

RURAL ECONOMY AND CONNECTIVITY COMMITTEE

SALMON FARMING IN SCOTLAND

SUBMISSION FROM DR SALLY CAMPBELL, ECOLOGIST, BACTERIOLOGIST, BOARD MEMBER OF SCOTTISH CREEL FISHERMEN'S FEDERATION

[Please also Review the submission by Dr Sally Campbell to ECCLR committee,
February 2018 no.22: Environmental Impacts of Salmon Farming](#)

1. General Views on Current state of salmon industry in Scotland

The much too limited research by government that has been conducted already shows very clearly that this industry is **too big, impacting negatively in the inshore waters of western Scotland, creating disease problems and impacting wild salmon populations, so affecting a great economic driver in isolated communities in the Highlands**. Further, research shows very clearly that neurotoxin applications against sealice are causing lifecycle changes in other arthropods (shellfish including prawns, crabs and lobsters); the inshore creeling and diving sector of Scotland are the life blood of small communities in the western lochs and inshore waters of the Highlands. 88% of fishermen in Scotland are part of the inshore fleet. Creel boats make up 80% of the 1452 10m and under fishing vessels in Scotland's inshore commercial fishing fleet and generated £40.98 million for the Scottish Economy in 2015. (Marine Scotland Analytical Unit figures). The Cabinet Secretary of the Rural Economy and Connectivity has recently stated that the rural economy is fished by almost 1400 creel vessels around Scotland, most of them on the west coast lochs and inshore waters, most often in remote communities. For every boat it is estimated 3-4 permanent jobs are created in the supply chain. Salmon farm expansion takes more creeling grounds and hand diving areas away from local communities and the financial value is transferred to mostly foreign owned multinationals with very questionable long-term viability.

Economically vital for rural coastal communities' survival, is the development of the tourism industry bringing much more employment and financial benefit to local communities in Scotland than the profits of multinational fish farmers, which is taken off-shore. Sadly, local councillors, such as at Highland Council and Argyll and Bute Council both of which this last week (April 2018) disregarded scientific and ecological research showing the harm being done to the inshore waters of Skye and the Clyde and went ahead, granting planning permission for further biomass increase or new farms on the flimsy offer of employment and investment. The lack of understanding, or denial, of the Precautionary Principle and unintended consequences of salmon aquaculture has enabled the powerful lobby of multinational salmon aquaculture companies to ride roughshod over both statutory and governmental oversight. Further, community organisations fighting for pristine marine waters to enhance the sustainable creel, dive and tourism sectors, whether that be yachting, diving, kayaking, sailing or beach tourism growth in the west of Scotland, lack the financial and political clout and lobbying influence of aquaculture.

2. Do you have any views on action that might be taken to help the sector grow in the future?

Containment, with clear guidelines on treating waste or a huge reduction in biomass, and chemical inputs in every farm. This is really the only option if the pollution

footprint is to be contained and over time the damage already apparent is ameliorated. Accumulative waste along the west coast lochs is very disturbing. The cumulative impact from several salmon farms in inshore clusters has not been addressed in official reports. To give an example of the total untreated discharges, without the data for neurotoxins or antibiotics: The Firth of Clyde “hosted” 17 farms in 2016, the last reported number, with a total of 23,780 tonnes of maximum biomass licenced. Of these farms 15 are owned and operated by The Scottish Salmon Company (SSC), in Loch Fyne, Loch Striven, Kyles of Bute and Lamlash Bay; two, in North and South Carradale in Kilbrannan Sound by Marine Harvest licenced for 2500 tonnes each, so a total of 5000 tonnes biomass. Whilst individual farms vary in licenced biomass the total content from the present 17 farms of discharges into the Firth of Clyde and its sea lochs for the years 2014, 2015, and 2016 approximate to the following:

- 38 tonnes of total copper from feed and nets
- 4 tonnes of zinc from feed
- 1539 tonnes of nitrogen as ammonia and urea
- 212 tonnes of phosphorus as phosphate
- 4939 tonnes of total organic carbon

It is surely time to look carefully at bioaccumulation of wastes and effects of treatment chemicals used in aquaculture on the ecosystem. But it is just not the number of farms but also the hydrodynamics of the area, tidal and current flow, and also the complexity of disease control. The SEPA model for waste and chemicals dispersal is still totally inadequate without proper understanding. Take the Clyde: It is clear the present growth is unsustainable. The known increases in sealice infestations, the effect of the neurotoxins on other shellfish, are indications of unintended consequences.

3. The farmed salmon industry is currently managing a range of fish health and environmental challenges. Do you have any views on how these might be addressed?

I intend to deal with one major class of chemical in use, **antibiotics**. For others see ECCLR written submission, referenced above. A new approach is required and should include reduced biomass (tonnes) in farms, adequate monitoring by SEPA for disease, and if containment is not recognised as the only way forward then make compliance, fines and loss of licence an important and used part of regulation. The SEPA workforce must be greatly increased so that self-monitoring of farms is reduced with unannounced visits by SEPA at any time. What must increasingly happen is the application of the **Precautionary Principle**, and a call to action. So, what is this Precautionary Principle? The precautionary principle is not defined in the EU Treaty, which prescribes it only once - **to protect the environment**. But **in practice**, its scope is much wider, and specifically where preliminary objective scientific evaluation, indicates that there are reasonable grounds for concern that the potentially dangerous effects on the **environment, human, animal or plant health** may be inconsistent with the high level of protection chosen for the Community. The **principle** is used as a strategy to cope with possible risks when extensive scientific knowledge on the matter is lacking. For example, with increased biomass in salmon aquaculture farms, antibiotics are incorporated into feed often as a preventative measure or prophylactic use to lower the risk of disease occurring, even when the fish is not currently ill with a particular infection.

Commonly used antibiotics include oxytetracycline, and tetracycline, important broad-spectrum antibiotics for humans too. Intensive rearing in large tonnes-farms is proving to be possible only when antibiotics are administered on a day by day basis. This is having serious consequences in our marine environment, resulting potentially in very serious consequences for human ability to fight infections. The antibiotic residues are excreted out directly into the marine environment. So why does it affect us in our ability to fight infections? Bacteria, viruses and other microbes have always mutated, and evolved, just as in the evolution of all living things. They survive the onslaught of medical intervention by mutating, changing their genetic defences, so our medical armoury no longer works against them, a sort of “survival of the fittest”.

This resistance to antibiotics is one of the greatest challenges we face as a society. Clearly, possible vectors of disease include waste water, and mobile carriers such as scavenger birds, gulls for instance; so too is faecal material and waste antibiotic-treated food from salmon aquaculture. The implications could be that using the marine environment for recreation, whether yachting, fishing, surfing, diving, kayaking, sailing and even paddling and collecting shells could pose a significant risk to human health now and in the future. The need to reduce antibiotics in aquaculture is paramount; there must be a compromise between dose and risk. For example, the economics of our tourist industry depends on a pristine marine environment so this could cause a reputational risk to the unique “Scottish” brand.

One way to reduce risk to human health, is to reduce fish biomass and chemical additives to feed. The present push from aquaculture companies and the Scottish Government is to massively increase biomass to increase markets and profitability. There is no compatibility. A local example is Marine Harvest, in North and South Carradale the company now wishes to increase the maximum fish biomass on each farm by 50% from 2,500 tonnes to 3,750 tonnes. We already know (FOI) that in just 2017, 108kg oxytetracycline and almost 29kg tetracycline, two broad spectrum antibiotics active against a wide range of infections in fish and humans, were used in the Carradale salmon farms. The larger the total tonnage of biomass and stocking density in a salmon farm the greater the risk of infections, whether by viruses or bacteria or parasites such as sea lice, all of which encourage treatments potentially serious for the ecosystem and those that depend on it, be it microfauna, shellfish, dolphins or us. Risk is present. It is vital that new farms are refused planning permission. At least 3 Scottish Salmon Company farms in Loch Fyne have applied to increase biomass (tonnes) on their farms and this week two have been granted planning permission by Argyll and Bute Council. The other is still with SEPA. It has to stop!

Increasing antimicrobial resistance (AMR), as it is known, is a next huge challenge for society. The need for much more investigative studies into the effects of such things as antimicrobial resistance (AMR) is paramount. Clearly risk is associated with abundance, not prevalence. If we cannot (yet) detect we cannot say there is no risk. Much more comprehensive risk assessments must be conducted, funded by the industry which pays nothing for their pollution potential; looking at the scale of pollution of estuaries and lochs is vital, to look for and assess antibiotic resistant genes (ARG).

There are clear implications for Policy and Environmental Management Practice. There are often indirect effects of pollution. **Unintended consequences** are of major concern. Most well-known effects are from pesticides. Many of us in older generations are familiar with the author and campaigner Rachel Carson and her book "Silent Spring"; the effect of DDT on the North American Eagle and other raptors forming paper thin eggshells, breaking in the nests, as they were incubated. The death of song birds due to DDT pesticides through eating dead insects in the 1950s and 1960s eventually drove drastic policy changes. Now it is bees and neonicotinoids, another pesticide with unintended consequences. These unintended consequences are said to result in a **Tragedy of the Commons**. But what is that? It is a term used to describe a situation in a shared-resource system where individual users act independently according to their **own self-interest** and behave contrary to the common good of all users by depleting or spoiling that resource through their collective action. The salmon aquaculture industry has done just that for past years, with the collusion of politicians, statutory bodies and local authority councillors.

But this story of biologically disruptive chemicals is not just about antimicrobials. A recent example of unintended consequences was the White Rumped Vulture in India, which had a role in removing animal carcasses. The increased use of Diclofenac (sold to us humans under a number of trade names, the most common being Voltarol) as a nonsteroidal anti-inflammatory drug (NSAID) taken or applied to reduce inflammation and as an analgesic reducing pain in certain conditions. Use of diclofenac in animals has been reported to have led to a sharp decline in the vulture population in the Indian subcontinent – a 95% decline by 2003 and a 99.9% decline by 2008. The mechanism is presumed induced renal failure. Vultures ate the carcasses of livestock that had been administered veterinary diclofenac, and were poisoned by the accumulated chemical, as vultures do not have a particular enzyme to break down diclofenac. The Government of India announced it intended to phase out the veterinary use of diclofenac. This is a salutary reminder to the democratic powers in Scotland, **beware unintended consequences**:

"The loss of tens of millions of vultures over the last decade has had major ecological consequences across the Indian Subcontinent that pose a potential threat to human health. Populations of feral dogs have increased sharply from the disappearance of vultures as the main scavenger of wild and domestic ungulate carcasses. With the rise in dog numbers is an increased risk of rabies and deaths by rabies of almost 50,000 people". The Government of India cites these deaths as one of those major consequences of a vulture species extinction. Similarly we must wake up to the unintended consequences of antibiotic resistance

4. Do you feel that the current national collection of data on salmon operations and fish health and related matters is adequate?

Much more easily accessible data will enable the public to call the industry and regulators to account. This needs to cover all features: biomass, chemical therapeutants, deaths, escapes, shootings, noise scarers, accumulation in the same area. Much closer inspections of the processing plants are required too, especially after the reported unacceptable blood discharges in Shetland. Education of Local Councillors in the implications of what data shows. Most elected members are neither scientists, ecologists nor experts in the field of fish disease. What is needed

is much more SEPA, and Marine Science oversight, compliance with real teeth, no further licences and no further “in perpetuity” licences for marine aquaculture.

5. Do you have any views on whether the regulatory regime which applies to the farmed salmon industry is sufficiently robust?

Already it is known that in the sediment catchment of salmon fish farms, in inshore marine waters, there is a wide prevalence of resistant genes in bacteria, which can spread from one to another bacterium. Salmon farmers will ask? Why do we need to act, why more and tighter regulation, where is the proof? We know enough to say there is a hazard, which poses unintended consequences for the ecosystem, and an unclassified, as yet, risk and threat. Are we as a society to move into a post antibiotic-era? Do we not need to safeguard intergenerational equity? We all, especially our elected representatives, need to understand that unintended consequences for us and the wider ecosystem are becoming urgent and critical. Like DDT and diclophenac, both stories of unintended consequences, it is no good saying “where is the proof of danger?” Use the Precautionary Principle; we call for action from the Scottish Government, SEPA, Marine Scotland and the multinational industry. Beware of the prevalent silo mentality...not proven, costs too much, employment, world markets, lobbying power of multinational salmon aquaculture etc etc, and proceed to demand 3 preliminary conditions

- Look at potential adverse effects
- Evaluate scientific data available
- Examine the extent of scientific uncertainty

Stakeholders, including communities, must be involved in forming a 25-year plan for water quality and the containment of microbial resistance. Local Councillors and Planning Officers must be educated in risk. This is a legacy issue, what do we leave for our grandchildren and our ecosystem? We have failed as a society in that this slowly emerging crisis in antibiotic resistance has reached the environment without action. Our ecosystem health is at risk. It is up to us to demand remedial action now!

6. Do you have any comments on how the UK’s departure from the European Union might impact on the farmed salmon sector?

Clearly a lack of seamless borders and a customs union are a significant challenge, as this also will be for creeling and diving fresh shellfish exporters to Europe. The salmon industry also has the huge reliance on a largely European workforce. Unless the industry addresses the chemical -neurotoxins and antibiotics problems, and other reputational risks, it may be locked out of more lucrative added value markets. The reputational risk to the “Scottish” brand is very high no matter what happens. In the not-too-distant-future salmon from Scotland will be unacceptable to many markets whether in the EU or North America. The carbon footprint from Scotland to Chinese markets is large at a time when the Scottish government is pinning its colours to renewable energy and low carbon energy.

Dr Sally Campbell
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