

***Debate on Aquaculture ‘This house believes UK
aquaculture production should at least double by 2020’.***
Fishmongers’ Hall, 4 October 2010

Dr Malcolm Windsor, Opposing the Motion for Salmon

Chairman, Ladies and Gentlemen. I would like to firmly oppose the motion that salmon farming should double over the next ten years.

The principal reason for my opposition is because of its adverse impacts on wild salmon stocks. It is clear that even at present levels of farmed production we can have no confidence that the wild stocks in areas with farms are as healthy as in those without farms. That is our benchmark, an internationally agreed principle that I will return to later.

But first, let me give you some background to the reasons for my opposition to the motion. For those of you who are not familiar with NASCO it is, as our Chairman indicated, an inter-governmental organization, established in 1984, to promote the conservation, restoration, enhancement and rational management of salmon throughout the North Atlantic. Its members are governments but we have over 30 NGO organisations accredited. Back in 1984, salmon farming was in its infancy with production in the North Atlantic

around 25,000 tonnes. Since then the industry has grown substantially such that last year (2009) production in the North Atlantic exceeded 1 million tonnes. Norway (~850,000 tonnes) and Scotland (~133,000 tonnes) are the main producers. In contrast, the harvest of the wild stocks has declined from around 8,000 tonnes in the early 1980s to about 1,200 tonnes today. Thus salmon farming production exceeds the wild fish harvest by about 1,000 fold.

It would be ridiculous to blame all the salmon's problems on fish farming but it is another adverse impact at a time when stocks are low. I can assure you that NASCO has gone to great lengths to ensure that it has the best available scientific information on the interactions between farmed and wild salmon stocks. Over the last 20 years NASCO and ICES have co-convened three major international symposia and it is clear from all the information presented that impacts on the wild salmon stocks can and do occur. Today I will focus only on the disease and genetic impacts of the industry on the wild stocks. I mean the effects of sea lice and of escaped farmed salmon on wild salmon populations. There can be other impacts associated with movements of stock for aquaculture, both farming and stocking, such as the devastating impact of *Gyrodactylus salaris* in Norway. And of nutrient enrichment and impacts of waste food and faeces on benthic communities – But I will not dwell on these today.

The growth of the industry has been so rapid that our scientific understanding of the impacts initially lagged behind and to be frank the industry was itself in complete denial that significant impacts could be occurring. That is now changing and progress has been made both in scientific understanding of the impacts and in managing them. However, it is clear from the findings of the most recent symposium, held in 2005, that farmed salmon can have very significant impacts on the wild stocks and that sea lice and escaped farmed salmon pose the greatest challenges. A clear conclusion from the symposium was that the very success of the industry and its continuing growth mean that increasingly stringent measures are needed to address the impacts. Why? Because the proportion of farmed fish escaping is maybe only a fraction of 1% of the stock of hundreds of millions of farmed fish in marine cages but an escapement of 1% in 1984 would have been very much less serious than it is today. So the numbers escaping remain large relative to wild fish abundance and some rivers have had up to 90% farmed fish! Furthermore, the enormous stock of farmed salmon held in cages, many hundreds of millions, means that even low lice infestation rates in the farms can lead to enormous production of larval sea lice.

So what are the negative genetic impacts on the wild stocks that concern us? These have been well documented in peer reviewed scientific journals. Genetic changes have been observed in some wild stocks exposed to farmed escapees. The evidence suggests that the

impacts are related to the number of farmed salmon intruding, their reproductive success, the abundance of the wild fish and the frequency of the intrusions. We do know from a very comprehensive experiment conducted in Ireland that the survival of farmed salmon in the wild is only about 2% that of wild fish reared in the same environment. However, the farmed salmon had an important initial advantage because of their larger size and they displace the wild fish. Interbreeding between farmed and wild salmon will result in hybrids with lowered fitness. So repeated intrusions could potentially lead to large scale hybridisation of wild populations and the extinction of any vulnerable wild populations. Those results were from real studies on real fish in real rivers but in addition genetic modelling studies suggest that with a fixed intrusion rate of 20% farmed fish a year into a wild population then within ten salmon generations there will be substantial changes in the wild population that may be irreversible. The affected populations could become a mixture of hybrids and fully farmed salmon descendants.

These models may be over-simplified but the findings are extremely worrying and we would be unwise not to heed the scientific warnings. That would certainly not be consistent with the Precautionary Approach.

To me, as a non-geneticist, it makes sense that a species that has established itself in over 2,000 rivers around the North Atlantic since

the last ice age ended about 10,000 years ago, and which returns rather precisely to the river of its birth has developed wide genetic diversity and local adaptations. A river in Northern Russia has very different characteristics to one in New England or one in South West France, so it is not surprising that over the millennia the salmon populations in them have evolved characteristics that enable them to survive and to thrive in that particular environment. Farmed salmon were, of course, originally based on wild salmon populations but over 20 years have been selected and selected for characteristics favourable to the farmer e.g. rapid growth and late maturation. I believe that it is strongly in the interests of both farmed and wild salmon that the wild stocks persist in their genetically diverse form. For the industry these stocks represent the ‘seed corn’ for the future and for wild salmon these adaptations are essential for their health and vitality.

Turning to sea lice, salmon farms not only produce salmon very well, they are naturally good at producing sea lice too. Although a natural parasite of wild salmonids, a study in Scottish waters concluded that more than 99% of the sea lice in the study area originated from salmon farms. Rearing farmed salmon in proximity to wild salmon rivers is risky and can lead to the wild fish picking up heavy sea lice infections as they migrate past the cages. Some wild fish have been found near sea cages with hundreds of lice on them. A fatal load for a small salmon smolt trying to adapt to life in the ocean! Sea lice management on farms has evolved considerably through, for example,

fallowing, single year class stocking and single bay management but there is a heavy reliance on a small number of key medicines and there is evidence of resistance developing to the main chemical treatments available to farmers. This is a very worrying development.

So my position is clear. I congratulate this quite new industry on its amazing growth and its successful marketing of what can be a very good product. But I do not believe that there should be any expansion at all, at least in the North Atlantic (the Pacific is a different story), until at least two conditions have been met:

First, that escapes are reduced to effectively zero. The wild stocks must be protected from genetic impacts. They are part of our natural heritage.

Second, all farms should have effective sea lice management such that there is no increase in sea lice loads or lice-induced mortality of wild salmonids attributable to the farms.

The overall principle, as I have mentioned, is that the wild stocks in areas with salmon farms should be as healthy as in areas without farms.

On containment, I do not see this goal as being unachievable. What other industry would be allowed to let its product escape by the

million into the environment? You do not see many pigs, cows or chickens on our roads. But the escaped salmon cannot be seen, they are below our radar. But they are there. It will cost money to make farms more secure, particularly in the face of the predicted increase in frequency of extreme weather events anticipated with a changing climate. Some sites may need to be closed or relocated as has happened in Norway where wild salmon protection zones have been designated. There is also a need to address the small-scale so called 'trickle losses' associated with handling mistakes on farms. And we will need effective monitoring to assess progress towards our goals. It might put the price of farmed salmon up by a penny or two a pound but it is essential for us and it is essential for the industry if it wants the consumer to regard their product as sustainable. If it cannot be done then, one day, the industry may need to use sterile salmon or one day the farms may have to be in closed, recycled facilities on land. This will add more than a few pence to the price of farmed salmon. We have just heard that transgenic salmon will be approved by the FDA. They will need these conditions too.

To achieve the goal for sea lice we will need effective lice management programmes that meet targets for lice loads at the most vulnerable life-history stage of wild salmonids. We need effective fallowing regimes, single year class stocking and strategic timing, and methods and treatments to achieve the international goal, and to avoid lice resistance to treatments. We also need monitoring regimes to

confirm progress towards the goal and our management measures will need to be adapted in the light of experience gained. If we cannot protect the wild stocks with an industry based in coastal areas close to salmon rivers then relocation may be needed. Or there may need to be lower limits set on production, Not a doubling! We are very nervous about the indications of resistance to the few effective, available treatments for sea lice. What then? Here we will need to support salmon farmers in seeking to be able to use all the weapons in the armoury.

I have heard the argument that fish farming is the only way to meet the world demand for fish protein. That might be true for molluscs and herbivorous or omnivorous finfish. But it will not be true for salmon farming until fish oil and fish meal are replaced by vegetable alternatives. A paper published in Nature in 2000 examined whether aquaculture actually enhanced or diminished the available global fish supply. It diminished fish supplies because carnivorous fish such as salmon require 2.5 – 5 times as much fish in their feed as is produced. I don't know where Dr Jaffa's figure of 1.7 to 1.0 comes from but I suspect that the 1.7 is dried weight and the 1.0 is wet weight. Given that most of the world's commercially exploited fish stocks are considered to be fully or over-fished I simply cannot see how doubling farmed salmon production could be achieved without dire consequences for marine ecosystems unless the proportion of fish meal and oil in the diets of farmed salmon can be greatly reduced.

Over-exploitation of pelagic fish stocks used mainly for reduction to fishmeal and oil has been implicated in the decline of other fish stocks used for human consumption and there may be impacts on other components of the ecosystem such as sea birds and marine mammals. We in the rich countries can afford to purchase fish meal and oil and feed it, at very significant loss of protein, to salmon. But let us not imagine that this creates fish out of thin air, it doesn't, salmon farming consumes far, far more fish than it produces.

I have also heard economic arguments. Salmon farming certainly does produce major economic benefits but so far as we are aware the UK production is hugely dominated by the Norwegian companies and the profits go there, not here. The employment produced is a benefit too but it is relatively small and would have to be balanced against the reduction in the employment benefits from wild salmon and sea trout if these stocks are lost. These benefits are actually much wider. A salmon angler for example will typically pay to travel, to fish, to stay in a hotel, to hire a car, to eat in restaurants and to spend in shops. His or her spouse might well also do the same and a fishing trip may well be combined with a tourism break. So the wild fish have a major multiplier effect in terms of tourism which salmon farming does not. But the economic values are much wider than that. The general public have been shown in economic studies to care about wild salmon and be willing to pay to conserve it. The wild salmon has a very high "existence" value to the public.

We in NASCO are not anti-salmon farming at all. Actually it has probably had some beneficial effects in reducing fishing pressure on the wild stocks. All our governments want sustainable aquaculture. But what we seek is a “win-win” situation with both healthy wild stocks and a sustainable industry. I do not believe that even at its current scale of production the industry has reached that point.

So, Mr Chairman, the impacts on the wild stocks of the salmon farming industry at present levels of production are well documented. I would only be prepared to support this motion when the salmon farming industry, at some future date, has effectively eliminated escapes and has sea-lice infection at such low levels that local salmon and sea-trout stocks are unaffected. Then we could say that it is an industry in tune with its environment. That day is not yet in sight and may require major changes to the industry if it is to be achieved.

Finally, I have to tell you that we in NASCO are in what has historically been a somewhat frustrating relationship with the industry internationally. But it is one which I hope will become a productive and mutually beneficial relationship where both can prosper, where salmon farming is sustainable and at the same time we can be sure that our children and grandchildren will be able to marvel at the wild salmon and its migrations. If we fail to protect wild stocks, and if consumer awareness of the damage done increases I believe the

industry itself will suffer badly as well as the wild stocks. Mr Chairman, I hope I have demonstrated to you that, even at present levels of production, we are experiencing disease damage and risking loss of genetic diversity and subsequent permanent loss of fitness in the wild stocks when they are already in trouble. To double salmon farming production would be foolhardy. I urge you to vote against the motion.