



3rd February 2024

To Whom It May Concern
From Concerned residents of Loch Long and Loch Linnhe

We are writing to express our major concerns about the Associate Feature in Holyrood Magazine: *Swimming Against the Tide* by Colin Cardwell (18th January 2024), copy attached. This article can only be described as lobbying advertorial by Loch Long Salmon, with the sole aim of influencing Ministers in their final decision on the Beinn Reithe (Loch Long) fish farm proposal.

From the magazine's website: *"Holyrood is frequently quoted within the Scottish Parliament as a source of reliable information and political debate and according to Ipsos MORI is the most widely read publication amongst MSPs, with the magazine cited as being influential in their decision-making"*. This sponsored article, reading as editorial, has been published, seemingly without any fact-checking, and at a critical time while the Reporter is still considering his recommendations in relation to the Beinn Reithe Appeal Hearing.

As we have not been granted, denied or invited to a Right of Reply, we are writing directly to you so that you have a more complete appreciation of the facts.

Within the feature, Loch Long Salmon's CEO, Stewart Hawthorn, makes several very questionable claims about his semi closed mega fish farm proposals - the technology of which is unproven, is still in an experimental phase^{1a} and has to date encountered several issues with structural failure², disease and mass mortalities, pollution, and sea lice.

1.

The technology, says Hawthorn, will also capture more than 85 per cent of solid waste and uneaten food, bringing it onshore where it will be treated to be used as a fertiliser or in biofuel or other green projects.

The waste collection technology he is hoping to use is still at the design stage, and therefore unproven. Meanwhile, his company has already had to admit - via their Counsel at the Loch Long Planning Appeal - that nothing like 85% has ever been achieved from a semi contained system stocked at density anywhere in the world. On being questioned at the Planning Appeal, James Finlay KC on behalf of LLS said,

"We've made it very clear that no farm is offering 85%, so if that is what Mr. Nicol is asking, which clearly it is, the answer is nowhere. We've made that absolutely clear."

Indeed, they admitted that the maximum ever achieved in experimental pens in Norway (5 times smaller than the pens proposed for Loch Linnhe) was 30-40% solid waste removal. For Beinn Reithe, SEPA granted their CAR licence on the expectation from their modelling that Loch Long

Salmon could deliver at least 85% recovery. This means that if the proposal went ahead, at least four times the fish excrement could be discharged untreated into the loch than is being claimed in this article. It must be noted, also, that the quoted percentage of claimed waste is itself only a percentage of the solid waste that settles out and collects as sludge in the bottom of the cage - the rest, the smaller particles, will be swirling around with the pumped intake water, before exiting into the loch. As mentioned at the Appeal by the National Park Authority, the CAR licence issued by SEPA states *“Each fish pen must be installed with infrastructure designed to capture 85% of the waste. It does not say that 85% of the waste must be captured”*.

Mr. Hawthorn continues with a vague assertion that the faecal/food waste will be used for fertiliser. However, this is not as simple as he would like to make out, as the salt content would first have to be removed, requiring increased investment, and running expense, with possible complications. The Scottish aquaculture faecal waste being currently converted into fertiliser is sourced from freshwater hatcheries and taken to be processed in Invergordon. In terms of “green” projects, any sludge (for fertiliser) or mortalities (for biofuel) would have to be transported from our rural areas with poor road infrastructure, in huge lorries, to facilities elsewhere.

There is no mention of the other pollution source, that being the urine excreted by the stocked fish, 100% of which will be concentrated in the cage before going into the loch, unbalancing the surrounding marine ecosystem, spreading pathogens³, and exacerbating the potential for algal blooms and micro jellies⁴ - major causes of mass farmed fish mortality. Note that jelly fish were cited as a possible reason for pump failures causing mass mortalities in a semi closed system in Canada in 2022.

2.

“Companies in Norway have been using and developing this technology since early 2014 and have been awarded full commercial licences since 2018,” he says. “It’s now ready to be deployed in Scotland on a commercial scale and

This claim was also made in Loch Long Salmon’s Appeal Hearing Final Statement submitted on their behalf by Burgess Salmon⁵.

In fact, although applications were invited for Development Licences as early as 2015 to encourage innovative solutions to the issues being faced by the industry, the first development (not commercial) licences were awarded in 2018 with a strict limit on tonnage – 780 tonnes, compared with the 8000 tonnes being proposed by Loch Long Salmon for its second site proposal at Lurignish. Out of the 104 Development Licence applications, only 23 were granted by 2021, of which it seems only 9 were for closed or semi closed technology⁶.

Salmar was the first company, in 2020, to convert its Development Licence into a commercial licence⁷. This was for their offshore Ocean Farm (a completely different concept), and by 2023, only three companies had applied to convert to full commercial licences, with only one inshore and semi-contained installation⁸, SalmoNor’s Aquatraz (which ran aground in a storm in 2019). Aquatraz is due to be available commercially this year.

Also in their Appeal Hearing Statement, Burgess Salmon claim on behalf of their client that more than 150 production cycles have taken place in semi contained farms, producing 10 million fish⁹. At the average 1kg limit for growth in a SCC, this would equate to 66.67 tonnes per production cycle. This is another example of how this remains an experimental technology and nowhere

near the proposals for the 3452 tonnes on Loch Long or the 8000 tonnes on Loch Linnhe, both at super density. The fact that only small-scale cycles have been run over 10 years should raise concerns that upscaling this technology is actually difficult and therefore risky.

3.

Importantly, capturing the waste means that a site using this technology can produce more salmon than an open net farm with less organic discharge and no chemical use for treatment for sea lice or discharge of treatment chemicals into the water.

This is the theory. However, the Norwegian Research Institute CtrlAqua April Report^{1b} clearly states that sea lice will be reduced, but not eliminated and there have been several reported instances of sea lice in the semi contained systems (e.g. MOWI's Neptune III)¹⁰. There is therefore NO guarantee that chemicals won't be needed, and the operator can easily apply for a chemicals licence **after** planning has been granted. Furthermore, it should be noted that while sea lice remain a persistent problem¹¹, most of the current mass mortalities in Scottish farms are from gill disease¹². The amoeba that causes Amoebic Gill Disease lives at, and below the intended 20m intake of (untreated) loch water¹³ so these cages will not solve the most severe current mortality issue in the industry, and the treatments for this are usually either bathing in fresh water or dosing/ polluting with hydrogen peroxide. Worse, due to the fish stocking density proposed within the pens and therefore the high risk of disease transmission, the numbers of mortalities caused in any one event by this increasingly prevalent disease could be catastrophic.

4.

significantly lower mortality rates and improved growth and survival rates. We believe that record, backed up by independent evaluation by a Norwegian government-funded research consortium, addresses many concerns that people have about the sector in Scotland. Our approach will be transformational.”

Mr. Hawthorn is referring to the afore-mentioned CtrlAqua Reports^{1a} which clearly state that semi-closed systems “*still have a way to go*” and are not “*off the shelf ready*”.

None of the following routinely raised concerns about the current salmon aquaculture sector will be satisfactorily addressed by this proposal:

- Fish Welfare. High biomass stocking density, required to make the system profitable, leads to stress¹⁴, skin lesions and fin damage, making the fish vulnerable to disease.
- Pollution (see above)
- Fish escape and impact on Wild Salmon. Through human error or structural damage, given that these larger units have collapsed² or been destroyed by storms¹⁰. Note that the Norwegian Fisheries Minister advised the Scottish Government in 2018 that they do not site fish farms on Wild Salmon runs¹⁵. The Lurignish site is directly on a Wild Salmon run.
- Disease. Either existing in the brood stock or from pathogens in the untreated loch water¹³
- Lack of local sustainability. Many suppliers of semi closed systems state in their marketing material that their cages are intended for growing fish to full size, but this has NEVER been achieved at a commercial scale, and indeed in the Beinn Reithe planning document Loch Long

Salmon state that they plan to transfer fish to open pens to grow to harvest size. Once in the open pen they will again be subject to the risks that this technology is trying to avoid.

- Global Sustainability. There is no explanation as to how this proposal will be able to source fish feed in a sustainable manner, such that the increase in demand will not negate any reduction in the percentage of wild fish hoovered up across the globe.
- Carbon footprint. Semi closed technology requires a dramatically greater level of shore-based infrastructure than open net, with power for water-circulation and oxygen pumps 24/7; transport of oxygen, food, sludge, mortalities, and live fish require regular HGV's travelling long distances on dangerous rural roads.
- Microplastics. These are a major issue both in our marine environment and in the fish themselves. In open net farms, they are the result of abrasion in the feed pipes, but far from alleviating the problem, semi contained systems are likely to be the worst offenders due to the additional quantity of plastic required for the surrounding cages. An estimated 325 tonnes of microplastics from Norwegian farms end up in their waters per year¹⁶ – the amount for Scotland is not known.

5.

“Production last year however was no higher than it was in 2016 so there’s been no progress made over the past five or six years in terms of growing the sector in Scotland. That strongly suggests we need to innovate and bring positive new approaches so that the industry can not only keep operating but positively thrive.”

See point 3. Inevitably, production is stagnating because mortalities are increasing year on year. This is largely because of gill disease, to which the fish will still be vulnerable whilst in a semi closed cage and, thereafter, in the grow-out phase in open net. Higher ocean temperatures driven by climate change¹⁸ are also of major concern relating to the viability of the industry, whether in open or semi closed cages.

6.

He’s encouraged by support on several levels including MSPs such as Fergus Ewing, Angus Robertson, Pam Gosal and Jenni Minto. “We also have the support of bodies such as Sepa, Forestry and Land Scotland and NatureScot plus the local MP, councillors, the nearest community council and a cross section of local people and groups who all believe that it’s time to do something positive and make a change.

“A range of environmental groups, including the Atlantic Salmon Trust, the Marine Conservation Society, the Scottish Wildlife Trust and the Sustainable Inshore Fisheries Trust also support using this technology because they recognise the benefits it can bring.”

We are very concerned that Mr. Hawthorn's roll call of supporters may not be quite as supportive as he would like to think. For instance, the Atlantic Salmon Trust say they were contacted by Loch Long Salmon for comment on the Beinn Reithe proposal, but state very clearly - in bold - on their website:

"We did not express any form of formal support for this development or its planning application."

We will be contacting those listed in due course to ascertain their current positions on both the Beinn Reithe and the Loch Linnhe proposals.

We trust that you will consider Loch Long Salmon's claims very carefully, based on the available facts rather than the enthusiastic optimism of a corporate lobbyist.

Yours faithfully,

Jane Hartnell-Beavis
Karen Ezard
Robin Stopford
Paul Nicoll
David MacDowall
Hilary Worton
Dr. John Campbell

Sources on following pages

SOURCES

¹ CtrlAqua is the Norwegian Centre for Research-based Innovation in Closed-Containment Aquaculture.

After eight years of government funded research, their Reports from April and August 2023 (copies available on request) state that pathogens cannot be excluded, that sea lice are reduced but not eliminated, that the systems are volatile and require 24/7 monitoring as unchecked changes in oxygen levels or temperature can cause fish illness or death, and that waste management has not been adequately researched as it has not been successfully implemented.

^{1a} From the April 2023 CtrlAqua Report: *“RAS has almost become an off-the-shelf product, while semi-closed facilities at sea still have a way to go. According to Chairperson Trond W. Rosten, this is the status after eight years of intense research conducted on fish in closed fish farms in CtrlAQUA.”*

^{1b} From the CtrlAqua Final Report:

“The use of S-CCs in the marine production phase of salmon was expected to prevent or reduce the influx of micro- and macroparasites if stocking pathogen-free smolt and controlling the intake water. However, the introduction of microparasites, which can spread by direct transmission, could pose a major threat for the future success of these systems.”

“Novel pathogens and new impacts of known pathogens could be a risk as higher population densities and slower exchange of water is expected in these systems.

“Atlantic Salmon in S-CCS are to a certain degree protected from infection with salmon lice, but there are no significant differences in development of prevalence and densities of other microparasites into S-CCS compared to nearby open cages.”

² Report in “Fish Farming Expert” 25.07.23:

“Osland Havbruk, which grows Atlantic salmon and trout, made an operating loss last year and says part of the reason was due to the non-delivery of two SCCS that were damaged in transport and collapsed after arriving on site, and deficiencies in two other SCCS already on site.”

*“The idea was that we should use semi-closed cages to avoid the lice pressure with subsequent treatment and biological challenges, **but it has turned out that the technology has not been fully developed.***

“Two of the four crashed before OH was to take over the cages. The other two were taken over by OH, but later proved to be so deficient that we have cancelled the contract in 2023. Nevertheless, OH has had - and will have - significant additional costs related to changes to the production plan, preparation of the site, follow-up of contracts and suppliers, clean-up after accidents and complaint handling.”

“Fiizk’s chief commercial officer Kevin Skarholt said the pens that collapsed were the first to be delivered of this model of this size.

“Unfortunately, there were principle structural issues with the pens that caused them to collapse shortly after they were moored.”

Note that these cages are the same size (30000m³) as the ones proposed for Loch Long and Loch Linnhe. Despite these disasters, Loch Long Salmon have quoted FiiZK Certus as their preferred supplier in their Appeal Statements for Beinn Reithe, stating in their presentations for Loch Linnhe that they are “best in their class”.

³ https://livingoceans.org/sites/default/files/Lousy%20Choices%20III_10_2022.pdf

“Semi-closed systems offer no hope at all for the reduction of pathogen transmission to wild salmon. While some such systems offer the option to collect solid waste, none provides treatment for liquid waste. In the liquid waste stream will be found toxic ammonia, decreased oxygen, parasites, viruses and bacteria, including Piscene orthoreovirus and Tenacibaculum maritimum,”

“But there is another reason that liquid effluent is a problem in semi-closed facilities. One of the things that has plagued all designs is that of inadequate flushing of the contaminated water. Salmon excrete ammonia and are sensitive to elevated levels of it in their environment, particularly when that environment is also oxygen-poor. Where netpens rely on ocean tidal action to carry effluent out of the cages and bring in freshly oxygenated water, semi-closed systems must rely on pumps and oxygenation of the facility’s water to maintain a healthy environment. Many of the prototype semi-closed systems fail to replace water adequately, especially as the fish grow larger.”

“To date (i.e., after a decade of innovation) semi-closed systems cannot exchange water efficiently enough to be physically and commercially viable grow-out facilities.”

“Rising levels of ammonia inside a salmon farm have potentially fatal consequences for the farmed stock. The first laboratory study of ammonia concentrations in seawater noted that salmonids are among the most sensitive of species to ammonia. During 48-hour LC50 trials with varying concentrations of ammonia, the researchers observed 100% mortality at ammonia concentrations above 0.6 mg/litre of seawater and described the effects:

“Moribund fish showed a characteristic behaviour indicating toxic effects on the nerve system, apparent from one to several hours before death. Coughing, twisting, loss of equilibrium, spiral swimming and convulsions were observed. Shortly before death, the fish often showed panic-like bursts of swimming. The fish collided violently with the walls or covers of the aquaria and then sank to the bottom in a coma-like state, in which there were no body movements except for weak and irregular opercular movements, and, occasionally, shivering fins. At death, the mouth was usually gaped open, and the fish often had wounds on the nose due to the mechanical trauma from collisions with the aquarium walls or covers.”

(Knoph, M.B., “Gill Ventilation Frequency and Mortality of Atlantic Salmon (salmo salar) Exposed to High Ammonia Levels in Seawater” Water Research, vol. 30, issue 4 (Apr, 1996)

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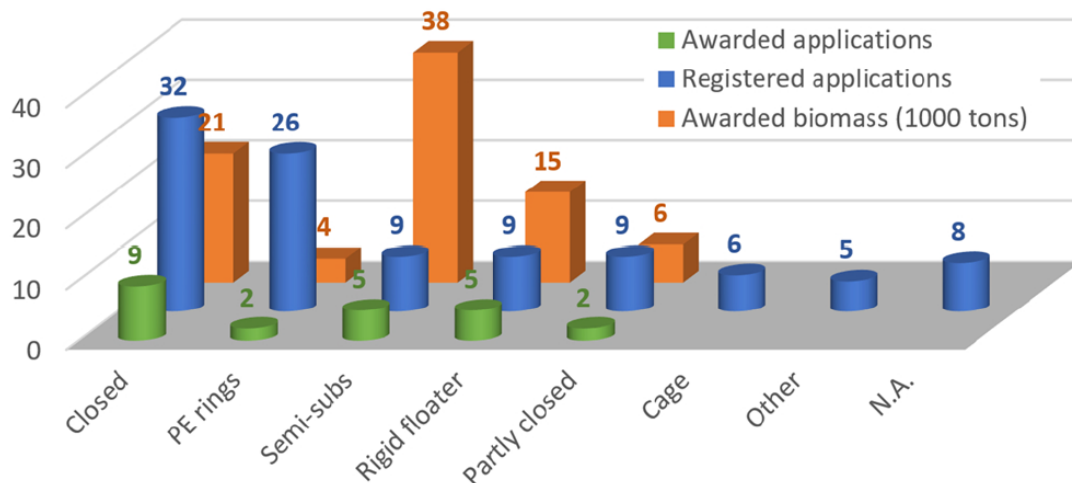
<https://www.sciencedirect.com/science/article/abs/pii/0043135495002332>)

⁴ From The Norwegian University of Science and Technology: “Are closed production technologies the solution to the sustainable challenges?” Authors Mi Le and Hanne Hadland]

“Jellyfish is a risk factor in semi- closed, as they are independent of light and weigh down to greater depths. In addition, the nettle cells in the jellyfish's catch threads can cause gill damage to the fish and have caused problems in larger accumulations in semi-closed facilities.”

⁵ Burgess Salmon Statement on behalf of Loch Long Salmon under 2.1
SCCS has been extensively used commercially for over a decade within Norway, and more recently in Canada and the Faroe Islands. In Norway they operated under ‘development licences’ prior to 2018 and ‘commercial licences since 2018. Importantly, “development licences” were used by commercial farmers for commercial production of salmon.

⁶ <https://www.sciencedirect.com/science/article/pii/S2352513422001119>



Farm concept	Registered applications	Awarded applications	Awarded licenses/biomass [1000 kg]	Percentage of awarded biomass [%]
Closed	32	9	30/21,204	27
PE rings	26	2	5/3900	5
Semi-subs	9	5	49/37,940	44
Rigid floater	9	5	19/14,820	17
Partly closed	9	2	8/6240	7
Cage	6			
N.A.	8			
Other	5			
Total	104	23	111/84,103	100

<https://www.fishfarmingexpert.com/development-permits-fisheries-directorate-norway/permit-conversion-anchors-the-future-for-ocean-farm-1/1339010>

⁸ <https://www.intrafish.com/technology/salmonor-applies-for-full-licenses-for-escape-proof-aquaculture-salmon-farming-concept/2-1-1203444>

⁹ Burgess Salmon Statement on behalf of Loch Long Salmon under 2.0
A conservative estimate is that more than 150 production cycles have taken place through SCCS – approximately 10 million fish – which is more than sufficient to draw conclusions on their efficacy and success.

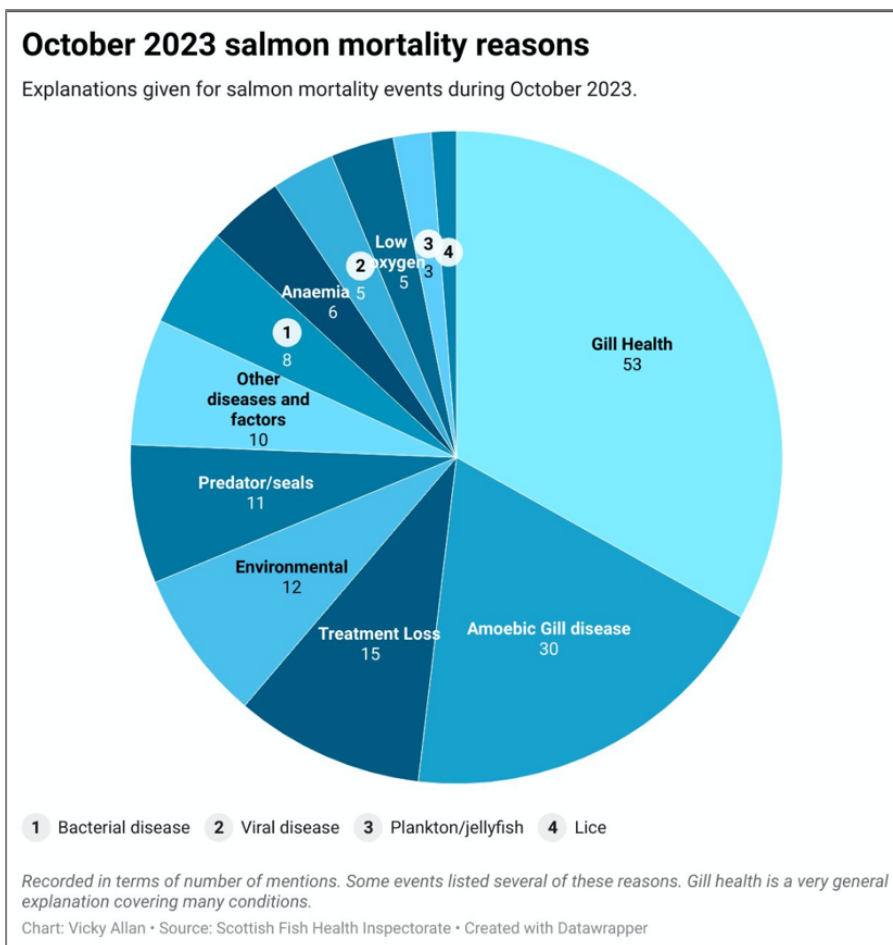
¹⁰ <https://www.intrafish.com/aquaculture/mowis-troubled-semi-closed-salmon-farming-cage-looks-for-new-home/2-1-853053>

¹¹ *“Originally, sea lice were thought to aggregate only in the upper 12 or so metres of the ocean. A study in 2019 found that salinity, rather than depth, had more to do with the dispersal of larval- and infectious-stage lice. The larval stages (nauplii) tended to avoid any waters with salinity lower than 30 ppt, while infectious-stage lice could be found in water salinities from 34.7 to 16 ppt.”*
 [Crosbie, T. et al, “Effects of step salinity gradients on salmon lice larvae behaviour and dispersal”, Aquaculture Environment Interactions, vol. 11, p. 181-190 (2019)]

https://livingoceans.org/sites/default/files/Lousy%20Choices%20III_10_2022.pdf

While some of the fancier semi-closed systems claim to have reduced sea lice ingress to the point where treatment is not required, they have to date only done so in trials scaled at less than commercial volumes or densities. The fact that even the industry continues to experiment with deeper semi-containment, requiring more powerful pumps and more oxygenation, suggests that the technology remains experimental.”

¹²



^{13a} <https://ctrlaqua.no/news/2022/05/05/two-pieces-of-fish-health-advice/>

Extracted quotes from Professor Are Nylund (University of Bergen):

...“However, there are several challenges that need to be addressed before the facilities can be put on the market: All the facilities I work with are prototypes that clearly need to be improved. They are designed for calm seas and cannot be placed anywhere. That’s just one of the challenges. And then there are some improvements that can be made to improve fish health in addition to avoiding salmon lice”, says Nylund.

“It should be possible to place the water intake at a depth greater than 20 metres. If you go deeper, you avoid more marine pathogens, despite the fact that the Tenacibaculum bacterium and the AGD amoeba will still be found there”, says Nylund.

“Treating the intake water is a theoretical possibility, but it is expensive because there are large amounts of water. I think we need to take it one step at a time, and this is not the first one”, says Nylund.

“Our research shows that as long as you do not have smolt that are free of viruses, you will get viruses in semi-closed facilities or any other aquaculture system for that matter”, says Nylund.

^{13b} And from The Norwegian University of Science and Technology: “Are closed production technologies the solution to the sustainable challenges?” Authors Mi Le and Hanne Hadland] *“Common diseases such as heart and skeletal muscle inflammation HSMB, and pancreatic necrosis have been detected in semi-closed facilities”*

¹⁴ Extract from “The effects of stocking density on fish welfare” by Louise Baldwin University of Plymouth:

“The welfare of intensively farmed fish is a subject of increasing interest and one of the principal areas of concern is stocking density. Several studies have examined the effects of density on the welfare of farmed fish and have found it to be a source of chronic stress with commonly reported effects including reduced growth rates, alterations in the physical condition and health of fish, and the activation of stress responses. Such changes in the biological and physiological systems of fish are indicative of a reduced welfare status.”

¹⁵ Q.3 from the Scottish Parliamentary Minutes of a Rural Meeting with the Norwegian Fisheries Minister

https://archive2021.parliament.scot/S5_Rural/Meeting_with_Norwegian_Fisheries_Minister_follow_up_info.pdf

¹⁶ From The Norwegian University of Science and Technology: Are closed production technologies the solution to the sustainable challenges? Authors Mi Le and Hanne Hadland] *“Common diseases such as heart and skeletal muscle inflammation HSMB, and pancreatic necrosis have been detected in semi-closed facilities”*

17 <https://www.fishfarmingexpert.com/aquaculture-salmon/feed-pipe-wear-putting-tonnes-of-plastic-into-sea/1257139>

18 <https://www.epa.gov/climate-indicators/climate-change-indicators-sea-surface-temperature>

Figure 1. Average Global Sea Surface Temperature, 1880–2020

