



**OFFICIAL REPORT**  
AITHISG OIFIGEIL

# Rural Economy and Connectivity Committee

**Wednesday 14 March 2018**

**Session 5**



The Scottish Parliament  
Pàrlamaid na h-Alba

© Parliamentary copyright. Scottish Parliamentary Corporate Body

Information on the Scottish Parliament's copyright policy can be found on the website - [www.parliament.scot](http://www.parliament.scot) or by contacting Public Information on 0131 348 5000

---

**Wednesday 14 March 2018**

**CONTENTS**

	<b>Col.</b>
<b>SALMON FARMING</b> .....	1
<b>SUBORDINATE LEGISLATION</b> .....	42
Road Traffic (Permitted Parking Area and Special Parking Area) (Midlothian Council) Designation Order 2018 (SSI 2018/60) .....	42
Parking Attendants (Wearing of Uniforms) (Midlothian Council Parking Area) Regulations 2018 (SS1 2018/61) .....	42
Road Traffic (Parking Adjudicators) (Midlothian Council) Regulations 2018 (SSI 2018/62) .....	42

---

**RURAL ECONOMY AND CONNECTIVITY COMMITTEE**  
**8<sup>th</sup> Meeting 2018, Session 5**

**CONVENER**

\*Edward Mountain (Highlands and Islands) (Con)

**DEPUTY CONVENER**

\*Gail Ross (Caithness, Sutherland and Ross) (SNP)

**COMMITTEE MEMBERS**

\*Peter Chapman (North East Scotland) (Con)  
\*John Finnie (Highlands and Islands) (Green)  
Jamie Greene (West Scotland) (Con)  
\*Richard Lyle (Uddingston and Bellshill) (SNP)  
\*Fulton MacGregor (Coatbridge and Chryston) (SNP)  
\*John Mason (Glasgow Shettleston) (SNP)  
\*Mike Rumbles (North East Scotland) (LD)  
\*Colin Smyth (South Scotland) (Lab)  
\*Stewart Stevenson (Banffshire and Buchan Coast) (SNP)

\*attended

**THE FOLLOWING ALSO PARTICIPATED:**

Jon Gibb (Lochaber District Salmon Fishery Board)  
Guy Linley-Adams (Salmon & Trout Conservation Scotland)  
Richard Luxmoore (Scottish Environment LINK)  
John Scott (Ayr) (Con) (Committee Substitute)  
Dr Alan Wells (Fisheries Management Scotland)

**CLERK TO THE COMMITTEE**

Steve Farrell

**LOCATION**

The Mary Fairfax Somerville Room (CR2)



# Scottish Parliament

## Rural Economy and Connectivity Committee

Wednesday 14 March 2018

*[The Convener opened the meeting at 10:00]*

### Salmon Farming

**The Convener (Edward Mountain):** Good morning. Welcome to the eighth meeting in 2018 of the Rural Economy and Connectivity Committee. I ask everyone to ensure that their mobile phones are on silent.

We have received apologies from Jamie Greene, who is tied up in a meeting in the chamber and is unable to attend. I welcome John Scott as his substitute. Donald Cameron, who would be attending as reporter for the Environment, Climate Change and Land Reform Committee is unable to attend today's meeting for the same reason.

Agenda item 1 is an evidence-taking session on salmon farming. As I do at the start of all such sessions, I ask members to declare relevant interests. Last week, I made a lengthy declaration of my interests on the subject. I do not propose to repeat it, but I refer members and other interested parties to it, and to my entry in the register of members' interests, which shows that I am a co-owner of a wild salmon fishery in Scotland.

**John Scott (Ayr) (Con):** I should declare an interest as I am a farmer, which is of relevance to the general business of the committee. However, I have nothing to declare that is relevant to today's proceedings.

**The Convener:** This is the second evidence-taking session in our inquiry. Today, we will take evidence from environmental and fisheries organisations. I welcome Jon Gibb, the clerk to the Lochaber district salmon fishery board; Dr Alan Wells, the chief executive of Fisheries Management Scotland; Dr Richard Luxmoore, the senior nature conservation adviser at the National Trust for Scotland, who is appearing on behalf of Scottish Environment LINK; and Guy Linley-Adams, solicitor, who is appearing on behalf of Salmon & Trout Conservation Scotland.

The first question is from John Mason.

**John Mason (Glasgow Shettleston) (SNP):** We will look at various areas today, but I will start on economic and other potential benefits. Highlands and Islands Enterprise and others have told us about the numbers of jobs that are linked to

salmon farming—HIE gave us a figure of 10,340 jobs. What are the economic benefits of the sea trout and salmon wild fisheries, and what are the other social and cultural benefits?

**The Convener:** I should have set the ground rules at the beginning. I think that everyone on our panel has given evidence in a committee before, but I point out that you do not need to touch the buttons in front of you. If you want to answer a question, catch my eye and I will try to bring you in at the relevant point. When I have, please do not look away and continue to talk, because I will have to interrupt you. If you keep an eye on me, I will indicate whether I want to bring someone else in.

Alan Wells seems to have got the hang of it straight away, so I will bring him in, at this point.

**Dr Alan Wells (Fisheries Management Scotland):** On the economics of salmon and sea trout fisheries, a relevant report by Public and Corporate Economic Consultants Ltd was published in March 2017. It did not break down the economics on a regional basis, but gave Scotland-wide figures, which I can indicate to the committee. Using 2014 figures, it said that there is about £135 million of angler expenditure, 4,300 full-time equivalent jobs, and £79.9 million of gross value added. That gives you an idea of the size of the industries.

**John Mason:** Are there benefits apart from the purely economic ones?

**Dr Wells:** Sure: there are all sorts of social benefits from participation in angling. We are blessed that because of the geography of where Scotland sits, we have a very long season—rivers are open for fishing from January all the way through to November. That is not the case in other countries—Norway, for example, where angling tends to take place during the summer. We therefore benefit from tourism through anglers coming from other countries for our long season.

**John Mason:** Do the tourists fly in, fish, then fly out again, or do they do other things, as well?

**Dr Wells:** That varies. It has been looked at, but I do not know the precise details from the PACEC report. People do a range of things. Anglers often bring their families, who might do other things if they are not interested in fishing. Some people come for a week and fish when the water is good and do other things when the conditions are not so good.

**Jon Gibb (Lochaber District Salmon Fishery Board):** We also should not underestimate the cultural importance of salmon, irrespective of angling. There are quite a lot of public walkways on the rivers that I manage on which I often meet people. Last year, an old lady stopped me and said, "Isn't it wonderful to see the salmon back?"

Salmon's importance is not just about angling and its commercial value; it is in the blood of west Highlanders to have salmon in the rivers.

**John Mason:** We have had a lot of emails and information from both sides on the discussion about salmon farms and wild fisheries. Is it generally possible for us to have successful wild fisheries and successful salmon farming, or do we have to choose one over the other?

**The Convener:** I will bring in Guy Linley-Adams. I note that Alan Wells and Jon Gibb both also want to come in, but I will try to spread it out a bit, to start with.

**Guy Linley-Adams (Salmon & Trout Conservation Scotland):** From the point of view of Salmon & Trout Conservation Scotland, the answer is definitely yes: it is perfectly possible for the two to co-exist. We are often labelled as an organisation that is against fish farming, but that is not correct. As the Environment, Climate Change and Land Reform Committee's report said, we are concerned about sustainable development of the industry, to ensure that it exists within environmental limits, but as a simple principle there is absolutely no reason why the two sectors cannot co-exist and thrive.

**The Convener:** Jon Gibb lives with that interaction, where he is. Would you like to come in on that?

**Jon Gibb:** As a fishery board in the middle of the west coast, the Lochaber board is most certainly of the view that there will be a situation—although we are not there yet—in which both sectors can thrive. As for forestry, hydro power and any other man-made activity, fish farming is a risk. We have to accept that; the issue is to quantify and minimise that risk. If we do it right, we might in the future be able to put a number on the impact of fish farming—say, a 10 per cent impact on wild salmon and sea trout stocks. The fact that we are not there yet has a lot to do with location, which we can get on to later. However, through working together and through projects to protect and enhance wild salmon and sea trout stocks we might be able to boost those stocks by, say, 20 per cent. It is not an unreasonable place to try to get to, but we are not there yet.

**Dr Wells:** It might be useful to put some context around where we are on fish farming in relation to wild fish. Fisheries Management Scotland is the representative body for district salmon fishery boards and charitable fisheries trusts across Scotland. We have a committee that looks at the issue. What we want is represented by the following four points: thriving salmon and sea trout populations and fisheries without negative impacts from salmon farming; harmonious local co-existence with an industry that understands the

importance of being a good neighbour and which communicates openly and transparently with stakeholders; a world-leading regulatory and planning system that protects wild fish and proactively seeks to address negative local impacts; and investment of a proportion of the profits that are generated by the industry in protection and improvement of local salmon and sea trout populations and fisheries.

That gives some context on where we are coming from. We can expand on those issues later in the session, if possible.

**Peter Chapman (North East Scotland) (Con):** You mentioned that 4,300 jobs are dependent on the wild fisheries. I assume that that figure includes jobs in hotels, tackle shops and the wider economy.

**Dr Wells:** The figure is not mine. It does, however, take into account the full range of jobs. It does not include just people who are directly employed in fisheries and management.

**Fulton MacGregor (Coatbridge and Chryston) (SNP):** Good morning. Is there solid evidence that disease spreads between wild and farmed salmon?

**Guy Linley-Adams:** If we include parasites within our definition of "disease", then the answer is definitely yes. Before the Environment, Climate Change and Land Reform Committee looked at the environmental impacts, Salmon & Trout Conservation Scotland commissioned the Norwegian Institute for Nature Research to look at the issue. It concluded that there is significant evidence of a pervasive and general impact of sea lice from salmon farms on wild salmonid populations. It is difficult to say whether a particular farm in a particular loch is causing a particular problem.

I am concerned that we concentrate on sea lice because we can see them and count them. There are other salmonid diseases in salmon farms, but there is not much evidence of whether those viral and bacterial diseases impact on wild salmonid populations. Correct me if I am wrong, but I suspect that it would be extremely difficult to do the research that would be required to find such evidence. We can say, however, that diseases in fish farms are unlikely to be positive for wild salmonid populations, although they may be neutral. However, we know that the sea-lice problem is not neutral.

**Fulton MacGregor:** As someone who does not know a lot about the salmon industry and who comes fresh to the issue, I wonder whether you could put that in context. What effect would sea lice have on the wild population, in terms of numbers?

**Guy Linley-Adams:** Do you mean the population of wild salmonids?

**Fulton MacGregor:** Yes.

**The Convener:** I am sorry to interrupt, but I will try to steer the panel. We will come to sea lice later. I want the discussion to focus on disease at the moment. Do you want to answer Fulton's question, Guy?

**Guy Linley-Adams:** I am happy to wait until the sea lice section.

**Dr Wells:** I do not disagree much with what was said last week about disease. It is incredibly difficult to try to assess disease in the wild population without massive sampling efforts. If fish are badly affected by disease, they die. The term "black box" was used last week—we simply cannot sample them. Marine Scotland science has done some small sampling, so the committee might want to ask it about that. I do not want to put words in its mouth, but my understanding is that it has not found much evidence of disease in wild fish. Again, the problem lies in using a representative sample.

The other issue that is relevant to disease and wild fish is that this is, to a certain extent, a numbers game. The number of vectors for disease between the farmed salmon industry and the wild salmon industry is significant. The Scottish Association for Marine Science report states:

"In 2014 ... about 179 thousand tonnes"

and

"48 million smolts were 'put to sea'"

in aquaculture. It compared that with about 0.6 million wild fish right across Scotland. The numbers of fish in the two sectors are wildly different, which is a big issue in terms of disease and in terms of sea lice, which we will come on to.

**John Scott:** Will climate change have any impact on the spread of disease from warmer waters?

10:15

**The Convener:** Do not be shy about catching my eye if you want to come in. Alan Wells is quite quick at it—he has obviously done this before.

**Dr Wells:** I have done this only once.

On climate change, the industry is seeing more of a challenge from the gill-health issues that are caused by rising seawater temperatures. That has been mentioned in the Environment, Climate Change and Land Reform Committee. Climate change might impact on the spread of disease among wild fish but, for the reasons that I

mentioned earlier, there is no evidence that we can point to one way or the other.

Climate change almost certainly affects the ability of wild fish populations to find food in the marine environment. We know that there have been phase shifts of plankton and the things that fish eat—they have moved about 1,000km to the north, which has a big effect on wild fish. I do not think that there is much evidence specific to disease, either way.

10:15

**Stewart Stevenson (Banffshire and Buchan Coast) (SNP):** I have a very narrow but related point. Martin Jaffa has described a reduced salinity event that had a significant impact. By his account, it was not to do with climate change, but I think that it is accepted that such events will happen in the future as a result of climate change and increased temperatures. Is that likely to mean that fish will move to colder waters further north? Will it have other effects? The desalination that has been described looked quite serious, even though the reduced salinity was not particularly marked.

**Dr Wells:** I have not seen that comment from Martin Jaffa about reduced salinity and I do not know whether it refers to the open sea or the head of a sea loch, where there can be extra freshwater input, for example if there has been a particularly wet summer.

**Stewart Stevenson:** In fairness, it was a loch, and it was not a local effect but an effect of a change in global currents. That is how Martin Jaffa described it. I speak to nothing about the science personally.

**Dr Wells:** You might want to ask Martin Jaffa about that. I do not know.

**Fulton MacGregor:** I have a general question about the disease spread that you have mentioned. What are the socioeconomic implications of that for wild fisheries?

**The Convener:** It seems that Alan Wells is still the only one answering.

**Dr Wells:** I am in the hot seat. I would look back, beyond my time in the sector, to a few decades ago, when there was an outbreak in wild fish of a disease called ulcerative dermal necrosis. Jon Gibb may want to talk about that. It was a big issue and a big worry at the time. There were signs a few years ago that UDN might have reappeared. There was a big response from the wild fish sector—we even funded a PhD student to look at the issue. As it turned out, it was not UDN. If we take into account the relative strength of wild fish stocks at the moment, a disease that has a huge impact on wild fish would be a big concern.

**Jon Gibb:** That is right. I do not have anything particularly significant to add to that, although I should stress that UDN is nothing to do with aquaculture—it is purely a disease in wild fish. In the past decade or so, certain rivers have dried up. The salmon have been constricted in pools, with a high density of fish in small pools. That affects rivers on the east coast more than those on the west coast and, in particular, rivers that are populated, usually in April or May, by early spring salmon. We have started to see a UDN-type disease, or at least the symptoms of UDN. The fish get a *Saprolegnia* fungus, which is a white fungal growth, and they succumb to it. You can have rivers that are literally full of dead fish, which, as you can imagine, is not particularly good for the marketing of fishing. The issue could have a long-term impact and could be linked to the global climate. However, as Alan Wells says, the truth is that we do not really know what the disease is or what is causing it. It is not UDN. The fish appear to be picking it up at sea and bringing it into rivers. If the environmental conditions—low water in the late spring and early summer—allow it to thrive, it can be a significant problem.

**Fulton MacGregor:** Has any analysis been done on the socioeconomic consequences of that disease and other diseases on wild fisheries and the wild fish industry?

**Dr Wells:** I do not think that that was covered in the PACEC report. It looked at various scenarios, but I do not think that it looked at that disease in particular. I suppose that we could draw numbers based on what would happen to relative catches and all the rest of it, but it is not quite as black and white as that. Some people will fish and not necessarily catch something, but they will still come back and fish, whereas other people have different drivers. It really depends on individuals.

**Fulton MacGregor:** Okay. That is helpful.

**The Convener:** We will move on to the next section with Richard Lyle.

**Richard Lyle (Uddingston and Bellshill) (SNP):** Good morning, gentlemen. The Environment, Climate Change and Land Reform Committee's report states:

"The Committee is concerned that diseases are still leading to large numbers of farmed fish being slaughtered."

It is concerned

"that salmon mortality will increase if production is doubled and considers fish health problems should be addressed across the sector, with a related decline in mortality rates".

I am drawn to the fact that Marine Scotland said:

"Throughout the 1990s and 2000s there was around 20% mortality of farmed salmon throughout the production cycle. This seems to have increased".

Do you share the ECCLR Committee's concern about

"the environmental impacts of disease in terms of rearing fish and ... slaughtered fish"?

How are they disposed of? To you, is 20 per cent an unacceptable figure?

**Richard Luxmoore (Scottish Environment LINK):** The death of fish on fish farms is a waste of good food, but it is primarily a welfare issue. From an environmental perspective, if all the fish on a fish farm die, it will not necessarily have an impact on the environment outside the fish farm; it is just a commercial problem for the farm. The problems arise if the causes of death, such as diseases, then transfer to the environment outside the farm. From an environmental perspective, it is the transfer of disease from the farm to the wild fish or the environment around the farm that is the problem.

The same issue arises with the disposal of dead fish as arises with the disposal of any waste. It is clear that that needs to be closely regulated, and the regulations enforced.

**Richard Lyle:** On that point, we have had reports of dead fish being transported on the back of a lorry. I think that that was in a newspaper that I read. It was totally denied; people said, "Oh, no—we put it inside a container and we transport it away and dispose of it very well." Is that the case?

**Richard Luxmoore:** I am sure that efforts are made to transport things carefully, but I have also seen television footage of stuff dripping out of the back of lorries. Having smelled pits full of dead salmon, I can say that it is not very pleasant to be close to that. That is of concern. It would be exactly the same if it was a truck full of dead cows—we would be worried about that.

**Guy Linley-Adams:** I reiterate what Richard Luxmoore said. The mortality within a farm is not necessarily a concern to wild fish populations unless some vector is leaving the farm and infecting the wild population. If we think of the farm as a black box, as long as what is within that black box is contained, it is not a concern, although there may still be an issue of animal welfare and an issue for the farmer. However, if there is a disease problem and a high mortality problem, that indicates that the management of the farm is not right. As I said in answer to an earlier question, it is indicative of a problem. It is unlikely to be positive for the wild fish that such a mortality level is occurring within farms.

**Dr Wells:** Absolutely. I was going to make a similar point. It is the underlying reasons for the mortality and the potential consequences for wild fish that are important. It is clear that more research needs to be done to understand that,



because we just do not know enough about it at present.

**Richard Lyle:** I agree. If I was a fish farmer and 20 per cent of my stock was being lost every year, I would seriously be doing something about it. Anyway, I will move on.

Can you share any examples from other countries of how the challenge might be better addressed?

**Guy Linley-Adams:** One medium to long-term solution that is often raised is that of closed containment. If the farmed fish are isolated biologically from the wider environment, the diseases are less likely to get in to start with. We see closed containment projects popping up in Norway—I am talking not only about land-based closed containment but about floating closed containment units, which would clearly be of greater significance in Scotland. One of the messages from the ECCLR Committee's report was that investment that incentivises closed containment, rapid research into it and anything that the Scottish Government can do to push us down that path would be very welcome.

**Jon Gibb:** I should declare that I am a registered fish farmer with a licence, albeit for restocking purposes—I grow fish. Taking a step back to the previous point, I think it is fair to mention that each individual salmon produces many thousands of eggs and there is a natural erosion. It may be tempting to look at the very high mortality rate and compare it with the mortality rates of sheep or pigs, for example, but salmon are entirely different. I agree with the other witnesses that the issue is indicative of a problem, but I know from running a farm that there is natural wastage. I would probably be happier with a figure of around 10 per cent, rather than 20 per cent, which the industry used to have.

**Richard Lyle:** Right, so you think that it is quite acceptable—

**The Convener:** I am sorry, Richard. Can I ask a question about that before you move on? I want to understand what Jon Gibb is saying. Are you saying that, as a farmer, you have losses of 20 per cent?

**Jon Gibb:** No. I do not have such losses—I run a very small operation—but I do get significant losses. I do not want to be drawn too much on whether 20 per cent is acceptable. If I had to say something about that, I would say that it seems rather high, but, as someone who represents wild fish interests, I would also say that the method that farms use to transport dead fish or whatever is not what is affecting us. The high losses are, perhaps, indicative of an underlying problem, and I do not think that the fish farm companies would necessarily shy away from that.

**Richard Lyle:** I will drill down into that answer. If I was a farmer and I was losing X number of cows or whatever, I would do something about it. Is there nothing that fish farmers can do? Norway is colder and has a lot of fjords—basically, it is a different sort of setting. Before anyone comes back to me, I stress that I support salmon farming and want to see it doubled, but why do we have 20 per cent losses? If we add escapes to that, we are losing 30 or 40 per cent of our production. No one in their worst nightmares should have that level of losses. I think that it is unacceptable, Mr Gibb. Do you?

**The Convener:** I will bring in Jon Gibb and then Richard Luxmoore, because I see that he wants to comment as well.

**Jon Gibb:** I want to clarify that the people who manage wild fisheries are not at all comfortable with that number. My point was simply that salmon is a different species; it is perhaps a little unfair to compare sheep and salmon. As Guy Linley-Adams said, the only way to guarantee what you seek is to have closed containment, with complete separation of wild and farmed stock.

**Richard Luxmoore:** This has already been mentioned, but rather than concentrating on whether 20 per cent or 40 per cent is acceptable, we should look at the overall trends. The trends of mortality on fish farms have been inexorably rising over the past four or five years. It is fair enough to say that there is now a range of different diseases that are causing that mortality, but the fact that the mortality rate is increasing suggests that, far from getting closer to being able to control those diseases, the industry is actually getting further away from that—the problem is getting worse.

There have been a number of comments about various things that are improving in the industry, but the one thing that is absolutely clear is that the problem of mortality is getting worse, and that indicates that the ability to control those diseases is getting worse.

10:30

**Stewart Stevenson:** A proportion of the fish that die on fish farms will die from disease. Is there any evidence—I have not heard any to date—of the transportation of those dead fish to their ultimate disposal causing a biological crossover of disease infection to wild fish?

**Richard Luxmoore:** I am not aware of any evidence.

**Stewart Stevenson:** That is fine.

**Dr Wells:** I am not aware of any evidence either, but two or three of my members were concerned because they witnessed the sort of leakage that we saw on television and, in one

instance, that leakage was close to a salmon river. The local authority was contacted but I do not know what happened about that.

**John Scott:** I ask the experts whether any one disease in particular is causing the unacceptable level of deaths on fish farms. Is it the gill disease? Is it the storm of a new disease of the sort that can ravage any type of farming—sheep or cattle, for example—until such time as it is controlled? I am not all that well informed in that regard, but the witnesses will doubtless tell me.

**Guy Linley-Adams:** As I understand it, the gill disease is one of the major causes of the mortality, combined with the application of mechanical treatments for sea lice. When the fish are already compromised in some way by the gill disease that they carry, putting them through a stressful mechanical treatment for sea lice causes the levels of mortality that we have seen. Also, the mechanical treatments are new and the farmers are still getting used to them, so a level of mortality is involved in that.

There is no one particular disease that is causing the issue. Obviously, the gill disease has caused a serious problem for the farmers in the past couple of years. I understand that some of the closed containment technologies that draw water from lower and deeper in the cages could deal with the sea lice getting into the cages in the first place, which would make the gill disease easier to treat. There are complex relationships going on between the diseases and the different treatments that are applied.

**Dr Wells:** That is a difficult question for us to comment on. There are various reports from the fish health inspectorate, so it might be worth asking it and the salmon farmers about the matter.

The gill issues that the fish farmers have been experiencing are not a single disease but a range of challenges, as I think they were called last week. Amoebic gill disease is one of those challenges. If you have jellyfish and other things that can physically irritate the gills, that can exacerbate the problem as well. I recall that the Scottish Parliament information centre briefing included some information from Marine Harvest's annual report that set out some of the challenges, but I cannot remember off the top of my head exactly what they were.

**Peter Chapman:** Good morning, gentlemen. We are interested in the interaction between fish farming and wild fish. There is some concern that numbers of wild fish in the east coast rivers are under some pressure as well, but there are no fish farms on the east coast of Scotland. The North Atlantic Salmon Conservation Organisation said:

“wild stocks of Atlantic salmon are currently vulnerable because of reduced marine survival all around the North Atlantic”.

Would wild salmon be in decline in both east coast and west coast rivers if there was no salmon farming? Would there be pressure on wild stocks regardless?

**Dr Wells:** It is worth emphasising that Fisheries Management Scotland used to be the Association of Salmon Fishery Boards. It has never been our position, either as Fisheries Management Scotland or previously, that fish farming is the only problem or pressure that wild fish face. There are a series of them. I mentioned earlier that the marine issues—again, I mention the “black box” issue—are a significant problem, whether in the east coast, the west coast, Norway or anywhere in the range of the Atlantic salmon.

However, the work that has been done to look at the effect of sea lice means that we can look at things in isolation. I do not want to go into a big long explanation about how it has worked but, essentially, two cohorts of fish are released into the wild. One cohort is prophylactically treated to protect the fish from sea lice and the other is not—it is the control. All the other pressures that happen in the marine environment will affect both of those experimental groups equally. Those experiments, which have been done in Norway and in Ireland, have shown that on average—there is a lot of variation—about 20 per cent fewer fish return to rivers from the control group compared with those that have been treated for sea lice. We can therefore look at the issue of sea lice in isolation from all the other issues, which affect both groups equally.

Last week, there was a lot of discussion about whether we can read across from Norway to here, and about all the things that make Norway different. I do not disagree with any of the points that were made. Norway has a very different geography, a different level of production and all the rest of it, but so does Ireland. It has a much smaller industry than we have in Scotland, and it does not have the fjordic sea lochs that we have here or the big fjords that Norway has. However, the experiments that have been done in Norway, which point to, on average, a 20 per cent reduction in returning adults coming back to the rivers, have also been done in Ireland with broadly the same results. Although I agree with everything that was said last week about the differences between Norway and Scotland, I do not agree with the conclusion that we cannot draw broadly from the results of those studies.

However, it is important to know what happens at a very local level, because we do not manage sea lice on a Scotland-wide level or a Norway-wide level; we manage them at local level. Also,

we do not manage salmon stocks at Scotland-wide level; we manage them on an individual river level. What is actually important is what happens at the very local level as the fish pass out of the rivers and pass the farms.

**Jon Gibb:** I concur with Alan Wells. We have never seen aquaculture as the main culprit for the decline of salmon and sea trout. However, it is clear that it is certainly adding an extra pressure to already threatened stocks.

Alan Wells mentioned the way that we can try to tease out the impact of sea lice using experiments with treated and untreated cohorts. Marine Scotland science has been doing some work on that in one of the catchments that I manage on the River Lochy. You might wish to ask it about that work, because that might give some answers, if only at local level. I will let Marine Scotland science speak for its work, but my understanding is that it has demonstrated that marine survival rates are extremely poor on parts of the west coast and certainly in my region of Lochaber. We will not find that on the east coast of Scotland, if we make comparisons.

We now have rivers that could simply be classed as rivers on which Atlantic salmon are extinct. The River Coe, which, as you probably know, runs through the middle of Glencoe, had one salmon redd in it this year, as far as we could count. That suggests that there may have been just one pair of salmon in the whole river. It used to be a thriving river. It is the same with the River Leven at Kinlochleven, where absolutely no salmon were caught and absolutely no salmon were seen. There is a new period of decline in parts of the west coast.

**Stewart Stevenson:** I address this question to Dr Wells, given the scientific research that he cited. What conclusion should we derive? Is it that that scientific test has told us about the effect of lice on wild fish at sea? In other words, given that there is a reduction in returning fish, should we infer that the mortality is occurring at sea and that lice are the vector of that mortality? Is that what we should conclude? Therefore, does that detach the effect of farms with lice from the effect that is occurring at sea, or am I misinterpreting it? I have not read the research, but I am sure that Dr Wells will have done so.

**Dr Wells:** I should perhaps mention my background: my postdoctoral research was on interactions between farmed and wild fish, and I was involved in a European Union funded project in Norway, Scotland and Ireland.

I am not sure that I entirely understand your question. Sea lice exist only in the marine environment, so it can only happen at sea; they die if they go into fresh water.

**Stewart Stevenson:** I absolutely understand the reference group and the prophylactically treated group and how you are testing whether going to sea—by which I mean being distant from the river that spawned them—affects those animals when they are distant from their spawning river. Naturally, there are lice well offshore in salt water—I understand the point that lice are salt-water animals. However, are we not ending up testing how the animals respond to lice distant from farms? In other words, are we testing the natural background level of lice rather than anything else?

**The Convener:** It will be useful if you explain as part of your answer the effect of lice on fish going to sea and the effect on those returning to river, because I think that that would clarify the dubiety here.

**Dr Wells:** I am happy to address both of those matters. The important point about sea lice and wild fish is that it is the smolts—the young fish leaving the rivers—where we see the impact. We know from long-term studies that have been done by the University of St Andrews and Marine Scotland science on the north coast of Scotland from the net fisheries that large multi-sea winter fish and one-sea winter fish or grilse that come back to the Scottish coast regularly do so with high levels of sea lice with no apparent physiological difficulties.

There is a big difference between a large fish coping with a number of lice and a small fish coping with a number of lice. Some of my work was on the physiology of fish and the effects that sea lice have on them. They cause all sorts of problems, including problems with the ability to regulate salt and water balance and how the gills and livers function.

Basically, if we take a fish at the point at which it is going through a major physiological change as it moves from fresh water to sea water, it is completely restructuring its gills and many of its organs are working in completely opposite ways. If it has a large infection of sea lice at that point, that adds an extra stressor on top of the change, and that is the problem. Whether those fish then die because of the number of sea lice or whether there is a secondary reason such as their being more susceptible to predation and all the rest of it takes us into the black-box argument. However, we know from the prophylactic treatments that fish survive better if we treat them.

On whether sea lice infestation happens at high sea or closer to the shore, the chances are that it is the latter, because the prophylactic treatments are time-limited: they last a matter of weeks rather than months or years. We understand that it is a relatively close-to-shore phenomenon.

**Stewart Stevenson:** We have heard the term “black box” being used. My definition of a black box is a container whose inputs and outputs are known but whose internal processes are unknown or irrelevant. Is that the definition that witnesses are using?

**Dr Wells:** Essentially, I am saying that we do not know what happens once the fish get out into the marine environment, because it is impossible to sample them. Whether that is a black box or something else, I do not know.

**Guy Linley-Adams:** To add to what Alan Wells said about sea lice being a problem for departing smolts, I would not want the committee to forget that it is also a problem for sea trout. Their habit is much more coastal, and juveniles and adults stay near the farms, so they are exposed to sea lice from the farms in a way that the adult salmon, which are further out at sea, are not.

**Stewart Stevenson:** Does that change the proportion of sea trout that go to sea, because some return and become brown trout?

**Guy Linley-Adams:** There is certainly a problem with what is known as early returning behaviour. Sea trout that are exposed to sea lice will return to the river because they appreciate that the lice will drop off. Jon Gibb and Alan Wells are better placed to talk about the detailed biology of that.

10:45

**Richard Luxmoore:** I want to draw attention to the difference between salmon and sea trout. Certainly in relation to fish farms, if there is a fish farm near the mouth of a river, the salmon smolts will go past it on the way out and disappear off to sea and, while they are passing, they can pick up sea lice. When sea trout go to sea, they are in the vicinity of fish farms for the whole of their life cycle in the sea and they are therefore much more at risk of picking up infections. Equally, when a salmon returns to the river, it passes a fish farm but, if it picks up any lice at that point, it does not matter much, because it is going straight into fresh water, where all the lice will die. It is really a problem for the smolts of the salmon and for the adult sea trout, although the issues are completely different for the two.

**Jon Gibb:** I have two brief points. First, for a bit of clarity on wild smolts and sea lice, we have to think back to a time before we had aquaculture in the sea lochs of Scotland. Unlike on the east coast of Scotland, west coast adult salmon tend not to run until around May. We believe that nature designed it that way so that the adult wild salmon, which carry sea lice totally naturally, do not cross over with the smolts leaving a river. Over the decades, with aquaculture, we have basically put

hundreds of thousands of adult salmon in the way of a creature that is not used to meeting sea lice. One might conclude that the only way of avoiding that is to move those adult salmon out of the way of the migrating smolts, or to separate them.

To go back to the important point about trout and sea trout, we certainly have a lot of anecdotal and written evidence that, when sea trout meet sea lice at sea, we get the early returning behaviour that Guy Linley-Adams alluded to. I do not have a lot of evidence to back this up apart from anecdotal evidence, but it may well be that over time—in essence, it is three decades—many more of those fish have been staying in fresh water. There is a lot of evidence that, in freshwater lochs, particularly where there are freshwater smolt farms, there are much increased populations of resident brown trout. That causes an imbalance and may cause a predation risk to salmon. We may have skewed the freshwater environment in that way.

**The Convener:** Peter Chapman has a further question on the issue.

**Peter Chapman:** There is a categorisation for the health of rivers, which can be graded as 1, 2 or 3. Will you explain to the committee the difference between the various grades? What social or economic implications might the grading have for particular areas of rural Scotland?

**The Convener:** I guess that Alan Wells and Jon Gibb will want to lead on that. Jon, do you want to go first?

**Jon Gibb:** I was going to pass the question to Alan, actually.

**Dr Wells:** On a Scotland-wide basis, Marine Scotland science uses what is called a conservation limits approach whereby it assesses the likelihood that a river will meet a target on eggs being deposited into rivers. If that target is likely to be met, the river is assessed as being relatively healthy, whereas other rivers are less likely to meet the target. There is a graded approach, with three grades of rivers.

The issue was discussed yesterday at the Environment, Climate Change and Land Reform Committee. Depending on what happens at that committee, in 2018, 28 rivers will fall into grade 1, which suggests that there is at least an 80 per cent probability that the conservation limit will be met over a five-year average; and 21 rivers will fall into grade 2, which sits somewhere between 60 and 80 per cent probability of meeting the conservation limit; but 122 rivers will fall into grade 3, which means that there is less than a 60 per cent probability that the conservation limit will be met. That includes the majority of the west coast rivers in the aquaculture zone.

The social and economic consequences of that tend to be quite river specific. As a representative body for boards and trusts, we deal with views that range from the view that a river going to grade 3 is a disaster—the anglers will not come, the angling clubs will not want to fish, and all the rest of it—to the view that that is a good representation of the situation and that it gives us something to work from to get the river back up to grade 2. There are a range of views across the spectrum.

**Peter Chapman:** What does it mean in practical terms if a river is grade 1, 2 or 3? What does it mean for the angler on the river?

**Dr Wells:** The biggest practical difference is that there is mandatory, 100 per cent catch and release for grade 3 rivers. People are not allowed to kill and take home a fish from them.

**Gail Ross (Caithness, Sutherland and Ross) (SNP):** Good morning, panel. Jon Gibb said that catches have substantially declined in the River Coe and the River Leven. Are they already grade 3 rivers or will they be downgraded because of those catches?

**Jon Gibb:** I said before that not a single salmon was caught on the River Leven, but a single pink Pacific salmon was caught there last year. It is interesting and bizarre that, because of how the model works, the River Leven has been made grade 1 this year. Members will have to ask Marine Scotland science about the model. The River Coe has gone from grade 2 to grade 3.

As Alan Wells said, the social impact of the gradings is river specific. However, generally speaking, I come across a feeling of disenfranchisement, particularly among local anglers up and down the west coast, who, with very few exceptions, have acted responsibly for the best part of the 20 years in which we have seen the declines, and have put the vast majority of their fish back. That has been well over 90 per cent or 100 per cent in some cases. They feel that they have been taken out of the equation and almost blamed for the decline. There is poor local feeling about that, which is perhaps avoidable. We need everyone to move in the same direction.

Does that answer your question?

**Gail Ross:** It does, to a certain extent, but I have a couple of follow-up questions. Are you confident that the grading system is adequate?

**Jon Gibb:** If you are asking for my personal opinion on that as a fishery manager, the answer is no, although I am encouraged that the model is being improved. It was brought in fairly quickly but, for the reasons that I, as someone who has to manage its results, have just mentioned, we do not feel that the model is currently fit for purpose.

**Gail Ross:** We have talked about mortality rates in wild stocks. Are there any catch-and-release mortality rates?

**Jon Gibb:** Alan Wells might be able to provide some numbers on that. I believe that studies have been done.

**The Convener:** I will let Alan Wells gather his thoughts before he does that because Guy Linley-Adams wants to answer the previous question.

**Guy Linley-Adams:** I will try to help the committee on the conservation limits and the various percentages. Salmon & Trout Conservation Scotland has looked at the conservation limits and put them into graphical form, so information on the east coast, the Clyde and Solway area and the aquaculture zone can be examined. The graphical representation shows that the probability of the conservation limits being hit is considerably lower in the aquaculture zone. That suggests that salmon populations are exposed to all sorts of risks such as climate change and habitat loss upstream, but something extra is going on inside the aquaculture zone that does not appear to be going on outside it. I can supply that graph to the clerks after the meeting.

**The Convener:** That would be helpful. There are two questions for Alan Wells. He can also answer the one about socioeconomics.

**Dr Wells:** On the grading system, Fisheries Management Scotland supports the principle of ensuring that exploitation is sustainable, and we have worked very hard with Marine Scotland science and a lot of fisheries biologists across Scotland over the years to improve the model. That is an iterative process, and we are encouraged by the way that it is going, but I do not think that anyone is arguing that the model is perfect.

That said, I emphasise Jon Gibb's point. There is a sense in which anglers and proprietors are almost seen as an easy target. We know that salmon are under a range of pressures, but I do not get a strong sense that exploitation by fisheries is right up there amongst them. It is right to have exploitation and to ensure that it is sustainable, but we also need to deal in a much more rounded manner with all the other pressures that salmon are under.

It has been a while since studies were done on catch and release. It was discussed yesterday at the Environment, Climate Change and Land Reform Committee. The rule of thumb is about 10 per cent, but I understand that Marine Scotland might be going to do a bit more work on that this year.

**Peter Chapman:** You have said that there will be 28 grade 1 rivers, 21 grade 2s and 122 grade

3s. What did things look like, say, 20 years ago? You reckon that we are going the wrong way. It might be an unfair question, but do you know how the situation has changed even in the past 10 or 15 years?

**Dr Wells:** The system has only been in place for three years and things have shifted quite markedly in that time. The system is driven by catch, to a reasonable extent, and we had a very good year in 2011, with very high catches across Scotland. However, the 2011 catches dropped out of the five-year average last year, and we have seen quite a marked drop on the back of that. I would not like to speculate on what things looked like 20 years ago—I am afraid that I am not qualified to do that.

**John Scott:** Given the foregoing discussion and the instrument that was under scrutiny at yesterday's Environment, Climate Change and Land Reform Committee meeting, would you describe the science behind the instrument as sufficiently robust? Should it proceed or not? A lot of people out there are very unhappy about the 122 rivers being categorised as grade 3, and I am far from certain that, as Dr Wells has already said, the catching of salmon is to blame for the apparent decline in fish stocks. After all, they face a significant number of other challenges.

**The Convener:** I could encourage all of you to give a yes or no answer, but I will not push you quite that hard. Jon, do you wish to kick off on that?

**Jon Gibb:** I simply refer the member to the answer that I gave previously about the River Leven. I do not believe that a model can be scientifically robust when it gives a grade 1 to a river where zero salmon were caught last year.

**Dr Wells:** The question is quite difficult for me to answer, given that I represent so many rivers across Scotland. As I have said, I think that the principle behind it is right, but there are concerns about the model. We are working hard to deal with that, and we are encouraged by the changes that have been made to the model over time.

One of the problems that we face in dealing with these issues and issues such as sea lice is that we lack the sort of infrastructure that they have in Norway. More robust information is available on these matters because other countries have large amounts of infrastructure, including fish counters, which allow them to look at the catch statistics on the same river and do much better quality control. It is also why it has been possible to do the sort of studies on sea lice that have been carried out in Norway. The fact that we do not have the same infrastructure is the primary reason why that sort of research has not been done in Scotland—it is

not necessarily because people have not wanted to do it.

**John Scott:** To paraphrase, then, the science has not been done to justify this massive recategorisation.

**Dr Wells:** As Stuart Middlemas said at yesterday's Environment, Climate Change and Land Reform Committee meeting, the general approach is very similar to that which is used in Norway, England and Ireland.

**Guy Linley-Adams:** The wild fisheries sector should apply to itself exactly the same precautionary approach that the ECCLR Committee called for in the aquaculture industry. If that means that more rivers get categorised so that there is 100 per cent catch and release—on a precautionary basis while the model is developed—that is only right.

**The Convener:** We will move on. Perhaps Colin Smyth could lead off with his questions.

11:00

**Colin Smyth (South Scotland) (Lab):** I return to the vexed issue of sea lice. I appreciate that we have covered the issue in quite a bit of detail so far, but I want to follow up a number of specific points.

First, Marine Scotland has different trigger levels from the guidance. Does the panel believe that it is using the correct trigger levels for sea lice on fish farms? Are they at the levels that you believe they should be? Is the action that is required once those levels have been reached appropriate?

**Jon Gibb:** I am sure that everyone will want to comment on this but, briefly, on the subjects of trigger levels and lice targets in general, I believe—and many people observing this have believed for many years—that the numbers are essentially meaningless. If a lice target does not take into account the number or biomass of fish in a fish farm or, indeed, the path of a smolt from a river to the open ocean, whether the number is one, three or eight lice per fish or whatever is meaningless. I just want to put that caveat in there before other people comment.

**Richard Luxmoore:** There are a number of trigger levels. The salmon farmers' code of good practice has trigger levels of 0.5 and one louse per fish at different times of the year, and then there are the Marine Scotland levels, which are supposed to trigger enforcement action. Those levels are based on the impact on the farmed fish. A farmed fish will suffer damage if it is carrying too many lice. If it is carrying a large burden of lice, it will die. If we measure the number of lice per fish, we are interested in the impact on the farmed fish. On their own, the numbers say nothing about the

impact on wild fish. As far as they are concerned, the important factor is the number of lice larvae that are shed into the sea from a fish farm. If a fish farm has 100,000 fish in it and one louse per fish, it will shed into the sea one tenth of the amount of lice larvae of a farm with a million fish in it. As Jon Gibb said, the correct measure of the impact on wild fish is not the number of lice per fish but the number of fish in the farm. Given an equivalent lice loading, the factor that determines the impact on wild fish is the volume of fish in the farm.

**The Convener:** Guy Linley-Adams, perhaps you would like to come in. I cut you off earlier when you were talking about sea lice, so it must be your turn now.

**Guy Linley-Adams:** On the various trigger levels, I noticed that the ECCLR Committee suggested that the level of 0.5 lice per fish in the code of good practice should be mandatory. That is with the proviso that the number of lice per fish is not a good measure; it should be the number of lice per farm, as my colleagues have suggested. It would be sensible to put in a ceiling above which farms should not operate and should be required to harvest early in order to remove the fish.

Below that level, and depending on where the farm is, we might need to apply adaptive management. At the ECCLR Committee, we heard a bit about that approach, which involves monitoring the impact of the lice on wild fish and feeding back to how the farms operate. However, there needs to be a ceiling above which the farm should not operate, and the trigger level of 0.5 lice per fish would certainly be our preference.

**Dr Wells:** I would go slightly further than that. Earlier, I mentioned that we deal with sea lice not on a Scotland-wide basis but in farm management areas. Therefore we should not look at individual farms but at groupings of farms. Farm management areas are ones in which there is synchronous stocking of fish; there is an element of synchronisation between the treatments and all the rest of it. There is quite a nice model for that, which is voluntary, but a new certification scheme from the Aquaculture Stewardship Council has been in place for a few years now.

A lot of the principles in that certification scheme would take the debate an awful lot further on. It is one of the main reasons why we are working much closer with Marine Harvest, because it is the one company in Scotland that has said that it will try to get all its farms through the certification. It requires a much lower threshold for treatment—0.1 lice per fish—but, crucially, it takes into account the number of fish in the area, so it also brings the overall area load into the equation. It requires the monitoring of wild fish, which is the adaptive management that we talked about and which was recommended by the Environment,

Climate Change and Land Reform Committee. A lot of the principles that we would like to see in the regulatory system already sit in the Aquaculture Stewardship Council's scheme—it is a nice model.

**Colin Smyth:** Just to be clear, should farms be required to publish certain information? Should that information be the number of sea lice per farm? Witnesses are nodding so I guess that there is consensus on that.

**Guy Linley-Adams:** We are completely happy with the recommendations of the Environment, Climate Change and Land Reform Committee report that farm-specific sea-lice data should be published in as close to real time as possible. We raised that in the Rural Affairs, Climate Change and Environment Committee in session 4 of the Parliament prior to the Aquaculture and Fisheries (Scotland) Act 2013. There was a lot of support for it then and now is the time to do it.

**Dr Wells:** If you publish farm by farm, you can add up the data for the farm management area and, if the farm management areas change, you can also take that into account.

**Richard Luxmoore:** In commenting on fish farm planning applications, Marine Scotland said that even if a farm adheres to the code of good practice level of one louse per fish, that provides no assurance that it will not have an impact on wild salmon or salmonid populations. Even Marine Scotland acknowledges that the code of good practice levels do not necessarily provide protection for wild fish.

Two years ago, we were all talking about the code of good practice levels—0.5 lice per fish and one louse per fish. We are now talking about Marine Scotland's trigger levels, which have gone up to three lice and eight lice per fish. It is almost as if those figures have become targets. Whereas two years ago, we were looking at levels of 0.5 lice or one louse per fish as being where we ought to be, we now seem to be thinking that, as long as there are no more than three lice per fish, that is not too bad. There is a shifting baseline of aspiration with the trigger levels, which is extremely worrying.

**Stewart Stevenson:** I just heard that we could work out what was happening in farm management areas by adding the figures for individual farms. Would that not be statistically invalid unless the dates on which farms reported were synchronised? Otherwise, you would be adding numbers from different timeline points, which would not give you an understanding of the farm management areas. Therefore, does that imply that we need to have co-ordination reporting points for individual farms so that we can make those aggregations and comparisons?

**Jon Gibb:** The simple answer is yes. There is a strong case for synchronising the sampling and the manner in which the reporting is done to indicate the biomass in the farm management areas. We are encouraged by the Scottish Salmon Producers Organisation's commitment to release farm-by-farm data by the end of April 2018.

**Dr Wells:** At the moment, assuming that there is no problem with the weather and the rest of it, farms count lice each week. If the requirement was for each farm to publish figures once a week, that would deal with that issue.

**Colin Smyth:** I would like to understand what happens in other countries. In written evidence, Salmon & Trout Conservation Scotland said:

"sea lice limits and enforcement are considerably weaker in Scotland than other European salmon farming countries."

How do sea lice limits and enforcement work in other countries? Are conditions in Scotland so different from other countries that we cannot import good practice from elsewhere?

**Guy Linley-Adams:** Salmon farming in the Faroe Islands operates under a fairly rigorous scheme. The Faroese require their farms to report their lice figures fortnightly and, when they exceed 1.5 lice per fish in three consecutive reports, they have to harvest out their farms within two months—three strikes and you are out. If a farm reports more than 1.5 three times in a row, the fish come out. Importantly, from the point of view of adaptive management, the next time that the farm is stocked, the farmer has to put fewer smolts in. That means that the following production cycle is at a lower level and, therefore—in theory at least—the lice issue should be addressed. If it is not addressed, the level goes down further.

The Environment, Climate Change and Land Reform Committee talked about the adaptive management process that it wants to apply. That is one of the ways that it might seek to do it in Scotland.

**Dr Wells:** I emphasise the variability across Scotland. It is not remotely fair to say that, if there is a problem in one farm, there is necessarily a problem in another. We are all operating in a complex system.

Part of the problem is that we do not fully understand the consequence of any particular lice level in a particular location at a particular standing biomass of fish. It is likely that that will vary and that is where the adaptive management is crucial. If we can find a way of monitoring what is happening in the wild fish population in relation to what is happening in the farm, we can tailor the approaches area by area rather than trying to take a one-size-fits-all approach.

**The Convener:** Last week, we heard informally from the Minister of Fisheries from Norway, which has lower targets than we have in Scotland. He suggested that there was a traffic-light system. Has anyone come across that? It was an interesting procedure whereby, if a farm reaches green level, it can stock more and, if it reaches red level, it has to reduce inputs.

**Dr Wells:** I am aware of the broad principles of that but not the detail. It is an example of adaptive management but it would not necessarily work in Scotland if we used the specific thresholds that are permitted in Norway. My understanding is that the Norwegians permit up to about 30 per cent of the wild stock to be impacted negatively before it goes up to the top level. Our stocks on the west coast are not able to withstand such a level, which is certainly the difference between a grade 2 and a grade 3 and probably significantly more than that.

**Mike Rumbles (North East Scotland) (LD):** I will focus on legislation and regulation to protect wild fish. The Environment, Climate Change and Land Reform Committee's recent report on the environmental impacts of salmon farming said:

"The Committee is not convinced SEPA (or any other agency) is effectively monitoring the environmental impact of salmon fisheries. The Committee is also not convinced that the regulations, protocols and options for enforcement and prosecution for the sector are appropriate, and being appropriately deployed."

What legislation or regulations should be amended in what way to protect wild fish from any impact on salmon farming, and which organisation should be responsible for regulating that?

**Guy Linley-Adams:** The Salmon & Trout Conservation Scotland petition from 2016 drew everyone's attention to the fact that there is a gap in the law in that no Scottish public authority is charged with dealing with the interaction between farmed and wild fish. We are pleased to see that the ECCLR Committee—I hope that I am calling it by the right name—accepts that and points to that gap in the law.

That gap can be plugged in a number of ways. I have looked at it from the purely legal point of view. You could amend the Aquaculture and Fisheries (Scotland) Act 2007 or the Marine (Scotland) Act 2010. You could apply the Water Environment and Water Services (Scotland) Act 2003 and introduce new controlled activities regulations—CARs—under that. It all depends on what the Government's policy decision is in relation to which regulator has to pick up that issue.

There are a number of different ways of approaching the issue, all of which we would be happy to work with the Government to deliver.



**Mike Rumbles:** It does not have to be the Government. The committee can produce a committee bill.

**Guy Linley-Adams:** Indeed.

**The Convener:** Alan, would you like to comment on that?

11:15

**Dr Wells:** I would just emphasise what the Environment, Climate Change and Land Reform Committee said, as I agree with it. We have a situation where the fish health inspectorate has a remit for the health and welfare of the fish in the cages but not for anything outwith them. We talked earlier about the number of fish in the cages. The Scottish Environment Protection Agency is responsible for consenting that biomass, but it does not view sea lice or sea lice leaving the cages as part of its remit.

I do not have a specific view on the legislation that needs to be amended. We need to work out exactly where we want to get to and then look at the various pieces of legislation and decide on the best way to get there.

A few weeks ago, the chief planner hosted a meeting that I attended, along with representatives from the industry; the local authorities, which deal with the planning applications that come in; and the various regulators. There was a strong sense that the biggest outstanding issue that is not dealt with by the system at present is that of interactions between wild fish and farmed fish.

Various reports have been produced. There was an independent consenting review a few years ago, and there have been various other things. Basically, they have said that the issue should be taken out of the Town and Country Planning (Scotland) Act 1997 and shifted somewhere else, perhaps to a marine licensing system under the Marine (Scotland) Act 2010, which Guy Linley-Adams mentioned. However, simply moving the issue from one system to another will not deal with the underlying problem. We need to deal with that problem, and the system will then be able to work through it from there.

**Jon Gibb:** I can speak from a slightly more local perspective, as we see the end results of regulation. As we know, applications are dealt with by the planning committees of local authorities, usually at meetings to decide on major developments. Fish farm applications are considered alongside applications for people's house extensions and garage conversions or whatever. That seems rather odd to me. We cannot expect the required level of knowledge to be sitting in those committees. That would be completely unfair, and I think that Highland

Council's response to the ECCLR committee hinted at that.

I refer to the comment in the ECCLR committee's report that

"There are too many regulators and too little effective regulation."

I have a certain sympathy with the fish farmers on the issue. The ECCLR committee is not saying that there is not enough regulation. It is saying that there is not enough "effective regulation", so it is clear that the regulation needs to be streamlined in some way, in everyone's interests.

As Alan Wells mentioned—this also refers back to a point that was made earlier about sea lice—SEPA fundamentally decides on how many fish are allowed in a cage. I would argue that, therefore, it is overseeing sea lice by default, although it maintains that it is not. That needs to be clarified.

The responsibility is a hot potato that has been passed around for many years, and it needs to find a home. One organisation needs to have broad enough shoulders to take it on.

**Mike Rumbles:** Do you believe that the responsibility should be SEPA's? It has been particularly criticised by the Environment, Climate Change and Land Reform Committee. Do we need to change the law and the regulations to give SEPA proper responsibility for regulating the matter? There is a view that another organisation should be set up but, if people are saying that there are too many regulators and there is not enough effective regulation, is the solution to make sure that SEPA gets a proper instruction to do it?

**Richard Luxmoore:** The problem is that we have three regulators, all of which deny that it is anything to do with them. We have the unedifying spectacle of everyone taking a collective step backwards and scrambling for the exit. SEPA argues that it is nothing to do with it because there is not a pollutant, the fish health inspectorate says that it is interested only in farmed fish, and the local authorities are more interested in garages.

I have a letter from SEPA that deals with exactly that point. It says:

"SEPA acknowledges that sea lice and escapes of farmed stocks are pressures in the water environment. For these pressures however, Marine Scotland and the Local Authorities are the principle bodies for regulating existing and new aquaculture developments."

In other words, "It's nothing to do with us."

As Jon Gibb has said, that is not the case, because the primary lever for controlling sea lice escapes is limiting the volume of fish on fish farms—or the number of fish on an individual farm. We have been looking at the new consultation on

the depositional zone regulation, the preamble to which says that one of its main outcomes will be an increase in the volume on fish farms from 2,500 to 8,000 tonnes. We have this existing problem with fish farms, which at the moment do not exceed 2,500 tonnes, and SEPA is talking about increasing that many times with absolutely no consideration of the impact on wild fish. As we have seen, it has said, "This has nothing to do with us", but it is the main body for limiting the size of individual fish farms—which is the main source of pressure on wild fish population.

**Mike Rumbles:** In that case, should the Parliament give SEPA the clear responsibility for regulating this?

**Richard Luxmoore:** The problem is that, with the way in which fish farms operate, anyone who applies for a new fish farm must—besides getting their Crown Estate lease—jump through two principal regulatory hoops: first, they have to get a CAR licence to discharge pollutants; and, secondly, they have to get planning consent. It is up to the fish farms which of those they go for first, and they tend to play one off against the other. In other words, they will get their CAR licence, and then they will say to the local authority, "We've got our CAR licence, so SEPA must think that it's okay. It's up to you now." Nobody wants to be seen to be standing in the way of a new fish farm that someone else has already approved. Instead of the process being split in two, we need a single streamlined process in which a person submits a single application for a fish farm and all the impacts are considered together.

**Guy Linley-Adams:** I endorse everything that Richard Luxmoore has just said, but perhaps I can give the committee a little bit of history. In its fish farm manual of 2005—in other words, prior to the Aquaculture and Fisheries (Scotland) Act 2007—SEPA stated that it would limit the biomass on fish farms to protect important stocks of wild salmonids. What I think happened then is that in 2007, when the sea lice powers were given to the fish health inspectorate, SEPA thought, "Well, that's not us any more, then" without appreciating that the powers that the inspectorate was given related just to farmed fish, not to the interaction between farmed and wild fish. I think that that is where the problem arose, but it is difficult to find that out, because SEPA does not have a great institutional memory.

It is perfectly possible for SEPA to take on this role. Indeed, if you look at SEPA's responsibilities under the water framework directive and the fish element of the categorisation of the status of water bodies, you will see that this would fit quite neatly with what it already has to do. As I have said, the Water Environment and Water Services (Scotland) Act 2003 already allows regulations to be drawn,

and there is no reason why regulations could not be drawn under that act to place this matter within SEPA's responsibilities. It would not require primary legislation.

**Jon Gibb:** I would just back up what the other witnesses have said. Richard Luxmoore mentioned two processes that anyone who wants to set up a new fish farm has to go through, but there is actually a third that happens before any of those take place—application for an aquaculture production business licence. As a fish farmer, I have to apply for one, and it is essentially a licence to operate that is issued by Marine Scotland. There is the possibility of using that licensing system to address some of these issues, and with regard to planning and CAR applications for fish farms, we would certainly like Marine Scotland to take a far stronger view that it is currently taking.

Currently, Marine Scotland is fairly neutral in its response because it is acting as a statutory consultee, exactly the same as the fishery boards, whereas I would argue that Marine Scotland or SEPA are best placed to take this on.

**Richard Lyle:** I agree. We should put someone in charge.

Gentlemen, you have vindicated the point that I made last week. I thought that there were too many fish in fish farms, but I was told the more the merrier, because they are all happy if they are swimming about in big shoals. Thank you for confirming what I said. I think that that is the other point that we should be looking at.

**Mike Rumbles:** Correct me if I am wrong—I do not want to put words in your mouth—but what I am getting from you is that there should be stronger regulation, that there should be someone in charge of that regulation, and that that should more likely than not be SEPA. Is that right?

**The Convener:** Most people are nodding or shrugging their shoulders.

**Dr Wells:** Someone should lead, but I do not have a strong view about who it should be. What is really important is that what many people understand as the current regulatory lacunas, whereby wild fish seem to fall through all the gaps, desperately need to be addressed.

**John Finnie (Highlands and Islands) (Green):** Are you all saying that there is no role for the local authority in the process?

**Guy Linley-Adams:** With another hat on, I have acted for groups on the west coast that have been considering fish farm applications and it is not just wild fish interactions that they are concerned about. Local communities have concerns about landscape, navigation issues and all sorts of things. There has to be some element of local

accountability. It would be untenable to remove responsibility completely from authorities on the west coast and place it in Edinburgh. I do not think that that would work. I would definitely see a role for local authorities.

**The Convener:** I could go right the way down the line, but for the *Official Report* I will say that you are all nodding at the suggestion that local people and local authorities should have a role. Are you happy with that, John?

**John Finnie:** That is helpful. Thank you.

**Gail Ross:** Various communities along the west coast are very nervous about new applications for fish farms or existing farms extending. Should fish farms be allowed in marine protected areas?

**Richard Luxmoore:** Marine protected areas have been designated for a number of reasons. There are protected areas for harbour porpoises and flapper skates, for example, and for different habitats, such as burrowed mud. All of those features are impacted to a different extent by fish farming. The measures that we would put in place for a harbour porpoise would not be the same as the measures that we would put in place for burrowed mud, because the impacts would be very different. One would not want to say that there should not be any fish farms in marine protected areas, because one would need to know what the particular impacts were.

That said, when the boundaries of the marine protected areas were originally drawn up, Marine Scotland looked at a range of priority marine features—I think that there were something like 80 priority marine features. Individual MPAs were drawn up and established to protect a list of certain priority marine features. Some priority marine features have no marine protected areas. For instance, the sea trout, which we have been talking about a lot, is a priority marine feature, as is the Atlantic salmon, but no MPAs have been set up to protect those. If you had set up a marine protected area to protect the sea trout, it would be perfectly reasonable for you to say that you did not want any fish farms in the MPA because of the problems of interaction of sea lice with the wild sea trout. The Government announced that those other priority marine features would be protected by a range of wider seas issues. I am afraid that I do not see a lot of evidence of that at the moment, certainly in relation to fish farms.

11:30

The committee may be aware that there was a problem a few years ago with damage to flame shell beds in Loch Carron, which is outside the marine protected areas, caused by dredging activity. That shows that, even if all the features within the marine protected areas are adequately

protected, there will still be damage outwith those areas to some of the features, some of which are extremely important.

**Gail Ross:** I know the example that you are talking about. A marine protected area was then set up to protect that bed.

Earlier on, we were talking about regulation. Do any of the regulations need to change to take into account priority marine features or MPAs?

**Richard Luxmoore:** Marine Scotland is carrying out a review of some of the priority marine features—I think that 11 of them are particularly susceptible to fishing pressures—to see whether other protection measures are needed. There has not been a review of the features that are particularly impacted or are likely to be impacted by aquaculture. It would be a good idea to carry out a review, because that has not happened and the assessment of the impacts on some of those features is not adequate.

**Dr Wells:** We have mentioned that Atlantic salmon and sea trout are priority marine features, but they are not part of the area protection element, so the issue is slightly outwith my locus. However, from a nature conservation perspective, some of my members are particularly interested in freshwater pearl mussels, which are critically endangered. They rely on salmon and sea trout to complete their life cycles—the migrating fish coming back into a river pick up the freshwater pearl mussel larvae and move them up the river.

That emphasises how important sea trout are, because some of the special areas of conservation for freshwater pearl mussels on the west coast are primarily sea trout rivers, rather than Atlantic salmon rivers. Therefore, sea trout need to be looked at not just because of their value in their own right, from a fishery and nature conservation perspective, but because of their linkage to those other critically endangered species.

**The Convener:** Does John Scott want to come in at this stage? I know that Gail Ross has further questions.

**John Scott:** I want to ask about the protection of maerl beds that have fish farms located over them. The Environment, Climate Change and Land Reform Committee has received evidence saying that that protection has not always been all that it might be. Would those of you who know about the issue like to discuss it?

**Richard Luxmoore:** Maerl beds are particularly susceptible to damage from sedimentation of organic material from fish farms. Various studies have indicated that where maerl beds are in proximity to fish farms, there is evidence of sedimentation at some considerable distance from

the fish farm. Maerl beds are also under threat from a number of other things, such as dredging, but fish farms are an additional pressure on them. That matter needs to be addressed.

When most of the fish farms were set up, no protection was in place for those maerl beds. The fish farms have now been there for some considerable time. In fact, more than 30 per cent of the 220-odd active salmon sea farms in Scotland are in protected areas, so those fish farms were in operation before the protected area was delineated.

There is an assumption that, if fish farming has been going on since before an area was designated, it cannot have been doing much damage. That is not a safe assumption, and we must look at the impact of the gross pollution of faeces and other organic material from fish farms. However, we have not even started talking about the therapeutic chemicals that are used in fish farms, and we are getting evidence that they are having much more widespread effects kilometres from them. We must look much more closely at the impacts of some of the existing fish farms in protected areas.

**The Convener:** This is a perfect opportunity to bring the deputy convener back in.

**Gail Ross:** My question is on the depositional zone regulations. SEPA has just closed a consultation, the results of which will come to us in June. The ECCLR Committee's report states:

"The Committee understands the new DZR that is being consulted on seems to allow the expansion of fish farms in more exposed locations while requiring a tightening of the monitoring of nutrient waste."

The report goes on to state that

"the new DZR model has not been peer reviewed. There is a lack of available scientific and published evidence to support the model."

The report also mentioned communities' concerns about fish farms that are close to the coast.

We are conflicted. We could put the fish farms further out to sea, where they would be more exposed, which would make coastal communities happier. However, are there problems with fish farms being more exposed in the DZR? Does the panel have an opinion on that?

**Richard Luxmoore:** I have already highlighted one major concern with the depositional zone regulations, which is that increasing the size of a fish farm will make the sea lice issue considerably worse. There does not seem to be any consideration of that in the mechanism, as it stands at the moment.

The dispersion of waste from fish farms is a very complex subject. However, we need to bear in mind that, within the aquaculture zone, which is

the west coast, 80 per cent of all the organic waste from terrestrial sources—the land—that enters the sea comes from fish farms. A single fish farm, which currently has a maximum size of 2,500 tonnes, produces the amount of sewage equivalent to a town twice the size of Oban. Virtually all the towns on the west coast produce the same amount of sewage as one moderately large-sized fish farm. Of course, waste is not allowed to be discharged from a single septic tank into the sea without being treated. If someone were to suggest building two Obans somewhere in the sound of Mull, and they said, "Is it all right if we just chuck this sewage straight in the sea?", they would get very short shrift from SEPA. Somehow, new fish farms seem to be exempt from a lot of those issues. We are talking about huge quantities of organic waste being put into the sea.

There have been various attempts to improve the modelling. SEPA uses a DEPOMOD model to predict the impact of the dispersion of waste from fish farms, and that model has gone through a number of different iterations—there was a phase 1 version and a phase 2 version. None of them is particularly good at modelling complex currents. A complex environment, with islands, different sea lochs coming into it and tidal currents going in all directions, has extremely complex currents.

Last week, I was at a presentation at which SEPA demonstrated the use of yet another model, which goes far beyond DEPOMOD for depositional zone regulations. That model showed much more complex interactions between all the currents, and showed deposition in very remote areas—2km or 3km away from the fish farm. The current models assume that all the impact is within 1km<sup>2</sup>, or within a slightly larger area now. Once the waste leaves that modelled 1km<sup>2</sup>, it is forgotten about completely, but we know where some of that waste goes. Some of it is channelled into very specific locations and deposited quite a long way from fish farms. At the moment, none of the models really captures that. The DZR model, which is based on another iteration of DEPOMOD will have exactly the same problems.

**Jon Gibb:** I appreciate that the question was specifically about the DZR, but I have some general comments about the newer, higher-energy sites. The sites that are close to my region are off the coasts of Rum and Muck—the inner isles.

It would be fair to say that the general direction of travel in the fish-farming industry is to look towards such new sites. However, from our perspective, one key piece of the jigsaw that has been missing prior to this is about working out the migration paths of the smolts from the rivers on the west coast of Scotland. If that were to be done as a pre-application piece of work, we might find from it that, on the issue of sea lice, parts of the

inner isles or elsewhere in those higher-energy sites might impact migrating fish far less than other sites. If we knew that, it might offer an incentive for the industry to meet expansion targets. It would also satisfy a great deal of wild fish concerns. However, at the moment, if someone wants to build a fish farm on the inner isles the usual authorities will allow it with no pre-application work at all, so we do not know what we are putting out there. In general, we would far prefer to see the relocation of inshore sites out to such sites but we would need to have that work done before.

At the moment, there is no mechanism in the regulations to allow a local authority to permit the relocation of inshore sites. As a fishery board and a statutory consultee, we often reply to such applications and say, "Yes, we are conditionally supportive of these sites but we would like to see smolt migration work done before you go in there and, secondly, a phased relocation of particularly sensitive sites." At the moment, the local authority has no power to say to an inshore site that already has full planning permission that it has to relocate biomass, so I suggest that we need a mechanism in the planning regulations to allow that. We might be knocking at an open door with some of the fish-farming companies on that.

**The Convener:** People are queuing up to speak and time is marching on, so I will take Alan Wells and then Guy Linley-Adams. I ask them to keep their answers very brief. If Guy is going to drop out, I will bring in Stewart Stevenson very briefly.

**Dr Wells:** For all the reasons that we discussed earlier about regulation, we are of the view that the DZR proposals as they stand should not be taken forward in isolation from a broader review of regulation more generally.

Most of the issues have been covered, but there is one thing in the DZR proposals that is a good principle: SEPA says that it intends to take on greater responsibility for monitoring, rather than operator monitoring.

**Gail Ross:** I am sorry—did you say that the proposals should not be taken forward and that it should be done as part of wider regulation?

**Dr Wells:** That was what we said in our consultation response.

**Gail Ross:** Thank you.

**Stewart Stevenson:** My point is on the arithmetic again. In relation to the idea of a large fish farm putting out the same amount of waste as Oban, I think that the natural biomass in an area will also put in waste material. Is it known by what proportion the natural biomass is increased by the presence of fish farms? I am not asking about local effects. Clearly, if we put the biomass in one

place, we will get it all in one place. I am asking a more general question.

**The Convener:** Richard Luxmoore can respond, and then we must move on to the next question.

**Richard Luxmoore:** The answer to that question is probably not the natural biomass, but we have to bear in mind that we are talking about an intensive farming operation. If we were to talk about the natural density of large mammals in the Highlands, it would be a certain number of kilos per hectare or something. However, if someone were to put in an intensive cattle farm there would be a very much greater density of animals per unit area. That is exactly the case with a fish farm. Not only does that put in a very high density of fish; it also chucks in large quantities of fish meal and food that have come from all over the place. That is a net input to that ecosystem and so will inevitably have a large effect.

**Stewart Stevenson:** It is therefore the density rather than the volume that we are speaking about, and I understand that point. I think that the convener now wishes me to shut up.

**The Convener:** I am not even going to go there with a response to that. Perhaps John Scott would like to move on to the next question.

11:45

**John Scott:** I want to ask about the problems of escapes of farmed fish as you see them. This is just for the record, because I am sure that we are probably all familiar with them to some extent.

I was intrigued to read that

"in Norway, escapes of farmed fish are considered to be the greatest threat to wild salmon."

Furthermore, we understand that, in Norway, the onus for catching any farmed fish that have escaped is on the fish farm, and it incurs the costs of doing so. That would be groundbreaking here.

**Dr Wells:** A couple of the elements of the regulatory system in Scotland are interesting in that respect. In Scotland, it is not an offence to have an escape; it is only an offence if you do not report an escape or the circumstances that might have led to an escape. If, say, you find a hole in the net, you have to report it, even if you do not know whether any fish have escaped.

Escapes happen in Scotland, and we are particularly concerned about escapes in fresh water. On one particular freshwater loch in Scotland, Loch Shin, there are two farms, and for a long time now, farmed fish have been found in the loch. However, because there are two farms and no reported escapes, both farms have simply said, "It's not us—there's no sign of an escape at

our farm.” Recently, Marine Scotland science has demonstrated through genetic analysis of the escaped fish that the escapes have been coming from both farms. No escapes have been reported but, for whatever reason, those fish have been getting out into the loch. There are all sorts of concerns around that such as genetic integration—in other words, genes from the farmed fish getting into the wild population through cross-breeding—but even if that does not happen, large numbers of escapes can swamp the wild population.

Generally speaking, Scotland’s lochs are nutrient poor, and because there are not huge amounts of habitats, the numbers of wild fish are relatively low. As a result, if large numbers of farmed fish come into those areas, that can cause problems. Equally, if there are escapes in the marine environment and those fish find their way into rivers, they can, again, cross-breed with wild fish, and we know that the cross-breeding fish are much less able to survive.

**John Scott:** In light of that answer and the answers that we have heard from others, I wonder whether you could propose some solutions while you are also defining the problems. We are interested in solutions.

**Jon Gibb:** With regard to freshwater fish farms, I hear what you say about solutions, but first of all, I would certainly back up what Alan Wells has said about the problems. We have three very large smolt farms in our region, and we get what is called—you might have heard this term—drip-drip escape. As a grower of juvenile fish, I know that they are not always the same size, and if you put them in a net pen, they will not always be held by it. They will escape. There are two burns where all the juveniles in the spawning areas have 100 per cent Norwegian genes—and that is probably the reason why open-cage farming in freshwater lochs is not allowed in Norway, although it is in Scotland.

I think that the solution for the freshwater farms is fairly straightforward. Indeed, farmers have already addressed the issue by starting to grow smolts in very large closed containment units—I am thinking specifically of Marine Harvest at Lochailort and Inchmore. There is a solution to the issue; it has already been tried and tested and is very much up and running.

**The Convener:** For the sake of clarity, do the juvenile fish that escape from freshwater farms have to go through the same process of going to sea to become mature, or can they become sexually mature just in the burns? I think that someone said that that was possible.

**Jon Gibb:** It is absolutely possible, particularly for the male fish. You can get what is called a precocious parr; it is a very odd term, but it refers

to a small juvenile fish that matures in fresh water. However, a lot of work has been done to show that they can make a large contribution to the spawning effort, so it is not all about large male Atlantic salmon returning from the sea. That genetic material can get into the wild population very quickly.

**Richard Luxmoore:** As has been highlighted, this is the number 1 threat in Norway. The main problem is that the escaped fish have lower survival levels once they get into the sea and rivers, and it does not take a very large change in the survival rate to have a major impact on the number of fish returning to the river at the end of the day.

**John Scott:** Should we pursue those escapees with the same vigour as the Norwegians? Should it be up to the farm from whence the fish came to recapture them? Would that lead to measures such as tagging and transponders? There are satellites now.

**Richard Luxmoore:** As Alan Wells said, genetic fingerprinting can identify the source of the fish quite well in many cases.

**John Scott:** But you want to know where the fish are and go and catch them.

**Richard Luxmoore:** Once the fish have got out into the environment, it is extremely difficult to catch them all—in fact, it is impossible—so the problem is really how to prevent them from getting out in the first place. As several people have said, the answer to most of the problems is closed containment. If we have closed containment, that will solve an awful lot of the big problems that we are talking about.

**Guy Linley-Adams:** As Richard Luxmoore said, the answer is not to let the fish out in the first place. That means growing them in closed containment. It will not stop all escapes—there will be accidents with closed containment—but there will be far fewer than there are now.

**Jon Gibb:** On escapes, we find locally that farmed fish tend not to run into rivers immediately but to mill around in the sea lochs for a long time. We have to think about what the knock-on effects of that are. There is an effect on the predation levels, particularly from common seals. The common seal population is doing well on the west coast and that might be because of the level of escaped fish around. We still lift the odd illegal net around the coastline on the west, as one might expect—it is in the culture—but, mostly, what we find in those nets is farmed fish.

**John Finnie:** One of my questions has been comprehensively answered—it related to the evidence about freshwater fish that Mr Gibb referred to in his written submission.

As an interim or general step, you talk about the use of closed containment rather than the imposition of a limit on the number or density of fish. Should that be a factor in freshwater and seawater fish farms?

**Jon Gibb:** On freshwater farms, it is a bit of an all-or-nothing situation. It does not make a great deal of difference to us what the total amount of fish is on a farm. The issues are escapes and excess feed falling down from the nets and having an impact on growing wild species below the nets, such as sea trout that want to go to sea.

The only reason that the sea trout goes to sea is to find food. If it comes across food on its migration path to the sea, there is every likelihood that it will simply revert to resident brown trout. There is evidence to suggest that that is happening. In Loch Lochy, where there is the largest freshwater smolt farm in Scotland, we are catching resident brown trout of up to 23 pounds. Before the fish farming days, a good resident brown trout in Scotland probably weighed 2 pounds, so we are getting enormous fish. Smolts—salmon and sea trout—are funnelled at the exits of the lochs on their way to sea and, at dams, you can sometimes see the huge trout picking off the smolts.

There are knock-on effects. For freshwater farms, it is not about numbers. I am sure that the other witnesses will want to comment on seawater farms.

**John Finnie:** Not to labour the point, we heard last week about how fish congregate together anyway, regardless of the space that they have. Should there be a limit on the density of fish? I am trying to use a layperson's term.

**Dr Wells:** To clarify the matter from a wild-fish perspective, the density in which the fish are farmed is much more of a welfare issue for the fish in the cages. If we are talking about escapes—when the fish get out—I am not sure to what extent the density of fish within the cages has a bearing on the matter.

**John Finnie:** Okay. My other question relates to medicines and chemicals. You are all familiar with the ECCLR Committee's report. It talked specifically about gaps in data and analysis, including in the analysis of the cumulative or additive effects of chemicals and medicines. Obviously, medicines and chemicals are used to treat farmed salmon that have sea lice. Will you comment on the impact that those treatments have on the environment and other species? In addition—I think that we have covered this point, but I will labour it—is the matter regulated effectively?

**Richard Luxmoore:** You are right to highlight that. There is a range of problems. One of the

best-documented studies is of one of the in-feed treatments, emamectin benzoate. The study was carried out by the Scottish Association for Marine Science a few years ago and concluded not only that levels of residues from that chemical were higher than expected, but that even at low levels—below the level at which it could be detected in the water column or the sediment—it was causing widespread mortality of wild crustaceans.

Emamectin benzoate has a half-life of 250 days once it gets into the sediment—half of it will have disappeared after about nine months. The European medicines directive defines a persistent biotoxin as one that has a half-life of 180 days. Emamectin benzoate is a nasty chemical that is being chucked into the sea in large quantities and which, at extremely low levels as far as we know, is causing mortality of 60 to 90 per cent of wild populations of some crustaceans. That is clearly not being adequately regulated at the moment, and there are on-going discussions about whether we need to radically reduce the amount of that chemical that can be put into the environment.

A number of other chemicals are used that are not regulated at all. We talked about gill diseases earlier. One of the main chemicals that are used to treat gill diseases is hydrogen peroxide, which is a very strong oxidising agent that kills off quite a lot of organisms in the sea. However, there are virtually no controls on the release of hydrogen peroxide into the sea and it is being used in increasing quantities because of the increasing incidence of gill diseases.

Some of the other chemicals are neurotoxins, which are in the news at the moment. Neurotoxins are used in bath treatments. The pen is contained temporarily and the chemicals are poured in. When the treatment is over, the containment is taken off and the chemical is just released into the sea. We know that the plumes from those treatments can be detectable 4 or 5km away. We do not fully know what the impacts of such treatments are, but I would not be surprised if some of them were much more extensive than we currently understand. There is a lot of concern relating to many of the chemicals that are used.

**The Convener:** Most of the panel are nodding. John Finnie, do you have a follow-up to that?

**John Finnie:** No.

**Stewart Stevenson:** I have been encouraged to ask about partnership, which I think has probably been adequately covered. That leaves me with a question about ways of engineering better solutions. We have talked about funnels beneath salmon farms and closed containment. Are there sufficient regulatory or economic incentives to bring about the adoption of such solutions in the fish farm industry?

**The Convener:** I will come to Jon Gibb first, as he is a declared fish farmer.

**Jon Gibb:** The incentive in all of this is to identify a site for a fish farm company where it can operate without risk to the environment. There might be an incentive with some of the things that we have already covered, be that monitoring of smolt movements, higher-energy sites or DZR coming into play, but I do not believe that there is a great deal of incentive for inshore sites, nor perhaps should there be, based on what we know.

**Dr Wells:** There are no incentives that I am aware of. I know that Norway incentivises some of the technologies, and we made the point to the Environment, Climate Change and Land Reform Committee that it would be good to see such incentives coming through in Scotland.

12:00

**Stewart Stevenson:** Will you briefly tell us what incentives matter in Norway that would help here?

**Dr Wells:** I do not know the specific details, but they have a green licence system, whereby the fee is reduced for companies that trial new technologies, whether that is closed containment or some other form of dealing with sea lice or other challenges.

The incentives in Norway come through the licensing system, so it is not necessarily a direct parallel. I am making the point that we should look at whether there is any way to incentivise the use of new technologies in Scotland.

**Richard Luxmoore:** One of the main arguments against a lot of the new technologies, such as closed containment, is that, because they are more expensive to operate, it is more difficult to run a farm at a profit. A financial incentive would be useful. With the green technology incentive to which Alan Wells referred, there is a 90 per cent discount on the licence fee. The licence fees are high, so that level of discount will produce effects.

Ultimately, salmon farms externalise a lot of their costs. I have talked about discharging sewage into the sea. If you have an intensive cattle farm, you must pay for the treatment or the disposal of that waste. Fish farms externalise those costs. They chuck the waste into the sea, and they do not have to pay for that—it is a free service.

Similarly, there is a free disposal service for the chemicals that are discharged into the sea through release from bath or in-feed treatments. If you have chemical residues resulting from your farming operation, you need to dispose of those appropriately.

Closed containment is a new technology. It is more expensive but, in effect, it brings in some of the costs to the economic envelope of the farm and gets them properly dealt with. The sooner we can move in that direction, the better.

**Guy Linley-Adams:** You need as many incentives as you can possibly give to closed containment. An option that the Scottish Government has before it is sea-bed leases. Now that the Crown Estate is devolved here, there is no reason why a Crown Estate lease for a novel site should not be available for a peppercorn rent.

If we want to incentivise closed containment, we must also address the externalities issue that Richard Luxmoore talked about. The licence fees for open-cage traditional fish farms are relatively cheap. If we go down the road of adaptive management, somebody will have to pay for that. Fish farmers might have to recognise that they will have to pay more for the right to operate farms in order to have the monitoring done to deal with all the problems that we and the Environment, Climate Change and Land Reform Committee have discussed.

**John Scott:** I want Richard Luxmoore to say a little about the depositional zones and the mechanical harvesting of waste. We are talking about an area of a kilometre square, which is essentially 100 yards by 100 yards. Would a suspended tray to harvest the fish poo not work and solve many of the depositional problems in the zones and deliver much of what we want to see? I think that that is being trialled in Norway.

**Richard Luxmoore:** That is called a funnel system, which is basically what it sounds like: you stick a funnel under the fish farm and it traps most of the waste. That does not need to be a square kilometre; it can match the footprint of the cage.

**John Scott:** Indeed.

**Richard Luxmoore:** That will trap the waste. The problem is then how to deal with that waste—you need to soak it out and put it into a treatment plant, which is not difficult technology.

Although a funnel will deal with one problem—the waste falling out—it does not deal with the sea lice issue, because they will still go into the farm and larvae will still come out of the farm. There are other technologies that involve putting a skirt around the farm, so that it is cut off from the surface water, but water is allowed to come in from underneath. That helps to protect the farm stock from sea lice infestations, but it does not necessarily prevent lice larvae from escaping from the farm. The solution is to put together the skirting and the funnel systems, so you end up with a completely closed containment system, which solves both your problems.



**John Scott:** Excellent—that is part of the solution that we are looking for.

**The Convener:** That would almost be a good place to end the meeting, but I have a final question. I encourage each of the panel members to give a yes or no answer. Given the current rules and regulations, can the growth targets of the farmed salmon industry be met without detriment to the wider environment?

**Jon Gibb:** My answer will not quite be yes or no, but nearly. Yes, they can be met, but not in the current locations, and there will need to be effective monitoring prior to going into the new locations, be that temporarily into the high-energy sites or, in the long term, into recirculation units.

**Dr Wells:** Under the current regulatory regime, no.

**Richard Luxmoore:** No.

**Guy Linley-Adams:** No.

**The Convener:** Thank you. Thank you all for your evidence this morning—it has been extremely interesting.

I briefly suspend the meeting to allow the witnesses to depart. I ask committee members to remain seated, because we need to move on to the next agenda item.

12:06

*Meeting suspended.*

12:08

*On resuming—*

## **Subordinate Legislation**

**Road Traffic (Permitted Parking Area and Special Parking Area) (Midlothian Council) Designation Order 2018 (SSI 2018/60)**

**Parking Attendants (Wearing of Uniforms) (Midlothian Council Parking Area) Regulations 2018 (SSI 2018/61)**

**Road Traffic (Parking Adjudicators) (Midlothian Council) Regulations 2018 (SSI 2018/62)**

**The Convener:** Agenda item 2 is consideration of three instruments that are subject to negative procedure, as detailed on the agenda. No motions to annul have been lodged. Does the committee agree that we do not want to make any recommendations in relation to the instruments?

**Members** *indicated agreement.*

**The Convener:** That concludes today's committee business.

*Meeting closed at 12:08.*



This is the final edition of the *Official Report* of this meeting. It is part of the Scottish Parliament *Official Report* archive and has been sent for legal deposit.

---

Published in Edinburgh by the Scottish Parliamentary Corporate Body, the Scottish Parliament, Edinburgh, EH99 1SP

---

All documents are available on  
the Scottish Parliament website at:

[www.parliament.scot](http://www.parliament.scot)

Information on non-endorsed print suppliers  
is available here:

[www.parliament.scot/documents](http://www.parliament.scot/documents)

For information on the Scottish Parliament contact  
Public Information on:

Telephone: 0131 348 5000

Textphone: 0800 092 7100

Email: [sp.info@parliament.scot](mailto:sp.info@parliament.scot)

---



The Scottish Parliament  
Pàrlamaid na h-Alba