Media Backgrounder, 2 October 2023

Scottish Salmon is Dead in the Warming Water!

On 4 October 2023, the Scottish Government will publish the 'Scottish Fish Farming Production Survey 2022' online via https://www.gov.scot/collections/scottish-fish-farm-production-surveys/

From: Lorna.Munro@gov.scot
Date: Mon, 4 Sept 2023, 15:44
Subject: RE: Date for 2022 fish farm production survey?
To: <salmonfarmingkills@gmail.com>

Hi Don

Just to let you know the 2022 production survey will be published at 9.30am on Wednesday 4th October.

Best regards

Lorna

As background to the forthcoming survey, we can expect a significant decline in salmon farming production. The 'Scottish Fish Farm Production Survey 2021' – published in October 2022 - predicted an 8% fall in salmon farming production in 2022 to 189,693 tonnes (just lower than the level in 2017) and it will give a prediction for 2023 (which could be even lower than 2022):

Table 24: Annual production of salmon (tonnes) 2001-2021 and projected production in 2022

Year	Tonnes	Percentage difference	Year	Tonnes	Percentage difference
2001	138,519	7	2012	162,223	3
2002	144,589	4	2013	163,234	1
2003	169,736	17	2014	179,022	10
2004	158,099	-7	2015	171,722	-4
2005	129,588	-18	2016	162,817	-5
2006	131,847	2	2017	189,707	17
2007	129,930	-1	2018	156,025	-18
2008	128,606	-1	2019	203,881	31
2009	144,247	12	2020	192,129	-6
2010	154,164	7	2021	205,393	7
2011	158,018	3	2022	189,693*	

*industry estimate of projected tonnage based on stocks currently being on-grown.

The total production of Atlantic salmon during 2021 was 205,393 tonnes, an increase of 13,264 tonnes (7%) on the 2020 total. This was the highest level of production recorded in Scotland.

The new 2022 production survey will also update survival (i.e. mortality) data for the 2020 smolt year class – the latest data for 2019 published via the 'Scottish Fish Farm Production Survey 2021' showed 74.4% survival (i.e. 25.6% mortality):

Survival and Production in Smolt Year Classes

Table 28: Survival and production in smolt year classes during 2002-2021

Year of smolt input	Smolt input (000's)	Harvest year 0				Harvest year 1				Harvest year 2				Total % of year class harvested (survival)	Year class weight (tonnes)	Yield per smolt (kg)
		Number (000's)	Weight (tonnes)	Mean weight (kg)	% harvest	Number (000's)	Weight (tonnes)	Mean weight (kg)	% harvest	Number (000's)	Weight (tonnes)	Mean weight (kg)	% harvest			
2002	50,086	272	824	3.0	0.5	22,602	96,205	4.3	45.1	15,555	71,988	4.6	31.1	76.7	169,017	3.37
2003	43,083	82	276	3.4	0.2	19,596	85,792	4.4	45.5	13,920	61,850	4.4	32.3	78.0	147,918	3.43
2004	39,041	168	319	1.9	0.4	15,075	67,738	4.5	38.6	14,237	67,537	4.7	36.5	75.5	135,594	3.47
2005	37,168	0	0	-	0	14,036	64,099	4.6	37.8	14,999	69,000	4.6	40.3	78.1	133,099	3.58
2006	41,091	115	211	1.8	0.3	13,787	60,890	4.4	33.5	15,881	73,631	4.6	38.6	72.5	134,732	3.28
2007	37,853	23	40	1.7	0.06	13,011	54,759	4.2	34.4	14,133	66,448	4.7	37.3	71.8	121,247	3.20
2008	36,662	116	216	1.9	0.3	16,338	77,621	4.7	44.6	13,666	68,070	5.0	37.3	82.2	145,907	3.98
2009	38,548	81	178	2.2	0.2	18,266	85,826	4.7	47.4	13,772	66,606	4.8	35.7	83.3	152,610	3.96
2010	38,490	128	268	2.1	0.3	18,694	91,105	4.9	48.6	13,053	64,178	4.9	33.9	82.8	155,551	4.04
2011	42,733	109	307	2.8	0.3	21,502	97,744	4.5	50.3	11,283	57,073	5.1	26.4	77.0	155,124	3.63
2012	41,094	127	301	2.4	0.3	21,264	106,161	5.0	51.7	13,712	76,305	5.6	33.4	85.4	182,767	4.45
2013	40,936	0	0	-	0	20,316	101,997	5.0	49.6	10,910	56,984	5.2	26.7	76.3	158,981	3.88
2014	48,112	286	720	2.5	0.6	24,038	114,112	4.7	50.0	10,940	51,321	4.7	22.7	73.3	166,153	3.45
2015	45,465	223	626	2.8	0.5	24,633	111,163	4.5	54.2	11,094	63,262	5.7	24.4	79.1	175,051	3.85
2016	42,957	114	333	2.9	0.3	25,596	126,445	4.9	59.6	7,165	45,224	6.3	16.7	76.6	172,002	4.00
2017	46,116	0	0	-	0	21,825	110,554	5.1	47.3	12,212	70,860	5.8	26.5	73.8	181,414	3.93
2018	45,513	84	247	2.9	0.2	26,324	132,090	5.0	57.8	8,883	49,146	5.5	19.5	77.5	181,483	3.99
2019	52,990	319	931	2.9	0.6	28,529	141,775	5.0	53.8	10,602	60,664	5.7	20.0	74.4	203,370	3.84
2020	52,492	323	1,208	3.7	0.6	29,697	144,695	4.9	56.6							
2021	51,131	16	34	2.1	0.03											

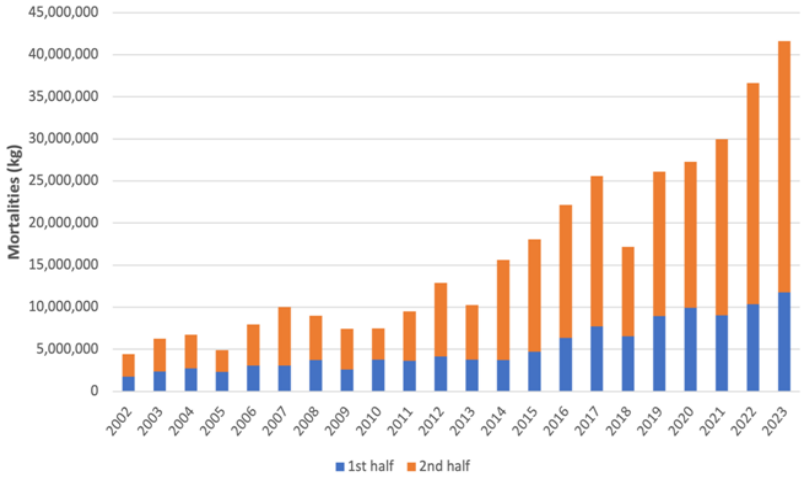
All the available mortality data for 2021, 2022 and 2023 points to even lower survival rates (i.e. higher mortality) for future year classes.

See 'Appendix: Scottish Salmon – the King of Death in 2023' enclosed below for more specific predictions based upon mortality data published by SEPA, Salmon Scotland, the Scottish Government and Mowi.

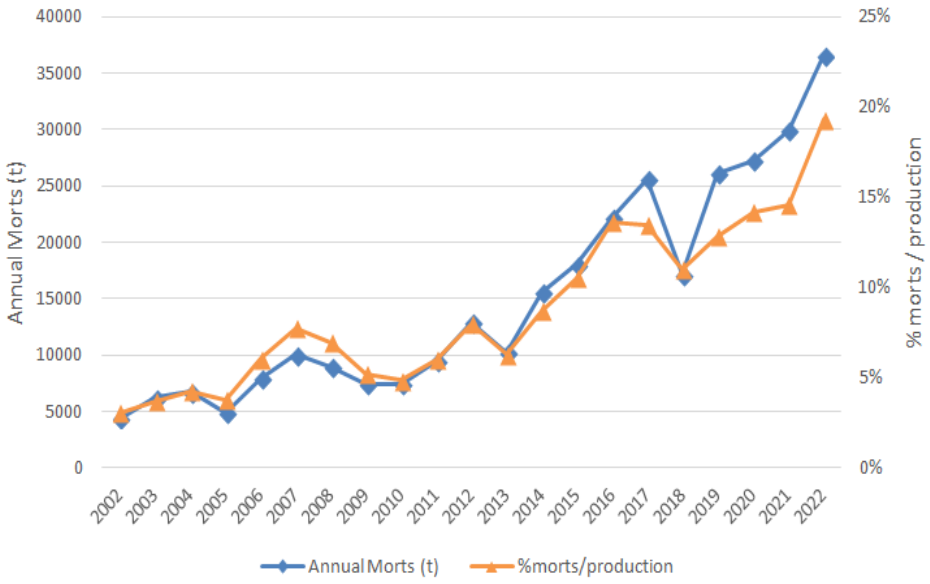
In simple terms, there is ample evidence to suggest 2023 will be the worst year on record for mortalities on salmon farms in Scotland.

Government Evidence of Rising Mortalities (& Rising Temperatures):

The Scottish Environment Protection Agency (SEPA) publishes mortality data by weight online via 'Scotland's Aquaculture' with 2022 the worst year on record at over 36,000 tonnes of morts and 2023 set to surpass 41,000 tonnes (see Appendix below for more detailed analysis).

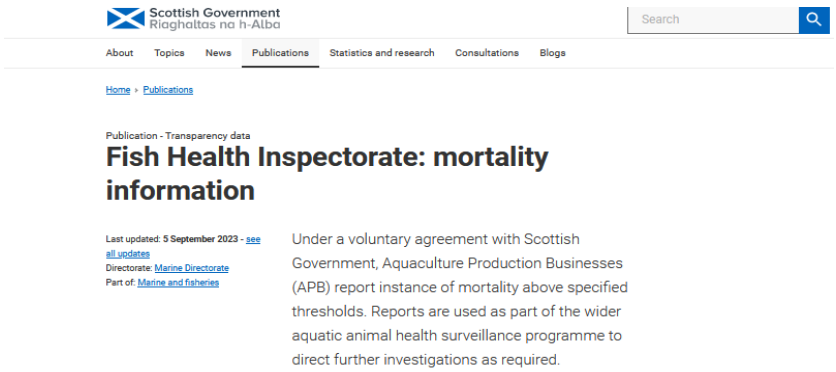


Nor is the trend of rising mortalities solely related to increasing salmon farming production – the mortality rate per tonne of production has sky-rocketed over the last two decades:



Increases in mortalities on salmon farms have been correlated with rising water temperatures. "At salmon farms, a strong link between milder winter temperatures, disease and increased fish mortality has been identified," reported a 'Marine Climate Change Impacts Partnership' paper co-authored by Marine Scotland Science and the Institute of Aquaculture in Stirling published in November 2022. "We have statistical evidence of an existing association of salmon mortality with milder winters and evidence of the emergence of amoebic gill disease in UK waters in association with warm summers and persistence with mild winters."

The Scottish Government publishes mortality data online with the latest published on 5 September 2023 (although not all mortalities are included – only 'Mortality Event Reports' above a certain threshold are reported to the Fish Health Inspectorate so the data is "not a comprehensive record of fish farm mortality").



The top twenty 'Mortality Event Reports' in 2023 (data up to early August) for all salmon farms features mostly land-based hatcheries but includes Organic Sea Harvest which reported 72.5% mortality at Culnacnoc salmon farm off the Isle of Skye with 346,226 morts and another 95,212 morts at 17.5% mortality reported in January 2023:

Mortality Event No	Business Name	Site Name	Date reported	Mort %	Explained reasons	Mort #s
MRT04207	Mowi Scotland Ltd	Inchmore	10/08/2023	36.21	Event Mortality	1,135,167
MRT03956	Bakkafrost Scotland	Applecross Hatchery	22/05/2023	27.73	Water Quality	797014
MRT03758	Mowi Scotland Ltd	Inchmore	20/01/2023	10.51	Unviable Eggs	455358
MRT04185	Mowi Scotland Ltd	Inchmore	03/08/2023	10.54	Poor genetics	421,796
MRT04079	Mowi Scotland Ltd	Lochailort Recirculation Hatchery	06/07/2023	3.39	Unviable Eggs & Alvin	346226
MRT03765	Organic Sea Harvest	Culnacnoc Salmon Farm	23/01/2023	72.52	AGD	325551
MRT03783	Bakkafrost Scotland	Geocrab Hatchery	30/01/2023	7.46	Ova mortality following transfer from supplier	237012
MRT03941	Mowi Scotland Ltd	Inverpolly	16/05/2023	7.58	RTFS	217641
MRT03976	Bakkafrost Scotland	Applecross Hatchery	29/05/2023	10.42	Water Quality	216330
MRT04231	Bakkafrost Scotland	Applecross Smolt Unit 2	14/08/2023	31.06	Stock Incident;	213,823
MRT03939	Bakkafrost Scotland	Applecross Hatchery	15/05/2023	6.04	Fungus	184728
MRT04184	Mowi Scotland Ltd	Inchmore	03/08/2023	9.39	Poor genetics	172,726
MRT03979	Mowi Scotland Ltd	Inverpolly	30/05/2023	7.53	RTFS	169704
MRT03957	Mowi Scotland Ltd	Inverpolly	23/05/2023	6.05	RTFS	159979
MRT03729	Mowi Scotland Ltd	Lochailort Recirculation Hatchery	12/01/2023	9.2	Unviable eggs	137970
MRT03830	Bakkafrost Scotland	Applecross Hatchery	27/02/2023	3.93	Fungus	124528
MRT04061	Mowi Scotland Ltd	Inverpolly	30/06/2023	6.23	Suspected parasitic challenge, water temperatures were too high to perform treatments (25oC)	121649
MRT03975	Bakkafrost Scotland	Couldoran Hatchery	29/05/2023	4.77	Stock Incident	98988
MRT03995	Bakkafrost Scotland	Couldoran Hatchery	05/06/2023	4.96	Development	97494
MRT03764	Organic Sea Harvest	Culnacnoc Salmon Farm	23/01/2023	17.5	AGD	95212

The top twenty 'Mortality Event Reports' in 2023 (data up to early August) for sea cage salmon farms only is headed by Organic Sea Harvest and features Bakkafrost, Mowi and Scottish Sea Farms:

Mortality Event No	Business Name	Site Name	Date reported	Mort %	Explained reasons	Mort #s
MRT03765	Organic Sea Harvest Ltd.	Culnacnoc Salmon Farm	23/01/2023	72.52	AGD	325551
MRT03764	Organic Sea Harvest Ltd.	Culnacnoc Salmon Farm	23/01/2023	17.5	AGD	95212
MRT04202	Bakkafrost Scotland	Geasgill	07/08/2023	14.93	Gill health related; Viral Disease (PD)	85,914
MRT03766	Organic Sea Harvest Ltd.	Culnacnoc Salmon Farm	23/01/2023	46.43	AGD	57276
MRT04224	Bakkafrost Scotland	Gravir	14/08/2023	10.02	Gill Health Related	56,048
MRT03914	Scottish Sea Farms Ltd	Sian Bay	04/05/2023	20.2	Bacterial Disease	55403
MRT04174	Bakkafrost Scotland	Geasgill	31/07/2023	8.02	Viral Disease (PD); Gill Health related	53,901
MRT04132	Mowi Scotland Ltd	Creag an T'Sagairt (Loch Hourn)	19/07/2023	6.16	Gill infections / CMS	49,907
MRT04229	Bakkafrost Scotland	Geasgill	14/08/2023	11.01	Gill Health Related	49,593
MRT04197	Bakkafrost Scotland	Gravir	07/08/2023	8.05	Viral Disease (PD/PRV); Gill Health Related	48,999
MRT03748	Scottish Sea Farms Ltd	Easter Score Holms	20/01/2023	6.8	Gill health related	43880
MRT04113	Bakkafrost Scotland	Gravir	17/07/2023	5.81	Viral Disease (PD); Gill Health Related	41,048
MRT04170	Bakkafrost Scotland	Gravir	31/07/2023	6.3	Viral Disease (PD/PRV); Gill Health related	40,886
MRT03700	Scottish Sea Farms Ltd	Shuna point	06/01/2023	7.9	Gill health Related	35125
MRT04035	Mowi Scotland Ltd	Linnhe	20/06/2023	3.54	HSMI	34660
MRT03958	Mowi Scotland Ltd	Creag an T'Sagairt (Loch Hourn)	23/05/2023	3.01	Thermolicer	31099
MRT03844	Scottish Sea Farms Ltd	Lismore West	10/03/2023	8.2	Handling; Bacterial disease	28592
MRT04059	Mowi Scotland Ltd	Linnhe	30/06/2023	3.01	HSMI	28394
MRT04190	Scottish Sea Farms Ltd	Kishorn B (North)	03/08/2023	8	Environmental; Gill Health	27,463
MRT03735	Scottish Sea Farms Ltd	Easter Score Holms	13/01/2023	3.9	Gill Health Related	26320

Of nearly 4,000 'Mortality Event Reports' filed since 2015 (in both freshwater and seawater), the biggest incident at over 1.5 million morts was Bakkafrost's Applecross Hatchery in September 2022 with four out of the top ten incidents being reported in 2023:

Mortality Event No	Business Name	Site Name	Date reported	Mortality %	Explained reasons	Mort #s
MRT03186	The Scottish Salmon Company	Applecross Hatchery	05/09/2022	53.33	Water Quality	1,576,522
MRT00964	Mowi Scotland Ltd	Lochailort Recirculation Hatchery	23/03/2019	50	Human error	1,521,479
MRT03650	Bakkafrost Scotland	Couldoran Incubation Unit	19/12/2022	80	Stock Incident - inlet pipe became blocked and created a vortex, which supersaturated the comphatch water.	1,159,752
MRT04207	Mowi Scotland Ltd	Inchmore	10/08/2023	36.21	Event Mortality	1,135,167
MRT03956	Bakkafrost Scotland	Applecross Hatchery	22/05/2023	27.73	Water Quality	797,014
MRT00744	Marine Harvest (Scotland) Ltd	Inchmore	21/08/2018	28	Oxygen supply failure	520,171
MRT00098	Cooke Aquaculture Scotland Ltd	Cliff Site	22/07/2016	100	Cyanobacteria bloom	520,000
MRT03758	Mowi Scotland Ltd	Inchmore	20/01/2023	10.51	Unviable Eggs	455,358
MRT00256	Cooke Aquaculture (Freshwater) Ltd	Furnace (FW)	21/06/2017	46.8	Salmon gill pox	444,787
MRT04185	Mowi Scotland Ltd	Inchmore	03/08/2023	10.54	Poor genetics	421,796

Of nearly 4,000 ‘Mortality Event Reports’ filed since 2015, the biggest incident in seawater was Organic Sea Harvest’s Culnacnoc salmon farm in January 2023 with Amoebic Gill Disease cited as the reason for mortality (other reasons cited include sea lice, algal blooms, jellyfish, Rickettsia, physical damage, viral disease, Pancreas Disease, Pasteurella skyensis, bacterial infection, Vibrio, Moritella and treatment):

Mortality Event No	Business Name	Site Name	Date reported	Mortality %	Explained reasons	Mort #s
MRT03765	Organic Sea Harvest Ltd.	Culnacnoc Salmon Farm	23/01/2023	72.52	AGD	325,551
MRT00038	Grieg Seafood Shetland Ltd	Cole Deep	15/12/2015	62.1	AGD, Sea lice	279,523
MRT00128	The Scottish Salmon Company	Ardgadden	11/10/2016	20.11	AGD, Algal bloom	221,922
MRT02536	The Scottish Salmon Company	Druimyeon Bay	25/10/2021	47.60	Gill Health Related	148,628
MRT03562	Mowi Scotland Ltd	Bagh Dail Nan Cean	23/11/2022	16.99	Rickettsia	148,460
MRT00659	Marine Harvest (Scotland) Ltd	Eilean Grianain	08/06/2018	16.69	Physical damage	140,488
MRT03320	Mowi Scotland Ltd	Marulaig Bay	29/09/2022	21.22	Gill infections / Jellyfish	139,023
MRT02671	The Scottish Salmon Company	Taranaish	06/12/2021	28.73	Gill Health Related	129,650
MRT03589	Mowi Scotland Ltd	Bagh Dail Nan Cean	01/12/2022	17.88	Rickettsia	128,114
MRT03525	Mowi Scotland Ltd	Bagh Dail Nan Cean	14/11/2022	12.66	Rickettsia	126,650
MRT03265	Mowi Scotland Ltd	Stulaigh	22/09/2022	19.5	Gill infections	126,642
MRT02498	The Scottish Salmon Company	East Tarbert Bay	12/10/2021	20	Gill Health Related, Environment	120,580
MRT02526	The Scottish Salmon Company	Druimyeon Bay	18/10/2021	21.96	Gill Health Related	116,680
MRT01754	Grieg Seafood Shetland Ltd	Leinish	18/08/2020	27.65	Complex gill disease and jellyfish	107,700
MRT03086	The Scottish Salmon Company	East Tarbert Bay	08/08/2022	7.73	Environment (Water Quality); Sea Lice related (Post-bath treatment)	105,355
MRT02459	Mowi Scotland Ltd	Grey Horse Channel Outer	04/10/2021	9.19	AGD	104,249
MRT01548	Grieg Seafood Shetland Ltd	Taing of Railsbrough Catfirth	19/02/2020	13.55	Bacterial infection (Moritella & Vibrio)	103,614
MRT01784	The Scottish Salmon Company	Sgian Dubh	27/08/2020	39.55	Water quality/Plankton/Gill Health	102,344
MRT03105	The Scottish Salmon Company	East Tarbert Bay	15/08/2022	8.12	Environment (Water Quality); Physical damage (Caligus)	102,008
MRT03254	Mowi Scotland Ltd	Muck	22/09/2022	13.79	Gill-Health Related	98,953
MRT03563	Mowi Scotland Ltd	Poll Na Gille	23/11/2022	13.49	Rickettsia	98,591
MRT02565	Mowi Scotland Ltd	Grey Horse Channel Outer	29/10/2021	10.07	AGD and FW Extended Treatments	98,533
MRT00360	The Scottish Salmon Company	Vuiabeag	11/09/2017	10.37	AGD, PD, Treatment	97,534
MRT00030	The Scottish Salmon Company	Sgian Dubh	03/12/2015	12.0	Treatment	97000
MRT03764	Organic Sea Harvest Ltd.	Culnacnoc Salmon Farm	23/01/2023	17.5	AGD	95212
MRT00134	Grieg Seafood Shetland Ltd	Gob na Hoe	27/10/2016	14.51	Gill issues, Treatment	93695
MRT02628	The Scottish Salmon Company	Taranaish	22/11/2021	14.99	Gill Health Related	92891
MRT01319	Mowi Scotland Ltd	Bagh Dail Nan Cean	10/10/2019	19.65	Pasteurella skyensis	92140
MRT03455	Scottish Sea Farms Ltd	Nevis B	28/10/2022	49.1	Environment; Gill Health Related	88161
MRT04202	Bakkafrost Scotland	Geasgill	07/08/2023	14.93	Gill health related; Viral Disease (PD)	85,914

Industry Evidence of Rising Mortalities:

Bakkafrost's 2021 Annual Report - published in October 2022 - red-flagged the "deadly cocktail" of micro-jellyfish and reduced gill health of farmed salmon:

> In Scotland, we had severe mortality in Q3 and Q4, with a total of 262 mDKK in exceptional mortality costs. The underlying issue was linked to the reduced gill health the fish develops due to the extended growth cycle in the marine environment, up to 22 months, due to the small average smolt size on release. The fish are exposed to hazards that impair their gills during this period. Late in Q3 and into Q4, there was a significant bloom of hydrozoans and micro-jellyfish, which deteriorated the gill health even more and led to very high mortality across several sites. In short, the micro-jellyfish bloom on top of reduced gill health was a deadly cocktail.

Read more via Bakkafrost is Dead in the Water in Scotland - 2021 Annual Report Details "Deadly Cocktail"! and Bakkafrost's Scottish Salmon Nightmare Gets Worse with 10,000 Tonne Black Hole in Scotland!

In July 2023, Bakkafrost issued a profit warning. Bakkafrost CEO Regin Jacobsen said: "The Scottish farming segment has had lower harvest weights in Q2 compared to the previous quarter, primarily caused by biology-led harvest at some sites and early harvest at some sites to reduce biological risk ahead of Q3."

Read more via BAKKAFROST: Preliminary results and profit warning for Q2 2023

Bakkafrost's 'Interim Report: Q2 2023 & H1 2023' (published in August 2023) included:

> The biological development in Scotland was improved during the first five months of 2023 with increased harvest weights and low mortality. Late in Q2 and continuing into Q3, biological development became more challenging. Environmental challenges affected fish being in their second summer in the sea, leading to higher mortality. This will affect the cost and mortality rates negatively in H2 and can compromise planned harvest volumes for 2023 in Scotland, with 5,000-6,000 tonnes, dependent on the continued biological development in H2 2023.

"Bakkafrost Scotland harvest volumes may be cut by 20%," reported Fish Farming Expert in August 2023. "Salmon farmer feels the heat after strong first five months of 2023."

"After tough Q2 for Bakkafrost, 'darker skies' cloud Scottish operations," reported Seafood Source in August 2023.

The Herald reported in August 2023:

> After record-breaking mortalities in 2022, the salmon farming industry in Scotland is facing another turbulentt year of shockingly high fish deaths and reduced harvest revenues, which is already being part-blamed on blooms of micro jellyfish.
>
> When I interviewed Bakkafrost CEO Regin Jacobsen, he acknowledged the problem at Geasgill farm and two others and blamed the tiny hydrozoans.
>
> "What we see right now," he said, "is mainly jellyfish which are coming in huge swarms or blooms. They are coming with the tide. It seems to be that specific sites are more vulnerable than others, and there is also a common factor that if the salmon is standing a very long time, meaning two years in the sea, they get more vulnerable after the second summer. We have three sites - Geasgill is one of them - and these three sites have in common that the fish have been standing there for a second summer now."
>
> Regin Jacobsen noted that, over the past ten years, microjellyfish incidents have become more severe and that has coincided this year with the heatwave. "We see that sea temperature is higher now. This year the temperature looked like it was running one month earlier than last year. We saw already in June this year that we had almost the same temperature in June that we had last year in July. This year in July we had the same temperature as August, and the difference was 2C which is quite significant."

The Herald reported in September 2023:

> The worst mortality event in Scottish salmon farm history was at Bakkafrost's Druimyeon site in 2021, which had a mortality of 82.1%, amounting to a mass of around twice that which has so far been seen at Geasgill.
>
> But Geasgill, whose mortality rate for July was 23.7%, is not the only Bakkafrost farm struggling with mortalities this year. Bakkafrost's CEO told me that two other farms had been impacted by microjellyfish. One of these was Gravir Outer on Lewis which suffered mortalities of 22.6% in July.

The Sunday Mail reported in September 2023 (quoting Don Staniford):

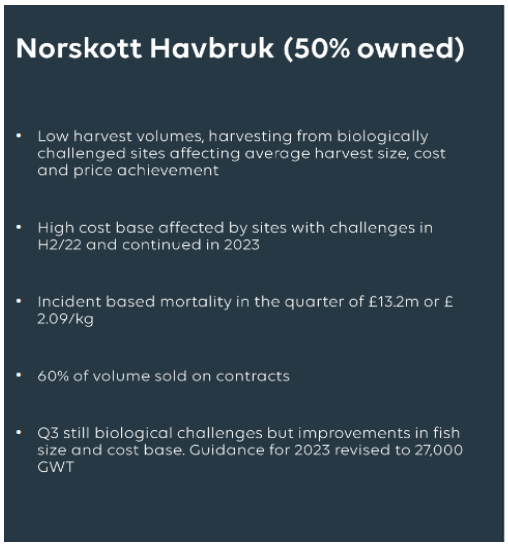
"A deadly cocktail of warming water temperatures, swarms of jellyfish, gill problems, infectious diseases, plagues of parasites and toxic algal blooms has killed off millions of Scottish salmon this summer."

The Sunday Mail article continued:

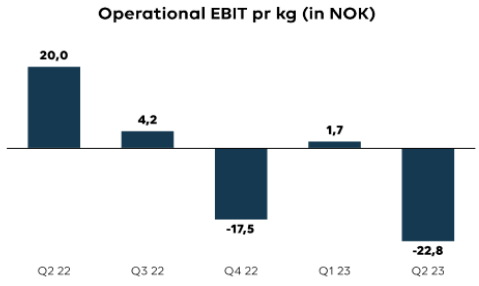
> Iain MacIntyre, director of marine operation at Bakkafrost Scotland, admitted to an issue with its salmon and blamed jellyfish.
>
> He said: "Salmon farming takes place in the natural environment and can face unique and difficult biological challenges, particularly when the water is warmer.
>
> "This has been the case at Portree when, following a prolonged period of hot weather, a jelly fish bloom moved through the area. We immediately deployed additional resources and equipment to resolve the issue and the relevant authorities were notified.
>
> "Our staff worked diligently and went above and beyond to manage a challenging set of circumstances and deal with the problems caused by the jelly fish bloom.
>
> "This was carried out in a matter of days and the jelly fish bloom has now passed through the site and the incident-based mortality has ceased.

Bakkafrost is not the only salmon farming company in Scotland feeling the heat. "Scottish Sea Farms cuts harvest estimate by 10,000 tonnes - company made £10.6m operating loss in Q2," reported Fish Farming Expert in August 2023. "Scottish Sea Farms has reduced its estimated harvest volume for 2023 from 37,000 gutted weight tonnes to 27,000 gwt as a result of biological problems at some sites that have continued from 2022, according to co-owner Lerøy."

Leroy (co-owner of Scottish Sea Farms – called Norskott Havbruk - with SalMar) reported in their Q2 2023 presentation published in August 2023:



100% basis, in NOKm	Q2 2023	Q2 2022	YTD 2023	YTD 2022
Revenues	692	884	1 197	1 523
Operational EBIT	-144	190	-135	295
Harvested volume (GWT)	6 325	9 489	11 495	17 329
Operational EBIT/kg	-22,8	20,0	-11,8	17,0
NIBD	2 647	2 067	2 647	2 067



Farming volumes (1000' GWT)

Farming volumes	2019	2020	2021	2022	2023E	2024T	2025T
Scottish Seafarms (Lerøy's 50% share)	12,9	12,0	16,2	19,0	13,5		

Read more on mortality problems at Scottish Sea Farms via:

[8,000 tonne shortfall for Scottish Sea Farms (Norskott Havbruk) due to "biological challenges"]

[64% Mortality at RSPCA Assured Scottish Sea Farms in Loch Nevis - as sold by M&S as "responsibly sourced"?!!]

[74% Mortality Reported by RSPCA Assured Scottish Sea Farms (Supplier to M&S) in Loch Nevis!]

Mowi – the largest salmon farming company in Scotland and the world – has also reported mortality problems. "Mowi Scotland cuts harvest forecast by 10,000 tonnes," reported Fish Farming Expert in November 2022. "Guidance reduced to 50,000 gwt for 2022 due to losses caused by micro-jellyfish."

Mowi's Q3 2022 report – published in November 2022 – included:

- Harvest volume guidance for 2022 maintained at 460 000 GWT. Mowi Norway increase from 272 000 GWT to 286 000 GWT partly offset by 10 000 GWT reduction in Mowi Scotland following biological issues.

> Furthermore, non-seawater costs were significantly impacted by incident-based mortality of EUR 7.6 million (EUR 1.5 million), or EUR 0.52/kg, related to micro-jelly fish blooms around Skye and the Western Isles causing elevated mortalities in some of our farms. As a response to these challenges several fish groups were relocated to other sites with good results.
>
> Sea lice levels and AGD challenges were relatively low in the quarter.
>
> Our Scottish farming operations has experienced a troublesome year with regards to biology and the 2022 volume guidance has been reduced to 50 000 GWT. However, we expect a recovery in 2023 with a volume guidance of 65 000 GWT.

"Harvest volumes in Scotland dropped slightly compared with third quarter of 2021, which was below guidance," reported Mowi in Q3 2022. "Biological issues related to gill health and effects from micro-jellyfish impacted growth and harvest volumes."

Mowi's Q2 2023 report – published in August 2023 – included:

> Biological performance in the quarter was relatively good, especially taking into consideration the record-high seawater temperatures. However, the high temperatures caused some feeding issues due to the challenges of storing and handling feed in such high air temperatures. The high temperatures also led to more challenging environmental conditions related to increased presence of plankton, algae and jellyfish.

Read more on Mowi's mortality problems via:

Annus Horribilis Salmonis: Mowi's "Troublesome Year" in Scotland - 22% fall in production!

32% fall in Mowi's Scottish Salmon Production!

56% Mortality at RSPCA Assured Mowi (but don't worry, it's certified as "farmed responsibly" by the Aquaculture Stewardship Council)!

Mowi's "Woes in Scotland" - Disease & Deaths Cause £5.6 Million Losses!

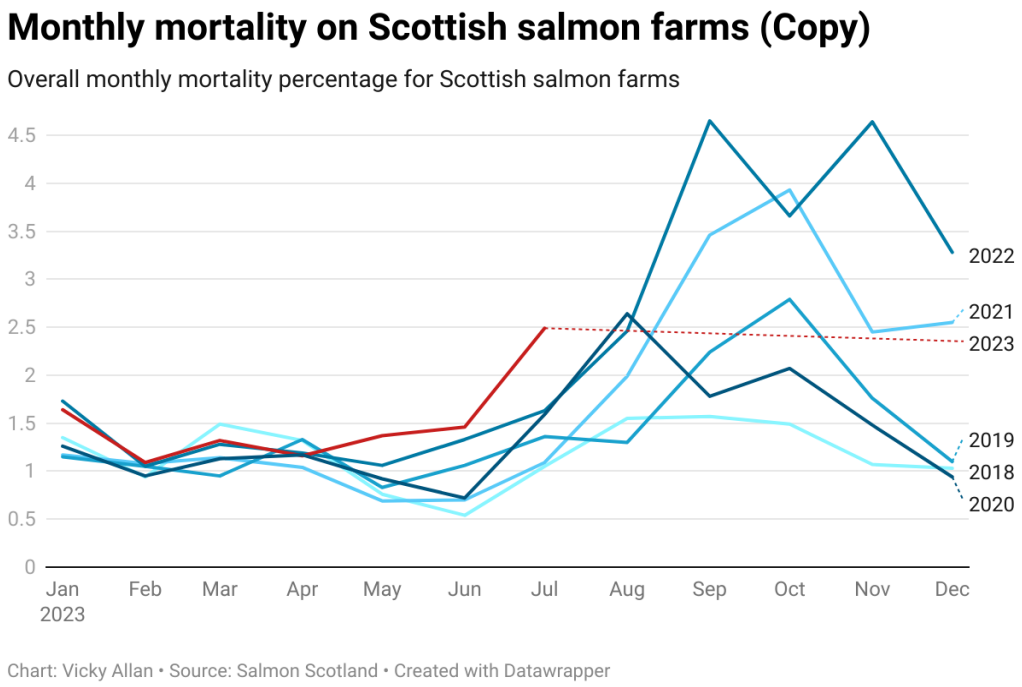
Mortality data for July 2023 published by Salmon Scotland in September 2023 reveals the scale of death rates at salmon farms – with monthly mortality peaking at 23.7% (Bakkafrost at Geasgill) and cumulative mortality peaking at 56.5% (Scottish Sea Farms at Dunstaffnage). Reasons for mortalities include jellyfish/plankton, gill health, viral disease and bacterial disease:

Salmon SCOTLAND **July 2023**

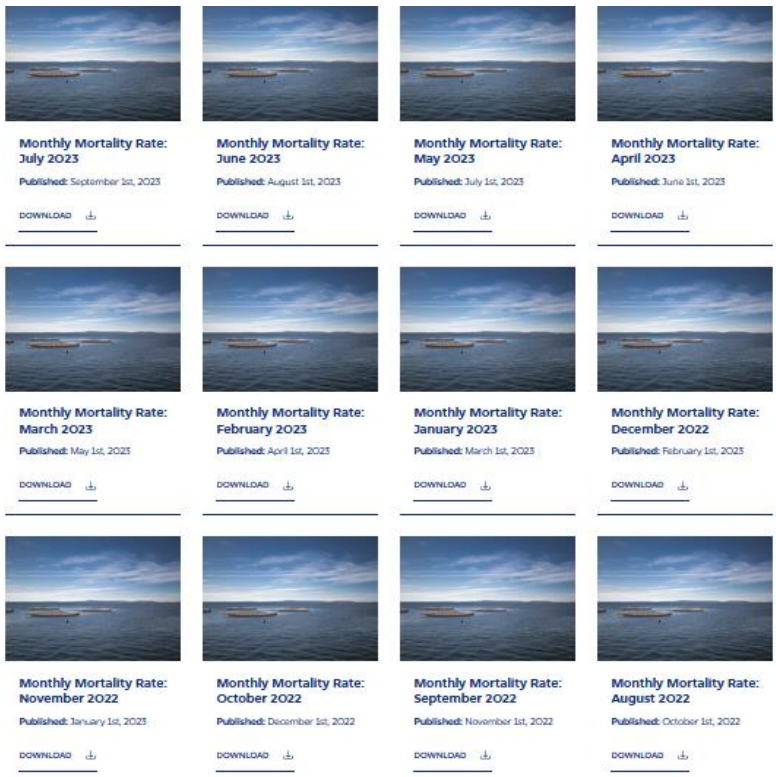
Company	Farm	Monthly mortality (%)	Notes	Cumulative mortality over full production cycle (%)
Bakkafrost Scotland	Geasgill	23.7	Jellyfish / plankton, Gill health related, Viral disease	In production
Bakkafrost Scotland	Gravir Outer	22.6	Jellyfish / plankton, Gill health related, Viral disease	In production
Scottish Sea Farms Ltd	Kishorn C (West)	16.2	Jellyfish / plankton, Gill health related	In production
Scottish Sea Farms Ltd	Kishorn A (South)	15.2	Jellyfish / plankton, Gill health related	In production
Bakkafrost Scotland	Lamlash	13.8	Jellyfish / plankton, Gill health related, Viral disease	In production
Organic Sea Harvest Ltd	Invertote	11.5	Viral disease	In production
Scottish Sea Farms Ltd	Kishorn B (North)	11.3	Jellyfish / plankton, Gill health related	In production
Scottish Sea Farms Ltd	Dunstaffnage	2.8 (Farm fallowed in Jul.)		56.5
Scottish Sea Farms Ltd	Kerrera B (Charlotte Bay)	4.1 (Farm fallowed in Jul.)	Gill health related, Bacterial disease	48.2
Mowi Scotland Limited	Boisdale (An Camus)	3.7 (Farm fallowed in Jul.)	Viral disease	28.2
Mowi Scotland Limited	Torridon	0.6 (Farm fallowed in Jul.)		25.3
Mowi Scotland Limited	Marulaig Bay	1.4 (Farm fallowed in Jul.)		24.2
Scottish Sea Farms Ltd	Lippie Geo	7.8 (Farm fallowed in Jul.)	Viral disease	22.0

Mortality data for August 2023 is expected to be published by Salmon Scotland on 1 October 2023.

The Herald's Vicky Allan [Tweeted in September 2023] about rising mortality on salmon farms:



Salmon Scotland has [published monthly mortality data since February 2018] and it makes for grim reading:



'Commercially Damaging' Data Hidden from the Public:

Back in 2013, the Salmon Scotland (then called the Scottish Salmon Producers Organisation) successfully lobbied against public disclosure and reporting of mortality numbers arguing that publication would be 'commercially damaging'.

Scottish watchdog labelled 'lapdog' after agreeing to keep fish farm deaths secret

from **Sunday Herald, 20 October 2013**

Scotland's environment watchdog has bowed to pressure from the salmon farming industry to keep the number of fish killed by diseases secret, according to internal correspondence seen by the Sunday Herald.

The **Scottish Environment Protection Agency (Sepa)** agreed to delete information on millions of fish deaths from **a public database** on fish farming launched this month because the **Scottish Salmon Producers' Association (SSPO)** argued it would be commercially damaging.

Therefore, the last data set publicly available on mortality numbers (in the sea phase of production only – we've never had published data on mortality numbers in freshwater) was over a decade ago – as published by The Sunday Herald in February 2013:

The huge rise in fish farm deaths

year / tonnes of dead fish / number

2012 / 13,627 / 8.5 million
2011 / 9,717 / 6.8 million
2010 / 7,159 / 5.5 million

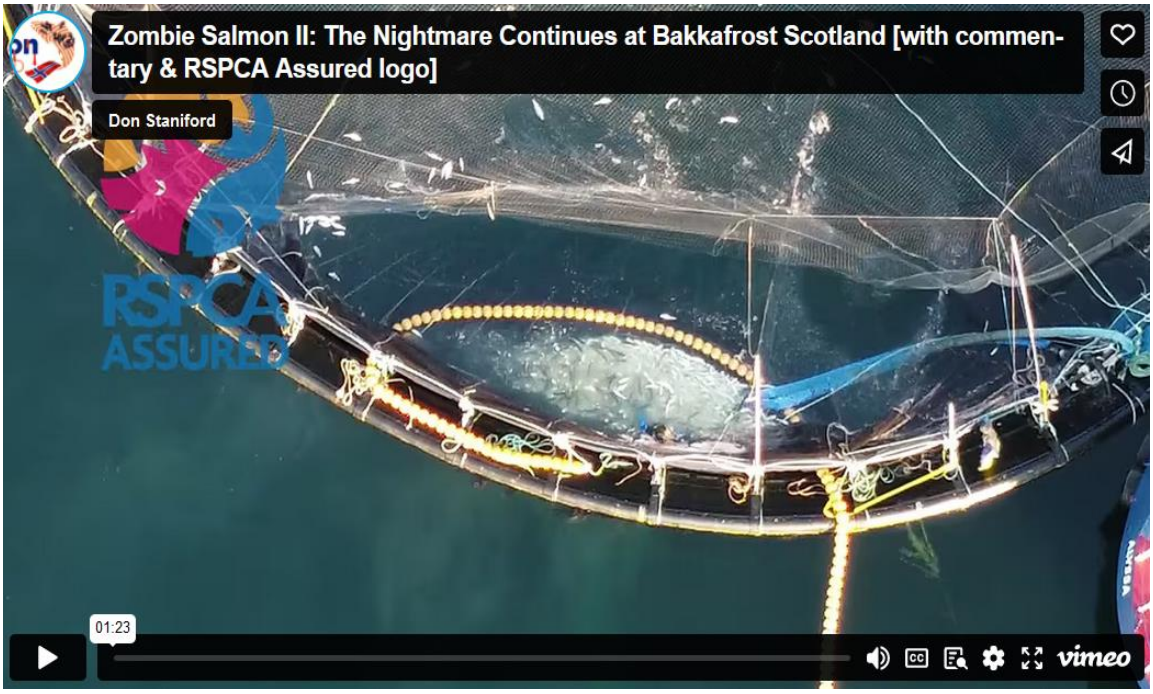
Based upon the published data above (i.e. 7,159 tonnes = 5.5 million morts; 9,717 tonnes = 6.8 million morts; and 13,627 tonnes = 8.5 million morts) the current projection of 41,623 tonnes of morts in 2023 (see Appendix below for specific details) could represent ca. 30 million morts.

And please remember that the figure of 30 million morts for 2023 would only represent the sea phase of salmon farming production – with many more millions dying in land-based hatcheries and freshwater smolt farms. In terms of 'Mortality Event Reports' filed with the Scottish Government's Fish Health Inspectorate the threshold for reporting can be as high as 6%

mortality per week in freshwater hatcheries (specific details via Mortality notification form and guidance).

Read more via:

Media Backgrounder: Year of the Dead Salmon - Bakkafrost Scotland is the King of Death!
Video Nasties of Dead Farmed Salmon Pile Up All Over the World!
Alexa, how many salmon die each year on Scottish salmon farms? 42 million* (but we don't know for sure as the answer is deemed "commercially damaging")!



APPENDIX: SCOTTISH SALMON – THE KING OF DEATH IN 2023

Farmed Fish Mortalities Reached Record Levels in 2022 & 2023 Could Be 20%+ Higher!

	1st Half of Year Mortalities (kg & %)		2nd Half of Year Mortalities (kg & %)		Total Mortalities (kg)
2002	1,735,974	39.32%	2,679,111	60.68%	4,415,085
2003	2,358,500	37.75%	3,888,761	62.25%	6,247,261
2004	2,742,238	40.81%	3,977,993	59.19%	6,720,232
2005	2,315,349	47.25%	2,584,749	52.75%	4,900,098
2006	3,066,129	38.55%	4,887,954	61.45%	7,954,083
2007	3,055,516	30.46%	6,977,220	69.54%	10,032,736
2008	3,719,249	41.50%	5,243,724	58.50%	8,962,973
2009	2,604,227	34.93%	4,851,680	65.07%	7,455,907
2010	3,787,126	50.65%	3,690,612	49.35%	7,477,738
2011	3,605,362	37.95%	5,895,354	62.05%	9,500,716
2012	4,127,175	31.97%	8,782,794	68.03%	12,909,969
2013	3,782,759	36.91%	6,465,613	63.09%	10,248,372
2014	3,730,656	23.90%	11,878,144	76.10%	15,608,800
2015	4,688,169	25.96%	13,372,043	74.04%	18,060,212
2016	6,336,327	28.60%	15,818,458	71.40%	22,154,785
2017	7,721,645	30.18%	17,860,040	69.82%	25,581,685
2018	6,543,792	38.16%	10,605,810	61.84%	17,149,602
2019	8,958,100	34.32%	17,141,399	65.68%	26,099,499
2020	9,918,898	36.35%	17,368,837	63.65%	27,287,734
2021	9,016,867	30.11%	20,926,980	69.89%	29,943,846
2022	10,354,894	28.26%	26,290,990	71.74%	36,645,884
2023	11,761,276		29,861,782**		**41,623,058****

Sourced from data published by the Scottish Environment Protection Agency via Scotland's Aquaculture website on 6 September 2023

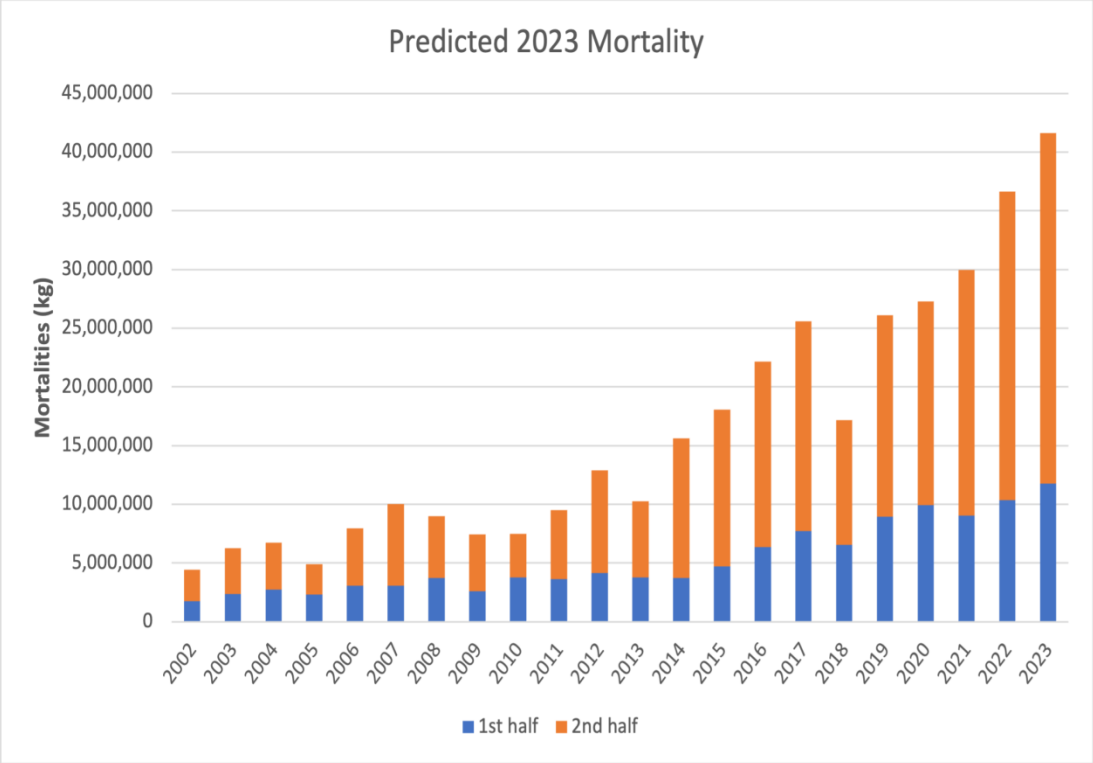
** Predicted 2023 total based upon 2022 data (i.e. if 10,354,894 kg of mortalities after six months of 2022 resulted in 36,645,884 kg at the end of the year then 11,761,276 kg after the first six months of 2023 could end up with 41,623,058 kg).

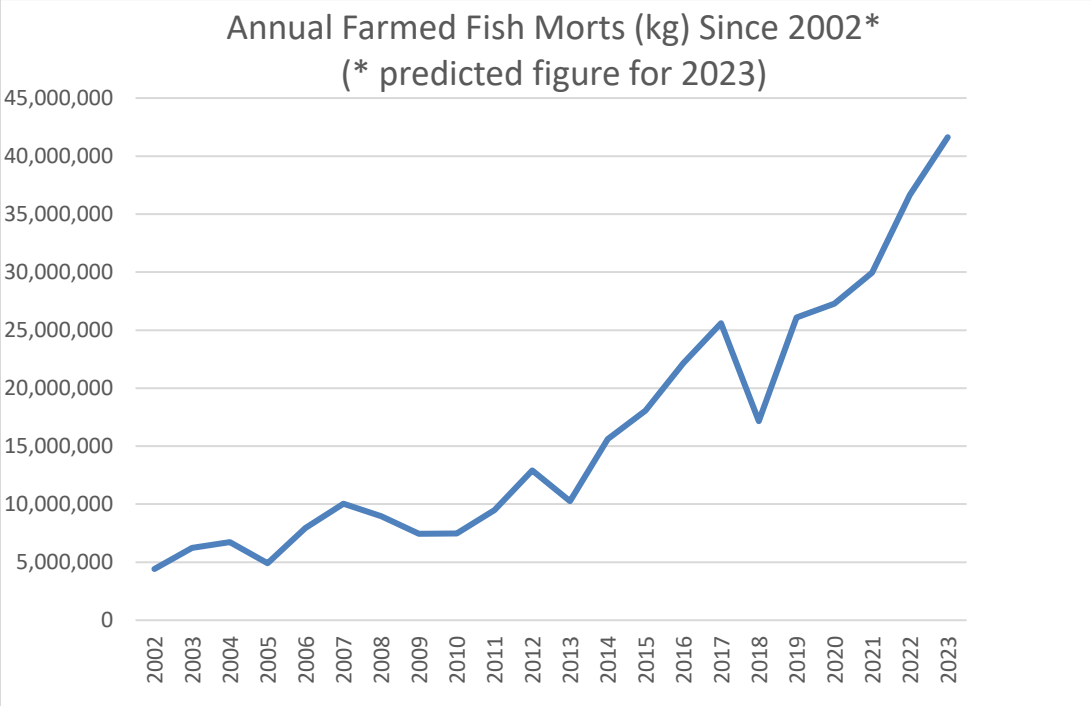
In other words, mortalities on fish farms in Scotland by weight in the first six months of 2023 increased 22% in one year (since the first six months of 2022) and increased 258% over the decade (up from 10,248 tonnes in 2013 to 36,646 tonnes in 2022).

Mortalities in 2023 are shaping up to be the worst ever with a record 11,761 tonnes of morts reported in the first six months of this year and 41,623 tonnes predicted by the end of 2023.

The final figure could be even worse if the marine heatwave – satellite data from the European Space Agency shows sea surface temperature more than 5°C higher than the average during this time of year - has accelerated mortality.

2023 – The Worst on Record EVER!





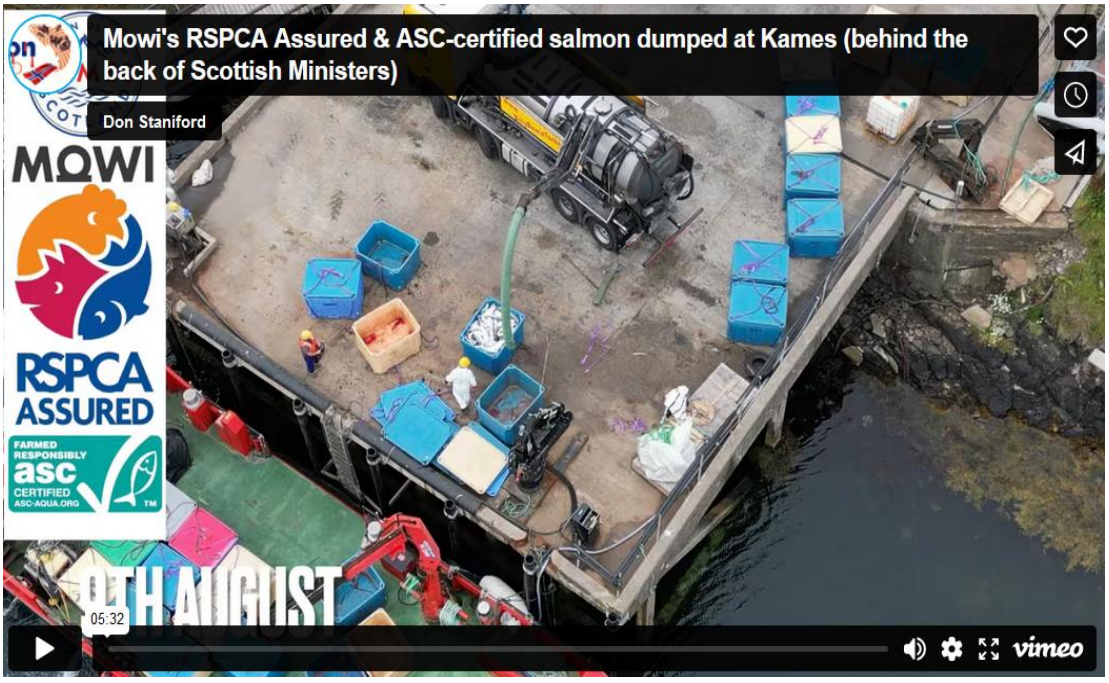
Source:
http://aquaculture.scotland.gov.uk/data/fish_farms_monthly_biomass_and_treatment_reports.aspx

Don Staniford
@TheGAAIA

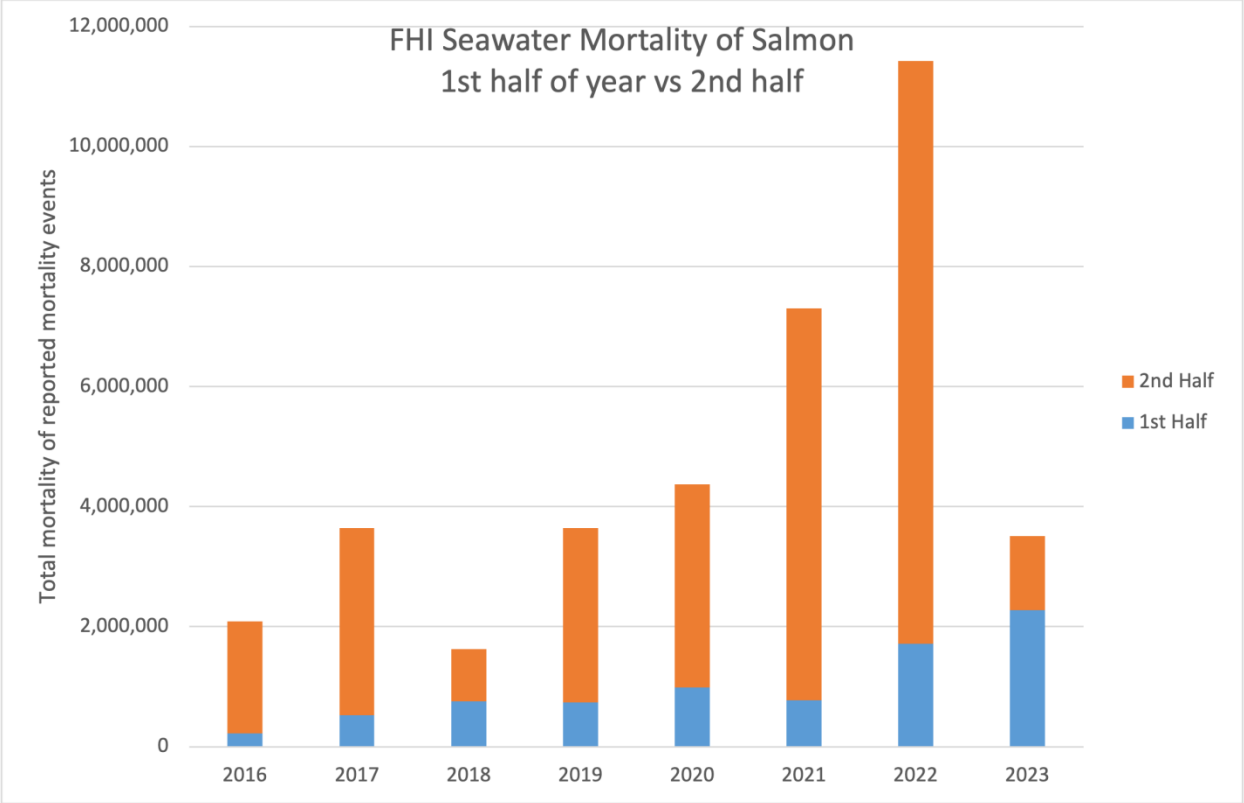
WORST EVER! @ScotlandSalmon
Mortalities on fish farms in Scotland were 11,738 tonnes in the first 6 months of 2023 @ScottishEPA aquaculture.scotland.gov.uk /data/fish_farm...
That's a 30% increase on morts reported in the first 6 months of 2021 & a 13% increase on 2022 @ScotGovMarine @rspcaassured

ASC and 9 others

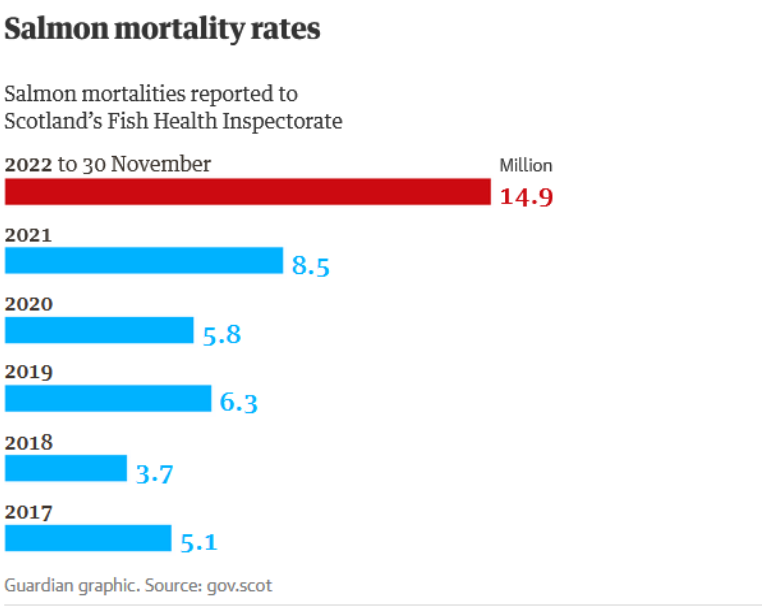
1:29 PM · Sep 22, 2023 · **440** Views



Mortality data published by the Scottish Government's Fish Health Inspectorate on 5 September 2023 shows the steep rise in deaths on salmon farms in Scotland in 2022 with mortalities in the first six months of 2023 even higher than in the first six month of 2022 (data is only available until early August 2023 – if the trend continues then 2023 will be even higher than in 2022):



The Observer newspaper reported in January 2023:



A closer look at the mortality data published by the Scottish Government's Fish Health Inspectorate on 5 September 2023 shows how deaths on salmon farms in Scotland are skewed towards the second half of the year with 89% of mortalities reported in the second half of 2018 and 2021:

	Number of Mortalities (2016 to 2022)				
Year	1st Half		2nd Half		Total
2016	222,158	10.66%	1,862,629	89.34%	2,084,787
2017	523,734	14.36%	3,122,494	85.64%	3,646,228
2018	754,425	46.35%	873,138	53.65%	1,627,563
2019	741,988	20.36%	2,902,951	79.64%	3,644,939
2020	986,931	22.60%	3,379,584	77.40%	4,366,515
2021	775,150	10.61%	6,528,938	89.39%	7,304,088
2022	1,714,356	15.01%	9,710,029	84.99%	11,424,385

Increasing Mortality & Decreasing Production

Whilst mortalities on salmon farms increased significantly in 2022 (up 22% on 2021), salmon farming production is predicted to decrease during 2022. The 'Scottish Fish Farm Production Survey 2021' (published in October 2022) predicted an 8% fall in salmon farming production in 2022 (production in 2021 increased 7% on the 2020 total):

Table 24: Annual production of salmon (tonnes) 2001-2021 and projected production in 2022

Year	Tonnes	Percentage difference	Year	Tonnes	Percentage difference
2001	138,519	7	2012	162,223	3
2002	144,589	4	2013	163,234	1
2003	169,736	17	2014	179,022	10
2004	158,099	-7	2015	171,722	-4
2005	129,588	-18	2016	162,817	-5
2006	131,847	2	2017	189,707	17
2007	129,930	-1	2018	156,025	-18
2008	128,606	-1	2019	203,881	31
2009	144,247	12	2020	192,129	-6
2010	154,164	7	2021	205,393	7
2011	158,018	3	2022	189,693*	

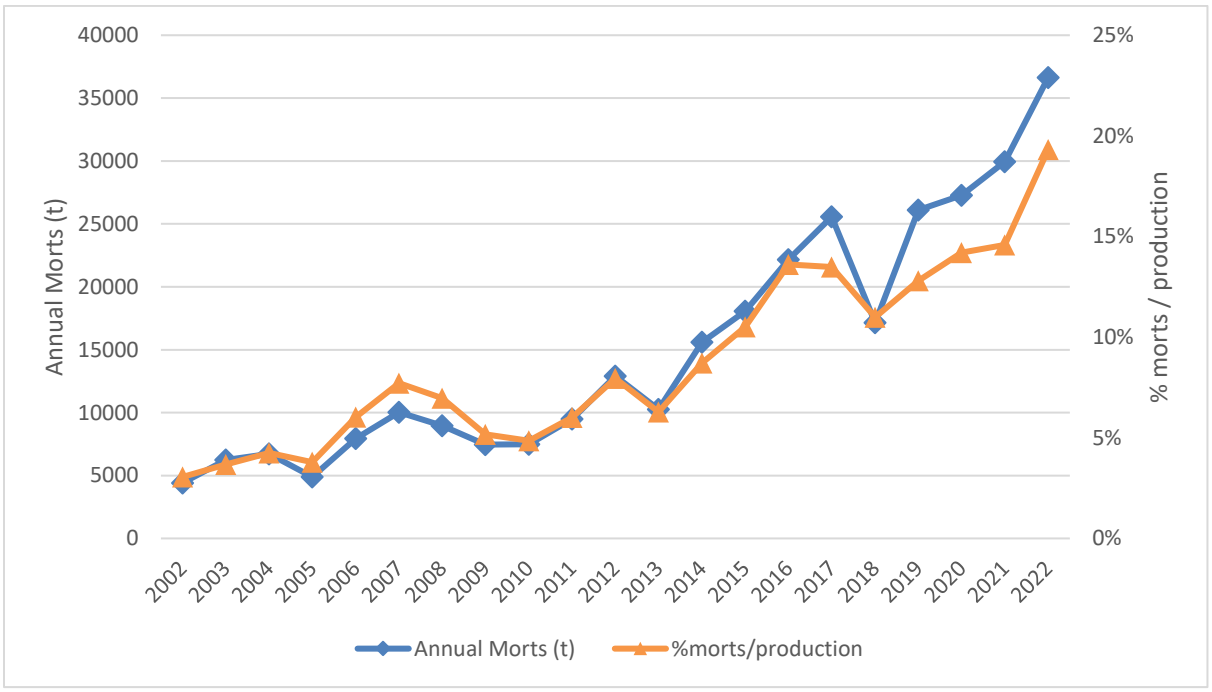
*industry estimate of projected tonnage based on stocks currently being on-grown.

The total production of Atlantic salmon during 2021 was 205,393 tonnes, an increase of 13,264 tonnes (7%) on the 2020 total. This was the highest level of production recorded in Scotland.

In other words, whilst 2021 was the highest salmon farming production on record the predicted data indicates that 2022 salmon farming production could be lower than back in 2017 (and predicted production for 2023 may be even lower – we will find that out on Wednesday 4 October 2023 when the 'Scottish Fish Farm Production Survey 2022' is published at 9.30am).

Increasing Mortality Rate Since 2002 – accelerating since 2018

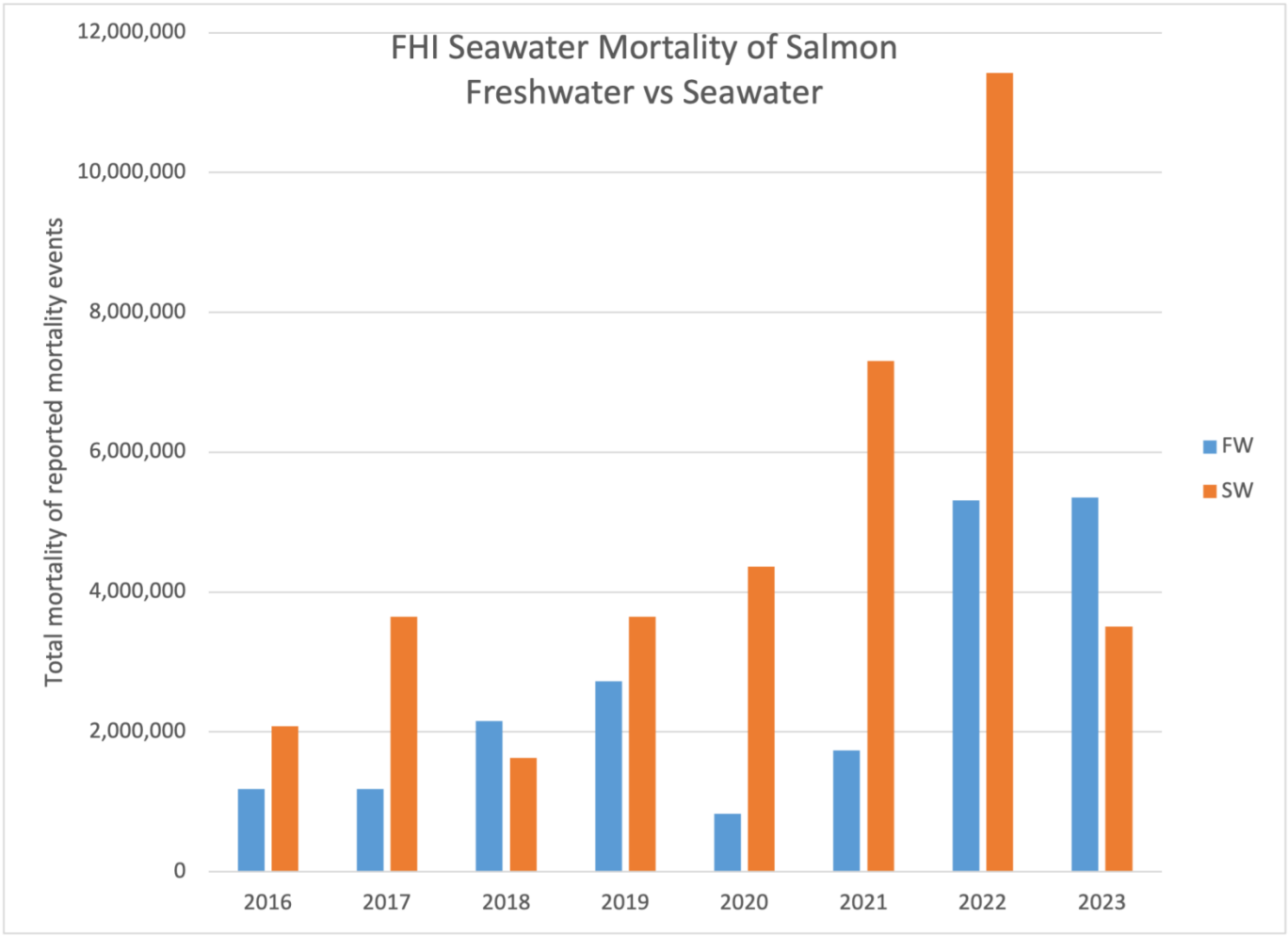
This chart below shows there is an obvious trend of both mortalities increasing with time and also with the proportion of production that is lost (i.e. mortalities are increasing both in absolute terms and as a proportion of production).



Sources:
https://www.gov.scot/binaries/content/documents/govscot/publications/statistics/2022/10/scottish-fish-farm-production-survey-2021/documents/scottish-fish-farm-production-survey-2021/scottish-fish-farm-production-survey-2021/govscot%3Adocument/scottish-fish-farm-production-survey-2021.pdf and http://aquaculture.scotland.gov.uk/data/fish_farms_monthly_biomass_and_treatment_reports.aspx

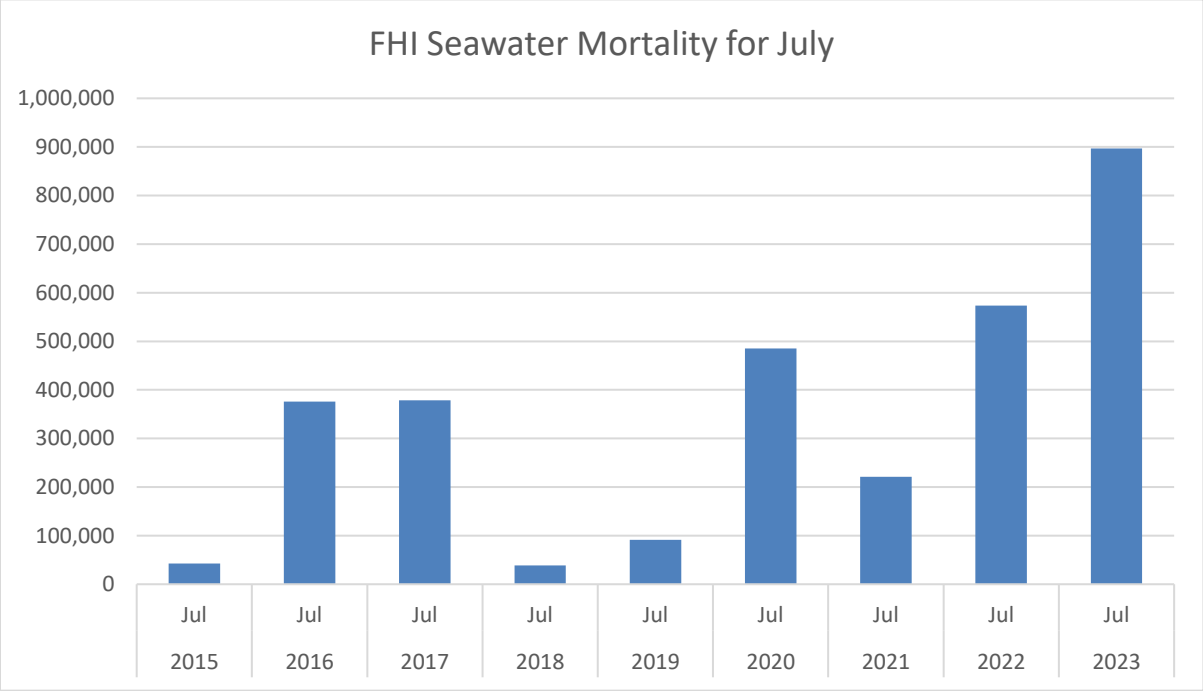
Increases in Freshwater & Seawater Mortality

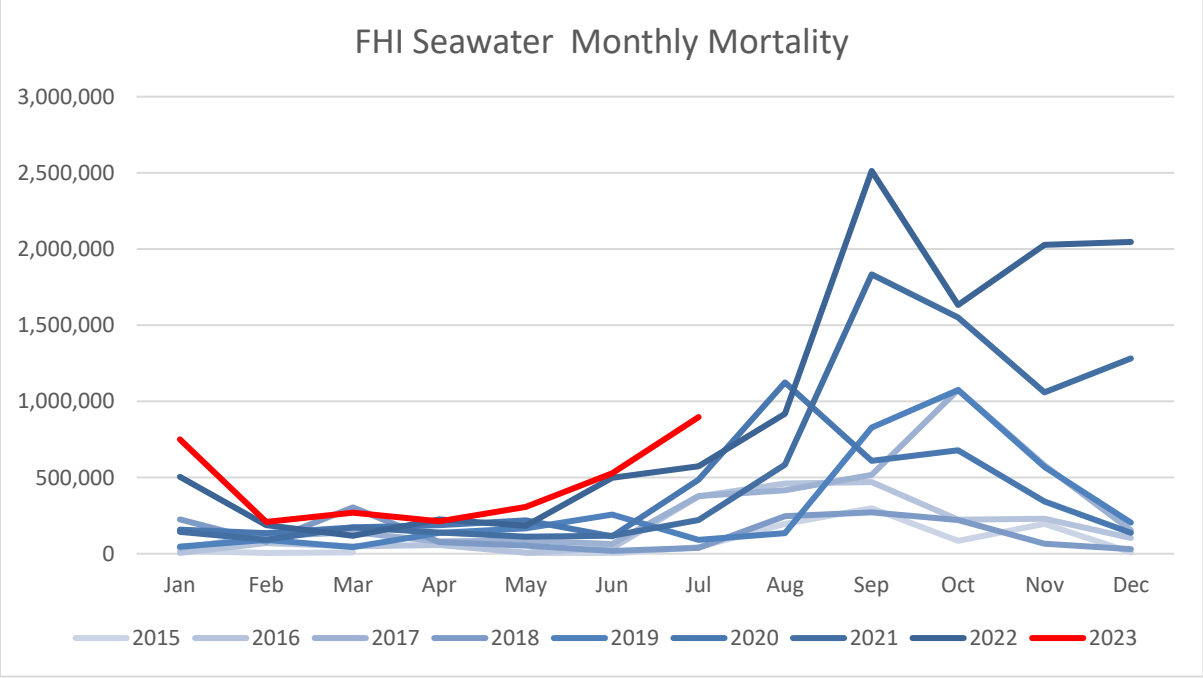
Mortality data published by the Scottish Government's Fish Health Inspectorate on 5 September 2023 shows how mortalities in seawater are generally much higher than in freshwater (2018 was the exception). Thus far in 2023 (data up to early August) there have been more deaths reported in hatcheries and smolt farms in freshwater lochs than in sea cages but the expected flood of mass mortalities in seawater later in 2023 is expected to shift the balance:

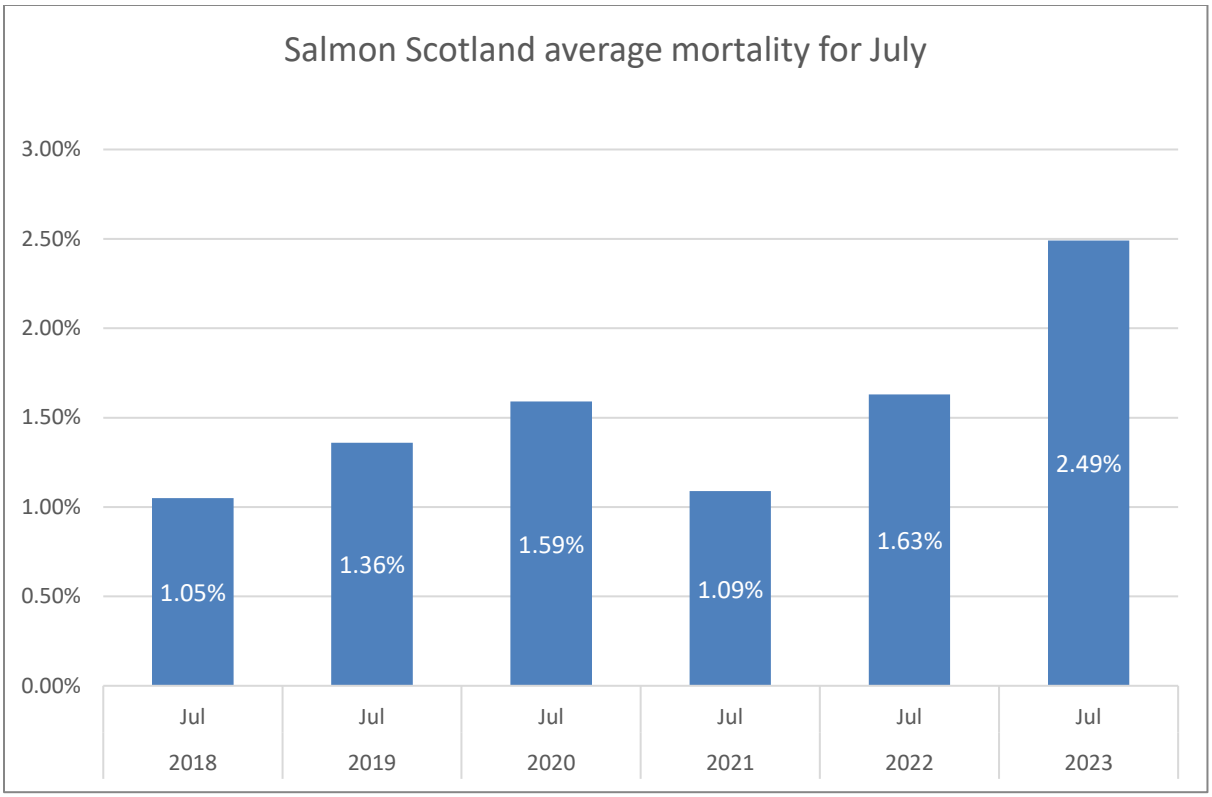


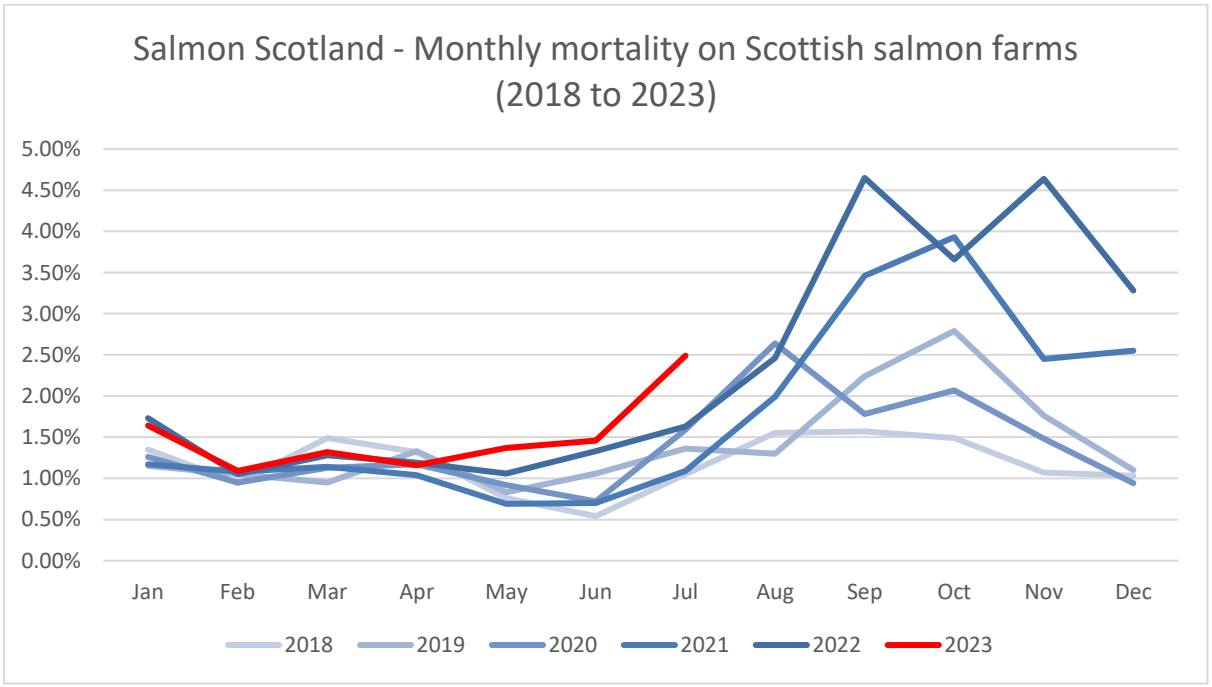
The Hot Summer of 2023 is Killing Off Scottish Salmon Faster Than Ever Before!

If we look at Fish Health Inspectorate mortality data (as published by the Scottish Government on 5 September 2023) and Salmon Scotland monthly mortality data for July 2023 (as published on 8 September 2023), they are both showing over 50% increases this July compared to last year (2022) suggesting this year is going to be far worse than ever for deaths on salmon farms in Scotland.






Salmon Scotland average mortality for July
3.00%
2.50%
2.00%
1.50%
1.00%
0.50%
0.00%
1.05%
1.36%
1.59%
1.09%
1.63%
2.49%
Jul 2018
Jul 2019
Jul 2020
Jul 2021
Jul 2022
Jul 2023


Salmon Scotland - Monthly mortality on Scottish salmon farms (2018 to 2023)
5.00%
4.50%
4.00%
3.50%
3.00%
2.50%
2.00%
1.50%
1.00%
0.50%
0.00%
Jan
Feb
Mar
Apr
May
Jun
Jul
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2018
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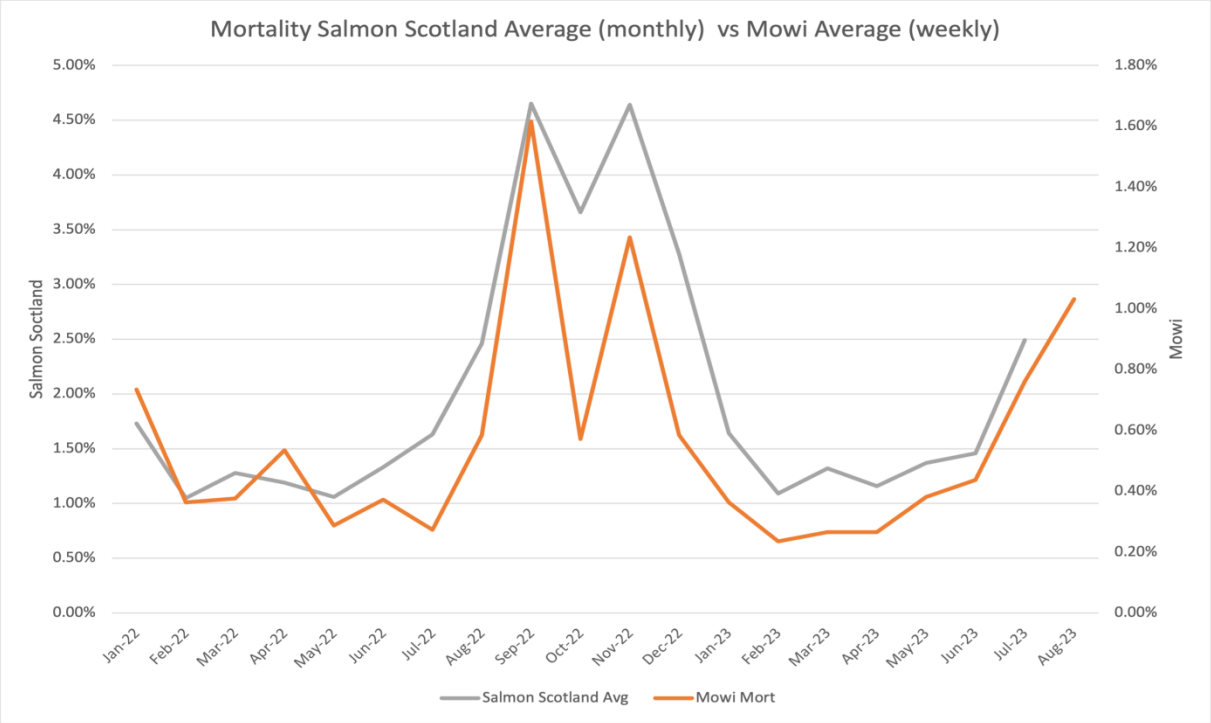
2022
2023

Mowi's Mortality Rate Mirrors the Mortality Rate of the Wider Industry



Sources:
https://www.salmonscotland.co.uk/reports and https://mowi.com/uk/sustainability/lice-mortality-reporting/

Bakkafrost & Mowi – the Kings of Death at Over 20 Million Morts Each!

Mortality data published by the Scottish Government's Fish Health Inspectorate on 5 September 2023 details 4,220 'Mortality Event Reports' totalling 62,269,892 dead farmed salmon in both freshwater and seawater since February 2015 (data up to early August 2023). Note that this is NOT a comprehensive picture of all mortalities – only 'Mortality Event Reports' above a certain threshold require reporting and 372 of the incidents did not disclose numbers of morts.

However, the FHI data provides an indication of which companies suffer the biggest mortalities. Of the 62.3 million morts reported, Bakkafrost (called The Scottish Salmon Company up to June 2022) and Mowi (called Marine Harvest until January 2019) accounted for by far the most mortalities with 21 million and 20.6 million respectively. Scottish Sea Farms (Norskott Havbruk) reported 7.2 million morts (although it is a company which has historically non-reported) and Cooke Aquaculture reported 5.4 million morts.

In September 2022, $camon $cotland analysed mortalities by company. Data published by the Scottish Government for the period January 2017 to August 2022 revealed over 35 million mortalities with Mowi and Bakkafrost leading the way:

Over 35 million mortalities were reported via nearly 3,000 'Mortality Event Reports'

– including:

Mowi (Marine Harvest): 666 'Mortality Event Reports' = 12,353,090 (19 missing #s)

The Scottish Salmon Company/Bakkafrost Scotland: 1,045 'Mortality Event Reports' = 11,728,798 (8 missing #s)

Cooke Aquaculture: 246 'Mortality Event Reports' = 3,426,628

Scottish Sea Farms: 479 'Mortality Event Reports' = 2,779,260 (161 missing #s)

Grieg Seafood: 206 'Mortality Event Reports' = 2,350,280

Loch Duart: 171 'Mortality Event Reports' = 921,252 (8 missing #s)

Since August 2022, many more millions of morts have been reported (note that historical cases have been reported filling in data gaps as well as more recent incidents).

The $camon $cotland report also looked at mortalities over the last decade using data published by SEPA via Scotland's Aquaculture:

Norwegian giant Mowi reported the most mortalities over the last decade (2010 to 2021) closely followed by The Scottish Salmon Company (renamed Bakkafrost Scotland in June 2022) with Grieg Seafood, Scottish Sea Farms (Norskott Havbruk), Cooke Aquaculture and Loch Duart racking up huge mortalities (Wester Ross Fisheries is a small company but were bought by Mowi in June 2022):

Mortalities by Company (in tonnes) - 2010 to 2021

Company	Mortalities (tonnes)
Mowi	63,359
The Scottish Salmon Company/Bakkafrost	55,483
Grieg Seafood	31,189
Scottish Sea Farms	29,089
Cooke Aquaculture	26,919
Loch Duart	10,219
Wester Ross Fisheries	835

[Note that just six companies – all foreign owned/controlled – account for over 99% of 'Scottish' salmon farming production. Read more via '$cottish $camon']

Read more via Media Backgrounder: Year of the Dead Salmon - Bakkafrost Scotland is the King of Death!