 2017 (21 months)

Vacasay (Loch Roag): December 2015 to September 2016 (10 months)

Vuia Beag (Loch Roag): March 2015 to August 2016 (18 months)

Vuia Mor (Loch Roag): March 2015 to November 2016 (21 months)

Scottish Sea Farms: Average time at sea = 18 months

Achintraid (Kishorn Site 1) (Loch Kishorn): August 2014 to January 2016 (18 months)

Achnacroish (Walters,Lismore East) (Lynn of Lorn): January 2016 to April 2017 (16 months)

Allt a Chois (Kishorn North Shore) (Loch Kishorn): September 2016 to November 2017 (15 months)

Ardintigh (Nevis C) (Loch Nevis): November 2014 to March 2016 (17 months)

Bellister (Dury Voe): October 2014 to April 2016 (19 months)

Bloody Bay (Sound of Mull): December 2014 to July 2016 (20 months)

Camas Doun Point (Kishorn Site 2) (Loch Kishorn): November 2016 to November 2017 (13 months)

Charlottes Bay (Kerrara B) (Firth of Lorn): March 2016 to November 2017 (21 months)

Creran A (Loch Creran): March 2014 to June 2015 (16 months)

Creran B (Loch Creran): November 2015 to March 2017 (17 months)

Dubh Sgeir (Lismore North) (Loch Linnhe): February 2016 to September 2017 (20 months)

Dunstaffnage (Firth of Lorn): April 2016 to November 2017 (20 months)

Earnsaig (Nevis A) (Loch Nevis): May 2016 to August 2017 (16 months)

Eilean Fada Mor (Summer Isles): September 2015 to February 2017 (18 months)

Fishnish A (Sound of Mull): March 2015 to October 2016 (20 months)

Fishnish B (Sound of Mull): March 2015 to November 2016 (21 months)

Fuinary (Sound of Mull): April 2015 to November 2016 (20 months)

Kishorn Outer, Offshore of Airigh-drishaig (Loch Kishorn): May 2015 to June 2016 (14 months)

Loura Voe (Site 3) (Dury Voe): September 2014 to December 2015 (16 months)

Port na Moralachd (Lismore A) (Loch Linnhe): December 2015 to July 2017 (20 months)

Port na Moralachd (Lismore B) (Loch Linnhe): April 2016 to September 2017 (18 months)

Scallastle Bay (Sound of Mull): March 2015 to November 2016 (21 months)

Shuna (Loch Linnhe): March 2016 to November 2017 (21 months)

Sian Bay (Loch Erribol): February 2016 to August 2017 (19 months)

Spelve A (Balure) (Loch Spelve): April 2017 to November 2017 (8 months)

Spelve B (Dalnaha) (Loch Spelve): April 2016 to January 2017 (10 months)

Stoull (Nevis B) (Loch Nevis): May 2016 to November 2017 (19 months)

Tanera 1 (Summer Isles): September 2015 to February 2017 (18 months)

Tanera 2 (Summer Isles): August 2015 to February 2017 (19 months)

Toy Ness (Scapa Flow): May 2014 to January 2016 (21 months)

Veantrow Bay (Stronsay Firth): November 2014 to August 2016 (22 months)

Vidlin Outer (Vidlin Voe): March 2015 to August 2016 (18 months)

Wyre (Gairsay) (Gairsay Sound): September 2015 to July 2017 (23 months)

Loch Duart: Average time at sea = 13.2 months

Badcall Site 10 (North Eilean na Bearachd) (Eddrachillis Bay): May 2016 to April 2017 (12 months)

Badcall Site 11 (Eilean Riabhach) (Eddrachillis Bay): May 2017 to April 2017 (12 months)

Calbha Site 5 (Calbha Beag) (Eddrachillis Bay): January 2016 to September 2016 (9 months)

Calbha Site 6 (East Rubh a Mhucard) (Eddrachillis Bay): June 2017 to September 2017 (4 months)

Calbha Site 7 (North Calba Bay) (Eddrachillis Bay): September 2015 to April 2016 (8 months)

Caolas Loch Portain (Loch Maddy): April 2014 to February 2016 (21 months)

Droighniche (Eddrachillis Bay): September 2016 to June 2017 (10 months)

Drumbeg (Loch Dhrombaig) (Eddrachillis Bay): September 2016 to June 2017 (10 months)

Eilean Ard (Laxford Site 3) (Loch Laxford): October 2014 to December 2015 (15 months)

Eilean a Mhadaidh (Laxford Site 2) (Loch Laxford): October 2014 to May 2016 (20 months)

Ferramus (Loch Maddy): July 2015 to January 2016 (7 months)

Foindle East (Laxford Site 1) (Loch Laxford): October 2014 to December 2015 (15 months)

Nedd (Eddrachillis Bay): April 2015 to September 2015 (6 months)

Oldany (Eddrachillis Bay): March 2016 to July 2017 (17 months)

Reintraid (Loch a Chairn Bhain): January 2016 to December 2016 (12 months)

Sandavaig (South Ford) (Bagh Nam Faolean): October 2016 to September 2017 (12 months)

Sound of Harris (Groay-Lingay) (Sound of Harris): April 2015 to March 2017 (24 months)

South Ford (Gashernish) (Bagh Nam Faolean): March 2013 to November 2014 (21 months)

South Ford East (Gashernish East) (Bagh Nam Faolean): September 2013 to November 2014 (15 months)

Torgawn (Loch a Chairn Bhain): January 2016 to February 2017 (14 months)

Grieg Seafood: Average time at sea = 19.1 months

Bight of Foraness (Swinnister Voe): April 2015 to October 2016 (19 months)

Corlarach (Loch Dunvegan): September 2015 to May 2017 (21 months)

East of Papa Little (Swarbacks Minn): August 2014 to January 2016 (18 months)

Hamnavoe, Lunnaness (Off Lunnaness): July 2015 to September 2016 (15 months)

Leinish Bay (Loch Dunvegan): September 2015 to June 2017 (22 months)

Linga (South of Linga) (Yell Sound): April 2015 to December 2016 (21 months)

North Voe (Linga Sound): August 2014 to May 2016 (22 months)

Setterness North (Off Lunnaness): February 2015 to July 2016 (18 months)

Swining Voe Site 3 (Collafirth Ness) (Swinning Voe): March 2015 to August 2016 (18 months)

Taing of Railsborough (Cat Firth): October 2015 to February 2017 (17 months)

Cooke Aquaculture: Average time at sea = 13.5 months

Bastaness (Hascosay Sound): April 2016 to August 2016 (5 months)

Bay of Cleat North (Papa Sound): March 2015 to January 2017 (22 months)

Bay of Meil (Shapinsay Sound): February 2016 to December 2016 (11 months)

Bay of Vady (Rousay Sound): March 2017 to September 2017 (7 months)

Bow of Hascosay (Hascosay Sound): March 2014 to December 2015 (22 months)

Burrastow (Vaila Sound): May 2016 to April 2017 (12 months)

Carness Bay (The String): April 2017 to September 2017 (6 months)

Cava South (Scapa Flow): November 2016 to June 2017 (8 months)

Chalmers Hope (Scapa Flow): August 2016 to March 2017 (8 months)

Cloudin (Vaila Sound): September 2015 to June 2017 (22 months)

Djuba Wick (Colgrave Sound): April 2013 to February 2015 (23 months)

Flaeshins (Colgrave Sound): April 2015 to November 2016 (20 months)

Kirk Noust (Rousay Sound): November 2016 to April 2017 (6 months)

Lyrawa Bay (Scapa Flow): November 2016 to July 2017 (9 months)

Ness of Copister (Hamna Voe, Yell): February 2015 to December 2016 (23 months)

North Sandwick (Bluemull Sound): April 2015 to January 2016 (10 months)

Ouse Ness (Papa Sound): December 2016 to September 2017 (10 months)

Quanterness (West Shargun Shoal) (Wide Firth): December 2016 to July 2017 (8 months)

Stead of Aithness (Aith Voe): November 2014 to July 2016 (21 months)

Turness (Skuda Sound): October 2014 to September 2015 (12 months)

Uyea Isle (Uyea Sound): September 2015 to June 2017 (22 months)

West Fara (Scapa Flow): September 2016 to June 2017 (10 months)

2002-2007 data:

Overall Industry Average = 20.1 months

Grieg Seafood: Average time at sea = 19.4 months
Loch Duart: Average time at sea = 19.9 months
Scottish Sea Farms: Average time at sea = 20.3 months
Cooke Aquaculture: Average time at sea = 20.3 months
Marine Harvest: Average time at sea = 20.5 months

Marine Harvest: Average time at sea = 20.5 months

Arbhair (Loch Leurbost) (formerly Lewis Salmon): November 2002 to August 2004 (22 months)

Ardintoul (Loch Alsh): March 2003 to January 2005 (23 months)

Bunavoneader Inner (Ardhasaig) (West Loch Tarbert): November 2003 to August 2005 (22 months)

Cairidh (Loch Ainort): December 2004 to October 2006 (23 months)

Callert (Loch Leven): February 2004 to November 2005 (22 months)

Camas an Leim (Torridon) (Loch Torridon): April 2004 to December 2005 (21 months)

Camus Glas (Loch Sunart): February 2005 to November 2006 (22 months)

Duich (Loch Duich): March 2003 to December 2004 (22 months)

Eishort (Loch Eishort): April 2003 to March 2005 (24 months)

Geo Beag (West Loch Tarbert): November 2003 to July 2005 (21 months)

Gorsten (Loch Linnhe): February 2004 to November 2005 (22 months)

Greshornish (Loch Greshornish): November 2004 to August 2016 (22 months)

Hole Bay (Loch Sheilaviag): January 2002 to September 2003 (21 months)

Invasion Bay (Loch Sunart): February 2005 to December 2006 (23 months)

Kingairloch (Loch a Choire) (Loch Linnhe): March 2004 to November 2005 (21 months)

Lemreway (Shell Outer) (Loch Shell): March 2005 to June 2006 (16 months)

Maol Ban (Inner Sound): July 2005 to October 2006 (16 months)

Mid Loch Shell /Pairc - East (C & D cage groups) (Loch Shell): January 2003 to August 2004 (20 months)

Mid Loch Shell /Pairc - West (A & B cage groups) (Loch Shell): October 2002 to August 2004 (23 months)

North Bay (Loch Sheilavaig): January 2002 to September 2003 (21 months)

North Channel (Loch Sheilavaig): March 2004 to July 2005 (17 months)

Noster (Loch Seaforth) (formerly Stolt Sea Farm): March 2003 to October 2004 (20 months)

Pecam Bay (Loch Erisort) (formerly Stolt Sea Farm): July 2005 to August 2006 (14 months)

Poll na Gille (Sound of Jura) (formely Pan Fish): March 2003 to July 2004 (17 months)

Port na Cro (Shuna Sound) (formerly Lakeland Marine): November 2002 to June 2004 (20 months)

Rossay (East Loch Tarbert) (formerly Stolt Sea Farm): March 2004 to February 2006 (24 months)

Sconser (Balmeanach Bay) (Sound of Raasay): December 2002 to October 2004 (23 months)

Scotasay (East Loch Tarbert) (formerly Stolt Sea Farm): March 2004 to December 2005 (22 months)

Seaforth (Loch Seaforth) (formerly Stolt Sea Farm): March 2003 to October 2004 (20 months)

Sgeir Bhuidhe (Loch Erisort) (formerly Stolt Sea Farm): December 2002 to June 2004 (19 months)

Skipport (Outer) (Loch Skipport): July 2003 to June 2005 (24 months)

Soay Sound (West Loch Tarbert): January 2002 to August 2003 (20 months)

Sron (Loch Alsh): April 2003 to December 2004 (21 months)

Stattic Point (Little Loch Broom): December 2003 to November 2005 (24 months)

Tarner Island (Loch Bracadale) (formerly Stolt Sea Farm): February 2003 to April 2004 (15 months)

Vacassay (N.Uist) (Sound of Harris) (formerly Stolt Sea Farm): April 2004 to March 2005 (12 months)

West Loch Bracadale (Bharcasaig) (Loch Bracadale) (formerly Stolt Sea Farm): April 2003 to September 2004 (18 months)

Scottish Sea Farms: Average time at sea = 20.3 months

Achintraid (Kishorn Site 1) (Loch Kishorn): September 2002 to July 2004 (23 months)

Achnacroish (Walters,Lismore East) (Lynn of Lorn): July 2002 to December 2003 (18 months)

Allt a Chois (Kishorn North Shore) (Loch Kishorn): November 2002 to August 2004 (22 months)

Binna Ness (Stromness Voe) (formerly Slett Salmon): April 2003 to February 2005 (23 months)

Bloody Bay (Sound of Mull): April 2003 to December 2004 (21 months)

Brei Geo Inshore (Sandsound Voe): January 2002 to October 2003 (22 months)

Brei Geo Offshore (Sandsound Voe): January 2002 to February 2004 (26 months)

Bring Head (Hoy) (Scapa Flow) (formerly Orkney Sea Farms): March 2004 to December 2005 (22 months)

Camas Doun Point (Kishorn Site 2) (Loch Kishorn): October 2004 to July 2006 (22 months)

Charlottes Bay (Kerrara B) (Firth of Lorn): July 2002 to December 2003 (19 months)

Creran A (Loch Creran): July 2002 to December 2003 (18 months)

Creran B (Loch Creran): February 2004 to December 2005 (23 months)

Dubh Sgeir (Lismore North) (Loch Linnhe): October 2002 to November 2003 (14 months)

Dunstaffnage (Firth of Lorn): July 2002 to December 2003 (18 months)

Earnsaig (Nevis A) (Loch Nevis): April 2003 to February 2005 (23 months)

East of Burra Ness: March 2002 to April 2004 (26 months)

Eday Sound (Noust Geo) (formerly Orkney Sea Farms): August 2004 to December 2006 (29 months)

Eilean Fada Mor (Summer Isles): September 2003 to May 2005 (21 months)

Fishnish A (Sound of Mull): February 2003 to November 2004 (22 months)

Fishnish B (Sound of Mull): February 2003 to July 2004 (18 months)

Fiunary (Sound of Mull): March 2003 to November 2004 (21 months)

Flotta (Weisdale Voe): April 2003 to November 2004 (20 months)

Foreholm (Sandsound Voe): May 2002 to February 2004 (22 months)

Kempie Bay (Loch Erribol) (formerly Pan Fish): September 2002 to April 2004 (20 months)

Loura Voe (Site 3) (formerly Dury Salmon): March 2003 to October 2003 (8 months)

Mangaster Voe Inner (formerly D & J Salmon): March 2003 to March 2005 (25 months)

North of Hoy (Weisdale Voe): October 2002 to August 2004 (23 months)

Oban Bay (Ardentraive, Kerrera A) (Sound of Kerrera): July 2002 to October 2003 (16 months)

Pobie Sukka (Site A) (Ronas Voe) (formerly MJM Salmon): August 2004 to May 2005 (10 months)

Port na Moralachd (Lismore A) (Loch Linnhe): July 2002 to November 2003 (17 months)

Port nan Ledaig (Lismore B) (Loch Linnhe): March 2004 to November 2005 (21 months)

Puldrite Bay (Wide Firth) (formerly Orkney Sea Farms): February 2003 to February 2005 (25 months)

Scallastle Bay (Sound of Mull): February 2003 to August 2004 (19 months)

Shuna (Loch Linnhe): February 2004 to December 2005 (23 months)

Sian Bay (Loch Erribol) (formerly Pan Fish): May 2003 to September 2004 (17 months)

Spelve A (Balure) (Loch Spelve): December 2003 to July 2005 (20 months)

Spelve B (Dalnaha) (Loch Spelve): November 2003 to June 2005 (20 months)

Stoull (Nevis B) (Loch Nevis): April 2003 to February 2005 (23 months)

Tanera 1 (Summer Isles): October 2003 to June 2005 (21 months)

Tanera 2 (Summer Isles): May 2004 to June 2005 (14 months)

Toy Ness (Scapa Flow) (formerly Orkney Sea Farms): January 2003 to July 2004 (19 months)

Loch Duart: Average time at sea = 19.9 months

Badcall Site 10 (North Eilean na Bearachd) (Eddrachillis Bay): April 2004 to January 2006 (22 months)

Badcall Site 11 (Eilean Riabhach) (Eddrachillis Bay): April 2004 to December 2005 (21 months)

Badcall Site 9 (North Rubha Geisgil) (Eddrachillis Bay): October 2004 to May 2006 (20 months)

Calbha Site 5 (Calbha Beag) (Eddrachillis Bay): October 2003 to May 2005 (20 months)

Calbha Site 6 (East Rubh a Mhucard) (Eddrachillis Bay): April 2003 to January 2005 (22 months)

Calbha Site 7 (North Calba Bay) (Eddrachillis Bay): April 2003 to February 2005 (23 months)

Drumbeg (Loch Dhrombaig) (Eddrachillis Bay) (formerly Ardvar Salmon): October 2002 to September 2003 (12 months)

Eilean Ard (Laxford Site 3) (Loch Laxford): October 2002 to January 2004 (16 months)

Eilean a Mhadaidh (Laxford Site 2) (Loch Laxford): April 2005 to February 2007 (23 months)

Ferramus (Loch Maddy) (formerly Stolt Sea Farm): December 2002 to May 2004 (19 months)

Foindle East (Laxford Site 1) (Loch Laxford): October 2002 to April 2004 (19 months)

Nedd (Eddrachillis Bay) (formerly Drumbeg Salmon): April 2004 to December 2005 (21 months)

Oldany (Eddrachillis Bay) (formerly Ardvar Salmon): March 2002 to February 2004 (24 months)

Reintraid (Loch a Chairn Bhain) (formerly Drumbeg Salmon): September 2003 to December 2004 (16 months)

Sandavaig (South Ford) (Bagh Nam Faolean) (formerly Marine Harvest): December 2002 to January 2004 (14 months)

South Ford (Gashernish) (Bagh Nam Faolean) (formerly Marine Harvest): April 2004 to January 2006 (22 months)

Torgawn (Loch a Chairn Bhain) (formerly Drumbeg Salmon & Ardvar Salmon): April 2003 to March 2005 (24 months)

Grieg Seafood: Average time at sea = 19.4 months

Bight of Foraness (Swinnister Voe) (formerly Ayre Salmon): November 2002 to November 2004 (25 months)

Boatsroom Voe (formerly Setter Ness Salmon): April 2002 to February 2006 (23 months)

Brindister Crossroads (Clousta Voe) (formerly Westside Salmon): October 2002 to June 2004 (21 months)

Brindister Voe (formerly Westside Salmon): June 2002 to February 2004 (21 months)

Collafirth Delting Site 2 (Colla Firth) (formerly Collafirth Salmon): July 2004 to May 2005 (11 months)

Collafirth Delting Site 3 (Colla Firth) (formerly Collafirth Salmon): November 2003 to April 2005 (18 months)

Easter Score Holm (The Deeps) (formerly Cro Lax): May 2004 to February 2006 (23 months)

Leinish Bay (Loch Dunvegan) (formerly Glendale Salmon): November 2003 to August 2005 (22 months)

Linga (South of Linga) (Yell Sound) (formerly Ayre Salmon): April 2002 to January 2004 (22 months)

Muckle Roe East (Heights) (Busta Voe) (formerly Scord Salmon): April 2002 to February 2004 (23 months)

North Havra (The Deeps) (formerly Wast Banks Salmon): October 2003 to August 2005 (23 months)

North of Papa (The Deeps) (formerly North Atlantic Seafarms): May 2003 to March 2005 (23 months)

Papa, East Head of Scalloway (The Deeps) (formerly Punds Voe Salmon): October 2002 to August 2004 (23 months)

Roe Sound (formerly Scord Salmon): February 2003 to January 2004 (12 months)

Setter Voe (The Deeps) (formerly G Duncan Salmon): May 2004 to February 2006 (22 months)

Setterness East (Bomlo) (Off Lunnaness): March 2004 to January 2006 (23 months)

Setterness South (Off Lunnaness): March 2005 to December 2006 (22 months)

Spoose Holm (Oxna) (The Deeps) (formerly G Duncan): May 2005 to February 2007 (24 months)

Swining Voe Site 3 (Collafirth Ness) (Swinning Voe) (formerly Sweening Salmon): April 2002 to November 2003 (20 months)

Swinnister Voe (formerly Ayre Salmon): January 2002 to September 2003 (21 months)

Taing of Railsborough (Cat Firth) (formerly Wadbister Salmon): October 2003 to June 2005 (21 months)

Wadbister Inshore (Wadbister Voe): October 2003 to April 2005 (19 months)

West of Burwick (Bur Wick) (formely Hoove Salmon): March 2003 to October 2004 (20 months)

Cooke Aquaculture: Average time at sea = 20.3 months

Basta Voe North West (Kirkabister) (Basta Voe) (formerly Thompson Bros): April 2003 to January 2005 (22 months)

Basta Voe South (Basta Voe) (formerly Mainstream): April 2003 to October 2004 (19 months)

Bay of Cleat (Papa Sound) (formerly Westray Salmon): June 2002 to June 2004 (25 months)

Bay of Cleat North (Papa Sound) (formerly Westray Salmon): May 2004 to May 2006 (25 months)

Bay of Ham (Rousay Sound) (formerly Aquascot): April 2003 to November 2003 (8 months)

Bay of Meil (Shapinsay Sound) (formerly Mainstream): November 2002 to April 2004 (18 months)

Bay of Vady (Rousay Sound) (formerly Mainstream): March 2005 to February 2007 (24 months)

Bow of Hascosay (Hascosay Sound) (formerly Aquascot): July 2002 to December 2003 (18 months)

Bunya Sand (Mid Yell Voe) (formerly Aquascot): October 2002 to December 2003 (15 months)

Carness Bay (The String) (formerly Mainstream): October 2003 to October 2004 (13 months)

Chalmers Hope (Scapa Flow) (formerly Mainstream): March 2004 to March 2006 (25 months)

Cloudin (Vaila Sound) (formerly Hoganess Salmon): December 2003 to July 2005 (20 months)

Djuba Wick (Colgrave Sound) (formerly Mainstream): March 2003 to November 2004 (21 months)

Hogan (Site 1) (Gruting Voe) (formerly Hoganess Salmon): January 2003 to July 2004 (19 months)

Mid Taing (Gruting Voe) (formerly Hoganess Salmon): April 2004 to June 2005 (15 months)

Mid Yell Voe (formerly Mainstream): September 2004 to March 2006 (19 months)

North Sandwick (Bluemull Sound) (formerly Thompson Bros) : May 2004 to November 2005 (19 months)

Ore Bay (Scapa Flow) (formerly Mainstream): March 2003 to January 2005 (23 months)

Quanterness (West Shargun Shoal) (Wide Firth) (formerly Mainstream): April 2003 to October 2004 (19 months)

South of Holm of Heogland (Site 4) (Bluemull Sound) (formerly Lakeland Unst): March 2003 to June 2004 (16 months)

Stead of Aithness (Aith Voe) (formerly Mainstream): October 2003 to May 2005 (20 months)

Turness (Skuda Sound) (formerly Lakeland Unst): October 2002 to July 2004 (22 months)

West Fara (Scapa Flow) (formerly Mainstream): July 2004 to June 2005 (12 months)

Wick of Garth (Bluemull Sound) (formerly Lakeland Unst): April 2004 to November 2006 (30 months)

Wick of Vatsetter (Colgrave Sound) (Mainstream): April 2004 to December 2005 (21 months)