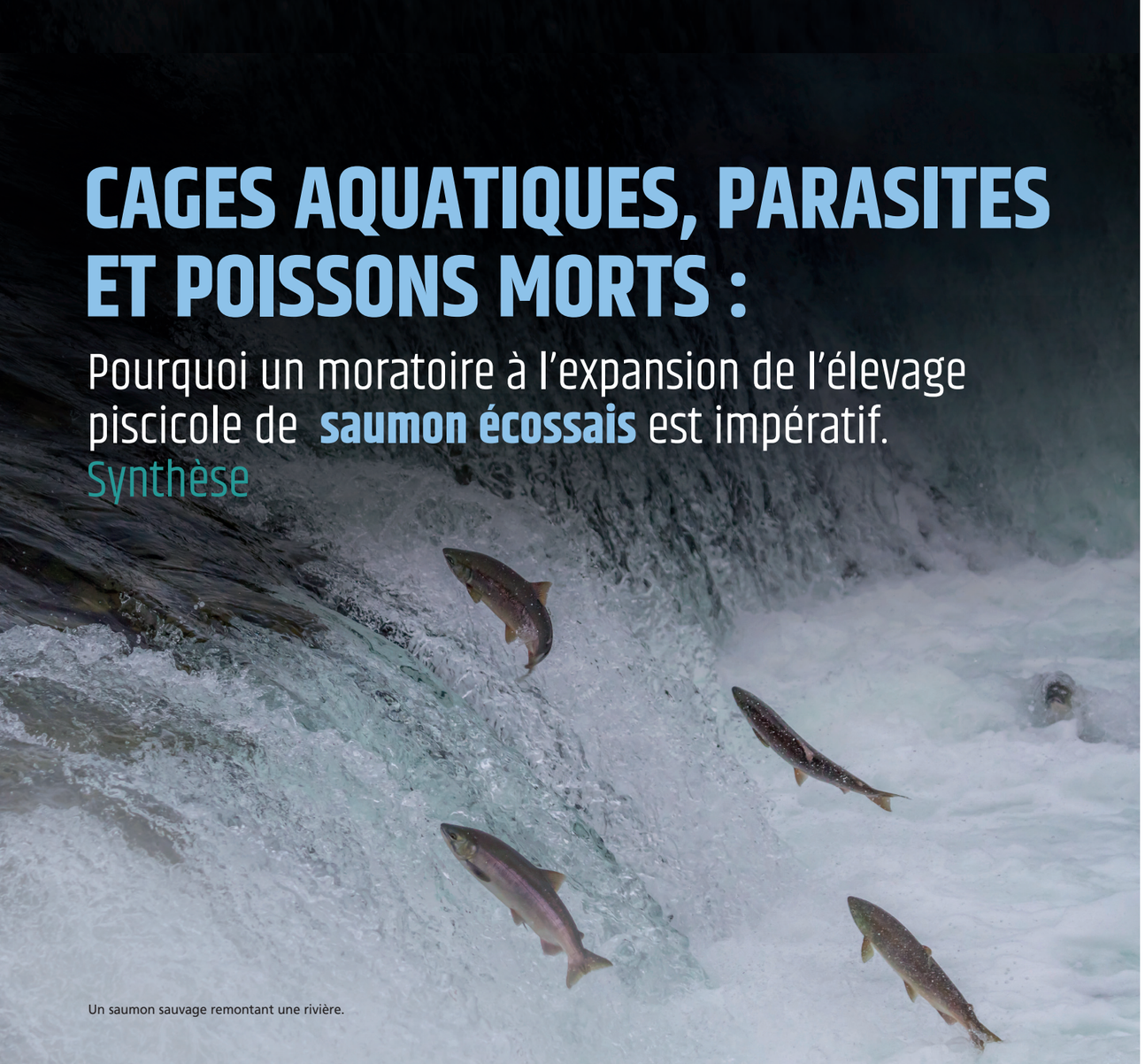
CAGES AQUATIQUES, PARASITES ET POISSONS MORTS :

Pourquoi un moratoire à l'expansion de l'élevage piscicole de **saumon écossais** est impératif.

Synthèse



Un saumon sauvage remontant une rivière.

Avec ses magnifiques paysages et son littoral escarpé, l'Écosse est une destination de choix pour observer la faune. Toutefois, sous ses eaux côtières se tapit une industrie en pleine expansion, truffée de problèmes touchant au bien-être animal et endommageant l'environnement et la biodiversité. Connu sous le nom de « Roi des poissons » grâce à son impressionnante capacité athlétique et son voyage épique de la rivière jusqu'à la mer, et inversement, le saumon atlantique est le poisson le plus emblématique de l'Écosse. Cependant, de nos jours, ils sont élevés en masse dans des exploitations industrielles, où leur migration s'arrête aux parois de leurs cages. L'élevage de saumon écossais a rapidement évolué, augmentant de 41 % au cours de la dernière décennie, et le secteur n'a pas l'intention de ralentir. En 2019, 203 881 tonnes de saumon atlantique ont été produites, mais l'industrie cible les 300 000 à 400 000 tonnes par an d'ici 2030 et une hausse additionnelle dans la production de 47 à 96 %.

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Les saumons sont des animaux sensibles capables de ressentir des émotions, de la douleur et de la souffrance. Pourtant, ils sont obligés de vivre dans des conditions qui ne respectent pas leurs besoins en matière de bien-être et près de 10 millions meurent précocement chaque année. Les évasions de poissons d'élevage dans le milieu naturel sont fréquentes, les infestations de poux de mer et les maladies incontrôlables, l'environnement et la biodiversité de l'Écosse en danger, et ces problèmes ne feront que s'aggraver avec l'évolution de cette industrie. Ce rapport décrit les principales répercussions de l'élevage de saumon, telles que documentées par la recherche scientifique et observées au sein d'élevages écossais lors d'une enquête récente.

UNE ENQUÊTE APPROFONDIE

Au cours de l'hiver 2020, CIWF a envoyé une équipe d'enquêteurs dans des élevages piscicoles de saumon sur la côte ouest de l'Écosse, l'île de Skye et les îles Shetland pour constater les conditions dans lesquelles vivent les saumons atlantiques d'élevage qui, à l'état sauvage, migreraient à des milliers de kilomètres au cours de leur vie. L'équipe d'enquêteurs a visité des exploitations appartenant aux principaux producteurs de saumon, qui représentent plus de 96 % de l'industrie du saumon écossais . Les enquêteurs ont constaté que les problèmes de bien-être sont généralisés dans les cages. Le manque de protection des saumons a été relevé dans tout la production. Des problèmes relatifs aux poux de mer et aux maladies ont été observés dans les exploitations de tous les producteurs : dans les cages en mer, aussi bien les saumons que les poissons nettoyeurs se trouvaient dans un état de souffrance.

APPEL À L'ACTION

CIWF, OneKind et de nombreuses autres organisations à travers le Monde, appellent à ce qu'un moratoire soit imposé à l'expansion de l'élevage piscicole de saumon écossais jusqu'à ce que les nombreux problèmes relatifs au bien-être et à l'environnement soient traités correctement et les pratiques considérablement améliorées.

Photos d'enquête montrant : un saumon avec des nageoires endommagées et des poux attachés à la tête (en haut à gauche); un saumon avec un œil manquant et une lésion buccale (en haut à droite); un saumon avec une plaie à vif (en bas à gauche); un poisson nettoyeur dans une cage à saumon (en bas à droite).

D'ÉNORMES PROBLÈMES PORTANT SUR LE BIEN-ÊTRE DANS LA PRATIQUE COMMERCIALE

En Écosse, de l'ensemble de saumoneaux (smolts ou jeunes saumons) placés dans des cages en mer au cours d'une année donnée, jusqu'à 28,2 % meurent pendant la production. Si nous y ajoutons les décès ayant lieu lors de la phase en eau douce, ce chiffre augmente bien davantage. Le nombre de poissons souffrant de conditions médiocres de bien-être ne peut être quantifié. Toutefois, il serait bien plus élevé que ce que relèvent ces données, car les chiffres de mortalité ne présentent que les poissons à l'extrême des problèmes. Un secteur où 1 animal sur 4 ne survivra probablement pas la période d'engraissement (lorsque les saumoneaux sont placés dans des cages en mer pour atteindre le poids à l'abattage) ne devrait pas être autorisé à poursuivre son extension.

Les poux de mer sont des parasites qui s'alimentent de la peau, du sang et des muqueuses de poissons comme le saumon. Leur population s'est accrue en même temps que l'expansion de l'industrie du saumon, qui n'a pas encore mis en œuvre une méthode préventive ou thérapeutique efficace, renforçant le bien-être et respectueuse de l'environnement. Les moyennes mensuelles de l'Organisation des producteurs de saumon écossais (« Scottish Salmon Producers Organisation » ou SSPO) suggèrent que le taux moyen de poux de mer femelles et adultes par poisson a augmenté de 96 % entre avril 2018 et mai 2019. Pour la même période, le nombre de saumons dans les exploitations écossaises a connu une hausse de près de 25 %.

Les poux de mer provoquent incontestablement des souffrances considérables, de la douleur et du stress, aux saumons. Dans ces conditions contre nature, confinés dans une cage en mer, les saumons ne peuvent pas échapper aux poux. Toutefois, les traitements développés par l'industrie pour débarrasser les poissons de ces poux de mer peuvent également entraîner des conditions très médiocres de bien-être et la mort du saumon. De nombreux traitements contre les poux de mer impliquent de soumettre les saumons à un éventail de conditions douloureuses et stressantes, et ont abouti à de nombreux décès. Par exemple, des bains chimiques avec des produits irritants ou des bains à l'eau chaude (traitement « Thermolicer »). L'utilisation de poissons nettoyeurs (labres et lompes) pour qu'ils mangent les poux de mer des saumons a eu une incidence sur les populations sauvages, car nombre d'entre eux sont capturés à l'état sauvage. En outre, il existe désormais des millions d'autres poissons dans la production dont le bien-être doit être pris en compte. Le bien-être des poissons nettoyeurs est insuffisamment pris en compte et les décès sont élevés dans les cages en mer. Ceux qui survivent jusqu'au bout du processus de production peuvent souffrir d'une mort inhumaine.

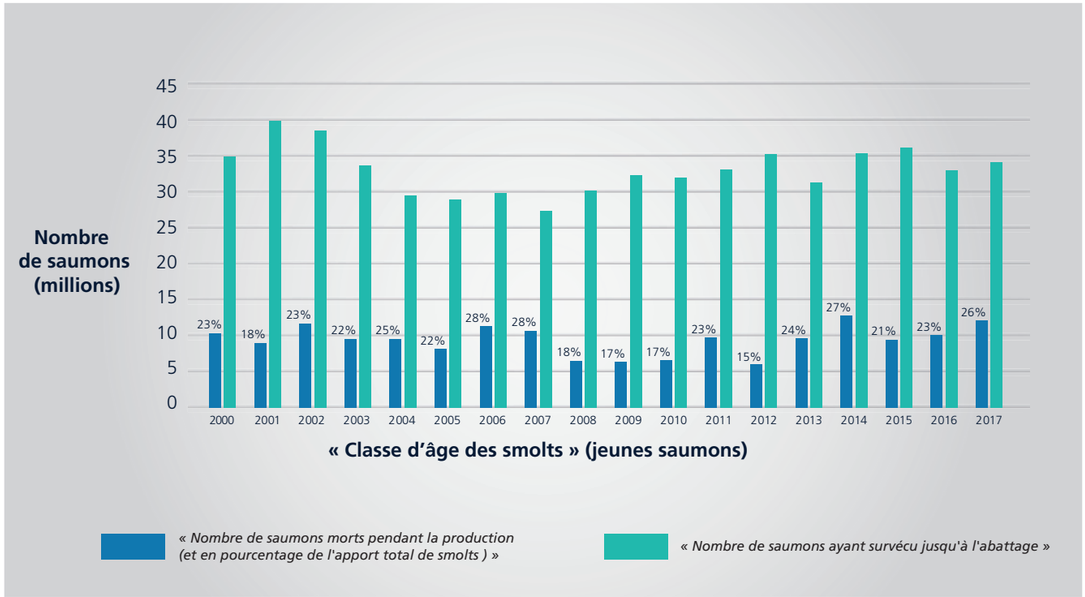


Figure 1. Le nombre de saumons de chaque classe d'âge de smolts qui ont survécu jusqu'à l'abattage ou qui sont morts pendant la production. Une "classe d'âge de smolts" représente le nombre total de smolts qui ont été transférés des installations d'eau douce vers les cages d'eau de mer au cours d'une année donnée ; ces smolts peuvent mourir ou être abattus à différents moments du cycle de production jusqu'à deux ans. Les pourcentages affichés au-dessus de la colonne bleue correspondent au pourcentage de smolts morts sur l'ensemble des smolts transférés en mer au cours d'une année donnée. Ces données proviennent de l'enquête sur la production piscicole écossaise de 2019 fournie par le gouvernement écossais.

Les conditions et le bien-être réduits des élevages piscicoles de saumon créent un environnement idéal pour la propagation des parasites et des maladies. Le saumon peut être atteint de diverses maladies, dont la maladie amibienne des branchies, l'anémie infectieuse du saumon, le syndrome de cardiomyopathie et la maladie du pancréas. En 2019, 4 031 528 des 6 281 720 décès (64 %) ont été provoqués par un éventail de maladies et leurs traitements (Fish Health Inspectorate, 2020).

NON-RESPECT DE LA LÉGISLATION SUR LE BIEN-ÊTRE ANIMAL

Les pratiques actuelles dans l'élevage piscicole de saumon écossais enfreignent la législation sur le bien-être animal. La loi de 2006 sur la santé et le bien-être des animaux (Écosse) impose un devoir de protection aux personnes responsables de tout animal vertébré pour promouvoir leur bien-être et éviter leur souffrance. Cela signifie prendre soin de leur bien-être physique et mental, ainsi que les protéger face à la douleur, les lésions et les maladies. Toutefois, les conditions habituelles de l'élevage ne permettent pas de mener à bien ces actions.

DOMMAGES ENVIRONNEMENTAUX

Non seulement l'élevage piscicole de saumon va à l'encontre du bien-être animal, il est également nuisible à l'environnement. Les déchets chimiques et organiques issus des exploitations de saumon écossais modifient la chimie des sédiments et tuent la vie marine du fond marin. Les déchets des exploitations peuvent appauvrir la qualité de l'eau et favoriser le développement d'efflorescences algales nuisibles, qui épuisent l'oxygène de l'eau, pouvant suffoquer les poissons de l'élevage qui ne peuvent pas s'en éloigner. Les produits chimiques et les médicaments, tels que le benzoate d'émamectine (un insecticide), sont également rejetés dans l'environnement. Nombre d'entre eux sont connus pour être toxiques pour les poissons et autres organismes marins, ainsi que pour les oiseaux et les mammifères.

RÉPERCUSSIONS SUR LES SAUMONS SAUVAGES

Les élevages piscicoles de saumon affectent les populations de saumon sauvage et de truite, car ils favorisent la propagation des poux de mer et des maladies jusqu'aux poissons sauvages. En outre, le croisement entre les saumons d'élevage qui s'échappent des exploitations et les saumons sauvages est une véritable préoccupation, car il existe la possibilité que le réservoir génétique sauvage soit modifié et compromette la condition physique du saumon sauvage, ainsi que sa capacité à s'adapter aux changements de son environnement. Selon les estimations, les populations de saumon sauvage et de truite des rivières écossaises ont diminué de 70 % au cours des vingt dernières années. Les poux de mer contribuent à la baisse du taux de survie du saumon sauvage en mer, tout comme un éventail de facteurs, dont le changement climatique, la pêche et la pollution marine.

ALIMENTER DES CARNIVORES

Les effets de l'industrie écossaise sur les populations de poissons sauvages s'étendent au-delà des eaux locales. Étant donné que le saumon atlantique est une espèce carnivore, les principaux ingrédients des granulés utilisés pour l'alimenter sont la farine et l'huile de poisson (FMFO). Environ deux tiers des FMFO utilisés sont fabriqués à partir de poissons sauvages essentiels aux réseaux trophiques marins et aux communautés humaines locales. Le saumon élevé en Écosse mange à peu près la même quantité de saumon sauvage que l'ensemble de la population humaine du Royaume-Uni. Les aliments des poissons nettoyeurs contiennent également des FMFO, qui accroissent davantage le nombre de poissons sauvages employés pour produire du saumon.

UN MORATOIRE EST IMPÉRATIF

L'industrie de l'élevage piscicole du saumon écossais est truffée de problèmes concernant le bien-être des poissons et de graves problèmes environnementaux. Nous demandons au gouvernement écossais un moratoire immédiat sur l'expansion de l'industrie. Nous interrogeons la pertinence de l'élevage de poissons carnivores migrateurs essentiellement sauvages, comme le saumon, dans un système alimentaire respectueux et durable.

UNDERWATER CAGES, PARASITES AND DEAD FISH:

Why a Moratorium on Scottish Salmon Farming Expansion is Imperative

OneKind
Ending cruelty to Scotland's animals

COMPASSION in world farming

CONTENTS

A report by Compassion in World Farming and OneKind, March 2021.

SECTION 1

EXECUTIVE SUMMARY

With its beautiful landscapes and rugged coastline, Scotland is renowned as a wildlife destination. But lurking under coastal waters is a rapidly expanding industry, rife with animal welfare issues and damaging the environment and biodiversity. Known as the King of Fish, with their impressive athletic abilities and epic journey from river to sea and back again, Atlantic salmon are Scotland's most iconic fish. But these days they are factory farmed in huge numbers where they can migrate no further than the cage walls. Scottish salmon farming has expanded quickly, growing by 41% in the past decade, and the industry has no plans to slow. In 2019 a massive 203,881 tonnes of Atlantic salmon was produced (over 38 million individual fish), but industry growth targets of 300,000-400,000 tonnes annually by 2030, involve a further 47-96% increase in production.

Rows of sea cages, each containing tens of thousands of farmed Scottish salmon (investigation footage)

Salmon are sentient animals who can feel emotions, pain and suffering; yet they are forced to live in conditions that fail to meet their welfare needs, and millions are dying prematurely every year. Escapes are common, sea lice infestations and disease are out of control, and Scotland's environment and biodiversity are at risk, with problems only set to intensify as the industry expands. This report describes the key impacts of salmon farming, as documented by scientific research, and as seen on Scottish farms in a recent investigation.

UNDERCOVER INVESTIGATION

In the winter of 2020, Compassion in World Farming sent a team of undercover investigators to salmon sites off the West coast of Scotland, the Isle of Skye and the Shetland islands to witness the conditions experienced by farmed Atlantic salmon, which in the wild would migrate thousands of kilometres in their lifetime. The investigative team visited farms from each of the main producers, that account for over 96% of the Scottish salmon industry and found that welfare issues in the cages are widespread and that there is an industry-wide failure to protect these sentient animals. Sea lice and disease problems were seen on farms owned by each of the producers, and both salmon and cleaner fish were suffering in sea cages.

CALL TO ACTION

Compassion in World Farming, OneKind and other organisations worldwide are are calling for a moratorium on the growth of the Scottish salmon industry.

Salmon swimming in sea cage (investigation footage)

HUGE WELFARE ISSUES IN COMMERCIAL PRACTICE

In Scotland, farmed salmon mortality rates can be as high as 28.2% in the seawater stage and including mortalities from the freshwater stage would push this number even higher. The number of fish suffering poor welfare cannot be quantified but it will be much higher than these numbers convey, as mortality figures only show the fish at the extreme end of the issues. An industry where 1 in 4 animals are unlikely to survive the 'grow out' period (when juvenile salmon are moved to seawater cages to grow to slaughter weight) should not be allowed to expand.

Sea lice are parasites that feed on skin, blood and mucus of fish such as salmon. Their numbers have grown alongside the expansion of the salmon industry, which is yet to implement an effective, welfare positive and environmentally friendly treatment or prevention method. Scottish Salmon Producers Organisation (SSPO) monthly averages suggest that the 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.

Sea lice undoubtedly cause salmon to suffer considerable pain and stress. In the confined, unnatural conditions of a sea cage the salmon are unable to escape the lice. However, the treatments the industry has developed to rid the fish of sea lice also lead to very welfare and death of salmon. Treatments for sea lice involve subjecting salmon to a variety of stressful and painful conditions that have led to deaths; for example, chemical baths with irritants, or warm water exposure ('thermolicer' treatments).

The use of cleaner fish (wrasse and lumpsuckers) to eat sea lice off salmon has involved impact on wild populations. Additionally, there are now millions more fish in the industry whose welfare must also be accounted for. Cleaner fish welfare is insufficiently protected and mortalities are high throughout their use in the sea cages, and some surviving through to the end of production may suffer an inhumane death.

The conditions and reduced welfare on salmon farms create the ideal environment for disease and parasite spread. Salmon suffer from various diseases including amoebic gill disease (AGD), infectious salmon anaemia (ISA), cardiomyopathy syndrome (CMS), and pancreas disease (PD). In 2019, 4,031,528 of the recorded 6,281,720 mortalities (64%) were due to a range of diseases and their treatments (Fish Health Inspectorate, 2020).

FAILURE TO ADHERE TO WELFARE LEGISLATION

Current practices in Scottish salmon farming breach 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.

ENVIRONMENTAL DAMAGE

Not only is salmon farming bad for animal welfare, but it is also damaging the environment. Organic and chemical waste from Scottish salmon farms is changing the chemistry of sediments and killing marine life on the seabed. Waste from farms can lead to poor water quality and harmful algal blooms, which deplete oxygen from the water, and can suffocate the farmed fish who cannot swim away. Chemicals and medicines, such as the insecticide emamectin benzoate are also released into the environment and many of these are known to be toxic to fish and other marine organisms as well as birds and mammals.

A salmon with sea lice and skin damage (investigation footage)

EFFECTS ON WILD SALMON

Salmon farms also affect wild salmon and trout populations, as they increase the spread of sea lice and disease to wild fish. Additionally, interbreeding between farmed and wild salmon is a real concern as it 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. It is estimated that wild salmon and trout numbers in Scottish rivers have dropped by 70% in the past 20 years. Sea lice contribute to decreased survival of wild salmon at sea, along with a myriad of factors including climate change, fisheries and marine pollution.

FEEDING CARNIVORES

The Scottish industry's effects on wild fish populations goes further than local waters. As Atlantic salmon are a carnivorous species, key ingredients for farmed salmon feed pellets are fishmeal and fish oil. Around two thirds of fishmeal and fish oil (FMFO) used is made from wild-caught forage fish that are important for marine food webs and local communities. Farmed salmon in Scotland eat roughly the same amount of wild-caught fish as the entire UK human population. Cleaner fish feed also contains FMFO, which further increases the number of wild-caught fish used to produce salmon.

A MORATORIUM IS IMPERATIVE

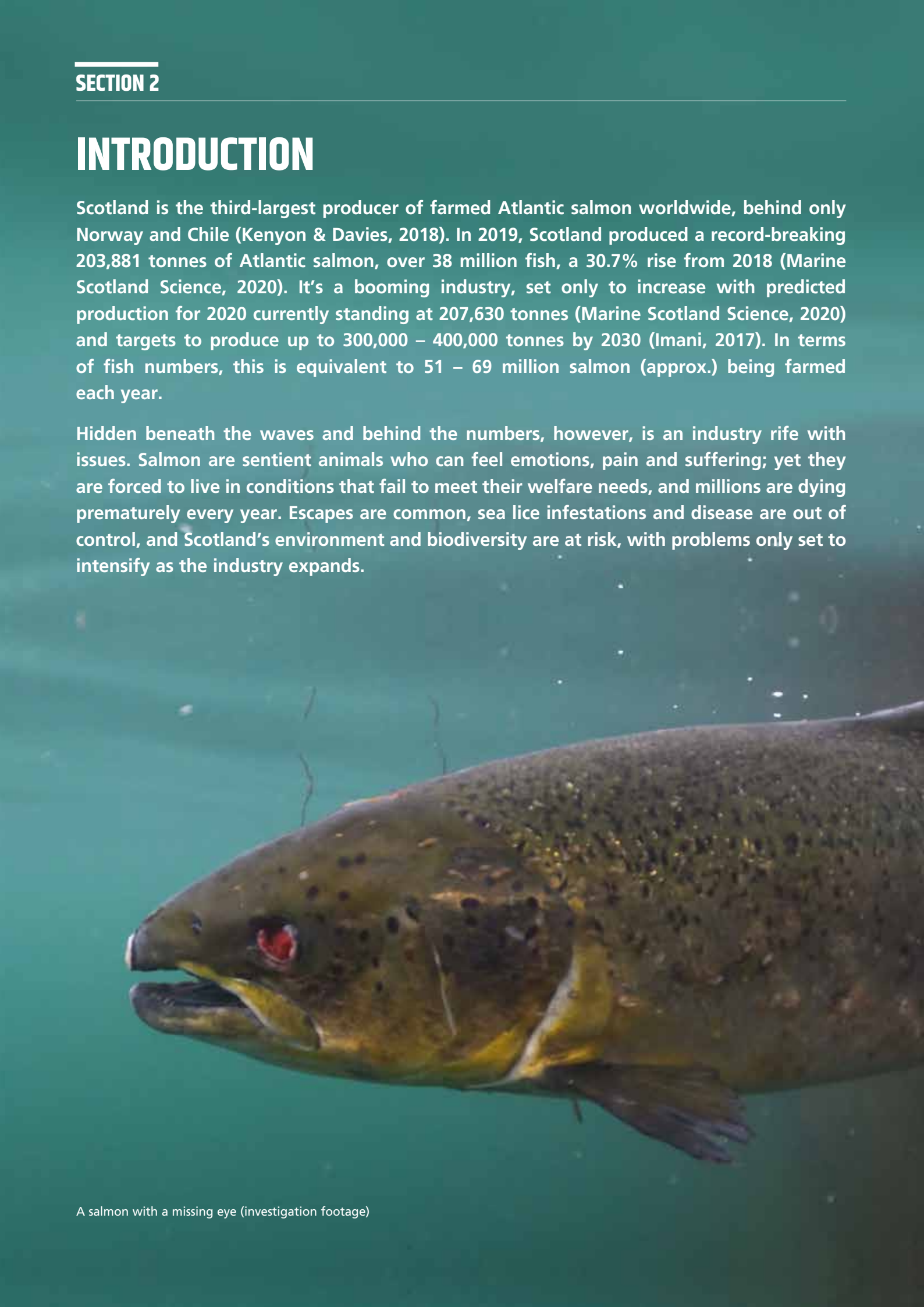
The Scottish salmon farming industry is rife with fish welfare issues and serious environmental problems. We are calling on the Scottish Government for an immediate moratorium on expansion of the industry. Ultimately, we directly challenge whether farming essentially wild, migratory carnivorous fish, such as salmon, has any place in a compassionate and sustainable food system.

SECTION 2

INTRODUCTION

Scotland is the third-largest producer of farmed Atlantic salmon worldwide, behind only Norway and Chile (Kenyon & Davies, 2018). In 2019, Scotland produced a record-breaking 203,881 tonnes of Atlantic salmon, over 38 million fish, a 30.7% rise from 2018 (Marine Scotland Science, 2020). It's a booming industry, set only to increase with predicted production for 2020 currently standing at 207,630 tonnes (Marine Scotland Science, 2020) and targets to produce up to 300,000 – 400,000 tonnes by 2030 (Imani, 2017). In terms of fish numbers, this is equivalent to 51 – 69 million salmon (approx.) being farmed each year.

Hidden beneath the waves and behind the numbers, however, is an industry rife with issues. Salmon are sentient animals who can feel emotions, pain and suffering; yet they are forced to live in conditions that fail to meet their welfare needs, and millions are dying prematurely every year. Escapes are common, sea lice infestations and disease are out of control, and Scotland's environment and biodiversity are at risk, with problems only set to intensify as the industry expands.



A salmon with a missing eye (investigation footage)

In the winter of 2020, Compassion in World farming sent a team of undercover investigators to the West coast of Scotland, the Isle of Skye and the Shetland islands to document the welfare issues faced by farmed salmon living, and dying, in Scottish waters. The investigation team visited 22 farms, covering each of the 5 top (in terms of annual production tonnage) salmon producer companies operating in Scotland. The team visited Mowi (formally Marine Harvest), Scottish Sea Farms, Grieg Seafood, The Scottish Salmon Company and Cooke Aquaculture, who together produced over 96% of Scottish salmon in 2019 (Ramsden, 2020). Investigators filmed overwater footage at 22 sites and additional underwater footage was secured from six of these. Footage gathered from these trips 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.

Investigators were faced with some haunting images; salmon swimming blindly around the cages with missing eyes, or those 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 into their skin, some had seaweed growing in open wounds. There was also evidence of gill damage, fin damage, abrasions and lesions, infection, and mouth

A salmon with fin damage, and sea lice attached to their head (investigation footage)

damage. There were many individuals that had clearly been suffering for a prolonged time – fish that should have been removed from the cages and humanely culled long before.

Cleaner fish were also recorded in some of the sea cages. These are fish that are used as a treatment for sea lice on salmon, but their inclusion inevitably introduces additional welfare issues. Investigators 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 some 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.

Based on the severity of the current industry problems, plans to expand are irresponsible and will lead to increased immense animal suffering, and environmental damage.

A salmon with a missing eye and mouth damage (investigation footage)

A salmon with a large exposed wound (investigation footage)

SALMON FARMING IN SCOTLAND

Salmon farming is a relatively young industry in Scotland, established in the 1970s. Since then, it has been growing fast, with a 41% increase in production from 2009 to 2019 (Scottish Government, 2020). There were 226 active salmon farms in Scottish waters in 2019, primarily on the west coast (Figure 1).

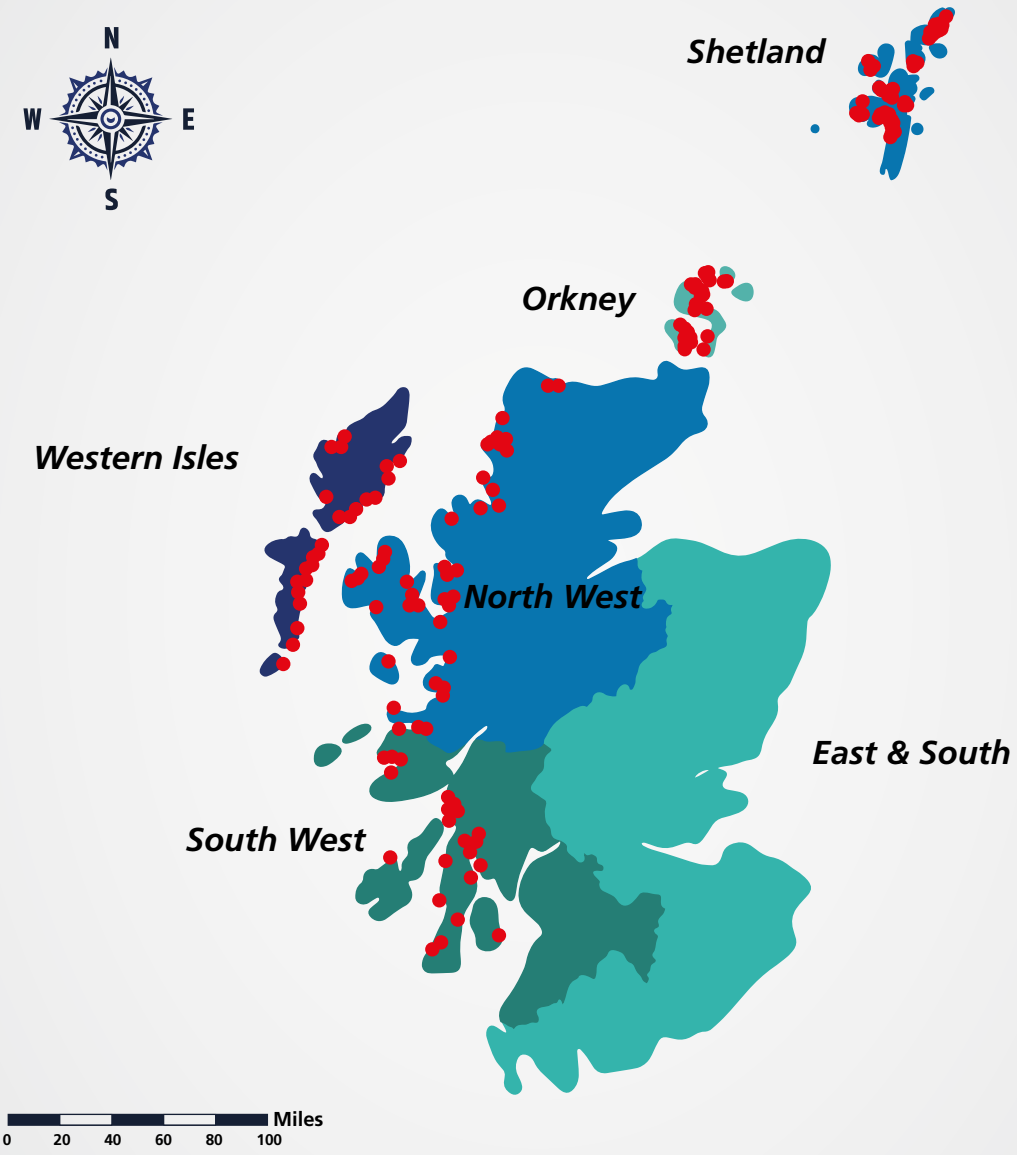


Figure 1. Location of salmon farm sites in Scotland. Red dots indicate location of sites that were active in 2019

Five companies own over 96% of salmon production in Scotland although none of them are Scottish-owned. Three of the main companies - Mowi, Scottish Sea Farms and Grieg Seafood – are Norwegian-owned, while The Scottish Salmon Company is registered in Jersey, and Cooke Aquaculture is Canadian (Scottish Salmon Watch, 2019). Furthermore, 89.7% of ova (unfertilised female reproductive cells) sourced in 2019 came from overseas. However, the impact of this industry will continue to affect the Scottish environment and the responsibility for animal welfare protection lies with the Scottish Government.

SALMON ARE SENTIENT BEINGS

When discussing salmon, the salmon farming industry tends to talk in tonnes, a practice that disregards the fact salmon are sentient animals with individual personalities (Church & Grant, 2018).

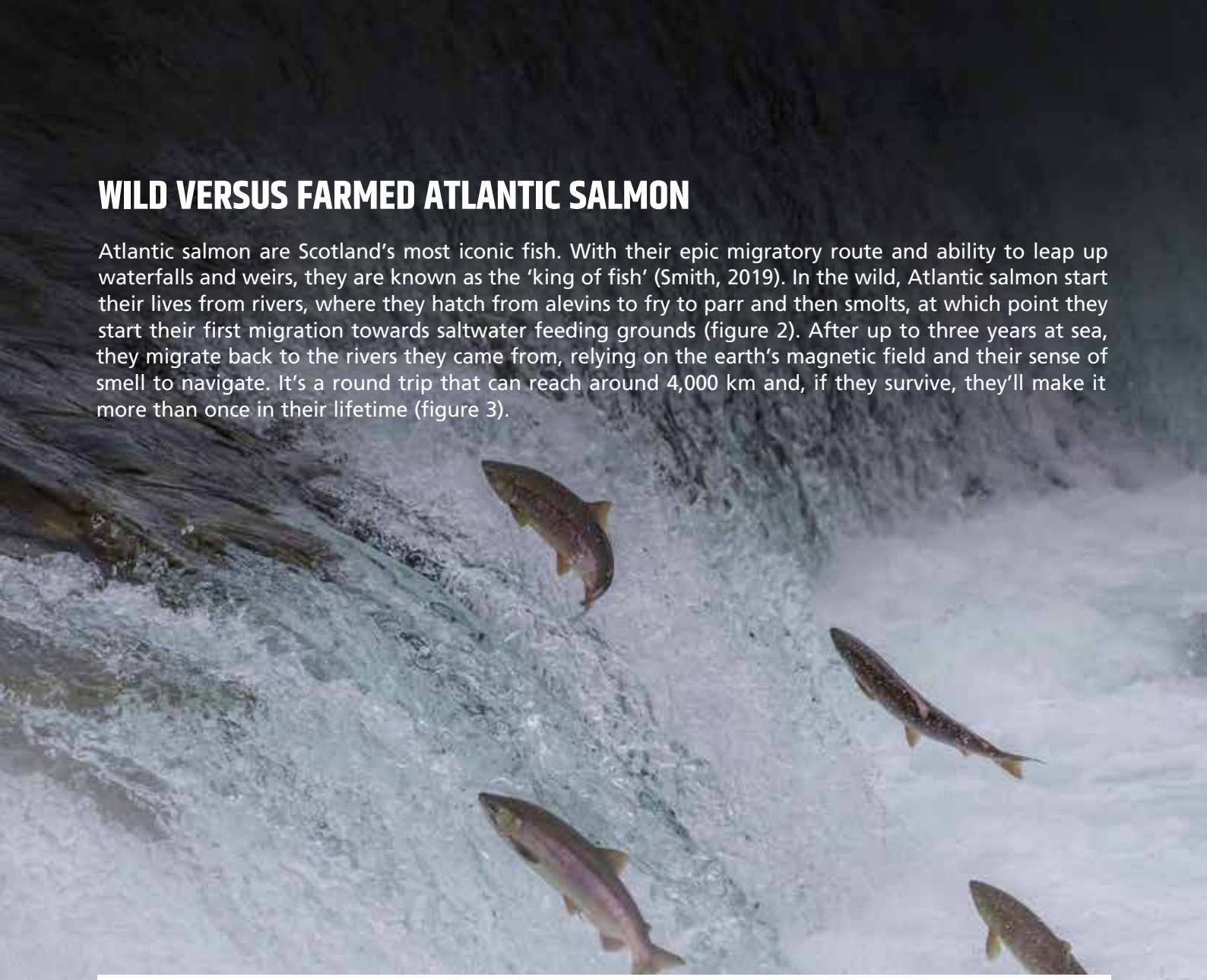
There is scientific consensus that fish can suffer and feel pain (e.g. Bjørge, et al., 2011; Nilsson, et al., 2019; Woodruff, 2018; Sneddon, 2015), with studies showing they possess pain receptors resembling those of mammals (Sneddon, 2015). Research by Mettam, Oulton, McCrohan, & Sneddon (2011) found that when rainbow trout, a species in the same family as Atlantic salmon, were in in pain, the use of painkillers reduced the behavioural changes they were displaying. Further studies on trout show that fish are able to learn from previous experiences and will avoid areas where painful shocks occur. However, they can be flexible too - choosing to enter an area where food or a companion are found even though they have previously avoided that area due to painful shocks (Dunlop, Millsopp, & Laming, 2006; Culbert, Gilmour, & Balshine, 2019). Emotions are harder to measure (in all animals not just fish), but we are able to estimate what fish may be feeling based on physiological and behavioural responses to events (Kittilsen, 2013). Atlantic salmon suffering from peritonitis (inflammation of abdominal membranes) following vaccinations showed reduced swimming and feeding activity (Bjørge, et al., 2011). 'Loser' or growth-stunted salmon are a common sight on salmon farms, swimming close to the surface, and exhibiting reduced activity. They are also smaller in size and anorexic. Analysis of brain activity and cortisol levels in these individuals by Vindas, et al (2016) suggest they may be suffering from depression.

Rearchers are continually discovering more impressive behaviours and cognitive abilities of fish, showing they are far more complex and intelligent than we realised (Chandroo, Duncan, & Moccia, 2004). Most importantly they have the capacity to feel and suffer (Braithwaite, 2010). Salmon are sentient individuals and their welfare must be safeguarded.

Group of salmon swimming in a sea cage (investigation footage)

WILD VERSUS FARMED ATLANTIC SALMON

Atlantic salmon are Scotland's most iconic fish. With their epic migratory route and ability to leap up waterfalls and weirs, they are known as the 'king of fish' (Smith, 2019). In the wild, Atlantic salmon start their lives from rivers, where they hatch from alevins to fry to parr and then smolts, at which point they start their first migration towards saltwater feeding grounds (figure 2). After up to three years at sea, they migrate back to the rivers they came from, 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 (figure 3).



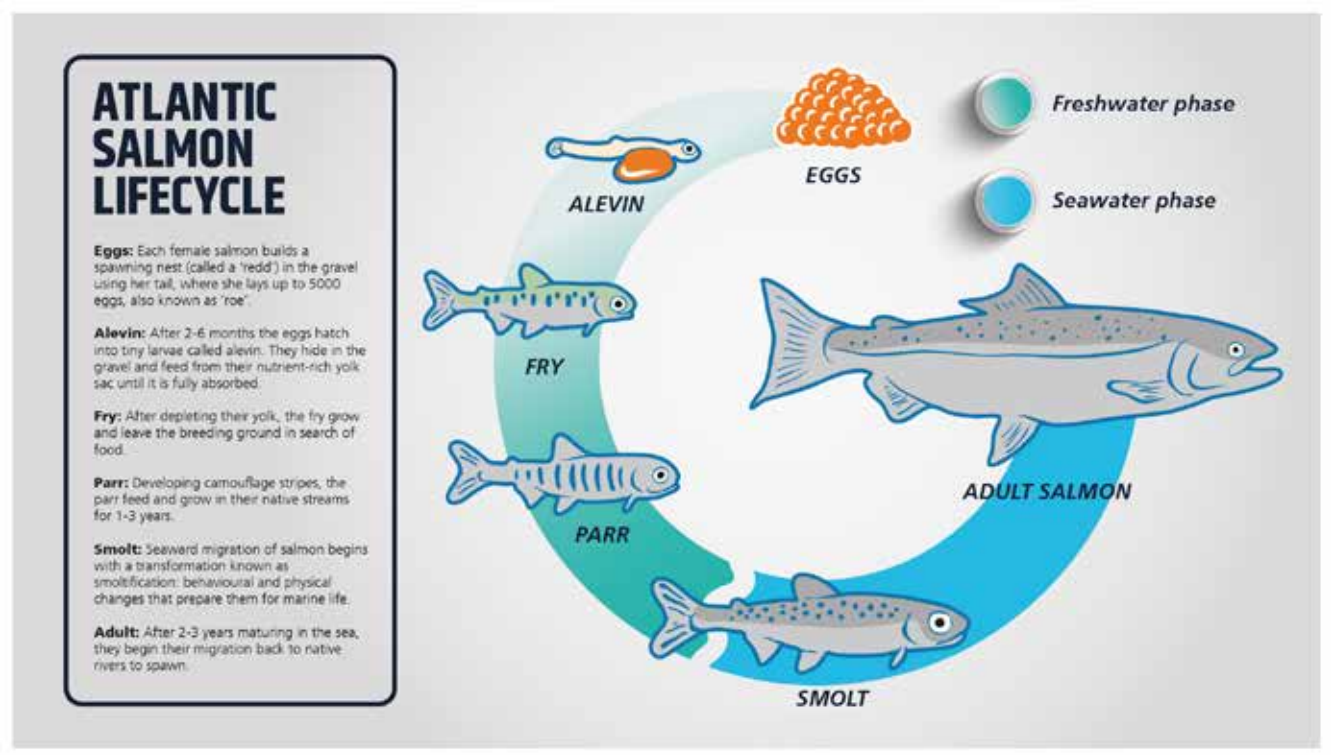


Figure 2. The lifecycle of the Atlantic salmon.

In a Scottish salmon farm, life is somewhat different. They begin as eggs in freshwater hatcheries, then once hatched, they spend the first year of life developing in freshwater tanks. Once they reach the smolt stage they are transferred to seawater cages, where they stay for up to two years. During this life stage in the wild, salmon would be migrating to sea and eventually back to their native rivers to spawn, covering thousands of miles (Aas, Klemetsen, Einum, & Skurdal, 2010). However, farmed salmon cannot migrate further than the cage walls.

Salmon with fin damage (investigation footage)

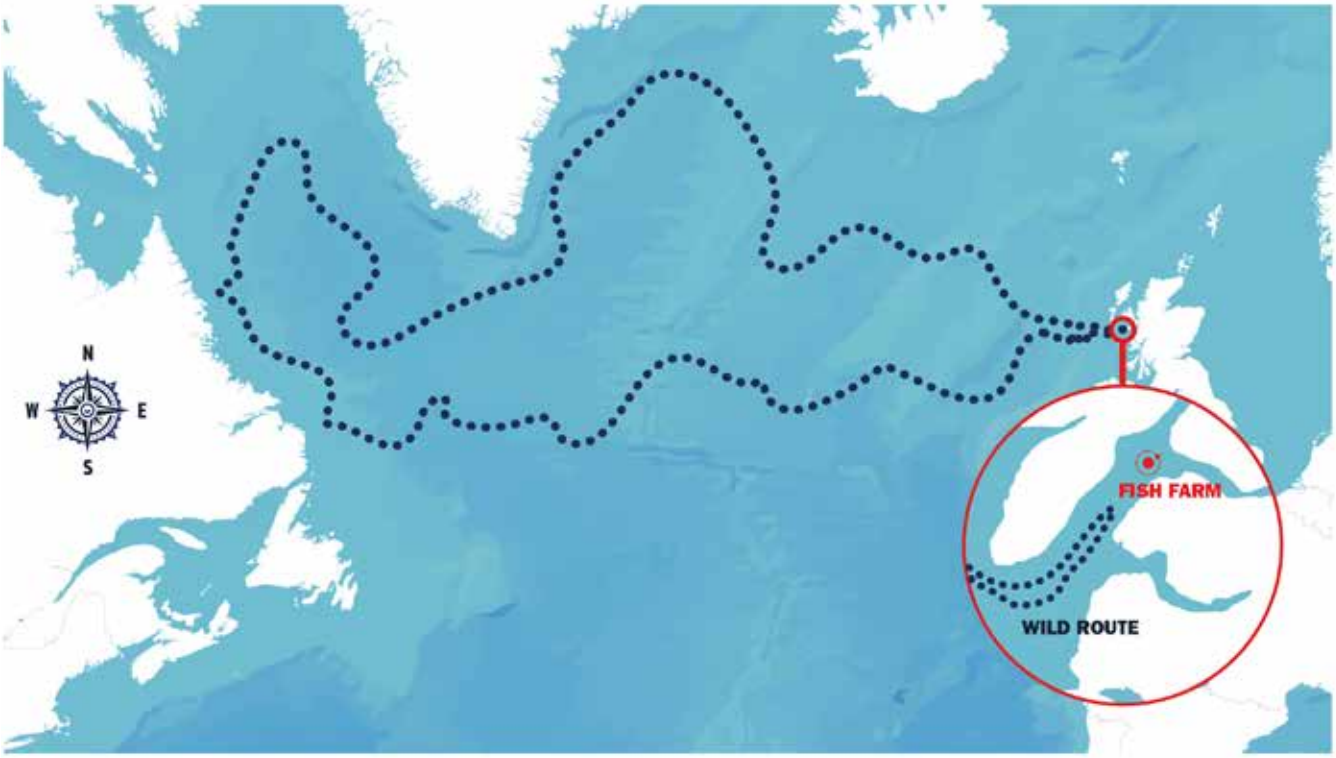


Figure 3. Approximate migration route of Atlantic salmon from Scottish rivers to sea and back again.

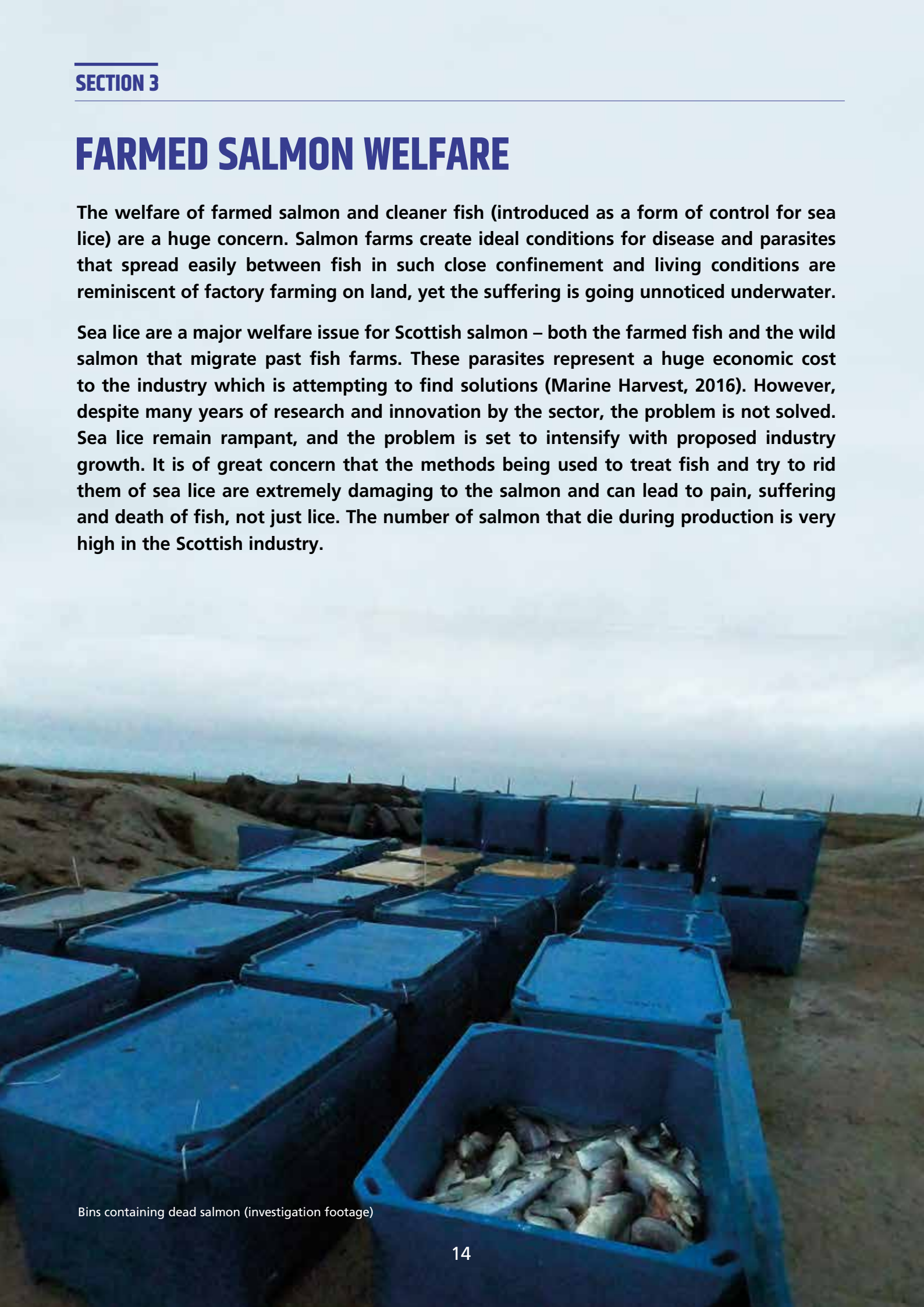
CALLING FOR CHANGE

This report reviews the major welfare and environmental concerns created by Scottish salmon farms today, with evidence of poor fish welfare across the industry from a recent investigation. Compassion in World Farming, OneKind and other organisations worldwide are calling for a moratorium on the growth of the Scottish salmon farming industry.

FARMED SALMON WELFARE

The welfare of farmed salmon and cleaner fish (introduced as a form of control for sea lice) are a huge concern. Salmon farms create ideal conditions for disease and parasites that spread easily between fish in such close confinement and living conditions are reminiscent of factory farming on land, yet the suffering is going unnoticed underwater.

Sea lice are a major welfare issue for Scottish salmon – both the farmed fish and the wild salmon that migrate past fish farms. These parasites represent a huge economic cost to the industry which is attempting to find solutions (Marine Harvest, 2016). However, despite many years of research and innovation by the sector, the problem is not solved. Sea lice remain rampant, and the problem is set to intensify with proposed industry growth. It is of great concern that the methods being used to treat fish and try to rid them of sea lice are extremely damaging to the salmon and can lead to pain, suffering and death of fish, not just lice. The number of salmon that die during production is very high in the Scottish industry.



Bins containing dead salmon (investigation footage)

HIGH MORTALITY RATES AND ESCAPES ARE COMMON

MORTALITY IN SEA CAGES

The mortality rates for fish on Scottish farms are shocking (figure 4). Of the smolts transferred into sea cages between 2000 and 2017, each year between 14.6–28.2% of smolts died before completing the full production cycle (Marine Scotland Science, 2020). Annually, around 33 million salmon are produced in Scotland, but over 9 million suffer and die every year during the seawater stage alone.

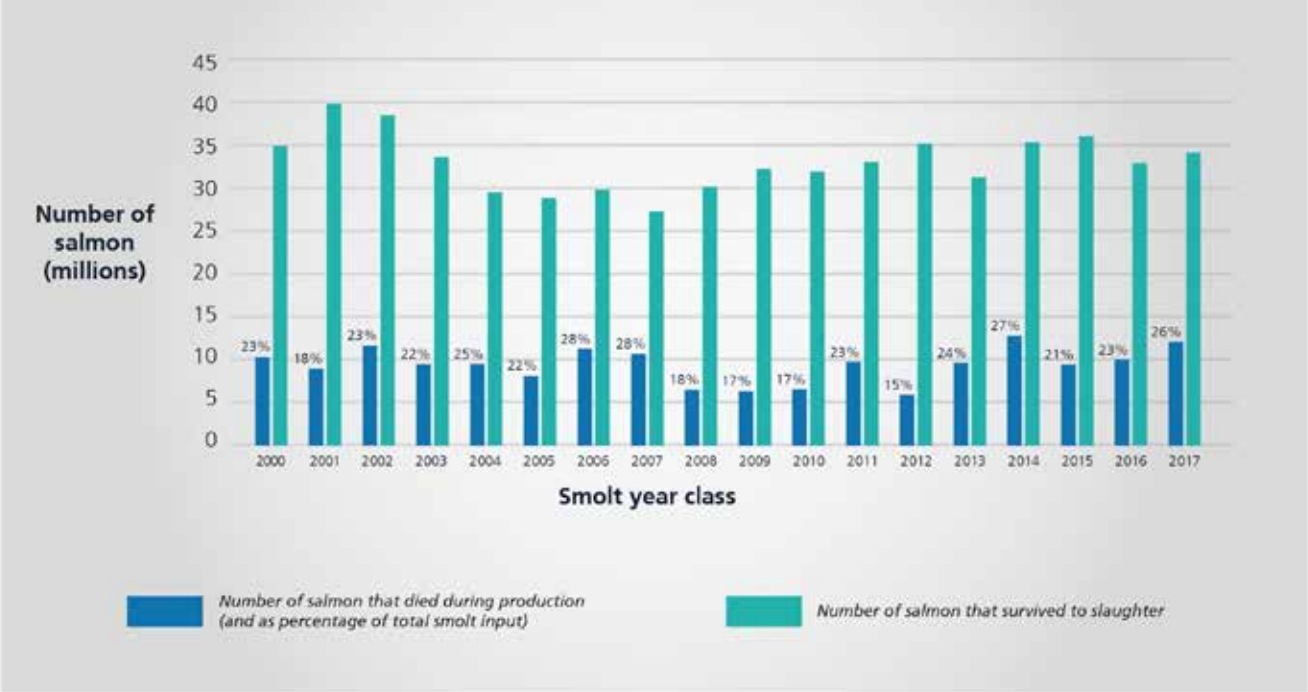


Figure 4. The number of salmon from each smolt year class that survived till slaughter or died during production. A 'smolt year class' represents the total number of smolts that were transferred from freshwater facilities and entered seawater cages in a given year; these may die or be slaughtered at various times within the following (up to) two year production cycle. The percentages displayed above the blue bar are the percentage that died out of all smolts put to sea in a given year. Data from the Scottish Fish Farm Production Survey 2019 provided by the Scottish Government.

Salmon are dying prematurely every day on Scottish salmon farms because of disease and parasites, adverse effects to treatments and stressful handling. Of the salmon mortalities reported to the Fish Health inspectorate in 2019, 86% of all mortalities recorded in sea cages were due to disease (Fish Health Inspectorate, 2020). Salmon also suffer physical injury and, consequently death, during bad weather and predation, both of which can also lead to escapes.

In our 2020 investigation, investigators observed dead fish floating in pens amongst the living. Boats to pump dead fish out of farms were stationed at some of the farms visited, suggesting recent high mortality events. Aside from the significance of high death rates for their welfare, there is also the issue of disposal of the dead fish.

Huge quantities of dead salmon are removed from pens and should be disposed of in a safe and environmentally responsible manner, in accordance with the Animal By-Product (Enforcement) (Scotland) Regulations 2013 (ABP(E)(S)). For example, incineration, rendering, in vessel composting or anaerobic digestion (Scottish Government, 2016). Dumping dead (included diseased) fish in landfill is a biosecurity risk as they are "potentially a reservoir for disease, an attraction for vermin, a contamination risk to land and water courses, can release methane and takes a considerable time to fully decompose" (Newton, 2014).

Dead farmed salmon being dumped in landfill (investigation footage)

Our investigators filmed at a landfill site in Scotland which was still burying dead fish (as of October 2020). However, use of landfill for disposal of aquaculture products is prohibited by European Union legislation (Animal by-products Regulation (2009). Previously there was a derogation that allowed fish farms in remote areas (which applies to most Scottish salmon sites) to dispose of fish in landfill, but the interpretation of this derogation has since changed, and from 1st January 2016 it applied only to terrestrial livestock (Scottish Government, 2016).

In Shetland, our investigators also filmed at a waste management site where dead salmon were being transported. Dead fish were found in a large open skip which was left exposed to wildlife; a flock of birds was flying around the skip and interacting with the waste.

Dead salmon rotting in landfill (investigation footage)

Birds interacting with dead salmon at a waste management site (investigation footage)

MORTALITY IN FRESHWATER PRODUCTION FACILITIES

Mortality of salmon once they reach sea cages is only half the story; between 25–50% of ova laid to hatch die before reaching the smolt stage (Marine Scotland Science, 2020) (figure 5). With production on such a massive scale, huge numbers of fish can be killed due to a single event. In March 2019, all 1,521,479 alevins (juvenile salmon) at Lochailort Recirculation Hatchery, owned by Mowi Scotland Ltd, were lost because of a human error that resulted in the recirculation pump stopping (Fish Health Inspectorate, 2020), and in August 2020 a fire on the wellboat Ocea Aquila resulted in the loss of all smolts on board, though numbers have not been provided (Fish Health Inspectorate, 2020).

Figure 5. Mortality events and totals reported to the Fish Health Inspectorate (FHI) by Scottish salmon farms during the freshwater production stages or obtained through FHI surveillance between 2017 and 2019. Data include only mortality events that exceed reporting thresholds. Mortality undisclosed: mortality events where mortality totals are unknown or were undisclosed. Source: Fish Health Inspectorate (2020).

ESCAPES

It is not only the numerous causes of death that prevent salmon from reaching slaughter size and weight. Farming huge numbers of animals in cages in the sea means that escapes can, and do, happen. This has negative consequences for the welfare of farmed and wild salmon.

Between 2017 and 2019 close to 110,850 salmon escaped from Scottish salmon farms, with the main causes recorded as equipment damage from weather or predation, and human error (Scotland's Aquaculture, 2020). In August 2020, almost 50,000 individuals escaped in a single incident when farm cages broke free from moorings at North Carradale farm, operated by Mowi Scotland, during storm Ellen (Scotland's Aquaculture, 2020).

Once free of their cage, farmed salmon are known to travel vast distances, for example individuals that escaped from North Carradale farm were discovered up to 150 miles away in English rivers (BBC News, 2020). Because they are accustomed to the farm, they are poorly adapted to life in the wild

so likely suffer from poor welfare (OneKind, 2018), and pose a risk to wild salmon and trout populations through transmission of disease and parasites (Jones, Bruno, Madsen, & Peeler, 2015). Interbreeding between wild salmon and escaped farmed salmon can also be damaging to the wild population as farmed salmon have lower fitness and less genetic variation compared with their wild conspecifics, which could weaken the fitness of the wild population (Karlsson, Diserud, Fiske, & Hindar, 2016).

One response from the industry is to produce 'triploid' fish with an extra pair of chromosomes, as they are sterile and unable to breed with wild populations. However triploid salmon have even lower welfare and suffer more issues than diploid salmon (OneKind, Fish Welfare on Scotland's salmon farms, 2018). For example, triploid salmon have been found to have higher incidence of cataracts, varying degrees of blindness, lethargy and emaciation (due to inability to feed) (Wall & Richards, 1992). Triploid salmon have more skeletal deformities, most notably lower jaw problems (Sutterlin & Collier, 1991), and gill deformities likely to affect metabolic gas exchange under strenuous exercise or poor environmental conditions (Sadler, Pankhurst, & King, 2001). Disease resistance impairments in triploid fish have also been found in some cases (Ching, Jamieson, Heath, Heath, & Hubberstey, 2010).

DISEASES AND PARASITES ARE WIDESPREAD

The conditions and reduced welfare on salmon farms create the ideal environment for disease and parasite spread. Salmon are crowded in cages, the water quality is often poor and they face regular handling and contact with abrasive surfaces and cage equipment, all of which have potential to cause gill damage, injuries and open wounds which increase the likelihood of infections (Miranda, Godoy, & Lee, 2018). Furthermore, the long-term stress they suffer weakens their immune system and increases their susceptibility to diseases (Haugan, 2016; Mazur & Iwama, 1993).

In 2019, 67% of all deaths reported to the Fish Health Inspectorate (FHI) throughout production (4,242,016 out of 6,250,889 deaths) were due to a range of diseases and their treatments (Fish Health Inspectorate, 2020), including those described below. Looking at the seawater stage of production only, the percentage is higher at 86% (Fish Health Inspectorate, 2020).

SEA LICE INFESTATIONS ARE OUT OF CONTROL

Sea lice are parasites that feed on skin, blood and mucus of fish such as salmon (Barrett, Oppedal, Robinson, & Dempster, 2020). They 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 (Erkinharju, Dalmo, Hansen, & Seternes, 2020). They naturally occur in the environment but at a much lower incidence; the high concentration of fish on farms however provides the ideal environment for these parasites to flourish (Tett et al, 2018).

Many of the fish filmed in our investigation had very high lice loads.

How are sea lice levels monitored and reported?

Sea lice levels have been managed through the following legislation: Aquaculture and Fisheries (Scotland) Act 2007, Aquaculture and Fisheries (Scotland) Act 2013, updated in 2019, and The Fish Farming Businesses (Record Keeping) (Scotland) Order 2008 (Scottish Government, 2020; Tett, et al., 2018). However, this is due to change soon; there is new legislation due to come into effect at the end of March 2021.

Sea lice attach to fish to feed on their skin, blood and mucus.

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 (SSPO, 2015). 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 FHI. If levels exceed six, intervention should occur (Scottish Government, 2020; Marine Scotland, 2019), however there is little evidence of effective intervention despite farms regularly exceeding limits (Salmon and Trout Conservation Scotland, 2018). For example, only one enforcement notice was handed out between June 2016 and November 2017, despite evidence of breaches in over 20 farms in 2017 (Salmon and Trout Conservation Scotland, 2018).

Sea lice levels are reported in several ways by various organisations including the Fish Health Inspectorate, who record weekly averages from farms exceeding threshold levels, and the SSPO who produce monthly averages from salmon farms. All counts are carried out by the salmon farms themselves with no independent auditing and there is a lack of detail about data collection and analysis methods (Smith, 2020). This lack of clarity does not give the whole picture of sea lice at all stages of the salmon life cycle and results in underestimations of the issue (Smith, 2020).

Furthermore, both the Code of Good Practice (2015) and Scottish Government thresholds only consider adult female sea lice, yet sea lice in other stages of their lifecycle been shown to impact on the welfare of salmon. Grimnes & Jakobsen (1996) infected Atlantic salmon with sea lice during their free-swimming copepodid (a younger, larval) stage, finding they had little impact on salmon. However, once the lice reached pre-adult stages, salmon suffered lesions,

osmoregulation (regulation of salt and water balance across membranes in the body) failure and mortality before lice reached the adult stages (Grimnes & Jakobsen, 1996).

Although sea lice averages may only be on average 2 adult female sea lice per fish in order to meet the current threshold for reporting to the FHI, individual fish can still be affected with much higher numbers. In our investigation we saw many fish with high lice burdens. For example, the fish pictured below appears to have at least 8 adult and 14 juvenile sea lice attached to their skin (just on one side).

New legislation on sea lice reporting

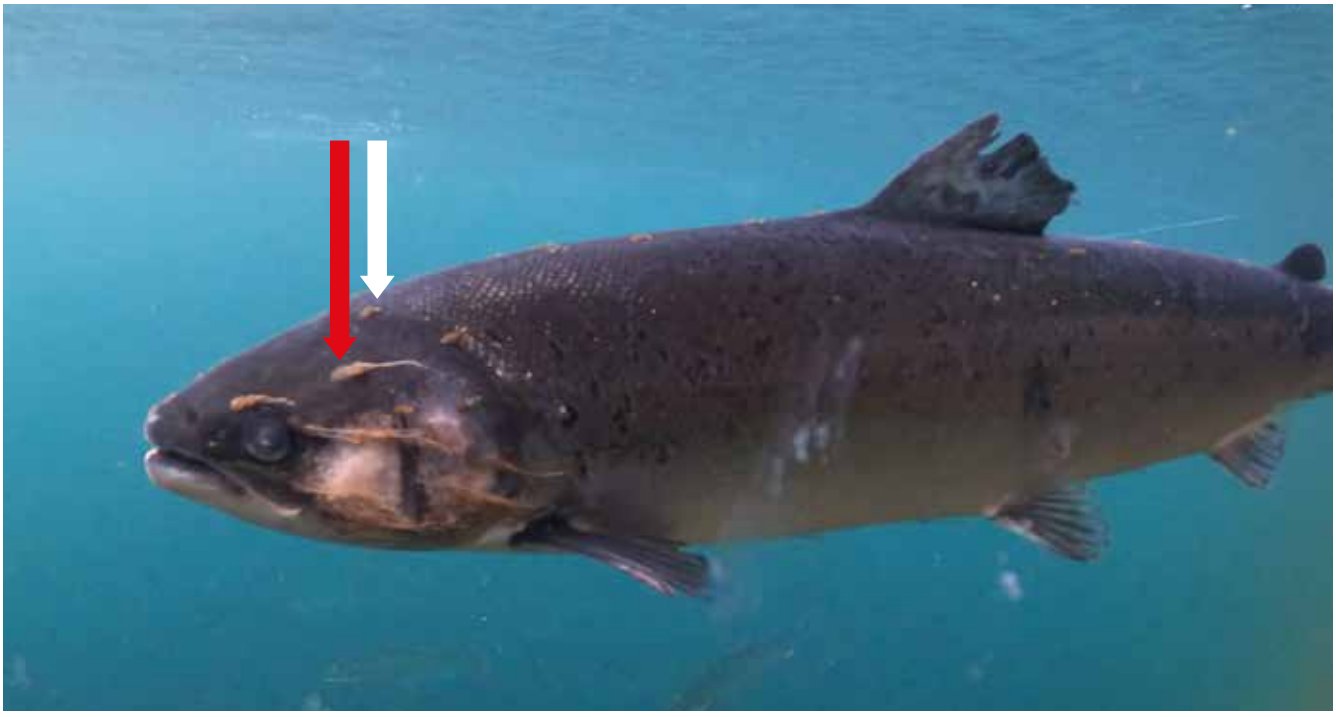
The Fish Farming Business (Reporting) (Scotland) Order 2020 comes into effect on the 29th March 2021 and makes weekly sea lice reporting mandatory, one week in arrears (Scottish Government 2, 2020). The Scottish Ministers made the Order based on Aquaculture and Fisheries (Scotland) Act 2007, to gain information in relation to the prevention, control and reduction of parasites on fish farms. The Order means that all active marine salmon sites must report on their sea lice count every week – independent of any trigger levels.

How severe is sea lice infestation in Scotland?

Our investigation footage filmed in winter 2020 shows salmon living in appalling conditions, rife with sea lice. It is a huge issue that is getting worse as production increases.

Salmon and Trout Conservation Scotland (2019) analysis of SSPO monthly averages shows 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 (Salmon and Trout Conservation Scotland, 2019).

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, including a weekly average (adult female louse) count of 16.68 reported by Ornish Island salmon farm, owned by Mowi Scotland Limited (Fish Health Inspectorate 2, 2020). Further analysis shows that salmon farms produced two to three times more juvenile sea lice in April 2019 than April 2018 (Salmon and Trout Conservation Scotland, 2019). This is particularly concerning for wild populations as it is the larvae that spread to wild salmon as they migrate past the cages (Salmon and Trout Conservation Scotland, 2019).



A salmon with adult (red arrow) and juvenile (white arrow) sea lice attached (investigation footage)

A salmon with a large chunk of flesh and skin missing (investigation footage)

WHAT ATTEMPTS ARE MADE TO CONTROL SEA LICE?

Sea lice control measures are reviewed by OneKind (2018) in their report Fish welfare on Scotland's salmon farms. They include medicines administered in feed, bathing in chemical treatments, such as hydrogen peroxide, thermolicers, hydrolicers, barriers and the use of cleaner fish. None are found to be fully effective, and many are harmful to salmon and regularly result in mortalities. Of the mortality data reported to the Fish Health Inspectorate (2020) between 2017 and 2019, over 2.6 million fish mortalities included 'treatment' in the explanation.

Thermolicer

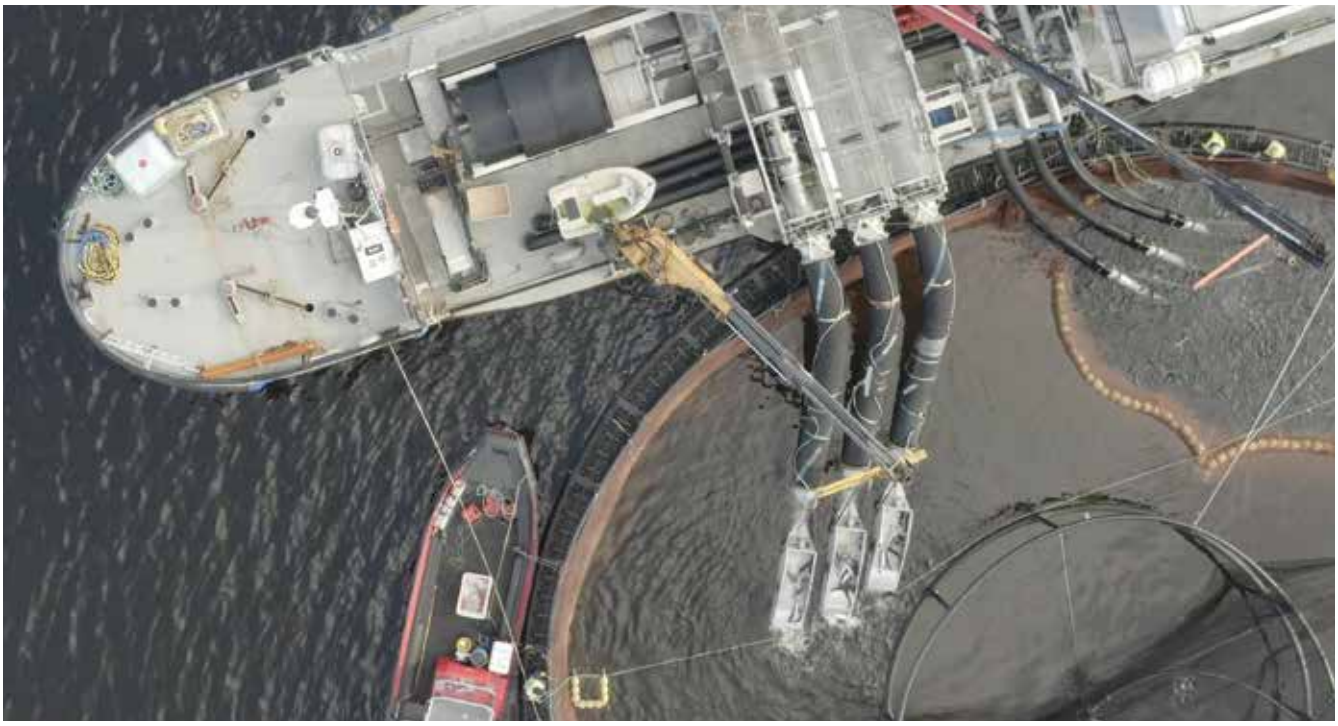
Thermolicers are machines that target sea lice by exposing salmon to a sudden increase in temperature, reaching as high as 34 to 38°C, causing sea lice to drop off the fish (Gismervik, et al., 2019). The process involves crowding salmon into a small area, pumping them up into the thermolicer and then out again, during which time they can suffer physical injury to fins, snouts, and scales from contact with abrasive surfaces. Salmon are sensitive to changes in their environment and experience optimal feeding and growth rates at temperatures between 11 and 14°C (Falconer, et al., 2020). Temperatures above 16°C can cause stress and reduced feeding and slower growth (Falconer, et al., 2020). Acute tissue damage, especially to the gills but also to the eyes and brains were observed in salmon exposed to the temperatures used in thermolicers (Gismervik, et al., 2019). Unsurprisingly, thermolicer treatments have been shown to be painful for salmon and initiate panic reactions which can lead to further damage to the fish (Poppe, et al,. 2018). In March 2020, over 11,000 salmon died following thermolicer treatment at Mowi Scotland Ltd owned salmon farm, Soay.

Hydrolicer

Hydrolicers use freshwater jets to physically remove sea lice from salmon, and can also cause physical damage to fish such as scale loss. It is a process similar to the thermolicer where fish are crowded and pumped from cages into delousing chambers. In 2017, Druimyeon Bay salmon farm, owned by The Scottish Salmon Company, had over 45,000 salmon die following a hydrolicer treatment.

Hydrogen Peroxide

Hydrogen peroxide, a type of bleach, is a commonly used treatment for sea lice. Salmon are either crammed together in a tarpaulin or pumped up into a well boat before being bathed in the chemical irritant. It can affect the gills of salmon, cause lesions and is known to increase stress levels (Vera & Migaud, 2016) and lower disease resistance, as well as result in mass mortalities. After hydrogen peroxide treatment, salmon are lethargic and show respiratory distress (Johnson, Constible, & Richard, 1993). The long-term use of this chemical may be limited by the discovery of reduced sensitivity of sea lice to hydrogen peroxide (Helgesen, Romstad, Aaen, & Horsberg, 2015).



Salmon being pumped out of the cage and onto a boat for a hydrolicer treatment (investigation footage)

THE WELFARE OF CLEANER FISH IS SACRIFICED FOR SALMON FARMING

Cleaner fish, including lumpsucker (*Cyclopterus lumpus*) and wrasse species, are used throughout Scotland to reduce sea lice (Marine Conservation Society, 2018). For the salmon, it is one way to try removing sea lice that may otherwise be treated with chemicals or harmful mechanical processes. For the cleaner fish, it is a lifetime of suffering from a host of welfare issues in attempts to reduce sea lice, which is often ineffective (Barrett, Overton, Stien, Oppedal, & Dempster, 2020).

Cleaner fish welfare

In the wild, wrasse and lumpsuckers live very different lives to salmon. Wrasse like the shelter of reefs and take cover under rocks, while lumpsuckers spend their time on or close to the sea floor. They all have very different biology, life history and welfare needs (Geitung, et al., 2020). Despite this, salmon and cleaner fish are grouped together in the same cages, forced to live and die alongside each other.

Significant welfare issues include starvation and competition for food, a lack of suitable habitat including shelter and places to rest, aggressive interactions with other fish, unsuitable temperatures, and disease (Powell, et al., 2017).

A third of lumpfish may die of starvation within the first few weeks in salmon cages in Norway, according to data by Breck (2015). Fin damage was the most common welfare issue for for both ballan wrasse and lumpfish in a study by Geitung, et al. (2020). For lumpfish a decrease in eye condition was also identified as a welfare issue (Geitung, et al., 2020). Salmon and cleaner fish can show agression towards each other (Powell, et al., 2017), and there is some evidence that cleaner fish may peck at salmon's eyes (Eurofish Magazine, n.d.). A lack of oxygen can also cause increased mortality where skirts or other methods of sea lice reduction are used (Stranden, 2020). Although cleaner fish are used to reduce sea lice, they also suffer from a high incidence and severity of parasitization by sea-lice themselves (Powell, et al., 2017).

Cleaner fish mortality

Scottish fish farms are not legally required to report or publish how many cleaner fish they use, where they come from, or how many die during production. Therefore, official data are not publically available but cleaner fish mortalities in commercial sea cages appear

to be high. Figures from Norway support this. Stranden (2020) estimated that between 20–60% of cleaner fish die before the end of a production cycle and that 150,000 fish die every day in Norweigan farms; according to Nilsen et al. (2014) mortalties ranged from 18 to 48%, with individual farms observing up to 100% mortality or loss; Bui et al. (2018) reported >65% mortality of ~193,000 cleanerfish in 12 commercial salmon sea cages; and a recent industry survey reported cleaner fish mortality of 42% (Stien, Størkersen, & Gåsnes, 2020).

In reality, the fate of most cleaner fish is unknown as deaths go unnoticed and survival rates are usually not recorded, but 100% will die as even if they reach the end of the production cycle they are not reused, they are harvested alongside the salmon. RSPCA standards require that cleaner fish are slaughtered humanely, and states this is usually a percussive blow for bigger wrasse or an overdose of anaesthetic for smaller fish or lumpfish (RSPCA, 2021). It is unknown what method of slaughter (if at all) is used for cleaner fish from farms not covered by RSPCA Assured.

A cleaner fish (lumpfish) in a salmon sea cage (investigation footage)

Demand for cleaner fish is high

The number of cleaner fish used by the salmon farming industry has increased exponentially since 2008 (Powell, et al., 2017). Cleaner fish are typically stocked at a ratio of one cleaner fish per 25 salmon, and numbers used in the Scottish industry were estimated to be in excess of 10 million in 2020 (Powell, et al., 2017).

Wrasse are primarily wild caught in the UK, both in Scotland and in south west England, which is putting huge pressure on wild stocks.

They have long life spans and are territorial with small home ranges. Their behaviour is also temperature dependent, with reduced activity in winter. This coupled with the lack of data on the health of wild populations means they are at risk of over exploitation (OneKind, 2018; Marine Conservation Society, 2018).

In 2018, 103,000 wrasse were farm-reared for use on Scottish salmon farms (Marine Scotland Science, 2020). There is limited data on the number of wrasse caught from the wild for use on Scottish salmon farms. In 2018, the Scottish salmon farming sector agreed to voluntary control measures (SSPO, 2018) for the capture of wrasse, and consequently, in December 2019 landings data were made publically available. A total of 30,564 wrasse were caught using wrasse traps in Scottish waters in 2018, with 53% returned to sea due to being under or over sized (SSPO, 2019). While their release is good in theory, it could have implications for their survival as the capture process can cause issues with their swim bladder and buoyancy causing them to spend time at the surface where they are vulnerable to predators (OneKind, 2018).

While wrasse have been used for sea lice removal for the past 30 years, they stop feeding at temperatures below 6°C (Kelly, Alzaid, Nash, & Gamperl, 2014) which makes their use limited during winter months. This has led to the usage of an alternative cleaner fish species that remains active at lower temperatures – lumpsuckers, also know as lumpfish (Powell, et al., 2017). All lumpsuckers used on salmon farms in Scotland are produced in farms, with a total of 660,000 produced in 2019 (Marine Scotland Science, 2020).

How effective are cleaner fish?

The effectiveness of cleaner fish as sea lice control is under debate. Both lumpsuckers and wrasse are opportunistic feeders that also eat other marine life they find within the cage which can reduce their effectiveness, and not all cleaner fish feast on sea lice. Some studies reported only 15 to 36% of lumpsuckers actually consumed sea lice when they were observed (Imsland, et al., 2014)

Analysis of 500 Norwegian salmon farms showed that though results were mixed, on average, there was no difference between levels of sea lice on farms with cleaner fish and without (Barrett, Overton, Stien, Oppedal, & Dempster, 2020). Other studies have shown that success is dependent on a variety of factors. The presence of other sea lice prevention methods such as lice skirts dramatically decreases the effectiveness, by reducing the opportunities for cleaner fish to feed on lice (Gentry, Bui, Oppedal, & Dempster, 2020). Lice skirts decrease the oxygen levels and slow the flow of water, which may cause salmon to swim deeper but cleaner fish stay in shallower waters (Gentry, Bui, Oppedal, & Dempster, 2020).

AMOEBIC GILL DISEASE

Amoebic gill disease (AGD) is caused by the parasitic amoeba *Neoparamoeba perurans*. It is a potentially fatal condition that damages the gills of salmon, causing a build-up of mucus on the gills, rapid breathing, and eventually suffocation. Salmon suffering from AGD may spend longer at the surface, suffer from weight loss and appear lethargic (Rozas-Serri, 2019; OneKind, 2018).

AGD is commonly treated by bathing salmon in hydrogen peroxide (bleach), but this comes with its own risks. Salmon suffering from gill-related diseases are more susceptible to toxicity and at higher risk of chemical damage. There is only a small window of effectiveness before the treatment itself becomes fatal (Rozas-Serri, 2019). In December 2019, 21,445 salmon died following 'Mechanical lice treatment in fish affected by AGD' on Loch Greshornish salmon farm December 2019 (Fish Health Inspectorate, 2020) and over 1.7 million salmon died from AGD or AGD related treatments on Scottish salmon farms between 2017 and 2019 (Fish Health Inspectorate, 2020).

A dead salmon floating in a sea cage (investigation footage)

INFECTIOUS SALMON ANAEMIA

Infectious salmon anaemia (ISA) is an infectious viral disease that spreads easily within and between salmon farms. It is a notifiable disease within the UK with no treatment or vaccine. The only control method is compulsory slaughter followed by disinfection of the farm. Salmon infected with ISA suffer from severe anaemia, liver necrosis, and haemorrhaging.

CARDIOMYOPATHY SYNDROME

Cardiomyopathy syndrome (CMS) 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 (Garseth, Fritsvold, Svendsen, Jenson, & Mikalsen, 2017).

In July 2020, over 55,700 salmon died because of 'Harmful Algae Bloom, Gill Insult and CMS' – on Stulaigh salmon farm, owned by Mowi Scotland Ltd. A month later in August, another 41,594 salmon died on the same farm, for the same reason.

PANCREAS DISEASE

Pancreas disease (PD) 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 most likely mortality. In 2019, over 831,655 PD related deaths were reported to Marine Scotland, though this is an underestimation which does not account for PD outbreaks where numbers were unreported (Fish Health Inspectorate, 2020).

A BREACH OF ANIMAL WELFARE LEGISLATION

Salmon on Scottish fish farms should be protected under the following legislation:

- Animal Health and Welfare (Scotland) Act 2006
- The Welfare of Animals (Transport) (Scotland) Regulations 2006
- Aquatic Animal Health (Scotland) Regulations 2009
- Aquaculture and Fisheries (Scotland) Act 2013

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 providing them with a suitable environment that encourages natural behaviour, supplying an appropriate diet and protecting them from pain, injury, and disease.

Scottish salmon farming breaches animal welfare legislation in the following ways:

- Causes stress and increases exposure to disease and parasites
- Puts salmon at risk of physical injury from handling, contact with equipment, and predation
- Prevents natural behaviours such as under taking long-distance migrations
- Forces them to live in environments with poor water quality and reduced oxygen levels (Brown, Gowen, & McLusky, 1987)
- Inflicts salmon with treatments such as thermolicers that intentionally expose them to temperatures known to cause them pain and stress, and processes known to cause physical injury and death.

A salmon with a chunk of flesh missing from near their tail (investigation footage)

The findings of our investigation, and footage from past investigations shows salmon in very poor health and welfare state and with obvious signs of suffering. Upon reviewing the footage from a particular farm, our investigators found that a significant proportion of the fish were in an extremely poor state. Significant welfare problems were seen throughout the pen: lice damage, seaweed growing in open wounds, gill damage, fin damage, 'white heads' (large areas of exposed flesh on the head), abrasions and lesions, infection, damage to mouths. Some fish were missing eyes and had significant chunks of flesh missing. Compassion in World Farming reported these findings to the Animal and Plant Health Agency. We believe these findings are in violation of the Animal Health and Welfare (Scotland) Act 2006, which states that:

(1) A person commits an offence if the person does not take such steps as are reasonable in the circumstances to ensure that the needs of an animal for which the person is responsible are met to the extent required by good practice. (2) The circumstances to which, for the purposes of subsection (1), regard is to be had include— (a) any lawful purpose for which the animal is kept, (b) any lawful activity undertaken in relation to the animal. (3) For the purposes of subsection (1), an animal's needs include— (a) its need for a suitable environment, (b) its need for a suitable diet, (c) its need to be able to exhibit normal behaviour patterns, (d) any need it has to be housed with, or apart from, other animals, (e) its need to be protected from suffering, injury and disease.

In order to keep fish "protected from suffering, injury and disease" there should have been interventions that prevented the salmon getting to the state they were found in. The individuals with severe injuries should have been removed from the pen to be humanely killed to end their suffering.

While the farm that we reported was a particularly bad case we believe the conditions that salmon are provided with as standard industry practice are themselves causing suffering and are not in line with existing legislation on animal welfare.

SECTION 4

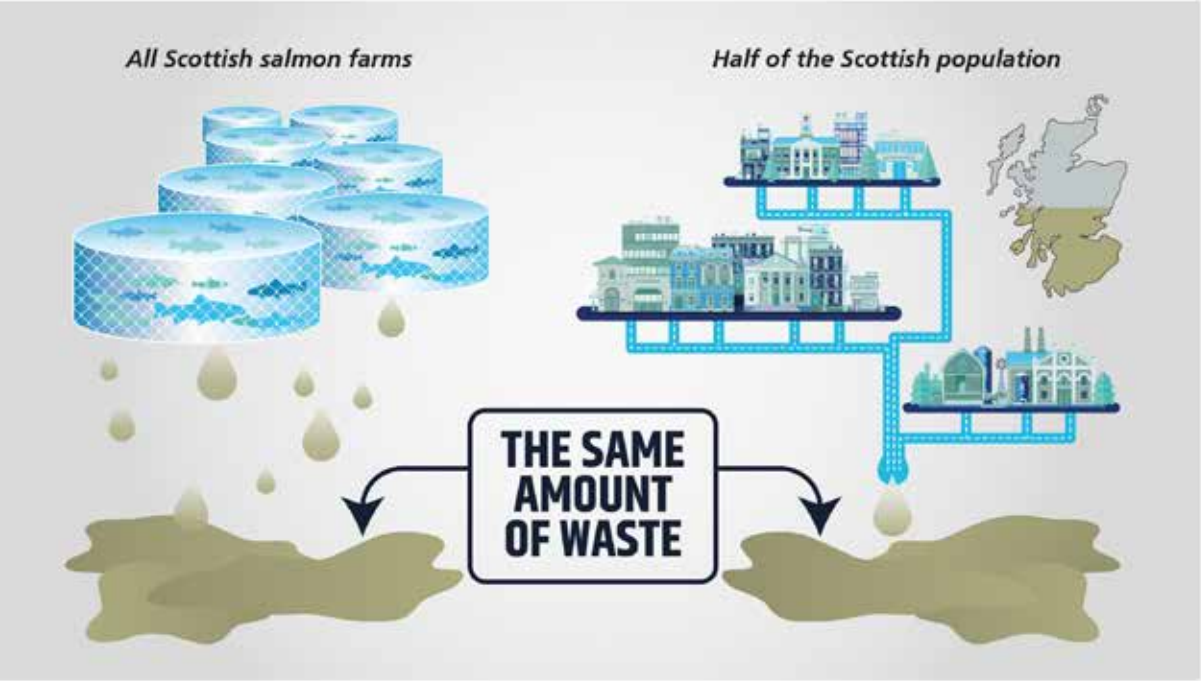
EFFECTS OF SALMON FARMING POLLUTION ON THE SCOTTISH ENVIRONMENT

Not only is salmon farming bad for animal welfare, but it is also damaging the environment. Organic and chemical waste from Scottish salmon farms is changing the chemistry of sediments and killing benthic (sea floor) communities.

Salmon swimming through murky water in a sea cage (investigation footage)

UNEATEN FOOD AND FAECES

Solid waste from salmon farms, mainly uneaten food and faeces, sinks to, and accumulates on, the seabed. While organic waste is naturally occurring in aquatic environments, the levels created by salmon farms are far above those seen naturally, and it is contaminated with chemicals and medicines. It is essentially untreated sewage going straight into the marine environment and in huge quantities, with reports suggesting that one fish farm can produce the same amount of waste as all the towns on Scotland's west coast combined (Undercurrent News, 2018), or that all Scottish salmon farms produce the same amount of waste as half of the Scottish human population (figure 6).



The influx of organic matter smothers various organisms living on and in the seabed. It can change the composition of the community and alter the chemistry of the sediment by depriving the area of oxygen. Effects on organisms living on the seabed can extend considerable distances from salmon farms. Sediment cores taken from underneath a salmon farm at Loch Crenan, a 1,500-ton salmon farm, showed reduced biodiversity up to 0.5km^2 around the farm (Reviewed by Tett et al, 2018). Directly underneath the farm, high numbers of resistant worms were recorded but few other organisms.

Salmon swim alongside the cage wall (investigation footage)

WATER QUALITY, EUTROPHICATION, AND HARMFUL ALGAL BLOOMS

Release of compounds containing nutrients such as nitrogen and phosphorus, has the potential to cause excessive plant and algal growth. This can lead to a depletion of oxygen in the water after the bacterial degradation of the algae (eutrophication) (Chislock, Doster, Zitomer, & Wilson, 2013). This is detrimental to fish welfare if oxygen levels become too low (Cottee & Peterson, 2009). Studies, reviewed by Tett et al. (2018), have found increased concentrations of ammonium around Scottish salmon farms as well as reductions in dissolved oxygen levels.

In the wild, salmon have the capacity to swim away from harmful algal blooms and areas of poor water quality. In a farm, they are trapped, left to suffer the effects which include damage to and clogging of gills and reduced oxygen levels, both of which can lead to suffocation (Brusle, 1995).

In 2019, close to 83,500 farmed salmon died following a harmful algal bloom at the Scottish Salmon Company owned Quarry Point farm on Loch Fyne. Further mortalities were also reported from Ardcastle salmon farm on Loch Fyne during the same bloom but exact figures are unrecorded (Fish Health Inspectorate, 2020). In Norway, there was a loss of over eight million fish in a week in 2019 because of harmful algal blooms that spread across the coast (Cockburn, 2019).

CHEMICALS AND MEDICINES

Use of chemicals and medicines is commonplace on Scottish salmon farms; they are used for:

- Treating infections and disease
- Controlling sea lice infestations
- Antifouling agents for protecting farm infrastructure
- Food additives to boost copper and zinc in farmed salmon diets

Treatments and food additives are administered in feed or as baths or dips (bathing fish in chemicals either in while crowded in a tarpaulin or on a wellboat) and make their way into the environment through uneaten food and faeces or by dispersing into the water column. Antifoulants are transferred in paints or as steeps for nets and leech into the environment over time (Amara, Miled, B, & Ladhari, 2018).

The fate of chemicals in the environment depends on chemical characteristics and local conditions, but once released they can decrease water quality, accumulate in sediments and bioaccumulate up the food chain (Urbina, Cumillaf, Paschke, & Gebauere, 2019). They also have detrimental effects on non-target species such as bivalves and lobsters (Urbina, Cumillaf, Paschke, & Gebauere, 2019).

The main chemicals used include the insecticides Deltamethrin, Cypermethrin, Azamethiphos, Teflubenzuron, Emamectin Benzoate, and hydrogen peroxide, all reviewed in detail by Tett (2018).

DELTAMETHRIN

Deltamethrin is a treatment used to kill sea lice, but it can also kill or damage other marine crustaceans, and other organisms (Van Geest, Burridge, & Kidd, 2014). The Scottish Environment Protection Agency (SEPA) has described it as 'potentially highly toxic to marine organisms' (SEPA, 2020). Indeed, research has shown that it is acutely toxic to European lobster larvae in Norway and can impact areas up to 39km^2 around salmon farms (Parsons, Escobar-Lux, Sævik, Samuelsen, & Agnalta, 2020). A total of 3.82kg of Deltamethrin was discharged into the marine environment in 2019, with the highest release of 0.76kg at a Mowi salmon farm, Port na Moine North (SEPA, 2020). Research has demonstrated 1-hour (h) LC50s (i.e., lethal thresholds) for lobster and shrimp ranging from 3.4 to 142 ng/L of Deltamethrin, which is well below the prescribed aquaculture treatment concentration (Burridge, Lyons, Wong, MacKeigan, & VanGeest, 2014; Fairchild, et al., 2010). N.B. 1 nanogram (ng) =0.000 000 001 g.

AZAMETHIPHOS

Azamethiphos is a bath treatment for sea lice. In 2019, 286kg of Azamethiphos was released into the Scottish environment, which is an increase of 76% from 2018. It is thought to degrade within approximately five days once released into the environment but is highly toxic to birds and marine life (SEPA 2, 2020), including the salmon it is used to treat. Short

term exposure to azamethiphos causes reduced immune responses in mussels (Canty, Hagger, Moore, Cooper, & Galloway, 2007) and it has found to be acutely toxic to lobster larvae (Parsons, Escobar-Lux, Sævik, Samuelsen, & Agnalta, 2020).

EMAMECTIN BENZOATE

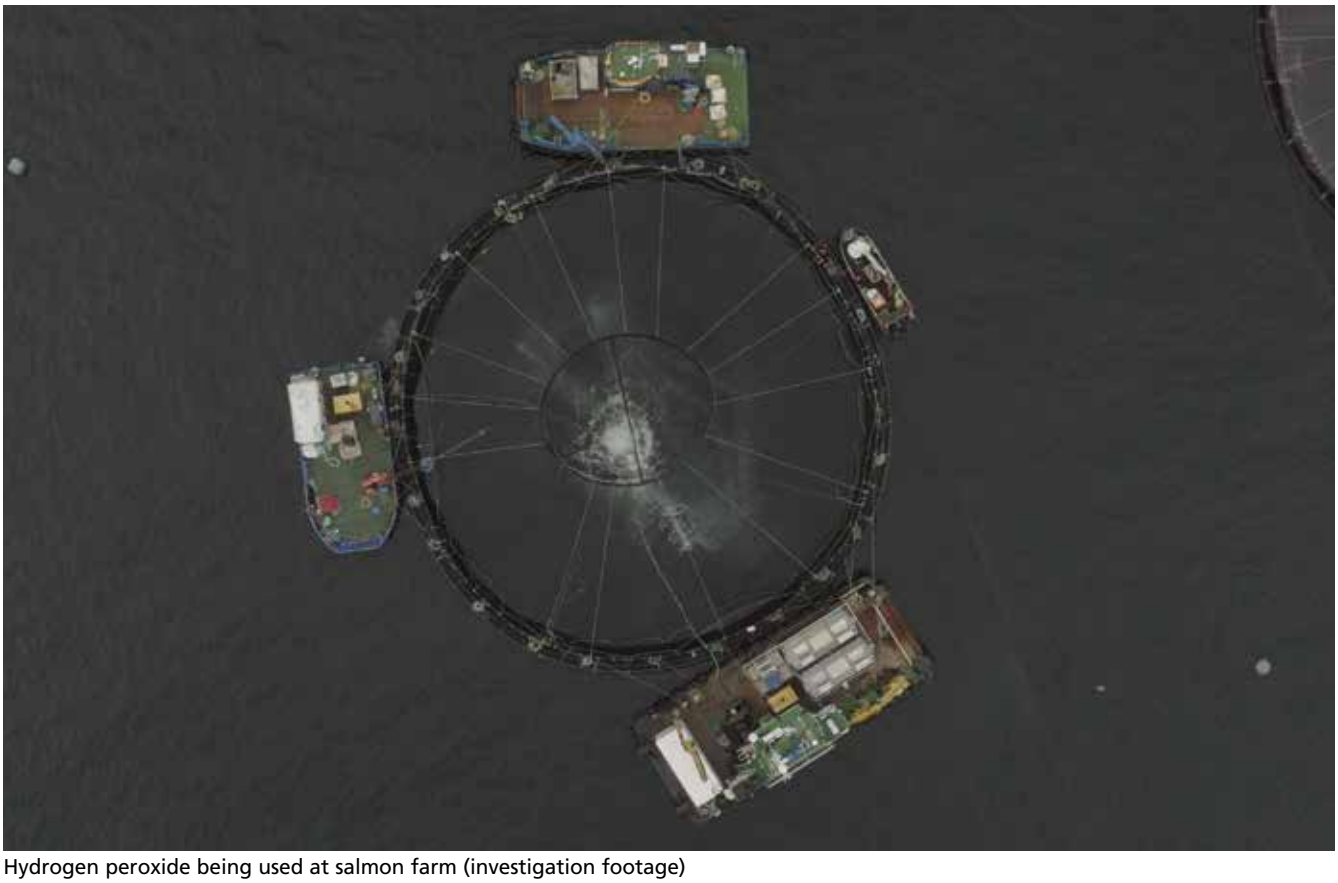
Emamectin benzoate, commonly known as 'Slice', is used to treat sea lice and is administered in salmon feed. It is known to be toxic to fish and other marine organisms as well as birds and mammals (Bloodworth, Baptie, Preedy, & Best, 2019; (SEPA 3, 2020) and accumulates in sediments around salmon farms. A SEPA investigation into levels of emamectin benzoate around eight Scottish salmon farms in 2018, found evidence of the chemical in 98% of samples taken (SEPA, 2018).

While emamectin benzoate use is regulated, there appear to be few consequences for breaches. In February 2020, Loch Roag, owned by the Scottish Salmon Company, was found to be in breach of the regulations after applying six treatments in a year, rather than the allowed maximum number of three. The breach was investigated but no further action was taken (Edwards, 2020).

A total of 45.5kg of emamectin benzoate was released from Scottish salmon farms in 2019, which is an increase from 32.2kg in 2018 (SEPA, 2020).

HYDROGEN PEROXIDE

Hydrogen peroxide is a bath treatment for sea lice. It is not subject to the same standards and regulations as other treatments because it degrades quickly when in sea water so does not persist in the environment. However, it does cause mass mortalities of salmon and has been found to be lethal to all larval stages of lobster in Norway, at concentrations between 10 to 43% of those recommended for sea lice treatment on salmon farms. (Escobar-Lux, Parsons, Samuelsen, & Agnalt, 2020). Temporary effects on the shelter seeking behaviour of adult lobster have also been observed (Escobar Lux, Parsons, Samuelsen, & Agnalt, 2020).



Hydrogen peroxide being used at salmon farm (investigation footage)

ANTIBIOTIC RESISTANCE

According to the World Health Organisation, antibiotic resistance is one of the biggest threats to global health, food security, and development today (World Health Organisation, 2020). Antibiotic resistance happens when bacteria change in response to the use of these medicines. Resultant infections are harder to treat than those caused by non-resistant bacteria (World Health Organisation, 2020). Antibiotic resistance is accelerated by the misuse and overuse of antibiotics, as well as poor infection prevention and control (World Health Organisation, 2020).

Antimicrobials are used on salmon farms to control bacterial infections. Their use in Scotland has been reduced in recent years, with a move towards vaccinating salmon (Luthman, Jonell, & Troell, 2019). It is still prominent in other areas such as Chile (Miranda, Godoy, & Lee, 2018). Studies have shown that antimicrobials can reside in salmon and make their way into our food chain, but it is likely that 70 to 80% of antimicrobials administered to salmon are released into the environment, where they have the potential to change the composition of microbial communities and increase the amount of resistant bacteria (Watts, Schreier, & Hale, 2017).

Responsible Use of Medicines in Agriculture Alliance (RUMA) has set 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 17.2mg/kg of production (RUMA, 2018). In 2018, this dropped to 6.5/kg of production (RUMA, 2019).

SCOTTISH WILDLIFE AND BIODIVERSITY ARE BEING DAMAGED

WILD SALMON AND TROUT

The environmental impacts of salmon farming are documented in a report published by the Scottish Parliament (2018) stating simply that "more farmed salmon implies more sea lice (and thus more costs for farmers and more impact on wild salmon)" (Scottish Parliament, 2018, p. 6). Farms create ideal conditions for the spread of parasites and diseases, which can spread between farms and wild salmon and trout populations. Sea lice contribute to the decreased survival of wild salmon at sea, along with a myriad of factors including climate change, fisheries and marine pollution (Susdorf, Salama, & Lusseau, 2018). In 2018, 37,196 wild salmon were caught in Scottish waters, which is the lowest catch since records began and a 33% drop from the 2013 to 2017 five-year average (Scottish Government 3, 2020). This vast drop in catches highlights that wild salmon stocks are in trouble and at risk of becoming endangered. It is estimated that wild salmon and trout numbers in Scottish rivers have dropped by 70% in the past 20 years (Salmon and Trout Conservation, 2020).

Salmon farms increase the spread of sea lice and disease to wild populations locally. There is a lack of detailed research in the UK waters, but studies conducted in British Columbia show infection rates around fish farms as being 73 times higher

Wild salmon leaping upstream

than in areas without fish farms (Martin Krkošek, 2005). Risks to wild salmon and trout extend further afield though as escaped salmon can travel vast distances (Hansen & Youngson, 2010).

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 (Karlsson, Diserud, Fiske, & Hindar, 2016). In Norway, there is a strong significant correlation between intensive salmon farming, escapes and introgression, which is the transfer of farmed salmon genes into wild populations (Karlsson, Diserud, Fiske, & Hindar, 2016). This has the possibility to impact wild salmonids in various ways, with observed effects including a change in the age and size of maturation (Tett, et al., 2018).

SEALS

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 breach US regulations in place to protect marine mammals in the wild (Edwards, 2020). This comes as part of the approved Animals and Wildlife (Penalties, Protections and Powers) (Scotland) Bill which amends the Marine Scotland Act (2010) and repeals the provision to grant licences for the shooting of seals to protect fisheries and fish farms (The Fish Site, 2020).

Until recently, seals could be shot under licence by salmon farmers

Prior to this ban, seals were shot under licence to prevent them from predating on farmed salmon (Edwards, 2020). They are natural predators and visit salmon farms looking for food, occasionally causing damage to nets and equipment and stress, injury, or mortality to salmon. Shooting can cause suffering due to the difficulty of successfully shooting seals in water and can injure rather than kill immediately, leaving seals to suffer before they die. In the first six months of 2020, 34 grey seals and 18 common seals were shot under licence (Marine Scotland, 2020).

CETACEANS

Acoustic Deterrent Devices (ADD) emit high frequency sounds to deter seals from salmon farms. They are used by over 140 salmon farms (Grant, 2020) and are a persistent and widespread source of underwater noise on Scotland's west coast (Findlay, et al., 2018).

Cetaceans (i.e. whales, dolphins, and porpoises) are a very vocal taxonomic group that rely on sound (Weilgart, 2007). It is essential to their survival. Noise from ADDs have the potential to impact their ability to echolocate and feed, communicate and locate mates (Simmonds, Dolman, & Weilgart, 2004). It can also cause stress, exclude them from areas of their habitat and temporarily or permanently damaging their hearing (Götz & Janik, 2013). The effectiveness of ADDs is a topic of much debate, with some shown to work only short term as seals habituate to the noise, while other studies have found that ADDs can attract seals that associate the sound with food (reviewed by Götz & Janik, 2013).

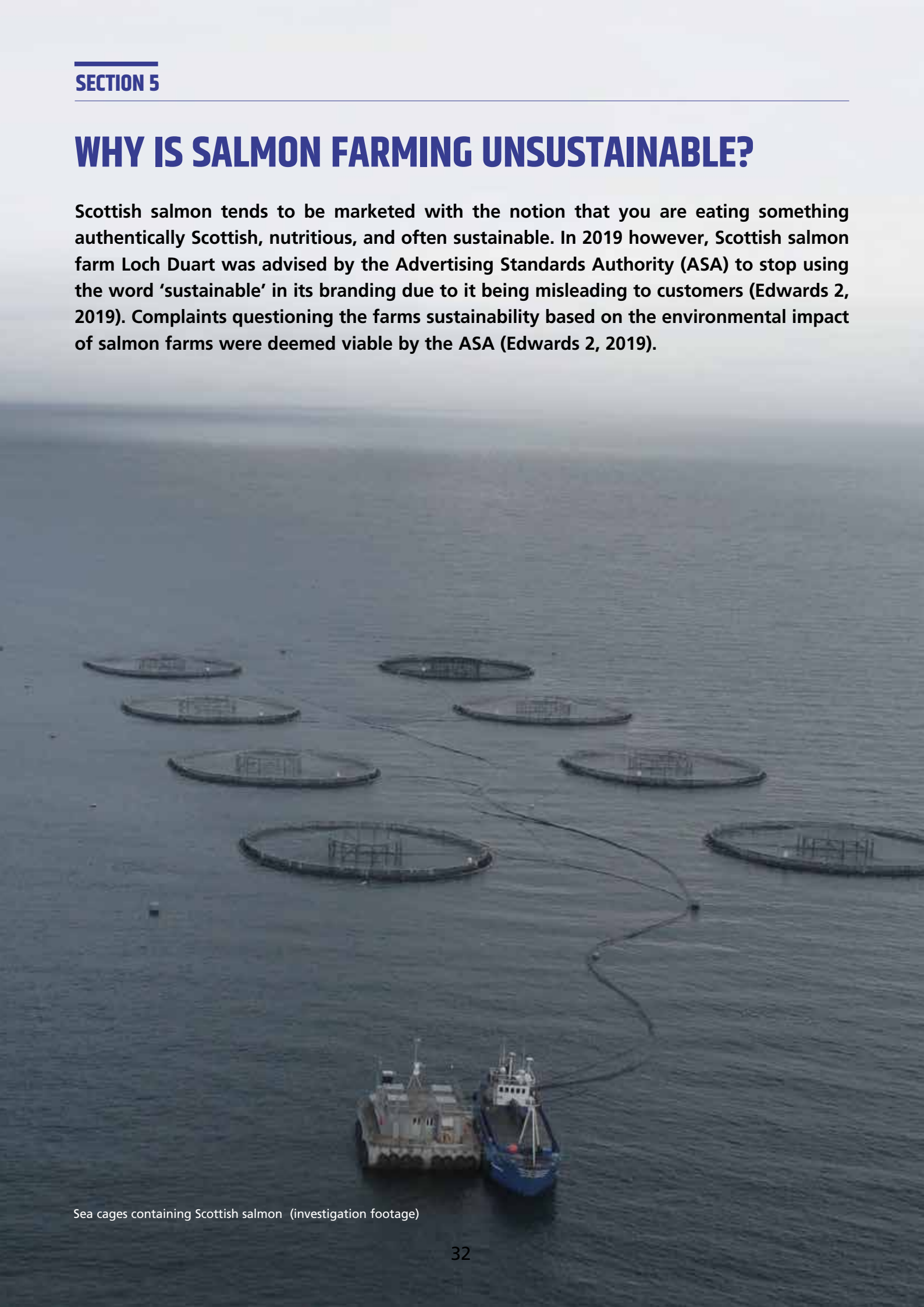
CRUSTACEANS

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 high levels of emamectin benzoate in the sediments (Bloodworth, Baptie, Preedy, & Best, 2019).

SECTION 5

WHY IS SALMON FARMING UNSUSTAINABLE?

Scottish salmon tends to be marketed with the notion that you are eating something authentically Scottish, nutritious, and often sustainable. In 2019 however, Scottish salmon farm Loch Duart was advised by the Advertising Standards Authority (ASA) to stop using the word 'sustainable' in its branding due to it being misleading to customers (Edwards 2, 2019). Complaints questioning the farms sustainability based on the environmental impact of salmon farms were deemed viable by the ASA (Edwards 2, 2019).



Sea cages containing Scottish salmon (investigation footage)

PRODUCTION OF FISHMEAL AND OIL

Fish farming takes a huge toll on wild fish caught for their feed. It may be marketed as a sustainable option that takes pressure off wild fish stocks, but this is selective omission that considers the farmed fish only. For carnivorous species such as salmon, it neglects to mention the vast numbers of wild fish that are caught to be ground down into fishmeal and fish oil – key ingredients for farmed salmon feed pellets. In the wild, Atlantic salmon in streams mostly feed on aquatic insects, and at sea they eat a variety of marine organisms, including crustaceans and fish (FAO, 2021). It is a diet rich in protein, fish oils and nutrients. On farms, they eat pellets formed from vegetable oils, plant protein, fishmeal and fish oil (Tett, et al., 2018). Globally, between 0.5 and 1 trillion fish are caught from the wild to be reduced to fishmeal and oil (Mood & Brooke, 2019). There is no protection for the welfare of these fish, who suffer greatly during capture and landing (Mood & Brooke, 2019).

According to calculations by Feedback (2019), the Scottish industry uses around 460,000 tonnes of wild fish every year to feed salmon; this is roughly equivalent to the amount of wild-caught fish purchased by the entire UK population (O'Sullivan, 2019).

If proposed growth targets (to produce 300,000 – 400,000 tonnes by 2030) are reached, that figure will increase to 770,000 tonnes of wild fish a year. On top of that, cleaner fish feed also contains FMFO, which further increases the number of wild-caught fish used to produce salmon. That is a huge pressure on wild fish populations that are already overfished or maximally sustainably fished (FAO, 2020).

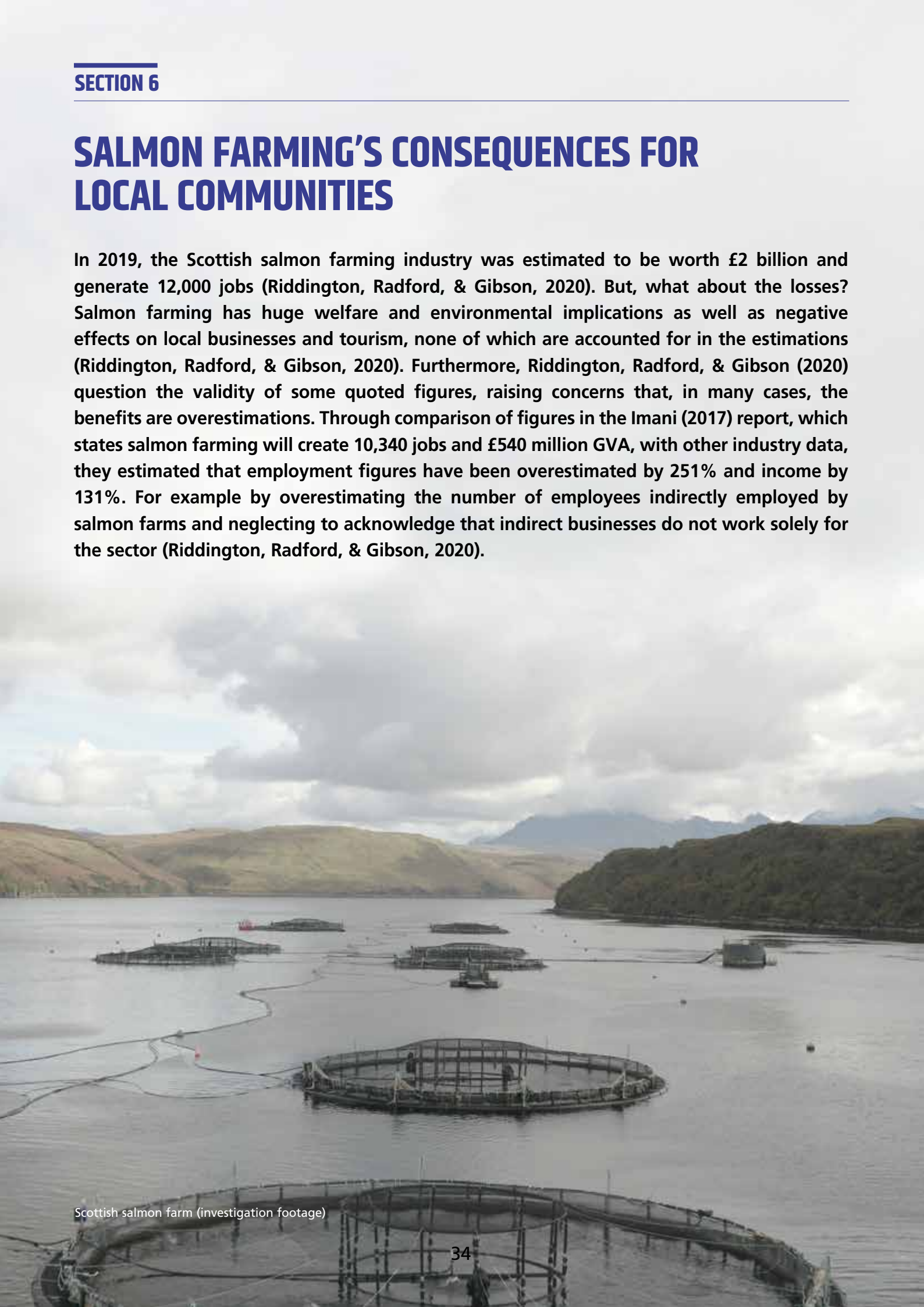
Around two thirds of fishmeal and fish oil used is wild caught by reduction fisheries, which catch fish specifically for this purpose (Cashion, Le Manach, Zeller, & Pauly, 2017). The main species are small pelagic fish including anchovies, mackerel, whiting and sardines, and they are sourced mainly from Europe, South America, and West Africa (Alder, Campbell, Karpouzi, Kaschner, & Pauly, 2008). The remaining fishmeal and oil is sourced from fishery by-products. Forage fish species play an important role in marine food webs because they are the principal means of transferring production from plankton to larger predatory fish and to marine mammals and seabirds. They also contribute directly to food security in many developing countries and they are used for fishmeal production. Several studies have showed environmental concerns about fishing in the low trophic levels on marine ecosystems (Cashion, Le Manach, Zeller, & Pauly, 2017; Alder, Campbell, Karpouzi, Kaschner, & Pauly, 2008; Naylor, et al., 2009).

Furthermore, approx. 90% of these wild-caught fish are food grade fish which could otherwise be eaten directly by humans (Cashion, Le Manach, Zeller, & Pauly, 2017). Feeding them to salmon means much of the calories are wasted, as with every step in the food chain energy is used up and lost, particularly in an industry with such a high mortality rate.

SECTION 6

SALMON FARMING'S CONSEQUENCES FOR LOCAL COMMUNITIES

In 2019, the Scottish salmon farming industry was estimated to be worth £2 billion and generate 12,000 jobs (Riddington, Radford, & Gibson, 2020). But, what about the losses? Salmon farming has huge welfare and environmental implications as well as negative effects on local businesses and tourism, none of which are accounted for in the estimations (Riddington, Radford, & Gibson, 2020). Furthermore, Riddington, Radford, & Gibson (2020) question the validity of some quoted figures, raising concerns that, in many cases, the benefits are overestimations. Through comparison of figures in the Imani (2017) report, which states salmon farming will create 10,340 jobs and £540 million GVA, with other industry data, they estimated that employment figures have been overestimated by 251% and income by 131%. For example by overestimating the number of employees indirectly employed by salmon farms and neglecting to acknowledge that indirect businesses do not work solely for the sector (Riddington, Radford, & Gibson, 2020).



Scottish salmon farm (investigation footage)

JOB CREATION

Expanding the salmon farming industry will create some employment opportunities, but there is little evidence to suggest it will grow to the same extent and the same applies to revenue (Riddington, Radford, & Gibson, 2020). A proposed 12 cage salmon farm within the Wester Ross Marine Protected Area (MPA) would generate only six jobs and potentially 2 apprenticeships, that's a small gain for all that destruction (Williams, 2020).

IMPACT ON TOURISM AND LOCAL BUSINESSES

Tourism contributes substantially to Scotland's economy, with an estimated value of 10.5 billion in 2018 (Scottish Enterprise, 2020). Salmon farms disrupt the use of the Scottish coastline, limiting the use of waterways and destroying the stunning views tourists flock to see. In 2011, tourists' general perception was that salmon farms would not stop them visiting the area, though expansion could have a negative impact on their view of the Scottish landscape (Nimmo, Cappell, Huntington, & Grant, 2011). The industry has grown substantially since then, with production increasing from 158,018 tonnes in 2011 to a projected 207,630 tonnes in 2020 (Marine Scotland Science, 2020).

Tourists are the main users of hospitality venues, local attractions, and experiences, so without their business locals will inevitably miss out. As an example, in 1987 salmon farming was introduced to Loch Ewe in Wester Ross, a year later the thriving sea trout angling industry at Loch Maree collapsed, taking with it the trade from the many fishermen that flocked to the area for sea trout and booked up the hotel years in advance (Paxman, 2017; Walker, 2017). A report concluded "introduction of salmon farming in Loch Ewe close to the River Ewe's estuary played a prominent part in the changes in sea trout stock dynamics in the River Ewe system, leading to the collapse of the angling fishery in Loch Maree. The rapid change in sea trout stock structure there in the late 1980s was consistent with many other badly affected sea trout fisheries throughout the West Highlands and Islands following the development of local intensive coastal salmon farming" (Walker, 2017, pp.4).

More recently, a new salmon farm on the Isle of Skye was blocked because of the impacts on local fishermen who are losing fishing grounds to salmon farms and being pushed further out to sea into more dangerous waters with less shelter (Wayland & Wayland, 2020). Many are local family-run businesses that need the income so are at risk of going out of business (Wayland & Wayland, 2020). The Hebridean Whale and Dolphin Trust have also raised concerns about acoustic deterrent devices (ADDs) use excluding marine mammals from their habitats and the impact that could have on whale and dolphin watching (Hebridean whale and dolphin trust, n.d.), an industry that generated an estimated £3.7 million in 2015 (Ryan, Bolin, Shirra, & Garrad, 2018).

LOCAL OBJECTIONS TO EXPANSIONS

A proposed farm off the coast of the Isle of Arran received over 456 replies to its application, almost 94% of which were objections (Coast, 2019). Locals organised a protest and a petition with over 7,600 signatures (Herald Scotland Online, 2020; Cheshire, 2020).

Objections submitted in relation to proposed new sites in Argyll between 2012 and 2016 stated lack of regulation, low standards, and environmental concerns (Billing, 2018). Local businesses also expressed concerns with the reduced ability for others to use the lochs for leisure activities and the adverse impact on tourism and tourism-related businesses (Billing, 2018).

MARINE PROTECTED AREAS AND PRIORITY MARINE FEATURES

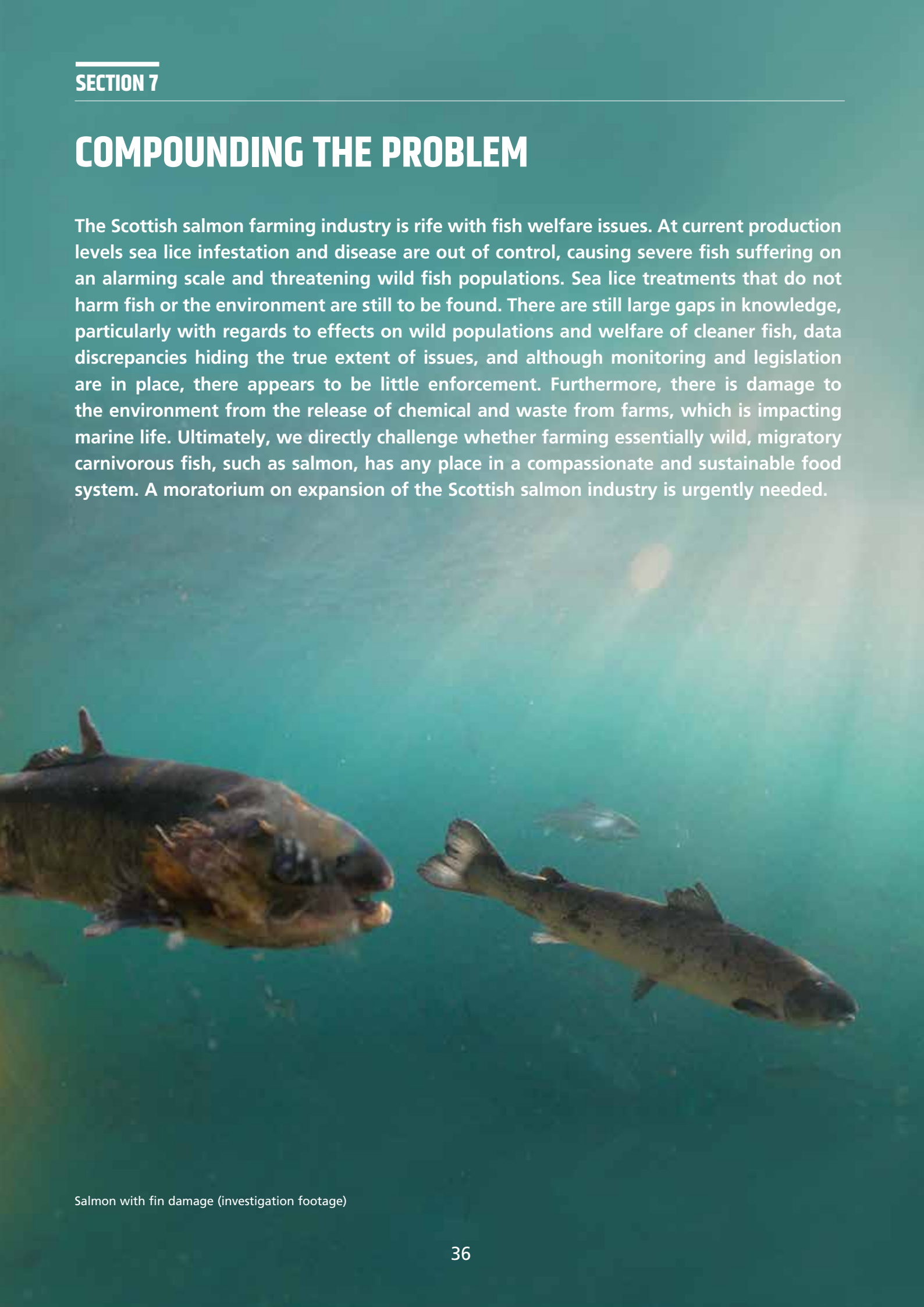
Scotland's Marine Protected Areas (MPAs) are in place to protect the most vulnerable species and habitats, yet in 2018 there were 103 active salmon farms within MPAs (Lorenzo, 2018). In 2019, Loch Creran, a sea loch and Marine Protected Area near Oban, was polluted with huge amounts of plastic pollution from manufacturing of salmon farm cages; the site was protected because of its endangered flame shells, hors mussel beds and reefs, was covered in waste and locals were furious (Edwards, 2019).

Maerl beds are a Priority Marine Feature in Scotland and an OSPAR threatened and declining habitat (NatureScot, 2019). Research shows that maerl beds under salmon farms showed a significant build up of waste up to 100m from the farms, a loss of maerl cover and a reduction in biodiversity (Hall-Spencer, White, Gillespie, Gillham, & Foggo, 2006).

SECTION 7

COMPOUNDING THE PROBLEM

The Scottish salmon farming industry is rife with fish welfare issues. At current production levels sea lice infestation and disease are out of control, causing severe fish suffering on an alarming scale and threatening wild fish populations. Sea lice treatments that do not harm fish or the environment are still to be found. There are still large gaps in knowledge, particularly with regards to effects on wild populations and welfare of cleaner fish, data discrepancies hiding the true extent of issues, and although monitoring and legislation are in place, there appears to be little enforcement. Furthermore, there is damage to the environment from the release of chemical and waste from farms, which is impacting marine life. Ultimately, we directly challenge whether farming essentially wild, migratory carnivorous fish, such as salmon, has any place in a compassionate and sustainable food system. A moratorium on expansion of the Scottish salmon industry is urgently needed.



Salmon with fin damage (investigation footage)

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Compassion in World Farming International
River Court
Mill Lane
Godalming
GU7 1EZ
Tel: +44 (0) 1483 521 950
Email: supporters@ciwf.org
Web: ciwf.org

OneKind
50 Montrose Terrace
Edinburgh
EH7 5DL
Tel: +44 (0) 131 661 9734
Email: info@onekind.org
Web: www.onekind.scot

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ciwf.org

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