Scottish Salmon Investigation FAQ

This document is strictly confidential

Contents

These questions are provided to help with answering supporter or media enquiries. When answering, please bring your comment back to what needs to change (the moratorium). Please be mindful regarding accuracy, so that there is no issue in regard to any legal liability.

We do not expect other organisations to agree with, or adhere to, Compassion's viewpoints. You may may have varying answers, for instance to what kind of fish one should or should not eat. We are providing Compassion's responses to these for your information only, to help guide you if you are unsure how to answer these.

Key Questions

What were the key findings from the investigation?	Some of the main welfare issues identified across the farms included salmon overcrowded in cages, sea lice parasite infestations and damage, fin erosion. Investigators also found blind fish and seaweed growing from open wounds. One of the farms was so poor that we reported it to the Scottish authorities. We also captured harrowing footage of poor cleaner fish welfare, dead fish being dumped into open pits, and a hydrolicer boat in action.
Are these one-off welfare issues?	Our investigator captured animal welfare issues across 6 farms from 5 salmon producers that cover over 96% of the entire Scottish salmon farming industry. It is clear from the footage, and the report, that these kinds of animal welfare and environmental issues, such as sea lice, disease and pollution, are endemic across the industry. It's urgent that the Scottish Government puts in place a moratorium. *More info:* It is also not the first time some producers have been exposed for poor conditions, e.g.) https://theferret.scot/mowi-fish-farming-deaths/ https://www.ciwf.org.uk/news/2019/05/salmon-farming-exposed
What do you want to happen as a result of the investigation and report?	There are major environmental and welfare impacts already in this industry which is trying to expand beyond its limits. We are calling for a complete moratorium on the expansion of salmon farming in Scotland. This must happen urgently. Or If there were thousands of sick and dying cows lying in fields, there would be a national outcry. Far from promoting expansion the Scottish Government should be dealing with these widespread animal welfare and environmental issues caused by these farms immediately.
Why are we targeting Scottish salmon, rather than Norwegian,	Scottish salmon is heralded as a high quality, premium delicacy. It's also exported globally to over 50 countries. By evidencing that even Scottish salmon are in fact suffering miserable lives, with high mortality rates and prolific sea lice infestations, and considering that all other Atlantic salmon

Canadian or Chilean salmon?	farming systems have similar welfare issues, this indicates that not only the Scottish industry but the global industry as a whole needs vast improvements.
Fish aren't like other animals—they don't even feel pain. Why should I care?	Fish are the most misunderstood farmed animals. They have a central nervous system, they can feel pain and suffer, and they are sentient. They can be curious, emotional and sensitive—just like a dog, a cat, or a pig. Scientific research reveals that fish are also intelligent—with some species passing mental tests that even primates, like monkeys and apes, fail. All animals deserve to live decent lives, but fish really are the forgotten trillions. Legislation is failing to protect fish and it is time we give them the care they deserve. We should protect fish as much as possible.

Why are fish a campaigning priority?	Fish are killed in the hundreds of billions per year globally for food production – or trillions when you include wild-caught fish. To put this in perspective, 60 billion terrestrial (land) animals are farmed for food. What's worse is that fish are the least protected group of farm animals. Many national and international animal welfare protection legislations do not extend to the lives and deaths of fish, and because of this, fish often suffer the greatest amount on the farms and during slaughter. Moreover, fish farming is the fastest growing type of food production in the world, so we must act now more than ever before to ensure the rate of growth of the industry slows right down until the welfare of fish is guaranteed. **More info:** Basic welfare practices are few and far between on fish farms globally. Moreover, there is inadequate research into how to ensure a fish lives an adequate life on a farm. This desperately needs to change. Improved legislative changes and business practices for fish welfare can make a drastic difference to the lives of many millions of animals in a relatively short space of time. Moreover, fish farming is the fastest growing type of food production in the world, so we must act now more than ever before to ensure the rate of growth of the industry slows right down until the welfare of fish is guaranteed.
What has Scottish salmon got to do with my country?	The UK exports salmon to over 50 countries around the world – this amounted to over 99,000 tonnes of salmon in 2019, so it is very much a global issue. *More info:* You can find how much Scottish salmon your country imported in tonnes in 2019 in the Export Data spreadsheet in the Strategy & Information folder (see the yellow column to the right for these figures).

There were different findings at each of the farms you visited. How can you say these issues are endemic to the entire industry?	Although some of the farms our investigators had different individual findings, and some were worse than others, all of the farms showed evidence of extensive parasitic infestations, disease and overcrowding. Moreover, all of these salmon lived in barren cages for as long as 2 years, produce huge amounts of waste that pollute the surrounding environment and are fed huge quantities of wild caught fish. It's clear that there needs to be a radical rethink of the industry if there are to be improvements for the lives of these animals and the impact they have on the natural environment. That is why we are urging the Scottish government to immediately implement a moratorium on the growth of the industry before it doubles in size, as planned.

Investigation

When and where was the investigation conducted?	This footage was captured from salmon farms off the coast of Scotland and the Shetland Islands in October-December 2020. In total investigators visited 22 farms and were able to film underwater at six. Our investigators found intense animal suffering across the five main Scottish salmon producers, that account for over 96% of the entire Scottish salmon farming industry.
What are the names of the farms?	We are not making the individual farm details public because our role is to change the inherent, endemic, cruelty in salmon factory farming, not target individual farmers. We will make more change for more animals by campaigning for systemic change. It's urgent that the Scottish Government puts in place a moratorium.
Did you report any of the fish farms to authorities?	Yes. One of Scottish Sea Farms' sites displayed major welfare issues which we believe was a violation of the Animal Health and Welfare (Scotland) Act 2006, meriting reporting to the Animal Plant and Health Agency. This included salmon with eyes missing, major lice damage, one with a big chunk of flesh missing from its tail, fungal/parasitic infections, fish with lesions and 'white heads' (large areas of exposed flesh on the head). Authorities have told us the farm is still being investigated.
Did you cause any biosecurity risk to the fish?	We created a biosecurity protocol for this investigation. Our investigators took steps to minimise any biosecurity risk to the surrounding environment. For instance, the investigator disinfected their diving gear between each dive. Of course, Scottish salmon farming itself may post a biosecurity risk with open pits of dead fish often left exposed.
Did you break any laws when accessing the farms? What are the current laws such as for trespassing?	The team did not illegally trespass on company property, did not enter cages, and did not damage nets or any other company property. Law on 'right to roam' is broader in Scotland than the UK so the team used their rights to access and film where permitted. Current laws relevant to this are:

	The Trespass (Scotland) Act 1865 Land Reform Act 2003 The Land Reform Act 2003 was introduced to improve "general rights of access, servitudes and encampment on private land". The act established universal access rights to most land which people have the rights. If these rules are exercised properly "respecting other people's privacy, safety and respecting the environment around them" then it is not considered trespass. The sea is also not owned by salmon farmers, so it is more about the land-based facilities.
How did you get the footage under COVID restrictions?	Investigators followed government guidance and adhered to local Covid restrictions during filming.

Report

What is the report about?	The report accompanies the investigation, looking at both the investigation and further research into the industry. It describes the severe animal welfare and environmental problems associated with Scottish salmon farming such as parasites, high death rates and salmon not afforded enough space, as well as the consequences of this industry for local communities. It also features information and photos from the investigation. Together the investigation and report create a strong case for a moratorium, with a view to phasing out intensive salmon farming altogether.
What were the key findings from the report?	Along with the findings of the investigation, the report summarises some of the main welfare issues with salmon farming as high mortality rates, sea lice infestations and the treatments and other fish used to control sea lice and barren environments etc. It also emphasises some of the dire environmental impact of salmon farming. *More info* 1. **The results from our investigation.** In the winter of 2020 Compassion in World Farming sent a team of undercover investigators to the West coast of Scotland and accompanying islands to witness the conditions experienced by farmed Atlantic salmon. The footage gathered showed that right across the industry, salmon are suffering on a large scale and the welfare of these sentient animals is not being sufficiently protected. ✓ Images obtained for this investigation showed some salmon swimming blindly around the cages with

	missing eyes, and some with large chunks of skin and flesh that had been eaten away. Many of the fish were covered in parasitic sea lice that were eating away at their skin, some had seaweed growing in open wounds. There was also evidence of gill damage, fin damage, abrasions and lesions, infection, and mouth damage from the nets. ✓ Cleaner fish were also recorded in many of the sea cages (fish that are used as a treatment for sea lice). We saw cleaner fish that were themselves being attacked by lice, had wounds with seaweed growing from them, and suffered damage from fungal infection. ✓ Water condition at the dived sites was poor, with visible particulate (oil, feed, faeces, algae) suspended in the water. Fish were overcrowded, and at one site the water appeared to be deoxygenated. 2. **Welfare issues.** The report summarizes the main salmon welfare issues as high mortality rates, sea lice infestations and the treatments used to control sea lice, they suffer also from several diseases, barren environments etc. Information about the welfare issues related to the use of cleaner fish to remove sea lice are also found. Mortalities of cleaner fish are also extremely high, they also suffer from starvation, lack of suitable habitat, aggressive interactions or diseases. 3. **Environmental impact of salmon farming.** The report demonstrates the environmental impacts of salmon farming, which includes: ✓ Organic and chemical waste coming from uneaten food and faeces. ✓ Potential for eutrophication and production of harmful algal blooms. ✓ Antimicrobials used in salmon farms could increase antibiotic resistance. ✓ Salmon farms increase the spread of sea lice and disease to wild populations locally. ✓ Farmed salmon escapes lead to interbreeding with wild salmon which can compromise wild populations fitness. ✓ Seals and cetaceans are affected by predator control measures in salmon farms. ✓ The use of fishmeal and fish oil in fish feeds is unsustainable since vast numbers of wild fish are caught to feed salmon; these are mostly food grade that could otherwise be eaten directly by humans, and energy is lost during the conversion to salmon flesh.

	4. **Scottish salmon farming breaches animal welfare legislation**. The Animal Health and Welfare (Scotland) Act 2006 places a duty of care on those responsible for any vertebrate to promote their welfare and prevent suffering. That means looking after their physical and mental wellbeing and protecting them from pain, injury, and disease. However, typical farming conditions do not allow for this. 5. **Report conclusions:** Compassion in World Farming and OneKind are calling for a moratorium on the growth of the Scottish salmon industry until the numerous welfare and environmental issues can be properly addressed, and conditions are significantly improved.

Producers

Please note we are targeting the Scottish Government, not producers. This information is provided in case you are asked specific questions – in which case please feel free to share this information.

Which producers run the farms in the investigation?	Our investigator captured footage from the farms contracted to 5 key salmon producers, which collectively account for over 96% of the industry. These include **MOWI Scotland, Scottish Sea Farms, Grieg Seafood, The Scottish Salmon Company and Cooke Aquaculture.**
How much salmon does each producer produce in Scotland? [1]	In 2019, the total amount of farmed salmon produced in Scotland was as much as 165,200 tonnes. • **MOWI Scotland** produced 65,400 tonnes of salmon in 2019, which is 39.6% (40%) of the total. • **Scottish Salmon Company** produced 33,800 tonnes of salmon in 2019, which is 20.5% of the total. • **Scottish Sea Farms** produced 25,900 tonnes of salmon in 2019, which is 16% of the total. • **Cooke Aquaculture** produced 23,400 tonnes of salmon in 2019, which is 14.2% of the total. • **Grieg Seafood** produced 11,300 tonnes of salmon in 2019, which is 6.8% total.
What percentage of the industry do these producers cover?	These 5 producers altogether cover over 96% of the entire Scottish salmon farming industry. The other ~3% is produced by Loch Duart, Organic Sea Harvest, and Wester Ross Salmon.
Are they all Scottish producers?	The £2 billion salmon farming industry marketed around the world as Scottish is virtually all (99%) owned by overseas investors in Norway, Switzerland, Cyprus, Canada and other countries. *More info:* • **MOWI Scotland** is a Norwegian seafood company with operations in a number of countries around the world.

	• **Scottish Sea Farms** are owned by SalMar (Norway) and the Lerøy Seafood Group ASA of Norway. • **Grieg Seafood** is a Norwegian aquaculture company. • **The Scottish Salmon Company** is headquartered in Edinburgh and incorporated in Jersey. • **Cooke Aquaculture** is a vertically integrated aquaculture corporation based in Blacks Harbour, New Brunswick, Canada, with salmon farming operations in Atlantic Canada, the US, Chile and Scotland, as well as seabass and seabream farming in Spain.

Why have you released the footage to media rather than showing it to the producers?	By releasing the investigation to the public, our aim is to create awareness of the issues and garner swift and definite action on behalf of salmon at Scottish Government level.
Are the producers to blame for this cruelty?	Fish welfare is an increasingly urgent issue due to the amount of systematic suffering that is simply accepted for these misunderstood animals. We believe that protections for these animals should be recognised by law and enforced properly by countries that are home to these industries. That is why we are by calling for a moratorium at Scottish Government level.

Are these farms assured by the RSPCA?	Information is not available on whether the individual farms investigated are RSPCA assured. However, the RSPCA does assure much of the Scottish salmon industry. It appears that all of MOWI's, Grieg Seafood, and Scottish Sea Farms are RSPCA assured.
Is this cruelty the RSPCA's fault?	The RSPCA does incredible work improving the lives of millions of farmed animals through their farmed animal certification programs and other activities. Countless farmed fish undoubtedly have better lives because of the RSPCAs involvement, but overall, the salmon industry has such widespread and systemic welfare problems it needs to be halted. We have shared our finding with our friends at the RSPCA and are in dialogue with them over the Scottish salmon industry and ways our organisations can work together to improve it.
Would you recommend people buy RSPCA Salmon?	At the moment, the Scottish salmon industry is responsible for an animal welfare and environmental crisis. The entire industry needs an overhaul, and while some farmers are adhering to higher standards than others, we would recommend consumers are cautious when buying farmed salmon in general. Due to the serious animal welfare and environmental consequences, we therefore do not encourage consumers to buy farmed salmon, Scottish or otherwise.

Do these farms/producers have any other certifications?	Information is not available on whether individual farms are certified, but we can find certification per producer – all filmed producers appear to be certified. Despite many of these farms being accredited with various certifications, the welfare of these sensitive animals is not adequately protected. There needs to be a radical transformation of both the industry and the standards required for certification. *More info:* ○ **Grieg Seafood** are also GlobalGAP certified, and they want to be 100% ASC certified by 2023 ○ Some **MOWI Scotland** farms are Label rouge and ASC certified ○ **The Scottish Salmon Company** have some GlobalGAP and Label Rouge certified farms. ○ **Scottish Sea Farms** have been awarded ISO 9001 for quality standards, they have been awarded British Retail Consortium Grade A certificate and they comply with the SSPO (Scottish Salmon Producers Organisation) Code of Good Practice. ○ **Cooke Aquaculture** are also GlobalGAP and Label Rouge certified. They have the ISO 14001 (Environmental management) and some of their farms are organic and have the Soil Association certification.

Scottish Salmon Farming

How many salmon are farmed/slaughtered each year?	In Scotland, huge numbers of Atlantic salmon are farmed each year. In 2019 alone, Scotland produced a record-breaking 203,881 tonnes of Atlantic salmon, which is equivalent to around 35 million fish.[1] This does not take into account the high death count before slaughter - which can be over a quarter in just the seawater stage (even higher with the freshwater stage) - so the total number of fish farmed will be even higher. More info: NOTE that Brexit and COVID has had an effect on the industry: https://www.bbc.com/news/uk-scotland-scotland-business-56041955
Where do the salmon come from?	Scottish Salmon Think Tank says salmon eggs for farms are mostly imported to Scotland from Norway. The salmon come from eggs in freshwater hatcheries. Broodstock (adult female salmon) are stripped for eggs which are fertilised. Once hatched, the salmon spend their first year of life growing in freshwater tanks. When they reach the juvenile stage, they are transferred into seawater cages.

[1] Estimate based on an average weight of 5.8kg per salmon.

How long will be the salmon be kept in these cages?	The salmon can live in these cramped sea cages for as long as 1-2 years. The salmon that reach slaughter age are around 3 years. A life spent caged is not life at all – salmon deserve better.
Doesn't the industry bring in lots of money to Scotland/provide lots of jobs?	Someone is paying the price for the appalling conditions on the salmon farms and at the moment that's the salmon and the environment, and eventually it could be Scotland, and its reputation, as a whole if the expansion goes ahead. We need to take into account the losses. Salmon farming has huge welfare and environmental implications as well as negative effects on local businesses and tourism. This industry is already unsustainable, and it's only set to get worse. *According to our report, some data has shown that employment figures related to Scottish salmon farming have been overestimated by 251% and income by 131% for example by overestimating the number of employees indirectly employed by salmon farms.* *Salmon farming is wreaking ruin on marine ecosystems, through pollution, parasites and high fish mortality rates which are causing billions of pounds a year in damage. Taken together, these costs amounted to about $50bn globally from 2013 to 2019. (New Changing Markets report, alongside Just Economics).* *More info:* *NB. Important to know Scottish Salmon Farming worth 2 billion to economy: https://thefishsite.com/articles/salmon-farming-worth-2-billion-to-scottish-economy* As much as 99% of caged salmon production from Scottish-branded companies operating along the west coast is controlled from outside of Scotland.[2] Most of the industry is Norwegian (Mowi, Scottish Sea Farms and Grieg Seafood) and Cooke Aquaculture is Canadian.[3] Three of Scotland's big six salmon farming firms are owned by Norwegian companies: Mowi (formerly Marine Harvest), Scottish Sea Farms and Grieg Seafood.
I heard that pink dye is added to farmed Scottish salmon to make them look	The red colour of farmed salmon is obtained by adding pigments in salmon fish food, otherwise the flesh would be pale. Farmers do that to achieve the coloration that meet consumer preferences but also, the substance is needed for reproduction, proper growth and survival of the fish.[4] *More info*

[2] Scottish Salmon Watch

[3] https://theferret.scot/salmon-scottish-owned-abroad/

[4] Dissing BS, Nielsen ME, Ersbøll BK, Frosch S. Multispectral Imaging for Determination of Astaxanthin Concentration in Salmonids. Browman H, editor. PLoS One [Internet]. 2011 May 10 [cited 2021 Feb 5];6(5):e19032. Available from: https://dx.plos.org/10.1371/journal.pone.0019032

'healthier'. Is this true?	This substance is called astaxanthin and contains mainly carotenoids pigments.
What brands is Scottish Salmon sold under and where is it sold?	Scottish salmon can be sold under various brands, depending on the retailer, country and farm. In any case, suffering in the salmon industry is endemic and needs a firm response from Scottish Government. Due to the serious animal welfare and environmental consequences, we therefore do not encourage consumers to buy farmed salmon, Scottish or otherwise.
I thought Scottish Salmon was wild caught!	75% of all the salmon eaten globally is farm-raised (as of 2017 – this number is likely to be larger now).[5] Most of the salmon that comes from Scotland is farmed – and people have no idea.

Salmon welfare

What are the key welfare issues with salmon farming in Scotland?	High mortality rates, sea lice infestations and painful treatments, infections and disease, barren environments, an inability to express natural behaviours such as migration and the use of cleaner fish. Right now, fish are suffering – and we are urging the government to put in place an immediate moratorium on expansion. *More info:* Many of the welfare issues on salmon farms in Scotland are also common in other Atlantic salmon farms around the world. Please see below, and the report, for more information around welfare issues in salmon farming. Please see the table at the end of this document to see death rates of salmon, and why we use 'up to a quarter of these salmon won't make it to slaughter'.
How do salmon live in the wild?	Salmon are extraordinary animals! They migrate thousands of miles back to where they were born after living for years at sea. In farms, salmon spend their entire lives trapped in sea cages, not being able to express this intrinsic instinct to migrate. Like other fish, salmon are smart, sensitive and deserve a life free from pain and suffering. *More info:* In the wild, Atlantic salmon start their lives in freshwater rivers such as in Scotland. When they become smolts (the name for juvenile salmon who have been through 'smoltification' which is a complex series of physiological changes where young salmonid fish adapt from living in fresh water to living

[5] https://journalistsresource.org/studies/environment/food-agriculture/farmed-versus-wild-salmon-research-explainer/#:~:text=The%20volume%20of%20farmed%20Atlantic,find%20and%20generally%20more%20expensive.

	in seawater), they start their first migration towards saltwater feeding grounds. This can be as far away as the West of Greenland. After up to three years at sea, they migrate back to the rivers they came from to spawn, relying on the earth's magnetic field and their sense of smell to navigate. It's a round trip that can reach around 4,000 km and, if they survive, they'll make it more than once in their lifetime.
What is better for fish welfare—buying wild-caught fish or farmed fish?	The two issues are inter-linked. Our oceans are teetering on the brink of collapse because too many wild fish are being pulled out too quickly, and fish farming is playing a major role in this collapse. Salmon farming has become part of the problem. We know that almost all wild caught fish suffer immensely when caught and killed, and between 20%-25% of all wild fish caught are ground up into fish meal and fed to farmed fish. So, if consumers buy farmed fish species that are carnivorous (eats other fish, crustaceans etc.), like cod, sea bass, sea bream, trout or salmon, they are directly contributing to the suffering and disappearance of fish in the wild. *More info:* Of course, buying farmed fish species that are vegetarians (herbivorous), like carp or tilapia, would mean that wild caught fish are spared. If kept in high welfare systems, then herbivorous farmed fish would be the higher welfare choice. Due to the serious animal welfare and environmental consequences, we therefore do not encourage consumers to buy farmed salmon, Scottish or otherwise. Reducing fish consumption by eating "less and better" should be encouraged.
Are there more humane ways of farming salmon?	We are calling on the Scottish Government for a moratorium on the expansion of the Scottish Salmon industry. Confining carnivorous species in underwater cages and depleting our oceans of wild fish in order to feed them, is pure madness. Reducing stocking density and improving water quality would make a difference for the welfare of farmed salmon, as well as reducing sea lice infestations and painful procedures such as sea lice removal methods. Ultimately, we directly challenge whether farming essentially wild, migratory fish, such as salmon, has any place in a sustainable food system.

Stocking density

Why is it an issue crowding lots of	Like all animals, fish need space to move freely and express natural behaviours. When lots of fish are overcrowded into a small space, disease can spread more easily. Crowded salmon can also be more stressed, and this

fish into a small space?	can result in aggression, fighting and physical injuries from biting. On the other hand, low stocking densities can also result in aggressive territorial behaviour. In the wild salmon are able to get away from each other. *Additional info:* Fish excrete into the water, so in these crowded cages, waste products such as ammonia can build up to dangerous levels. The resulting poor water quality can significantly impact a fish's wellbeing, reducing oxygen levels and increases the spread of disease. Also, most fish breathe via the water and so having lots of fish in one area means that the oxygen levels in the water will rapidly deplete. Sudden changes in the environment, like a rise in temperature, can result in the fish struggling to breathe and even dying. Fish may want to choose to be in certain areas to adjust to differing levels of light or varying temperature. The ability to choose where the fish feels most comfortable will be highly restricted in crowded cages. This, for instance, will force fish into uncomfortably warm or exposed parts of the farms when they would prefer to be in cooler areas, resulting in further increases in stress and aggression, and can even cause sun burn to their sensitive skin.
What stocking densities does CIWF recommend for Atlantic salmon?	10Kg/m^3 or lower in sea cages. Current levels can be as high as around 25 kg/m^3.
Some of the fish in the investigation were on their own and had lots of space around them. They didn't look overcrowded.	In the wild salmon can swim up to 4000km across oceans, but on factory farms, thousands are crammed into a cage. The average stocking density across the entire cage is higher than we would recommend, and there'll be areas in the cage with a far higher density and other areas with a lower density so a snapshot of one fish will not be representative.

Sea lice and diseases

What are sea lice, and why are they harmful? How do salmon catch them?	Sea lice are parasites that feed on the skin, blood and mucus of fish, causing tissue damage, increased mortality rates and chronic stress. While sea lice are a naturally occurring salmon parasite, and at low numbers do not cause significant damage, high parasite numbers can occur when host fish are kept in crowded, confined spaces such as salmon farms. **More info:**

	The Code of Good Practice for Scottish Finfish Aquaculture sets out best practice measures for all types and stages of finfish production in Scotland and is mandatory for members of the Scottish Salmon Producers Association. In the code, thresholds for sea lice treatment vary depending on the time of year. From 1st February to 30th June the threshold is set at 0.5 adult female lice per salmon, and from 1st July to 31st January it is raised to 1 adult female lice per salmon. The Scottish Government also have trigger levels which were updated in 2019. If salmon farms exceed an average of two adult female sea lice per fish, they must report levels to the Fish Health Inspectorate (FHI). If levels exceed six, intervention should occur. In 2019, there were 324 reports of weekly average sea lice levels exceeding two adult female lice and 29 reports of levels exceeding six adult female lice. In our investigation we saw fish that appeared to have large numbers of sea lice eating away at their skin – one example had least 7 adult and 9 juvenile sea lice attached, just on one side of it's body. Sea lice leave painful open wounds and ulcerations, leading to stress, anaemia, reduced growth, reduced osmoregulatory and respiratory ability, impaired body defences, risk of secondary infections and, ultimately, death. Sea lice float through the open water into the cages and attach to the salmon's skin to feed. According to the Just Economics 2021 Dead Loss report, Sea lice have cost the Scottish salmon industry an estimated $465 million from 2013 to 2019. According to the Just Economics 2021 Dead Loss report, Sea lice have cost the Scottish salmon industry an estimated $465 million from 2013 to 2019.
I thought Salmon in the wild also had lice – how much more of a problem is this in Scottish Salmon farms?	Sea lice occur in the wild but spread particularly fast on salmon farms with a high concentration of fish in cages on fish farms, that are unable to escape them. Scottish salmon farms are harming both farmed and wild salmon. Sea lice infestations on salmon farms may even increase sea lice levels in vulnerable wild salmon populations as the sea lice larvae can spread to wild salmon as they migrate past the cages.[6] That's why we are calling for a moratorium on the growth of the industry.
What about other diseases in fish farms?	Apart from sea lice, other prevalent diseases in salmon farms include: • **Amoebic gill disease** is caused by a parasitic amoeba that damages gills and can lead to suffocation. • **Infectious salmon anaemia** (ISA) is a viral disease that spreads easily within and between salmon farms. Salmon infected with ISA suffer from severe anaemia, liver necrosis, and haemorrhaging.

[6] Monthly averages show that average adult female sea lice count per fish increased by 96% between April 2018 and May 2019. In the same period, there was close to a 25% rise in the number of salmon on farms in Scotland. Also, further analysis shows that salmon farms produced two to three times more juvenile sea lice in April 2019 than April 2018.

	• **Cardiomyopathy syndrome** affects the heart and muscles of fish. One of the main signs of CMS in salmon cages is extended periods of increased mortality as salmon often show few external signs, though they may suffer from haemorrhages and have raised scales. • **Pancreas disease** is caused by the salmonid alphavirus (SAV) and causes necrosis of pancreatic tissues. Salmon infected with the virus, which is most common during the first year at sea, suffer weight loss and anorexia, low energy, and often die.

Sea lice treatments and cleaner fish

What are the key welfare issues with thermolicers and hydrolicers?	Treatments that exist to treat parasites such as sea lice often introduce their own welfare problems. **Thermolicers** are machines that target sea lice by exposing salmon to a sudden increase in water temperature, reaching as high as 34 to 38°C. Salmon are sensitive to changes in their environment and experience optimal feeding and growth rates at temperatures between 11 and 14°C. Exposure to these temperatures can result in acute tissue damage, especially to the gills but also to the eyes and brains. Furthermore, the process involves crowding salmon into a small area, pumping them up into the thermolicer and then out again, during which time they can suffer physical injury to fins, snouts and scales from contact with abrasive surfaces. This process is stressful for the fish and can even lead to a high number of mortalities. **Hydrolicers** are machines that use freshwater jets to physically remove sea lice from salmon, and they can cause scale loss. It is a stressful process similar to the thermolicer where fish are crowded and pumped from cages into delousing chambers, which can also cause stress, pain, injuries and ultimately death.
What are the key welfare issues for cleaner fish, and why isn't this a good option for treating sea lice?	Cleaner fish, some captured in the wild, are placed in sea cages to try to control sea lice on salmon as they can eat the parasites off their skin. They are not a suitable option for treating sea lice on salmon as it introduces a whole new set of animals into the farms, which also suffer from terrible welfare. In the cages, they can suffer from starvation, lack of suitable habitat, aggressive interactions and diseases, and they are also attacked by sea lice themselves. Cleaner fish deaths in the cages are very high, and those that do survive the production cycle are discarded – they are not stunned before they die or killed in a way that takes their welfare into consideration. *More info:* You can find more information on Compassion's cleaner fish infographic here:

	https://www.compassioninfoodbusiness.com/media/7444184/cleaner-fish-welfare.pdf Cleaner fish, which are typically lumpfish and cleaner wrasse, are placed in sea cages to try to control sea lice on salmon as cleaner fish can eat the parasites off their skin. However, the welfare of the cleaner fish is not protected. In the cages, they suffer from starvation, lack of suitable habitat, aggressive interactions and diseases, and they are also attacked by sea lice themselves. Cleaner fish deaths are also very high, and those that do survive the production cycle will die at the end. Salmon are typically stunned before being slaughtered, but the cleaner fish are left behind in the cages and left to die without any prior stunning. Cleaner fish are not a suitable option for treating sea lice on salmon as it introduces a whole new set of animals into the farms, which also suffer from terrible welfare. The industry sacrifices the welfare of the intelligent cleaner fish for the production of salmon. Cleaner fish are also not proven to be effective at reducing the lice levels on salmon farms and keeping them low.
Where do cleaner fish come from?	Cleaner fish are typically two species – some farmed, some wild caught and placed in the sea cages. *More info:* Cleaner wrasse are primarily wild caught in the UK, both in Scotland and in south west England, which is putting huge amounts of pressure on wild population levels. All lumpfish used on salmon farms in Scotland are produced on farms dedicated to raising them - as many as 660,000 lumpfish were farmed in 2019.
What do the cleaner fish eat?	Naturally, both lumpfish and wrasse eat a variety of food depending on what is available to them. Not all cleaner fish feast on sea lice - some studies reported only 15 to 36% of lumpfish consumed sea lice when they were observed. Cleaner fish feed also contains fishmeal and oil, adding further to the number of wild-caught fish needed for salmon production. *More info:* In new environments, they can adapt to find something to eat. They also eat other marine life they find within the cage.

Slaughter and high mortality rates

Are farmed salmon in Scotland stunned before slaughter?	The Scottish salmon industry typically uses electrical and percussive stunning methods (administering a severe blow to the skull of the fish) when slaughtering Atlantic salmon. This number is high and may be at least as much as 70-80% of the industry. However, stunning prior to slaughter is not

If so, what percentage?	mandatory under law, and so there still may be thousands of animals that are killed without prior stunning. That's why we are calling for a moratorium on the growth of the industry until action is taken by the Scottish Government to ensure all these animals die in a fast and painless way.
Many salmon die before they reach slaughter weight. Why is the mortality rate so high?	Salmon are dying every day on Scottish salmon farms. In any given year, many as a quarter may die before slaughter from diseases and parasites, sea lice treatments (such as thermolicers and hydrolicers) and negative reactions to handling. Salmon also suffer physical injuries and, consequently death, during bad weather and predation, both of which can also lead to salmon escaping from the farms into the wild.
I saw an Animal Equality investigation on salmon slaughter, doesn't this contradict what you're saying?	This investigation showed salmon being mis-stunned and poorly handled, which resulted in a painful, traumatic death for these animals. We still think stunning should be mandatory across the whole industry, but also properly regulated and audited to ensure the salmon die in a fast and painless way.

Enrichment

What is enrichment and why do fish need it?	Fish suffer from boredom and frustration as much as any other farmed animal. Good welfare means giving fish an environment that is similar to wild conditions and complex enough to meet their behavioural and mental needs. Intensive farms are usually barren and very different to natural habitats. Barren environments limit the expression of natural behaviours, such as migrating, resulting in negative impacts on the physical and mental health of the animals, with many experiencing inescapable boredom from swimming aimlessly for years. Ultimately, we directly challenge whether farming essentially wild, migratory fish, such as salmon, has any place in a sustainable, humane, food system. *Additional info:* Environmental enrichment involves deliberately increasing environmental complexity to improve welfare. There are a growing number of studies showing the various welfare benefits of enrichment for fish - there is evidence for reduced aggression, a reduction in disease and injuries, improved cognitive capacity and exploration, reduced impact from stress and decreases in larval deformity and reduced mortality. Enrichments that give the fish some more complexity in their environment can include shelters (e.g., pipes or shells), changing the colour of the tank, or adding a cover to the top to create a shade. There are even some examples of music having a positive effect on fish growth. Some level of control over the environment is generally good for animal welfare and may be achieved by use of self-activated feeders for fish.

	The understanding of how enrichment affects captive fish is gradually increasing, and this is a promising method for improving the welfare of farmed fish. Please see our food business resource on enrichment for salmon for more information [here].
What are the natural behaviours that salmon are prevented from expressing in farms?	In farms, salmon spend their entire lives trapped in sea cages, not being able to express this intrinsic instinct to migrate. Sea cages also limit the choices of salmon, which can in turn cause stress. As salmon are stuck in a small, barren area without spaces to hide or find shelter, they are unable to move to new environments in response to changes such as temperature, oxygen levels, weather etc. They also cannot hunt for fish, which they would normally do in the wild.
What sort of enrichment do you propose?	Salmon farms could use environmental enrichment. For example, it has been scientifically proven that providing sand, colouring the walls blue and partially cover the tanks in the freshwater stage when they are juveniles, as well as interactive feeding in sea cages when they are adults can actively improve the welfare of salmon. Ultimately, we directly challenge whether farming essentially wild, migratory fish, such as salmon, has any place in a sustainable, humane, food system.
Are these any drawbacks with installing enrichment for fish?	One challenge when adapting enrichments for commercial use is maintaining hygiene and the ability to clean tanks with more structural items. Another common issue is that after finding appropriate enrichments, there is a risk that too few are added and then they can become a source of stress for the fish due to competition over access. None the less, this provides a reason for essential research. Ultimately, we directly challenge whether farming essentially wild, migratory fish, such as salmon, has any place in a sustainable, humane, food system.

Environmental issues with salmon farming

What are the key environmental issues with salmon farming in Scotland?	Salmon farming has a significant impact on the natural environment. It pollutes surrounding waters with waste, chemicals and antibiotics. Parasites and diseases that manifest within the farms more easily spread to wild fish communities. Salmon farming also contributes to the destruction of our seas. The feed for farmed salmon partly consists of fish caught from the wild – each salmon can eat as many as 350 fish in its lifetime. As many as a quarter of wild caught fish are used to feed farmed animals, and this is wasteful and 90% of these could be fed directly to humans. **More info:**

	Organic and chemical waste which change the chemistry of sediments and kill marine animals and plants living on the sea floor. The waste comes mainly from faeces and uneaten food. Salmon farms release compounds containing nutrients such as nitrogen and phosphorus. Both nutrients have the potential to cause eutrophication, decreasing water quality and producing harmful algal blooms. The use of **chemicals and medicines** also harm the environment. They are used for treating infections and disease, controlling sea lice infestations, antifouling agents, such as chemicals in paint, for protecting farm infrastructure (e.g., by keeping dirt off equipment), and food additives to boost copper and zinc in farmed salmon diets. Moreover, you can read about antibiotics below. Salmon farms increase the spread of **sea lice and disease to wild populations** locally. Wild populations of salmon and trout have declined in the years since salmon farming increased. **Salmon that escape from farms** are a problem for wild fish: interbreeding with wild salmon is a real concern that has the potential to alter the wild gene pool and compromise the fitness of wild salmon along with their ability to adapt to changes within their environment. **Harm to seals and cetaceans (dolphins, whales and porpoises).** In June 2020 shooting of seals by salmon farmers was banned. Prior to this ban, seals were shot under licence to prevent them from predating on farmed salmon. Acoustic Deterrent Devices (ADD) emit high frequency sounds to deter seals from salmon farms. Noise from ADDs have the potential to impact cetaceans' ability to echolocate, feed, communicate and locate mates. It can also cause stress, exclude them from areas of their habitat and possibly damage their hearing. As hearing is essential for these animals to survive, hearing damage or loss can be fatal. The in-feed sea lice treatment emamectin benzoate is toxic to crustaceans, with a recent study showing that crustacean abundance and species richness is lower in areas with elevated levels of emamectin benzoate in the sediments. The use of **fishmeal and fish oil** in fish feed: vast numbers of wild fish (up to a quarter caught) are ground down into fishmeal and fish oil – a key ingredients for farmed salmon feed pellets. This is wasteful as 90% the wild fish could otherwise be eaten directly by humans, and calories are lost in the process. There are many vulnerable communities, such as in the West coast of Africa and South America, that rely on these small wild fish for food and trade. The wild fish are also an essential element of the marine food web. These small fish are low in the food chain and eat plants, and they themselves then feed larger fish.

Antibiotics

Why are antibiotics used in fish farming and why is this an issue for fish welfare?	Antibiotics have revolutionised modern medicine and saved millions of human lives. But the systematic overuse of antibiotics in human and animal medicine is undermining their ability to cure life-threatening infections in people by creating dangerous bacteria which are resistant to antibiotics. Globally, over 70% of antibiotics are fed to farm animals, and fish are no exception.

	Use of antibiotics in farmed fish means that the fish may be more able to survive in overcrowded and dirty conditions. Antibiotics should not be used as a substitute for proper hygiene and husbandry. Responsible Use of Medicines in Agriculture Alliance (RUMA) sets out maximum antibiotic usage limits of 5mg/kg production on salmon farms in the UK. In 2017, the Scottish salmon farming industry far exceeded this target, using 16.1mg/kg of production. In 2018, this dropped to 6.5/kg of production, which still exceeds the limit. **A total of 1,011.3 kg of antibiotics were used by the sector during 2018**.[7] *More info:* Irresponsible antibiotic use refers to: - Prophylactic (preventative) use (i.e., giving them to fish that are not sick) - Routine use (i.e., giving them to fish frequently in their feed) - Use of certain antibiotics that are critical for human health (according to the WHO) Farmed fish are usually given antibiotics in their feed. Antibiotics protect fish from various diseases, but as with land animals there are issues when they are given feed as a preventative measure or when the entire group is treated with antibiotics even though only a few of the group are diseased. Use of antibiotics in these ways means that the fish may be more able to survive in overcrowded and dirty conditions; so more fish can be crammed into a small sea cage in filthier water. This has huge welfare implications for the fish. Antibiotics should not be used as a substitute for proper hygiene and husbandry. Antibiotic use has been reduced recently due to the use of vaccinations for salmon (these can be oral, immersion or injected).
How does irresponsible antibiotic use also impact the surrounding environment?	When feed containing antibiotics is given to fish in an open environment like a sea cage, some of the antibiotics will leak out, reaching the surrounding environment. A large amount of antimicrobials administered to salmon can be released into the environment, where they have the potential to change the composition of microbial communities and increase the number of antibiotic resistant bacteria. *More info:* Irresponsible use also means that microbes may achieve resistance to antibiotics faster, risking the future effectiveness of antibiotics for human beings. Studies looking at sediment beneath sea cages have found antibiotic resistant genes, with these found up to several kilometres away from the farms.

[7] https://www.ruma.org.uk/wp-content/uploads/2019/10/RUMA-TTF-update-2019-two-years-on-FULL-REPORT.pdf

	Medicated pellets can also be eaten by wild birds, fish and aquatic animals living in the surrounding waters. Antibiotics can also be damaging to the aquatic plant environment, particularly to algae, which are often at the bottom of aquatic food chains.

Land-based closed farming systems

Why are they farmed in sea-cages? Can't you use a land-based closed system (artificial tank) so that you can 'filter out' the lice and avoid environmental destruction?	Farming salmon in sea cages is cheaper and easier than farming salmon in artificial tanks on land. However, land-based salmon farming has attracted increased investments in the past years. It is also expensive to achieve the environmental parameters needed for salmon survival on land (size of the tanks, electricity, etc). *More info:* Salmon farming requires marine conditions. A key condition is the temperature. The optimal temperature range for salmon is between 8 and 14C. Salmon farming also requires a certain current to allow a flow of water through the farm. The current however must not be too high to not allow the fish to move freely around in the sites. Such conditions are typically found in waters protected by archipelagos and fjords and this rules out many coastlines. Major welfare problems with land-based systems: as the systems are so expensive to run, fish are stocked at extremely high densities (e.g., 100kg/m3 as compared to the recommended 10kg/m3) to make them economical. They are also completely barren tanks, with zero enrichment because water flow must not be impeded.

Fishmeal & fish oil

What is the problem with feeding wild fish to farmed fish?	We face a global crisis of overfishing. Fish farming is responsible for much of the industrial fishing of our endangered oceans. Many widely farmed species such as salmon are carnivorous and, in the wild, they hunt other fish. When farmed, these animals are fed fish feed that is made of wild-caught fish. Approximately 20-25% of all wild-caught fish are used to make fishmeal and oil. This comprises of somewhere between 450 billion and 1 trillion individual fish. To make matters worse, the wild-caught fish are not ensured humane slaughter, meaning that there is an additional welfare cost in the production of fishmeal and fish oil. Also, the fish used for FMFO are "forage fish," such as sardines and anchovies, which many wild fish and mammals rely on for food. They are an important step in the marine food chain, so their removal from the seas can affect many wild animals, leaving them with little to eat. *More info:* Without massive new marine conservation areas and industry regulation, we may face a future of empty seas without wild fish.

	Many widely farmed species such as trout and salmon hunt other fish in the wild. In order to farm these animals, they are fed fish feed that is made of wild caught fish. Approximately one quarter of all wild-caught fish are used to make fish feed – somewhere between 450 billion and 1 trillion fish. In other words, it can take up to 350 wild caught fish to raise a single farmed salmon, so fish farming actually increases the pressure on wild stocks. Since these wild fish die without any form of humane slaughter or prior stunning, the welfare cost of the fish feed is massive.
Is there an alternative to feeding wild fish to farmed fish?	Fish farming systems could only use leftovers/trimmings from processing plants as a source of fish meal and oil. Some fish certification schemes encourage their producers to use trimmings but do not commit to phasing out the use of wild caught fish in their fish meal, which we would like to see them do. Alternatives to fish meal and fish oil are in development, such as algae, yeast, insects or microbes, and large strides are being made to make these alternatives commercially viable in the future.

Harm to wildlife

Do farmers still kill seals that make their way onto Scottish salmon farms?	In June 2020, the Scottish Government voted to ban the shooting of seals on Scottish salmon farms. This move was made to prevent the United States banning salmon imports from Scotland on the basis that they breech US regulations in place to protect marine mammals in the wild (Edwards, 2020). In the first six months of 2020, 34 grey seals and 18 common seals were shot under licence.

(Edwards, 2020).

Biosecurity

What is the biosecurity risk associated with dead farmed fish exposed to wildlife?	Dead animals can expose humans and wildlife to infectious diseases. This is as dead bodies are rapidly colonised by microbes, which can then go on to infect animals and possibly humans. Dead animals also increase exposure to ectoparasites (external parasites – such as sea lice) and bodily fluids such as blood and faeces.
Are regulations to dispose of dead salmon not being followed? And if so, is this widely true for most farms and	It is forbidden to landfill or bury untreated fish waste. Fish waste should be destroyed for example by an incinerator that has a pollution prevention and control (PPC) permit from the environmental regulator or local council.

who should be enforcing this/have we raised this with appropriate authorities?	In Scotland, dousing fish waste in formic acid is one of the main methods of waste disposal. This mixture of chemicals and waste is then collected by a company that processes the waste. Liquid wastes are stored securely on site while they await disposal or recovery.

Scottish policy

Isn't fish welfare currently protected by national UK law?	There are currently no laws protecting salmon welfare during their lives. Some of the producers make claims to protect fish welfare, and some certification schemes cover welfare issues. However, these are often vague and do not go far enough, and so do not meaningfully protect the welfare of the farmed salmon. For fish to be truly protected in the UK they need government intervention to guarantee adequate legislation that all producers must follow. While some of the fish farming industry in the UK operates to higher welfare slaughter standards than the rest of Europe, there are no specific laws that require the humane slaughter of fish, so extreme suffering during life and death is still a possibility.
What are the types of policies the Scottish government should introduce?	Firstly, we are calling for an immediate moratorium on the growth of the salmon farming industry in Scotland, as current plans to double the size of the industry by 2030[8] will be further devastating for both animal welfare and the environment. The Scottish government needs to address the core issues including sea lice infestations, pollution and the use of fishmeal and fish oil. Ultimately, we directly challenge whether farming essentially wild, migratory fish, such as salmon, has any place in a sustainable, humane, food system.

Other global salmon farming industries

Which other countries farm salmon?	Some of the largest producers of salmon globally include Norway, Chile, and Canada. All Atlantic salmon farms across the globe share the same welfare issues with Scotland. However, Chile faces additional major issues with the use of antibiotics. Chilean farms are affected by a bacterial disease called Salmon

[8] https://aquaculture.scot/

	Rickettsial Syndrome which they struggle to keep under control. This results in the frequent application of antibiotics. Also, in Chile regulations are less strict than in other countries. In Norway, humane slaughter is mandatory, and the maximum stocking density allowed is 25 kg/m^3 (CIWF asks for 10 kg/m^3) as aligned to organic certification levels. Norway and Scotland are the only countries that publish mortalities events. In 2019, the percentage of losses due to mortalities was 15% in Norway and 13.5% in Scotland.
Are these welfare issues also found on other Atlantic salmon farms, such as in Norway?	Many of the welfare issues found of Scottish salmon farms are also found on most other global salmon farms. The main difference is that humane slaughter is mandatory in Norway.
Why are we targeting salmon when other carnivorous species also have poor (or sometimes worse) welfare (e.g. trout, bass, bream etc)?	Salmon is one of the most well-known fish species and consumed across the globe. It is also considered to be a high-quality product, and salmon farms are marketed as beautiful, fresh and responsible. This could not be further from the truth. Salmon farms demonstrate some of the worst features of fish farming, including high stocking densities, parasitic infestations, disease and pollution. By demonstrating that even the 'high-quality' farmed fish lives a miserable life, then it becomes clear that few other farmed fish are living lives worth living.

General questions

Should we stop farming salmon altogether?	Ultimately, we directly challenge whether farming essentially wild, migratory fish, such as salmon, has any place in a sustainable, humane, food system. Together the investigation and report create a strong case for a moratorium, with a view to phasing out intensive salmon farming altogether. At the very least, the Scottish government needs to properly regulate the industry to ensure the salmon have better lives while being farmed. Some of the salmon's intrinsic needs, such as the motivation to migrate, can never be met while kept in confinement. Organically certified fish meets the highest welfare standards, but even organic salmon are fed on a diet of wild caught fish which contributes to the collapse of our global fisheries.
What should I look out for when buying	Buying truly higher welfare fish is tricky. Due to the serious animal welfare and environmental consequences, we do not encourage consumers to buy farmed salmon, Scottish or otherwise.

higher welfare fish?	Given the incredible pressure that our oceans are under, we should all be eating less fish. If people want to continue sustainably eating some fish into the future, our society must eat far fewer of them, and replace most of the fish in our diets with plants. Currently, it is virtually impossible to find truly higher welfare fish as none of the fish certification labels adequately protect fish welfare. All fish labelling programs fail to address the suffering of wild caught fish that are ground up into fish meal and fed to farmed fish. Wild caught fish, although they lived good lives swimming free, undergo long and excruciating deaths when pulled from the ocean by commercial fisheries.
Don't we need to eat large amounts of fish to be healthy?	There has been some confusing messaging, encouraging consumers to eat more fish. Considering how devastated many marine ecosystems are, if this advice is widely followed there will soon be no fish in the sea. While fish do contain essential nutrients, it is also possible to get similar health benefits from consuming the right sort of plants – such as nuts, seeds. The EAT-Lancet report indicates we could eat anywhere between 0-100g of fish per day, and rounds this to 28g daily – this is equivalent to one serving of fish every 4 days. You can be perfectly healthy replacing fish with other plant-based sources.
Why are you trying to damage the Scottish Salmon industry at a time when the industry is already under pressure? (Brexit etc)	We believe consumers deserve to know the truth about salmon farming so they can make their own mind up. Scottish salmon is a huge multi-billion-pound international business – and the entire industry plans to double in size by 2030.[9] Our investigation shows terrible conditions in farms across the industry, including dirty water where fish struggle to breath, deformities, sea lice infestations and other disease, harmful sea lice treatments and exposed wounds. No industry should continue with such horrific levels of suffering, so action needs to be taken now to halt the expansion.

Table: Highlighted column are survival rates, so mortality rate is 100-survival rate.
In the last 10 years of data for death rates, the majority are over 20%, a few just below that, and a couple over 25%. Please note these are reported as survival of smolt year classes, and not an annual mortality rate. The annual mortality is made up of more than one smolt year class.

[9] https://aquaculture.scot/

Scottish Fish Farm Production Survey 2019

3. Atlantic Salmon - Production

All files

Table 28: Survival and production in smolt year classes during 2000-2019

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			
2000	45,185	765	2,673	3.5	1.7	22,726	96,539	4.2	50.3	11,354	53,535	4.7	25.1	77.1	152,747	3.38
2001	48,643	557	1,227	2.2	1.1	23,528	90,230	3.8	48.4	15,619	73,255	4.7	32.1	81.6	164,712	3.39
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	45,375	84	247	2.9	0.2	26,324	132,090	5.0	58.0							