OFFICIAL REPORT
AITHISG OIFIGEIL

Rural Economy and Connectivity Committee

Wednesday 7 March 2018

Session 5

The Scottish Parliament
Pàrlamaid na h-Alba

Wednesday 7 March 2018

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RURAL ECONOMY AND CONNECTIVITY COMMITTEE

7th 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:

Professor James Bron (University of Stirling)
Donald Cameron (Highlands and Islands) (Con)
Tom Davy (Scottish Government)
Gordon Hanning (Scottish Government)
Professor Herve Migaud (University of Stirling)
Professor Paul Tett (Scottish Association for Marine Science)
Steve Westbrook
Humza Yousaf (Minister for Transport and the Islands)

CLERK TO THE COMMITTEE

Steve Farrell

LOCATION

The Mary Fairfax Somerville Room (CR2)

Scottish Parliament

Rural Economy and Connectivity Committee

Wednesday 7 March 2018

[The Convener opened the meeting at 10:04]

Subordinate Legislation

National Bus Travel Concession Scheme for Older and Disabled Persons (Scotland) Amendment Order 2018 [Draft]

The Convener (Edward Mountain): Good morning and welcome to the seventh meeting in 2018 of the Rural Economy and Connectivity Committee. I ask everyone to ensure that their mobile phones are on silent. No apologies have been received.

Agenda item 1 is consideration of an affirmative instrument on the national bus concession scheme. One or two members would like to make voluntary declarations of interest.

Stewart Stevenson (Banffshire and Buchan Coast) (SNP): My entry in the register of members' interests states that I am the honorary president of the Scottish Association for Public Transport, and I might be thought to have an interest—I say this on a voluntary basis—in that I am a holder and user of a bus pass.

John Mason (Glasgow Shettleston) (SNP): I also have a bus pass.

Peter Chapman (North East Scotland) (Con): I am the proud owner of a bus pass as well.

Richard Lyle (Uddingston and Bellshill) (SNP): I, too, own a bus pass, but I very rarely use it.

The Convener: Thank you—we have identified those members who have bus passes.

We will take evidence from the Minister for Transport and the Islands on the affirmative instrument, which is detailed in the agenda. The motion that seeks our approval of it will be considered at item 2. I ask members to note that there have been no representations to the committee on the instrument.

I welcome Humza Yousaf, the Minister for Transport and the Islands; Tom Davy, the head of Transport Scotland's bus and local transport policy unit; and Gordon Hanning, the head of the concessionary travel and integrated ticketing unit.

I invite the minister to make a short opening statement.

The Minister for Transport and the Islands (Humza Yousaf): Thank you, convener. To all those with bus passes, I am pleased to say that we will be keeping them.

Good morning and thank you for inviting me to discuss the draft National Bus Travel Concession Scheme for Older and Disabled Persons (Scotland) Amendment Order 2018. The order sets the reimbursement rate and capped level of funding for the national concessionary travel scheme in 2018-19. In doing so, it gives effect to an agreement that we reached in January with the Confederation of Passenger Transport, which represents the bus industry.

The agreement was based on a reimbursement economic model that was developed in 2013 on the basis of independent research that was commissioned by the Scottish Government and following extensive discussion with the CPT and its advisers. With the CPT and our respective advisers, we have reviewed and updated the model and the forecasts and indices that were used in it during 2017, and we have used that as the basis for the proposed terms for 2018-19.

The proposed reimbursement rate in 2018-19 is set at 56.8 per cent of the adult single fare. We believe that that rate is consistent with the aim that is set out in the legislation that established the scheme, whereby bus operators should be no better and no worse off as a result of participating in the scheme. The fact that this year's rate is only marginally different from last year's rate of 56.9 per cent will provide a welcome degree stability for bus operators.

On the basis of the reimbursement rate and our expectations for future journey numbers and fares, we forecast that claims for reimbursement will come to £202.1 million over the next year. That figure is reflected in the draft order as the budgetary cap.

The order is limited to the coming year. Our work to update the model during 2017 identified a significant uncertainty around what should be the impact of changes in the relative level of the adult single fare. We agreed with the CPT that we would leave that element of the model unchanged for 2018-19, but we agreed to return to the matter during 2018 to inform next year's negotiations.

The committee will be aware that we have recently consulted on ways to ensure the longer-term sustainability of the national concessionary travel scheme, on the implementation of our commitment to extend free bus travel to young modern apprentices and on whether to provide companion cards for disabled people under the age of five. When the consultation closed in

November 2017, it had attracted almost 3,000 responses. Those have been analysed, and a summary report and individual responses will be published in the coming weeks. We will also set out our response to the consultation.

We know that older and disabled people greatly value the free bus travel that the scheme provides, which enables them to access local services, visit friends and relatives, and gain from the health benefits of a more active lifestyle. The order provides for those benefits to continue for a further year on the basis that is fair to operators and affordable to taxpayers.

I commend the order to the committee, and I am happy to answer any questions.

The Convener: Thank you, minister.

Mike Rumbles (North East Scotland) (LD): The figure that is mentioned in the order is £202.1 million, but according to the budget booklet that we were all given when we voted through the budget, the budget for concessionary fares and bus services is £269.1 million. Where has the other £67 million in the budget gone?

Humza Yousaf: The bus service operators grant—BSOG—which we use to subsidise the bus industry, accounts for the vast majority of that. Another element is financial transactions, which we might use for the bus emissions abatement scheme, to make buses cleaner and greener. I can provide the member with a detailed breakdown in writing if he wishes.

Mike Rumbles: That would be very helpful.

The Convener: It would be helpful if you could submit a breakdown of the budget figure to the clerks.

Humza Yousaf: Of course.

Mike Rumbles: You said that the figure of £202.1 million is not very different from the figure in previous years. That is a limit that cannot be breached, is it not? Has the limit come close to being breached in previous years?

Humza Yousaf: Yes. I have the figures for the budget cap and the scheme payments from 2006 right the way through to the present day, in which there is some variation. Our forecast for this financial year—2017-18—is that we will be at the limit of the cap. In 2015-16 and 2016-17, the figure came in under the cap, but there are years when payments came in above the cap. Those figures are forecast using a model that is agreed with the CPT. If the member would find it helpful, I am sure that we can provide him with the budget cap and payment figures for the past 10 years.

Mike Rumbles: That would be very helpful. The reason I ask is that I met the bus operators, who told me that because the limit cannot be breached, there is no incentive to advertise the free bus travel scheme. Moreover, it appears that bus operators are not being encouraged to advertise the use of the concessionary cards, which would stimulate greater bus use. I notice that, for the first time, the number of bus journeys has gone below 400 million.

Let us assume that the Scottish Government's objective is to increase bus use, and the finance is capped at £202 million out of a budget of £269 million. The bus operators would like to advertise the scheme to achieve more bus travel, but they indicated to me that the Scottish Government has a policy of telling them not to encourage people to use the scheme and not to advertise it. I would like to know whether that is true.

Humza Yousaf: No such policy exists. There is no direction like that from the Scottish Government.

Mike Rumbles: Would you be happy if the bus operators advertised the scheme?

Humza Yousaf: Yes, of course. That is why we had a consultation on the longer-term sustainability of the scheme. On the issue of card holders, I have the figures in front of me. In 2006-07, there were 900,000 card holders; there are now more than 1.3 million. There has been an increase over at least the past decade, which is positive news. I do not think that the figures bear out what Mr Rumbles said. Again, we can provide him with the figures.

Mike Rumbles: You are not worried—the Government has absolutely no concern—about the bus operators advertising the scheme.

Humza Yousaf: No, I have no concern about that. However, the bus operators have made a fair point to Mr Rumbles. There is concern about the longer-term sustainability of the scheme. As the committee well knows, we have an ageing demographic, as does most of western Europe, so we have to find a balance between making the scheme fair and realising its benefits, and making it sustainable in the long term. That is why we consulted on the scheme, and it is because of the vast interest in the scheme that the consultation garnered about 3,000 responses.

I said in my opening remarks that we will publish the analysis of the consultation in the coming weeks, followed by the Government's response to that. The operators' concerns about the sustainability of the scheme, because of the budget cap, are not unfounded. I can appreciate that they would have such concerns, but I say to Mr Rumbles that the aim of the consultation is to see how we can make the scheme sustainable in the long term.

John Mason: I want to ask about reimbursement. I recently used the bus six times in one day. If that had been six single fares, in Glasgow the cost would have been about £13. If the company gets 56 per cent, that would be about £7. If I had bought an all-day ticket, the cost would have been £4.50, so the operators appear to be making a profit. Is that taken into account when the percentage reimbursement is fixed?

10:15

Humza Yousaf: It is. Again, as I said in my statement, we agreed in 2013 to review the model, and we have been looking at reviewing it ever since. You have to appreciate the dynamics at play here; the bus operators will, somewhat understandably, look to defend their position, and we will do our best to get the best value for the taxpayer. In that respect, I should point out that we have managed to get the reimbursement rate down from 73.6 per cent at the beginning of the scheme in 2006-07 to 56.8 per cent now, which of course represents a good deal for the taxpayer.

We have agreed to remain consistent on the adult single fare for the coming financial year, but I will be reviewing it throughout 2018, and we will look at the possible changes that we might make in 2019-20. I think that there are issues with regard to other fares, and it is only right that we explore them. I can give a promise that the matter will absolutely be part of our consideration in 2018, but there has to be a negotiation and a discussion—almost a compromise—with the bus operators.

John Mason: Some of the companies have two levels of single fare, one for when you just turn up on the day and the other for the tickets that you buy and have on your phone. I assume that the higher rate is being used.

Humza Yousaf: I will double-check that with Gordon Hanning.

Gordon Hanning (Scottish Government): This is quite a new development, and we are discussing it with the bus companies. There is a precedent in that, on Megabus and Citylink services, the fares when you turn up on the day have always been much higher than those that you get when you book in advance. In that case, we worked out a formula that recognised the validity of both positions.

Mobile-phone-based fares have been quite a recent development, and they are a bit cheaper than cash-based fares. We are in the middle of discussions with the bus companies that are in that position—I think that there are three of them—but our view is that, given the precedent that has already been set, we should use not the higher fare but some mix of the two. I expect that that is what will happen.

The Convener: As no one else has indicated that they wish to ask anything, I call Colin Smyth to ask the final question.

Colin Smyth (South Scotland) (Lab): I note that the minister said that the bus pass would be staying, but he did not give any guarantee that when, as some of my older colleagues have done, I reach the age of 60, I will be able to access a pass. I am sure that we will see the results of that work soon.

Do you agree that setting the rate at a percentage of the adult fare is actually an incentive to bus companies to keep such fares high? After all, they will, by definition, receive a higher payment. Will that issue be addressed when you reconsider such matters in future?

Humza Yousaf: We have been aware of that issue since the beginning of the scheme. Before I go on, though, I should say that it will, I am sure, be many, many years before Colin Smyth reaches the age when he needs a bus pass.

We have very strict tests in place for any bus operator that wants to increase the adult fare. Bearing in mind the need for brevity, convener, I can share some information on this with the committee, but I point out that any bus operator that wants to increase the adult single fare has to undergo a standard fares test that involves providing a heck of a lot of data to Gordon Hanning and the team to analyse and pore over to find out whether any such increase is fair and justified.

No matter what fare we ended up using, Colin Smyth would still be correct: there could be an incentive for some bus operators to increase the adult fare. However, that is why we have those checks and balances in place. If it helps the member—and for the sake of brevity—I will go through the usual protocols and send the convener some detail on the standard fares test.

The Convener: That would be helpful.

There is actually one more question, and it comes from Peter Chapman.

Peter Chapman: I just want to explore the cap a wee bit more. Is the £202.1 million an absolute cap? You said that the cap had been breached in previous years. What happens if demand is greater than what is allowed under the cap?

The Convener: I will ask my colleague Tom Davy to answer that question, but there have been times when payments have gone above the budgetary cap. Again, I will send on some details, but Tom will be able to provide some more detail now.

Tom Davy (Scottish Government): Claims have exceeded the cap on five occasions. On three occasions, the cap was applied, so claims above the value of the cap towards the end of the year were not met in full. On two occasions, the claims were in effect met above the cap by means of exceptional payments under the general grant-giving powers. Those payments were equivalent to the claims being met, but they were associated with various issues to do with transitions to new reimbursement arrangements and so on, so they do not represent a precedent. The cap is there and it is a cap but, on occasion and for good reason, we have gone beyond it.

Humza Yousaf: I understand that, if there have ever been exceptional circumstances that might have been outwith the bus operator's control, we have been happy to look at that. If we looked at the winter weather that we have just had—although bad weather tends to depress patronage—and saw the opposite effect and it was outwith the bus operator's control, we would not be closed minded to continuing to hold a conversation with that company.

It is important to stress that the concessionary scheme is about dialogue with the bus operators. We try to be fair when we can be.

Peter Chapman: It would appear that the cap is not a cap. If you get to the final three weeks of the campaign and you have reached the cap, what happens to folk who have bus passes? Are those passes still honoured?

Humza Yousaf: They are still honoured. As I understand it, the bus operators would have to pick up the tab for that; they would not be reimbursed by the Government.

As I say, we have to have a level of flexibility. The cap is there and it has been applied, but we should also be reasonable, because we know that the cap is based on forecasting and we do not always get forecasting right to the penny and the pound. It is not an exact science, but the scheme is based on the data that we have available. There is some element of flexibility, which is based on the constructive dialogue that we have with the bus operators.

Mike Rumbles: Can I ask another question?

The Convener: You can have one final question, Mr Rumbles.

Mike Rumbles: Regardless of whether there is a cap, I would like a response to my first question. If one bus company decides to advertise to encourage people to use their bus passes and it gains more revenue that way, if there is a cap, the other bus companies will not be reimbursed by the Government for that advertising process. Is that correct?

Humza Yousaf: I see what the member is doing there. The principle of the reimbursement rate is that the bus operator should be no better and no worse off. If a bus company chooses to increase patronage by getting more older people to take day trips on its buses, it should be in a better position, even if the cap is breached.

I understand where the member is going with his logic, and I go back to my point that the long-term sustainability of the scheme has to be looked at because of Scotland's population and demographics. However, if you are asking me as a minister in the Government whether we have ever given direction to bus companies, I would say that my only direction has been that it is a very popular scheme, the benefits of which I recognise, and that if the bus companies want to advertise and get more older people to use their bus routes, they should do so.

The Convener: Thank you minister. Do you want to make a short closing statement or do you believe that the questions have brought out all the relevant points?

Humza Yousaf: I am happy to waive my right to a closing statement.

The Convener: It is not a right; you are not quite in a court yet.

We look forward to receiving the information that you have undertaken to give us.

The next item is formal consideration of the motion. I invite the minister to move motion S5M-10336.

Motion moved,

That the Rural Economy and Connectivity Committee recommends that the National Bus Travel Concession Scheme for Older and Disabled Persons (Scotland) Amendment Order 2018 [draft] be approved.—[*Humza Yousaf*]

The Convener: Do members have any comments?

Richard Lyle: People said that the scheme would be amended or done away with, but it is nice to see that it has been retained. I compliment the minister on that and I am more than happy for us to approve the order.

The Convener: I think that that was a political point. There appear to be no further comments.

Motion agreed to.

10:25

Meeting suspended.

10:25

On resuming—

Disabled Persons (Badges for Motor Vehicles) (Scotland) Amendment Regulations 2018 (SSI 2018/44)

Scottish Road Works Register (Prescribed Fees) Amendment Regulations 2018 (SSI 2018/50)

The Convener: Agenda item 3 is the consideration of two negative instruments, which deal with disabled persons' badges for vehicles and the Scottish road works register. No motions to annul the instruments have been received. Does the committee agree that it has no recommendations to make in relation to the instruments?

Members *indicated agreement.*

10:26

Meeting suspended.

10:29

On resuming—

Salmon Farming

The Convener: Item 4 is salmon farming in Scotland. I welcome to the committee Donald Cameron, who is here on behalf of the Environment, Climate Change and Land Reform Committee.

I will ask members to declare interests, and I will make a detailed declaration of my interests, so that the committee and others are aware of them. As members will know, my entry in the register of interests shows that I am a co-owner of a wild salmon fishery. The salmon fishery is on the River Spey, on the east coast of Scotland. The migration routes for smolts leaving the river and salmon returning to the river are along the east coast, where there is no significant salmon farming that could affect those fish. Thus, salmon farming has no impact on my registered interests as a salmon fishing proprietor.

I want to make it clear that I approach the inquiry with a very open mind and over 40 years' experience in salmon biology. I understand that salmon farming has a significant role to play in a vibrant Scottish economy.

Would any other committee member like to declare interests in relation to salmon fishing in particular?

Donald Cameron (Highlands and Islands) (Con): I am not a member of the committee, but I think it appropriate to refer to two points in my entry in the register of interests: I own a property that benefits from an income from fish farming and from a wild fishery.

10:30

The Convener: This is our first evidence session in the committee's inquiry into salmon farming. Today, we will take evidence from an aquaculture research body and an economist who has a detailed knowledge of the sector. I welcome Professor Paul Tett, who is a reader in coastal ecosystems at the Scottish Association for Marine Science; Professor James Bron, who is a professor in aquatic animal health at the University of Stirling; Professor Herve Migaud, who is a professor of aquatic breeding and physiology at the University of Stirling; and Steve Westbrook, who is an economist and author of the Highlands and Islands Enterprise and Marine Scotland report "Value of Scottish Aquaculture 2017".

You have all given evidence to committees before, so you will know that you need not press any of the buttons in front of you. If you want say

something or answer a specific question, try to catch my eye, and I will bring you in at the appropriate moment. As I say to committee members, once you begin speaking please do not studiously avoid my eye, because I may need you to condense your answer to allow someone else in, so that everyone gets a chance to speak.

John Mason: Exports are a huge part of the salmon farming industry, so my question to begin our inquiry is on exports. Is it the case that irrespective of how much salmon we produce, we will be able to export it, or could we produce too much? Could we sell more at home? In recent days, the United States has been talking about tariffs on some goods, although not fish—yet. Should we be concerned about exports?

Steve Westbrook: Currently, there are no constraints because no matter how much the salmon farms produce, it can be sold either in the home market or the export market. As members are probably aware, the structure of the industry is such that the same companies that dominate the Scottish industry also own businesses in Norway, Chile and other countries, so they divide up the world market tactically between them. According to our figures, Scotland produces about 7.5 per cent of world production, which makes it a relatively minor player worldwide.

When we carried out research for our study, we spoke to all the main producing companies and other people with knowledge of the sector. While we were doing that work, the industry stated its expectation to double production by 2030; our brief was also to consider a timescale to 2030. No one had any doubts that if the industry were to double production, it would be able to sell the product, given the growth of the world market and the fact that the companies know about the international plans and scenarios. The simple answer is that there does not appear to be a constraint. However things change when one is looking 10 years ahead.

John Mason: If we look at the issue the other way round, will there be enough food to feed all the salmon? I understand that the food is largely imported.

Steve Westbrook: Food production can be expanded. You might be aware that Marine Harvest is opening its own food plants on Skye. In fact, some people are concerned that that might reduce the sales and production of other companies in the United Kingdom. I have seen no evidence to suggest that there will be a constraint on the availability of food.

The Convener: Would James Bron or another member of the panel like to comment on the food issue?

Professor Herve Migaud (University of Stirling): I would be happy to comment on that.

Fishmeal and fish oil are what we are discussing. They are finite resources, but there has been a lot of innovation through efforts to find alternative diets. Research on diet substitutes has been going on for at least 10 years, so I do not feel that diet will be the main limitation on growth in the industry.

That said, salmon is a global market, and it will depend on how the growth is sustained in other parts of the world. I am thinking of Chile, Canada and Tasmania. There is an aspiration for growth all over the world, so we must look at the global supply.

There have been many innovations, as a result of which different types of proteins and meals have already been introduced to the salmon diet, and I do not think that there is any reason why that process will not go further. Therefore, I do not believe that food production is a major issue.

The Convener: We will go into that in greater depth later on.

John Mason: I have one more question. Steve Westbrook stressed that salmon is a global market. It has been suggested by Highlands and Islands Enterprise that Scotland would do better if our salmon was seen as more distinct, although I think that Scottish salmon has protected geographical indication status. I am fairly new to the subject, so it would help if you could comment on whether Scottish salmon is seen as distinct around the world. Is it important that it should be more distinct?

Steve Westbrook: The branding in the UK is such that Scottish salmon is marketed as the prime product. Supermarkets and others stress it—they put the name of the farm on packaging and so on. However, it is a bit dubious whether Scottish salmon is better than salmon from, say, Norway. It can be a matter of taste. There is no doubt at all that in the countries in which Norwegian salmon is promoted, it will be promoted as being the best. However, Scottish salmon is important to the UK market.

With exports, there can be differentiation. There is the Label Rouge in France, which Marine Harvest supplies. A percentage of its products—the company's best products, if you like—go under that label. There is a branding distinction even within the production of one company.

As part of my work for the HIE report, I spoke to Wester Ross Salmon, which is one of the smaller producers, about how it sells into the American market, where it has a niche. When the company or its agents speak to restaurant chains, they promote their salmon as being the best. In

America, the company sells its product as Wester Ross salmon rather than as Scottish salmon.

Branding works in many different ways. It can be a tricky area, because supermarkets might depend on Scottish salmon, but if there is a shortage of supply and they have to bring in Norwegian salmon instead, it has to be marketed in a more generic way.

Peter Chapman: Steve Westbrook said that Scottish salmon comprises about 7.5 per cent of the world market. I assume that you were talking about farmed salmon.

Steve Westbrook: Yes.

Peter Chapman: What percentage of the demand for salmon is met by wild salmon catches? I want to get a feel for how much is farmed and how much is wild.

Steve Westbrook: I have not looked at that recently, but when we looked at it some years ago, the percentage share of farmed salmon was very dominant over that of wild salmon. Now we tend to see farmed fish in top restaurants, with farmed fish from Shetland being promoted as a prime product. It is certainly my experience that wild salmon is very rarely on the menu.

Professor Paul Tett (Scottish Association for Marine Science): The most recent figure that I have for commercial landings of wild salmon in the north-western Atlantic region, which covers the whole of northern Europe, is about 2,000 tonnes a year. In comparison, the Scottish harvest of farmed salmon is 160,000 or 170,000 tonnes and the Norwegian harvest is over 1 million tonnes.

Peter Chapman: So, wild salmon makes up a very small percentage of the marketplace.

Professor Tett: Yes.

Stewart Stevenson: Looking at the world market, I think that Alaskan salmon, which is a reasonably significant player, is wild. It is a salmonid, albeit that it is a different species.

Professor James Bron (University of Stirling): That is true. There are very large wild stocks and therefore very little farming in most of that area.

Stewart Stevenson: Is there a brief way of characterising the difference between Alaskan salmon and the salmon that is bred on farms?

Professor Bron: They are an entirely different species, and you can easily differentiate them on the basis of appearance, for example. If you had just a fillet, you could differentiate through a range of tests including various molecular tests. They are very easy to distinguish.

Steve Westbrook: The wild salmon that you are talking about and which you get in the supermarkets is definitely less fatty than Scottish salmon. However, as a consumer, I find that the element of fat in Scottish salmon makes it perfect for frying, baking and so on, while I find the wild fish drier. It is a matter of taste.

Fulton MacGregor (Coatbridge and Chryston) (SNP): On Norwegian salmon, which we have talked about a wee bit, our briefing notes say that three of the five largest salmon farming companies are Norwegian owned. Does that have any impact on benefits to Scotland?

Steve Westbrook: That is a tricky issue. Over the past 25 years, Scotland has lost a number of small producers. A study on Skye that was carried out 25 years ago showed that there were lots and lots of small producers; gradually, though, they were taken over by the multinationals that now dominate the industry.

There is a downside that I should highlight. We were asked to look at intellectual capital and innovation in the sector as drivers of economic impact, and there is no doubt that the bigger companies such as Marine Harvest in Norway tend to focus on that. We do not have those jobs. However, although most of the research and development work on the new technologies that will come about—key among which are the ability to develop larger offshore sites and recirculation for onshore smolt units—is being done in Norway, once those technologies are proven, they can be imported into this country and implemented in a cost-effective way. The balance is probably quite beneficial.

Fulton MacGregor: I am not bothered where someone running an organisation or company comes from, but it seems that the Norwegian aspect is significant. Indeed, earlier answers suggested that the Norwegians are obviously competitors. I suppose that my question is whether there is any impact on the Scottish market of the companies being Norwegian owned.

Steve Westbrook: The impact is probably beneficial. For example, Marine Harvest, which is the largest producer, has split the market so that it sells most of its UK production in the UK. If you like, that fits its national model. If it had no UK or Scottish sites, it would be selling Norwegian salmon into Scotland and competing against the other companies.

Gail Ross (Caithness, Sutherland and Ross) (SNP): My question leads nicely on from Fulton MacGregor's line of questioning and focuses on the HIE report to which Steve Westbrook had quite a big input. That report estimated that 10,340 jobs, or thereabouts, have been created in Scotland as a result of direct, indirect and induced impacts of

salmon farming. Can you tell us about those direct and indirect jobs? Where, roughly, are they located?

10:45

Steve Westbrook: Specifying the numbers for rural Scotland or the Highlands and Islands within the Scottish total was not part of my brief, although I would quite like to have done that. However, for this meeting I worked through the different categories. Any figures that I quote are taken from the report, which is on HIE's website and was released last June.

The report includes a table that shows the number of jobs in each element of the supply chain, which add up to the 10,340 that Gail Ross mentioned. Very approximately, almost half of those, or roughly 5,000, will be in rural Scotland—if Inverness is counted as rural—and nearly all of those will be in the Highlands and Islands. The vast majority of jobs on the sites are in the Highlands and Islands. The processing jobs have tended to move away from there and most are now in other parts of Scotland.

An important aspect of job types is that, in the Scottish economy, there is increasingly a problem with the number of jobs in low-earning occupations and sectors going up and the number of higher-paying ones going down. The rates of pay for the people who work on the farms is relatively good compared with, for example, people who work in processing.

Therefore, not only is salmon farming an important employer in terms of the total, but the types of jobs have been very suitable for the people in rural areas who might not have had other opportunities—particularly with the number of farming and fishing jobs going down in many areas.

Gail Ross: In the report, you also talk about additional economic benefits. I represent a big rural constituency, so I know that at many farm sites the people with those jobs have partners who have other jobs that do things such as keeping local schools open. What social and community impacts do fish farms have in rural areas?

The report also talks about a community charter for Scottish Salmon Producers Organisation members that includes a community benefit fund. Can you tell us more about that?

Steve Westbrook: I am not very familiar with the community benefit fund.

On the impacts of individual companies that have farming sites—we have done work for Marine Harvest, the Scottish Salmon Company, Wester Ross Salmon and others on the question of employment—it has actually been a very beneficial mixture. If a company comes into an area and creates 10 or 12 jobs, about half those jobs go to local people, who then benefit from them, but other people move in to fill the other jobs. That helps to repopulate or to increase the population of areas. The workers who come in might have partners who get other jobs. Work that we have done for companies shows that quite a lot of the partners work in local hospitals, teach in local schools and so on, so there is a very strong impact.

Another important impact is where a site is developed that is usable by other sectors; for example, leisure boats can use a marine site. The industries are very well integrated into their communities. That is certainly the message that we get. They are valued not just for the jobs that they provide, but for those wider impacts.

The Convener: We will move to the next question. Steve Westbrook has been put under the spotlight; maybe this question will allow some of the other witnesses to come in.

Jamie Greene (West Scotland) (Con): Good morning, panel. I will start with some questions about statistics. I hope that someone on the panel has knowledge of them—I have gone through my briefing papers, but cannot find the specific ones that I am looking for.

What proportion of the salmon that are farmed in Scotland is consumed in the domestic market, and what percentage is exported?

The Convener: Steve Westbrook was about to answer that, but I want to see whether I can bring in another panellist. If anyone else would like to say something, they should indicate; if not, I will let Steve Westbrook answer. It looks like he is still under the spotlight.

Steve Westbrook: Exports are tricky, because the figures that you see are a combination of those for fish that are sold as produced and those for processed fish, and double counting can sometimes occur. There is also re-exporting. For example, fish from the Faroes go down to Grimsby, are re-exported, and then go into the export figures, even though they are not produced in this country. Therefore, the situation is quite complex. However, as a rule of thumb, around half of the Scottish production is consumed in the UK, either with or without its being processed and packaged here.

Jamie Greene: I apologise to Steve Westbrook. Unfortunately, this line of questioning might remain at your side of the table, but we have many other questions for the rest of the panel. Are the fish that are consumed in Scotland or the UK processed in the UK, or do they exit the UK and come back as processed products?

Steve Westbrook: I have not come across any examples of fish being processed elsewhere and then coming back. That might occasionally happen because of world markets but, generally speaking, all the value is added in the UK, although not always in Scotland.

Jamie Greene: I presume that whole fish, as opposed to processed fish, are a proportion of the export market. Is there more opportunity for Scotland to develop its processing industry? I read in our meeting papers that the number of processors has decreased quite dramatically over the past 10 years, as we have been exporting more whole fish. What are the reasons why the whole-fish export market is increasing and the processing industry is not doing so well?

Steve Westbrook: The economics tend to work better if the fish are processed closer to where the consumers consume them, not least because, in some countries, the rates of pay and such like in processing—whether that is smoking or whatever—are much lower than they are in the UK. Therefore, there will always be that trend. However, there has been an upward trend for processing in the UK, as well. Almost every year, we see more and more different salmon products in the supermarkets. As more value is added to them and packs are made smaller, there is more employment impact from that in the UK. I do not think there is a lost opportunity for more processing in this country; it tends to happen.

Jamie Greene: You seem to be quite buoyant about the processing industry in that respect.

Steve Westbrook: Yes. We might come on to Brexit, but there is potentially a problem with the labour supply in processing, because there is a very high dependence on overseas labour.

The Convener: We will keep comments on Brexit for the section on that, which, as you rightly say, is coming down the tracks to us later in this session. As Jamie Greene has no more questions, we hope to bring in some of the other witnesses.

Stewart Stevenson: I would not hold your breath too much, convener. I think that we will move to scientific matters after my questions, although there can be a scientific aspect to this issue.

I am interested in how we get the maximum yield off a fish carcase. In part, that can be to do with how the fish is bred and how the farm is operated, but it can also be to do with the industrial process. What are we doing to improve the proportion of the flesh of a whole fish that goes for consumption?

I recently visited someone in my parliamentary constituency whose business is to retrieve the discards from the processing—the heads and skeletal remains—and turn that into food, much of which is exported in dried form to west Africa, where it is regarded as a delicacy. It is clear that there is scope for doing more than we currently do, but what is the industry doing that helps to drive up yield from the carcases?

Professor Bron: I am afraid that that might be outside our scope.

Steve Westbrook: From the economics side, the yield is quite high. The impression that I get from the companies is that they try to use as high a proportion as they can. There is salmon in dog food, for example, and that will be the very lowest quality that companies can get off the salmon. I have not heard anybody say that there is an opportunity to increase that, but colleagues might have other comments.

Professor Migaud: I agree. I am not aware that there is a lot of opportunity to increase the yield. A lot of work has been done on that, and a lot of new technologies have been implemented in processing firms. Making sure that as much of the product is recovered as possible is an important part of the business of salmon farming. Companies are also starting to convert a lot of the trimmings into added-value products.

Over the years, selective breeding has been used. Salmon have many traits, two of which are quality and yield, which is really to do with the muscle mass that is produced. Companies still select for that, but I do not know whether there is a lot of scope for increasing it significantly.

Stewart Stevenson: On the biology of the fish, does the yield go up as the fish's age goes up? In other words, is there an incentive to keep fish longer because more will be got out of them for lower investment, or is there an incentive that moves in the other direction?

Steve Westbrook: It is the opposite. Because of the constraints on our biomass and what sites can produce, there is a cycle of around 24 months for salmon. The quicker they can be harvested and the quicker the next fish can be brought in after a fallow period the better for producers. That is very much in producers' interests, rather than keeping fish on farms for as long as possible.

Stewart Stevenson: Is the fish a better product if it grows more slowly?

Professor Bron: I do not think that we have an answer to that.

Steve Westbrook: That might depend. If it grows more slowly, that might be because it is not being as well fed or that conditions in slow-growing areas are not as good. For example, Shetland might have the best conditions in Scotland as far as currents and growing areas are

concerned, and the salmon are quite fast growing up there.

Professor Bron: The feed that the fish are given and, as Steve Westbrook has said, the environment in which they are brought up will have different effects on flesh quality. The issue is less about the fish's age than about experience.

Stewart Stevenson: I will ask a final question to close off my little section. Is there scope or a requirement for further research? I am hearing that there are diverse outcomes in different parts of our geography that might have diverse economic benefits and disbenefits. Is there enough research? That is an invitation to the three academics to respond in a particular way, but the committee will want to hear evidence rather than simply opinion.

Steve Westbrook: On the economic front, an interesting question for the next 10 to 15 years is about the progress that might be made on sites that are further offshore. When we did a report on the Scottish sector back in 2007, I think, everybody in the industry said that we would have that by now. The way in which production has grown since then has been quite interesting. Because the industry has been so profitable, it has not had to take risks and make extra investments. However, as our report shows, if the industry is to achieve its target of doubling production, that will involve having more and bigger offshore sites. My colleagues might have better ideas about this, but it is very possible that, if fish are grown further offshore in different types of conditions, they might be of higher quality.

Professor Migaud: Of course the size of the fish matters because, to some extent, the yield will increase with the size. However, there will be a point at which the fish will potentially start to mature. Maturation during the on-growing stage is very detrimental, because that uses a lot of yield. That is true not only of salmon, but of most species. We want to grow the fish to an optimal size for the market and for the yield but before some of the physiology and biology, such as maturation, takes over, because that works against the industry and brings concerns about quality and the welfare of the fish. The industry has always tried to produce relatively large fish, which is why the salmon is a large fish that weighs 5kg or 6kg or more, if possible. However, there is then a risk that other physiological events will be detrimental.

The Convener: There are two follow-up questions. One thing that became clear in the Environment, Climate Change and Land Reform Committee's report was that there was use of wrasses and lumpsuckers for lice removal. Obviously, there is a limited lifespan for those fish within the regulations. Is there a market for wrasses and lumpsuckers, if they are edible? I do not know the answer to that. Should fish farms be looking at that, or are they doing so?

Professor Migaud: I can try to answer those questions. The industry is looking into that very important consideration, especially because the number of such fish is large and has been increasing. There has always been concern about what we can do with them at the end of the cycle, once they have done their job.

11:00

The two species are extremely different in terms of their biology and the potential for developing products and added value from them. On wrasse—especially Ballan wrasse—there has been a development of exports to Asia, where there is a market for the fish. There is not so much of a market for it in Europe, where it is not seen as a very good fish to eat. It can be found a little bit in France, in some French recipes, but it is not really what customers are looking for.

There are other interesting biotechnological developments that could come from wrasse species. I will not go into too much detail on that, but they have specificities and pigments in the blood that have some very interesting pharmaceutical properties. They are already being used as a powerful antioxidant.

What I am trying to illustrate is that the industry and the scientific community are very proactive in trying to find markets for those fish. If we consider lumpsucker, it is a bit different. As I am sure members are aware, there is a well-known fishery and market that is based on caviar or roe from the fish. However, on the nutritional value of the fish itself for consumers, it has not really been identified yet how we could market it. A number of chefs around the world are trying to be innovative in the way that they could cook, prepare and transform those products, and I think that some successes are coming, but we are still not there. More research is definitely needed in order to better use that kind of fish.

The Convener: Peter Chapman has a brief follow-up question, and then we will move on.

Peter Chapman: We are looking to get maximum yield. Is there a market out there to use the carcase and the bit that is left and process that into fish meal, and then feed it back to the salmon? Is that happening? It used to happen with meat and bone meal, and it was banned, for very good reasons. I just want to be sure. Is that part of the process?

The Convener: You will have noticed that there is nervousness among the committee because of the previous effects of doing that in sheep and

cattle. Who would like to head off down the route on that? Perhaps no one will. [*Laughter.*]

Professor Migaud: I would not say that I can give a formal answer, but I can say that it is definitely not done. That does not mean that fish trimmings are not used, but they are from other species. In other words, we cannot feed salmon with trimmings of salmon. That is definitely not allowed. However, trimmings, heads and other products that come from other fisheries and other species can be included in the form of fish oil and fish meal. They are of high value because they have rich content, and that is why they are used.

The products that are obtained from the trimmings from salmon can be used—not in the salmon industry, but in other industries. That can involve the livestock industry, for example, and very different species.

Peter Chapman: Thank you.

Richard Lyle: Good morning, gentlemen. The salmon industry has grown excellently over the past number of years and we want it to grow more, but the one problem that we have—we are coming to questions on the problem that the industry has—is the fish health and mortality challenges. There are quite substantial losses through escapes and mortality.

I am reminded that people now like free-range hens and not battery situations. I do not live near a fish farm, but we have pens that, to my mind, contain too many fish. Does that cause disease? Why has farmed salmon mortality increased in recent years? Why is there a difference in mortality rates between Scotland and Norway? As we have just heard, some of the companies that own the fish farms in Scotland are Norwegian, so why are there differences?

I have a few questions, convener, but I will try to put one or two of them together.

The Convener: Your questions are quite complex, Richard. Would you mind if we gave the panel the chance to answer that one first, then move on to the others?

Richard Lyle: I just want to make sure that I will have time to ask the other questions.

The Convener: You will get time. Who would like to start off on that question, which seems to be fundamental?

Richard Lyle: How do we solve the mortality rates?

Professor Migaud: I want to make two points. I am very clear that no mortality is acceptable. To put things in perspective, we need to look into mortalities in wild salmon and other economically important species all over the world. I am not justifying mortalities—we will come on to, and explain a little bit further, the differences with Norway and the challenges that the industry is meeting—but mortality in wild salmon is usually above 90 per cent. A number of studies have been done in the UK, the States and Norway that show that, in very few cases, mortality is 70 per cent—actually, that was one example—but, most of the time, mortality is between 90 and 99 per cent. In terms of the biology of the species, that is what happens in the wild. Again, that does not justify the fact that mortalities can be high in farmed salmon.

The level of mortality in salmon and other species such as salmonids is unique; it is very low compared with any other species when farmed in the sea anywhere in the world. I am not justifying that, but it is important to understand it. If you take most important marine fin-fish species in Europe and the world, the lowest level of mortality is in sea bass and sea bream. Usually, they have a survival rate of up to 40 per cent, which is very high for marine fish. Other temperate species such as cod have survival rates of, at best, lower than 10 per cent—so, they have 90 per cent mortality. There is a lot of experience with cod, because cod farming and research in the UK was very active during the past 20 years until the industry collapsed. There are also studies into wild cod mortality, which is 99.95 per cent; only a fraction of 1 per cent of that species survives in the wild. The biology of those species has been adapting so that the number of offspring that they produce versus the number that survive is their adaptation for survival in the wild environment.

Those were the two points that I wanted to make, but now we need to go deeper. I am sure that James Bron will be happy to start to explain the health challenges.

Professor Bron: I will continue if I can. We are in a period with a diverse range of health challenges. In the past, the situation was much simpler but, at the moment, there is an axis between sea lice and complex gill pathologies, which are caused by a range of pathogens and environmental influences. There are viral pathogens, bacterial pathogens and parasites, as well as the effects of water temperature on algal blooms, which cause gill problems and feed back to sea lice, too. There are a number of pathogens and, in part, the mortalities result from the combination of different pathogens.

You might have looked at lists of the causes of mortalities—a list was put out recently. The main recorded mortalities come down to gills, viral pathogens and, in terms of non-infectious reasons, damage from algal blooms and from treatments, and losses due to poor-performing fish and handling. We are in a position at the moment in which, largely due to the use of veterinary

medicines, we have had good control of, for instance, sea lice in the recent past, but those medicines are now less efficacious due to drug resistance. We have to move from a situation in which we have a large input from drug use to one in which we have to use a lot of different treatments. We have to rely much more on the use of different mechanical or physical approaches, on the use of drugs and of management tools, and on a whole range of different approaches to control the salmon.

You asked about differences between Scotland and Norway. We have quite a different industry and we also have a different range of environments here. In parts of Norway, problems for some of those pathogens are very low, whereas we have quite extensive problems with the pathogens in Scotland.

The Convener: A couple of people want to come in on that question.

Richard Lyle: I have just a quick question. Correct me if I am wrong, but basically, gentlemen, you are telling me that we have high mortality rates and that we cannot do anything about it.

Professor Bron: Not at all. The report gives the impression that nothing has really happened in terms of control of pathogens.

Richard Lyle: That is what I want to draw out.

Professor Bron: Fair enough. I have been working with sea lice for a long time now. When I started, there were farms that had an average of 100 sea lice per fish, so our control compared with the earlier industry is much better now. In the period between 2013 and now, there has been an impression that we are suddenly getting a lot more sea lice, but if you look at the actual figures, such as those in a recent paper by Hall and Murray, you will see that the numbers of sea lice have not been increasing. The reason that they are not increasing is that we have a lot more tools at our disposal to help to control those pathogens.

There is a particular problem at the moment with the axis of sea lice and gill problems, which makes it much more difficult to treat the sea lice or the gill problems, because the physiological gill problems make it more difficult for the fish to respire effectively; if their respiration is challenged, any handling stress or treatment stress may tend to impact their welfare or health. There has been a transition, as I said, and we have had to learn how to deal with those problems, but the industry is now much better equipped to do that. We have had a lot of new technologies and new equipment, both to remove sea lice and to treat those gill problems, and the industry has learnt how to cope with them.

In the recent past, there has been a transition as people learned how to treat those problems. A range of drugs is available for treating sea lice. Some of them—hydrogen peroxide, for instance—can be used to treat sea lice and amoebic gill disease. We can also use fresh water to treat amoebic gill disease and some other things. By moving diagnostics earlier for those gill problems, we can detect the problem earlier and treat it much more effectively; the mortality problems and health problems are therefore much less serious if we can start to treat them earlier.

The Convener: I will bring in other members now, and come back to Richard Lyle later.

Gail Ross: I do not know whether there are statistics on this. We are talking about farmed fish, but do we have any figures on the percentage of mortality in wild fish that is due to infection and disease?

Professor Bron: Our statistics on that are very poor. The ocean is a black box, so it is difficult to access that information. You can look at the number of fish that go out and the number of fish that come back again, and that gives you an indication of mortality at sea, but it is hard to identify the causes. You can also monitor wild fish for the presence of pathogens, but that does not normally tell you about mortality. Often there are pathogens that sit there and do not do any damage, so they do not have an impact on mortality. Some viral pathogens are present in wild fish but do not seem to have any effect on them. Getting reliable statistics is very difficult. Another problem is that, unless there is a huge die-off of fish so that they are washed up on beaches, people never know that fish are dying and do not look at the causes of deaths.

11:15

Fulton MacGregor: Your response to Richard Lyle about the development of resistance quite concerned me. We will talk about medicines later, so I do not want to steal anyone's thunder, but I assume that antibiotics are part of resistance; that is a big problem worldwide. How widespread is antibiotic use in farmed salmon, and what is the industry doing to tackle resistance in the salmon and the food chain? I assume that, if fish take antibiotics, they are in the food chain and we get them as well.

Professor Bron: There is very little use of antibiotics, particularly in the marine environment where use is tiny. We have very effective vaccines against the diseases that used to require antibiotic treatments. Scotland uses less than other salmon-farming countries, on the whole. Chile still uses a lot of antibiotics and has not been able to sell fish

to certain markets because of their level of antibiotics.

Professor Tett: I can confirm that answer. We discussed at the Environment, Climate Change and Land Reform Committee the problems in getting specific data on antibiotic use in Scotland, but the evidence that is available confirms what Professor Bron said. Antibiotic use in Scottish salmon farming is very low; it is much lower than that in Chile or parts of North America.

Richard Lyle: One of my points was not answered. Would creating more pens, and having a lower density of fish in them, be better for fish mortality? Yes or no?

Professor Bron: The densities that were used in the earlier days of farming were very high. However, work at the institute of aquaculture established the cut-off point at which health and welfare might suffer. Therefore, the farms all use relatively low fish densities, which are about right for the health of the fish. I cannot speak for salmon, but other fish species often need certain densities to be happy and healthy and relieved of stress. Professor Migaud may know the level for salmon.

Professor Migaud: For salmon, the level is 15kg per cubic metre. Because of salmon's natural behaviour of schooling, they tend to congregate and swim together. If you have more pens with fewer fish, they will still swim together in some areas of the pens. Having better usage of the volume that is available has been a challenge. Salmon's natural behaviour is why density matters for their wellbeing and their performance. They do not like to swim in isolation; they school together.

Richard Lyle: I have always wanted to ask that question; thank you for answering it. The report of the ECCLR Committee, of which I am a member, stated:

"The overall number of deaths as a result of disease, ill health and stress may be masked by the early harvesting of fish with disease or life threatening conditions."

Do you agree that that is the case?

Professor Bron: Do I agree that those factors are causes of death?

Richard Lyle: Yes.

Professor Bron: Stress can cause other conditions. Environmental stresses, particularly high temperature, have a big effect on pathogens and algal blooms, which are stressful. The more that fish need to be handled or treated, the more they will be subjected to stress, and that can have an impact. However, I am not sure what you mean by fish dying of stress. Stress is an important issue on a farm, and the farmers do everything that they can to keep it low.

Richard Lyle: I understand that the temperature of the sea has risen by up to 15° in the past number of years. Has that had any effect?

Professor Bron: The rise in sea temperature will not be that high, but there are rising sea temperatures and they will have an impact.

Professor Tett: The average sea temperature has gone up by about 1° in the last generation. It roughly reflects air temperature around Scotland. For most of the year, sea temperatures are within the optimum range for salmon growth.

Richard Lyle: That was actually a quote from a salmon producer.

What is your view of the risk of disease being transmitted between farmed and wild salmon? One of the suggestions is that escapees are mixing with wild salmon. Is that the case?

Professor Bron: We are farming something that is not very far from a wild fish, and it is in its normal habitat. The wild fish and the farmed fish will tend to have the same diseases in the first place. We are not moving an exotic species into a place where it has not been before, so it cannot bring in exotic diseases. The potential for introducing a disease to the wild population is low.

The reports highlight incidences in which aquaculture across the world has introduced diseases, but those cases tend to involve situations in which unprocessed trash fish, which might carry pathogens, are fed to farmed fish. That does not happen in Scotland—we use high-quality fish feeds that are absolutely sterile. Further, there are good controls on the movement of salmon and fish with health problems in Europe and elsewhere. Therefore, my impression is that the issue that you raise is not a big risk. People who have worked on the issue have not found there to be a high risk of transfer of diseases.

The question of sea lice is different. If you have more fish in an area, they might shed more pathogens, which might produce more pressure. However, I do not think that they will introduce new diseases into the wild populations or, necessarily, that the level of introduction will have a big impact. The issue is relevant on a case-by-case basis.

The Convener: I was at a meeting of the Environment, Climate Change and Land Reform Committee at which the issue that Richard Lyle has highlighted was discussed. There was a suggestion that the amount of deaths that occur was masked by natural harvesting. The SSPO said that, when fish show a likelihood of getting disease, they are harvested to prevent the disease developing. I think that that is the point that Richard Lyle was driving at. Is it the case that some of the fish that are harvested might have

disease or are starting to get a disease, or are you saying that that is not the case?

Professor Bron: I do not know the details of that, so I certainly cannot say that that is not the case. However, in terms of fish welfare, any fish that showed signs of developing a disease that was going to be a welfare problem would be harvested out.

Professor Migaud: Emergency harvest is happening. I do not think that there is any question about that. Fish farmers have a duty to ensure that they do not keep fish with conditions that could cause welfare issues to arise.

The issue develops mainly because of environmental reasons and the link to climate change, but there are multiple factors. The gills are extremely important to the fish and they are attacked continuously by phytoplankton, which are more common these days, and by amoebic gill disease, which is relatively new in Scotland. That might explain some of the difficulties and the challenges that the industry is experiencing. A number of factors have an impact on inflammation of the gills to the point at which fish welfare becomes an issue—we would not treat fish that have such damage to their gills that they probably would not cope with the treatment. In such circumstances the fish are not sick, but one of the main organs and the tissue that helps them to have normal swimming behaviour and to be in good health are not in a condition that would allow the fish to cope with the treatment. That is the problem.

At that stage, harvesting is, of course, important. It is important to stress that, in some cases, the salmon market is not just for big 5 or 6kg salmon. There is also a market for smaller fish. A proportion of fish—those weighing 2 or 2.5kg—is harvested, and that will have been planned all along because the consumer and retailers want the product. It is quite difficult to tease out all the effects.

Steve Westbrook: An important economic point is that Scotland is one of the relatively small number of countries in the world that can farm salmon, because of its sea conditions. If the warming of the water is making things more difficult or more expensive, it is very good that there are companies that are so profitable that they can put money into making things as good as they can be. The companies put huge amounts of money into treating the diseases that have been mentioned, because it is in their interest to protect the fish. For me, the fact that the companies are profitable is very favourable, because, if they were struggling at the margins to make their business work, they would not be able to afford to spend that kind of money.

Colin Smyth: I want to move the discussion on to sea lice. What is the panel's understanding of the impact of sea lice on the health and wellbeing of farmed fish, and the impact on wild salmonids of the transfer of sea lice from fish farms?

Professor Bron: That is probably a question for me. The answer is entirely context dependent. Many farms might have no problems with sea lice at all, and therefore there will be no effect on fish health in those farms. However, there are sites that have serious problems with sea lice, and those sea lice will have an impact on fish health.

Sea lice are mostly under control in Scotland. The data that has been produced shows that there has been no rise in sea lice numbers. There is an impression that sea lice numbers have skyrocketed, but the average numbers have remained relatively static. It is quite a feat to stay on top of the gill problems and the other problems with treatment. The ECCLR report sort of suggests that the industry has just sat back. In fact, I think that there has been more innovation and more development of the tools that are needed to treat sea lice in the past five years than there has been across a much longer period before that. The industry is very concerned about sea lice and is being effective in treating the problem.

Sea lice have an impact on farmed fish—if there was a lot of sea lice on a fish it would be very serious. They can cause lesions on the fish, which affect welfare directly but can also be portals of entry—ways in which other pathogens can get in. The sea lice also affect the fish in ways that might help other pathogens.

11:30

The other part of your question was on wild fish. As I said before, it is difficult to get a grip on the issue, because you do not get to see information on wild fish mortalities or wild fish with health challenges. Even in the normal course of events, without any fish farming, wild fish can get very high numbers of sea lice. It is normal for the prevalence to be 70 to 100 per cent—that is, at least 70 per cent of fish will be infected with sea lice.

Wild fish, including salmon, are large when they return to the coast, and they can have large numbers of sea lice on them without it impacting their health at all. Therefore, it is extremely difficult to work out the effect on wild fish. There would need to be an enormous sampling effort—at the moment, there is none—otherwise it would be very hard to predict the impact.

I do not know whether I have answered your question.

Colin Smyth: I think that you have. Do any of the other panellists want to add anything? I will wait to see whether they want to respond to my initial question before I return to the treatment of sea lice.

Professor Tett: In so far as sea lice are concerned, the SAMS Research Services Ltd report looked at published scientific evidence, so it is not necessarily completely up to date as far as trends are concerned.

I will summarise what we found. We could not find definitive evidence in Scotland that sea lice from farmed salmon are having an impact on wild salmon populations, but we found definitive evidence that that was the case in Norway. I will cite a summary of the situation in Norway:

"of 109 stations investigated along the Norwegian coast for salmon lice infection, 27 indicated moderate-to-high likelihood of mortality for salmon smolts while 67 stations indicated moderate-to-high mortality of wild sea trout."

Professor Bron: The circumstances in Norway are entirely different from ours, and their farming practices are different, so the same evidence does not exist in Scotland.

Peter Chapman: James Bron said earlier that some sites have a huge problem with sea lice and others have none. Does that mean we should be looking at abandoning the sites that have a huge problem and moving the farms to better sites?

Professor Bron: I should have defined more clearly what I meant by "serious problems". Some sites, because of their position or the sea conditions, especially if they have high freshwater input, will have no lice, whereas other sites commonly have lice. That does not mean that the situation is not controllable; it just means that the fish are generally infected with lice. Other aspects of farming practice may increase or decrease the number of lice. In addition, there tend to be fewer lice in waters with high currents, whereas there are more lice in waters that are much more static.

Peter Chapman: Are you saying that the sea lice issue would not be a reason to abandon certain sites, as it is controllable?

Professor Bron: I do not know the sites individually, but if there was a serious problem, they would have been abandoned already. In the early years, some sites experienced really high lice numbers. Such sites tend to be weeded out, because they are not productive and there are fish welfare problems, so they are just not useful to the industry. Those sites have mostly gone now.

The Convener: Before I bring in Professor Migaud, Richard Lyle has a supplementary, which may help to link the two issues.

Richard Lyle: It has been suggested that escaped farmed salmon is infecting and causing disease in wild salmon. Is that the case?

Professor Bron: There is no evidence to show that. I am not aware of any such situation in Scotland.

Richard Lyle: So It is a total fallacy that escaped farmed salmon is infecting in wild salmon.

Professor Bron: The first question in that regard would be to ask what they are they being infected with.

Richard Lyle: You tell me—you are the expert, not me.

Professor Bron: As I have said, I personally do not know of any evidence of that happening.

Professor Tett: The Norwegians concluded that there was a very low transmission of disease from escaped farmed salmon to wild salmon.

The Convener: The deputy convener wants to follow up on an answer that Paul Tett gave.

Gail Ross: Paul Tett talked about the correlation between what is happening in Norway and here, and you said that there cannot be any comparison between how they do it in Norway and what happens in Scotland. What are the differences? How do they do it differently and why can the methods not be compared?

Professor Tett: Professor Bron might want to say something about the differences in practice, but there are differences in the environment. Norway has much bigger and deeper fjords. Most Scottish sea lochs are small compared to them. Norwegian waters are also typically colder, particularly those in northern Norway. One would have go into specific detail about conditions in particular fjords and lochs to understand whether there are real differences between Scotland and Norway.

I would like to pick up on the notion of specificity. We talk about sea lochs but, like Scottish rivers, lochs all differ one from the other. It is important to understand the local conditions if we are to understand what might be responsible for higher incidence of sea lice or mortality in one loch. It would depend on water currents, which vary from loch to loch, and on what we might think of as the weather in the sea, which can change. A farm might be unlucky if it happens to be exposed to infection by a lot of sea lice larvae in a particular week because the main currents are flowing from a particular direction, while a farm a little way down the coast might escape that infection in one year then pick up a subsequent infection in another year.

On medication, we need to better understand marine weather and the way in which sea lice larvae are transmitted around the sea to reinfect sites.

Professor Bron: There is a difference in scale. Norway has much larger cages on the whole. The feeding regimes might be different and the product that producers are trying to get out might also be different. For whatever reason, there are differences in the numbers of escapees entering rivers. That number seems to be small in Scotland and high in Norway. This is not the case throughout the industry, but there are cages in Norway that would be difficult to sustain in Scotland just because of their scale. There are substantial differences.

Steve Westbrook: Norway produces 15 times more salmon than Scotland, so that gives some idea of the differences in conditions.

Professor Migaud: We have to be careful when we talk about Norway. Norway has an extensive coastline, and the conditions in the north are very different from the conditions in the south. It is not just Norway; we have to look at the geographical area and, even then, there are a lot of local differences that might explain why the data cannot be applied directly to Scotland.

The temptation to say that what happens in Norway shows one thing and that it could be applied directly to somewhere on the west coast of Scotland is high. However, scientifically, it is not always the best thing to do.

Colin Smyth: I want to come back to how we treat the problem, whatever the scale of it. There are different trigger levels for when sea lice should be treated. The industry code of practice is different from Marine Scotland's policy. Is there a scientific basis for a trigger level at which salmon should be treated for sea lice?

Professor Bron: As you say, there are two trigger levels, one of which looks to take action when there are three adult female lice, and one when there are eight. The code of practice has values of 0.5 and 1 adult female per fish, and similar values are used in the world industry, but nowhere was that a scientifically established number. It is a handy small integer that lets us count lice easily and say that we are keeping the levels low—if everyone sticks to that number, it will tend to keep lice levels low. However, as far as I am aware, there has been no scientific support for that number, so there are good and bad aspects to those trigger levels.

In Scotland, there are decision levels, but some countries have mandatory levels. That is dangerous because, if the fish have to be treated every time a small number of lice are found, that means repeated treatment with drugs and, because the lice become resistant to veterinary medicines, the more the fish are treated, the more likely the lice are to develop resistance. Mandatory treatment whenever a louse is seen is a very dangerous practice.

The other problem with trigger levels is that, statistically, such low numbers cannot be truly established without sampling an unsustainably large number of fish every time that a sample is needed. The smaller the cut-off point gets—for example if is dropped to 0.1 adult female lice per fish, as in some countries—the less chance there is of getting a realistic sample. There is also a balance between the trigger levels and what can truly be measured on a farm, in real time as it were.

It is quite a complex issue. I do not know whether that answers your question.

Colin Smyth: I think that it answers my question. It is a roundabout answer, in terms of the scientific basis, but it is interesting to hear the background to the trigger levels.

On action that can be taken to reduce the sea lice problem, the Environment, Climate Change and Land Reform Committee suggested that

"there may be greater scope for growing smolts to a larger size in close containment and RAS and transferring the fish to net pens for the final year of production only."

Is that proposal feasible? What other action should we take to tackle sea lice? Can the problem be tackled?

Professor Bron: Perhaps Professor Migaud would like to answer that.

Professor Migaud: A containment and recirculation system is already used in Norway and is coming to Scotland. It means that, rather than transferring smolt that are seawater adapted to open cages, they are transferred to a recirculation system in seawater, where they will be on-grown for a longer period. That reduces the time that the fish spend in open cages, which also reduces the health challenges. The industry in Scotland is developing that approach, too. That is one of the many strategies that have been developed over the past 10 years. There has been a huge amount of innovation since 2002, and the industry has been extremely proactive in that. Some strategies were new concepts to start with but are now fully implemented commercially.

The integrated pest management strategy used to be based mainly on things such as area management, fallowing and chemotheraputants. Now it will include the use of cleaner fish, preventive measures such as skirts around the cages and lighting systems that can keep fish away from the sea lice, which are mainly in the surface layer. It will include snorkel cages—I do

not know whether you have heard about those, but they again keep the fish lower down in the water column. It will include many different technologies. One that is undergoing full commercial testing at the moment is optical delousing, which uses a laser system that has been developed in Norway.

There are also functional feeds. The feed manufacturers have been developing innovative diets to include additives to boost mucus production, which can reduce sea lice attachment, or to boost the immune function of the fish so that they can defend themselves better against some diseases.

All those strategies have been developed over the past 10 years. Some of them have been commercially implemented and most farmers are using them. Some of them have gone beyond proof of concept but still need to be refined. Every time that a new solution or new technology is introduced, that brings challenges with it. It takes some research time to ensure that we optimise all the conditions.

11:45

One of the methods that are currently used is bath treatment with fresh water. Some of the companies have invested in wellboats with reverse osmosis that can produce their own fresh water, which is pretty difficult to do. That is quite amazing. The other approach is warm bath treatment, which is very new. It has only recently been introduced in the industry and there have been no initial problems. Currently, that treatment appears to be working pretty well. There is fantastic innovation in the industry.

The Convener: Do you want to follow that up, Colin?

Colin Smyth: It is difficult to follow that. It seems that an extensive amount of work is taking place. Are you confident that the problem can be tackled, given the list that you have just provided?

Professor Bron: At the moment, the problem is being tackled successfully. The idea of integrated pest management and using a diverse range of tools to attack a problem is important. In the past, only veterinary medicines were used and nothing else was done. More recently, veterinary medicine and farm management tools, such as fallowing, area management agreements, position of cages, stocking questions and genetics have been used. We have not yet talked about genetics but genetically resistant fish are being worked on. Together, those tools give a good chance of managing the lice. We are getting a handle on that.

As Herve Migaud says, many of the new techniques have appeared commercially in only the last three to five years and so they are still bedding down. The other problem is that people rarely use just one technique; they tend to use five or even 10 techniques at the same time. That means that, at the moment, we do not have a statistical evaluation of how a given technique works.

Another problem is that farms are very diverse in terms of their environmental context, how they are run, the number of fish and a whole range of things, which means that, from looking at farm A, which has technology X, and farm B, which has technology Y, it is not easy to say whether technology X is superior. The farms will have overlapping technologies and individual differences.

It is difficult to get those numbers, although that will come in time. However, at the moment a lot of tools are being used and we are still working out which are the best and the best ways in which to use them. It is not just about having the tools; it is about knowing when to treat the fish. As we have said, the gill problems also make the whole question more difficult.

The Convener: I am conscious that there are still quite a lot of questions to get through, so we will move on.

Gail Ross: I want to move on to the more environmental side of things. The Environment, Climate Change and Land Reform Committee's report states:

> "The Committee remains deeply concerned that it appears a precautionary approach has not been and is not being applied to the development of fish farms and in particular to farms in MPAs or in the vicinity of a PMF."

Is there any research that considers the impact of fish farms that are located near marine protected areas or priority marine features and is it an area for concern?

Professor Tett: We were not able to find much in the way of published papers on Scotland. The most significant paper concerned potential impact on maerl beds, which are meadows of slow-growing, calcareous red seaweed. There is probably a lot of evidence out there, resulting from the monitoring of protected areas and features. We need some way to assimilate and synthesise that information to determine whether there is a significant effect on marine protected areas.

I have heard anecdotal evidence from fish farmers that they are becoming reluctant to apply for licences in or near marine protected areas, simply because they find it too complicated and protracted to demonstrate that the farm activity might be compatible.

One issue in talking about marine protected areas in general is that we are talking about a

wide range of habitats and species. Some of them might be perfectly compatible with salmon farming activity and others are not; some we know something about, and some we do not. To take one specific example, I have a particular interest in seagrass meadows, which were probably flourishing around Scotland 100 years ago. A lot of them have disappeared over the past two or three generations. They may or may not be sensitive to fish farming in Scotland—that is certainly a concern in the Mediterranean—but I do not think that we know enough about them.

Summing that up, we should start with an attempt to bring together what is already known about fish farming in relation to protected areas. That would be a relatively simple task.

Gail Ross: What is taken into consideration currently when there is an application for a fish farm in an MPA?

Professor Tett: Typically, the regulators will look at the benthic impact. They will look at the footprint of the cage on the sea bed and basically ask whether that will affect the protected feature on the sea bed.

Gail Ross: How would concerns of the local community be taken into consideration?

Professor Tett: Do you mean the local people?

Gail Ross: Yes.

Professor Tett: That is getting into the issue of social rather than environmental licence, and it is important to distinguish those two. Despite some of the evidence that the Environment, Climate Change and Land Reform Committee heard, a lot of the environmental aspects are reasonably well controlled.

There are clearly many issues around the perceptions of the environmental effects of salmon farming. One way of putting that is that people interpret the effects depending on their own story of what they expect. People who see fish farming as a source of employment and who are happy to see fish farms will tell the story about environmental effects in one way. Those who appreciate the Highlands, say, as an area of natural beauty and think of it as pristine react much more strongly against fish farming. Those are factual things—people behave in those two distinct ways.

Those oppositional views are getting more intense, and we know—again from Norway, where there has also been research on it—that the issue is beginning to polarise coastal communities. We have to be aware of perception of environmental effects, as well as the effects themselves. I suspect that that came through in some of the evidence that was given to the environment committee that criticised the agencies and questioned whether they are doing their job.

Gail Ross: That is helpful. I move on to depositional zone regulation. Panel members will be aware that the Scottish Environment Protection Agency has proposed and consulted on new regulations relating to deposits on the sea bed. The ECCLR Committee's report states that 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",

and that the proposals will be introduced by the end of June this year. The committee is concerned that the proposed new model

"has not been peer reviewed"

and that

"There is a lack of available scientific and published evidence to support the model."

In terms that the committee will understand, can you say what the advantages and disadvantages are of the depositional zone regulations proposed by SEPA and how they will affect the economics and environmental impact of fish farming in Scotland?

Professor Tett: I cannot answer all of that, but I can tell you a bit about depositional problems. I do not claim to be completely familiar with the details of the regulations but, if we imagine a cage farm in very quiet waters, the fish wastes—the uneaten food and the faeces—will settle down on the sea bed directly underneath the cage set, so there is an obvious footprint under those conditions.

That caused considerable problems in the early days of fish farming, because the decaying material gave rise to bubbles of gas that rose to the surface. It really was a public horror. That sort of thing has been regulated for the past few decades via the allowable zone of effect. In effect, SEPA tells a fish farm, "You're allowed to have an effect on the sea bed within a prescribed area, but on two conditions: first, the effect must be contained; and, secondly, you must not kill off everything in the area." In other words, a minimum number of species must remain.

That works very well in quiet waters, and it limits the size of farms in waters where there is little turbulence, but farms are now being encouraged to move offshore into more active and energetic environments with stronger currents. In extreme cases, the currents might be so strong that there is no footprint on the sea bed, because the waste material is deposited over a much wider area. The question is how we regulate that wider impact, which is what I think the new regulations are aimed at. They could allow for larger farms but in

more dispersive waters and with less intense impact on the sea bed.

It then becomes a question of the health of the sea-bed community over a wider area. In the past, we have been willing to write off 2 or 3 per cent of the sea bed of a loch, knowing that, once the area is fallow, it will recover; indeed, all the evidence shows that that approach has had little effect on the overall health of the sea-bed community. However, we have a less clear idea of what will happen on this larger scale if we have amounts of material that do not make an obvious impact locally but which are distributed over a wider area.

Steve Westbrook: On the economics side—

The Convener: Sorry, Steve, but I want to let Stewart Stevenson ask a follow-up question before I bring you in.

Stewart Stevenson: Are the faecal deposits that we are talking about a potential disease vector?

Professor Bron: Potentially, yes. However, if the fish faeces have pathogens in them, the chances are that the fish themselves have pathogens that they are dispersing into the environment anyway. I am not sure, therefore, whether the faeces are more of a disease vector than simply having a lot of fish in the area in the first place. If the faeces get carried down loch, so will the pathogens that are already in the water.

Steve Westbrook: With regard to existing production sites and sites that have gone through planning and will be coming into operation in the next few years, the feedback that we got from all the companies was that they expect the changes to have a strongly positive effect, because the sites where they will be able to grow and harvest more fish will quite significantly outweigh those where there will be a loss. That is their understanding, based on their modelling.

The Convener: I might have misunderstood what you said there. Could you repeat it?

Steve Westbrook: With regard to the current carrying capacity of sites, the companies expect that, under the new regulations, a number of current sites and the sites that are coming on stream in the next few years will lead to quite a strong increase in the amount of fish that they can harvest and that that will more than outweigh those sites where the regulations might work the other way. They have done their own calculations.

Professor Bron: I should point out that different technologies are reducing the amount that is being deposited. In the past, feed might simply have been thrown in and anything uneaten would fall to the bottom, but now there are on-demand systems that allow fish feeding to be monitored to ensure that a lot if not all of the food is eaten. Techniques are also being developed to detect whether fish are feeding, and they are being used to reduce the waste matter that falls beneath the cages.

John Finnie (Highlands and Islands) (Green): Good morning, panel—it still is morning. My question is about medicines and chemicals, including synthetic chemicals and antibiotics, and the concerns about harm to organisms and the ecosystem.

12:00

Our sister committee, the Environment, Climate Change and Land Reform Committee, has expressed concern about a data gap and we have heard repeatedly that there are gaps in the information. That committee also expressed concerns that SEPA has permitted the discharge of priority substances and damaging substances. Its letter to this committee includes this quote:

> "it is not tenable for SEPA to adopt a position where commercial shellfish species are impacted by the day-to-day activities of fish farms."

I ask the witnesses about research about discharges and their effects on shellfish farming.

Professor Tett: The evidence at present does not show any harmful effects from salmon farming on shellfish farming. People should have in the back of their minds the history of tri-n-butyl tin, which was used as an anti-fouling compound until about 20 years ago. It was used on fish farm nets and proved to have a very harmful effect on invertebrates. It caused them to change sex, among other things. The case was documented and led to large change in regulations, so the compound is no longer used. That is what is in the back of the minds of shellfish farmers, who know the range of compounds that are used in fish farming.

To the best of my knowledge, concern can be found in the published literature about the compound emamectin, which is used in feed as a treatment for sea lice on salmon. It gets to the sea bed through faeces and is redistributed through biological and physical processes. Concern is beginning that it is having diffuse effects on organisms that naturally live in the sea bed, such as crustaceans and worms. It seems to be confined to the community on the sea bed at depths of 20, 30 or 40m, but most shellfish farms are by the seashore, such as oyster farms in intertidal waters, or mussel farms with mussels on ropes that may go down 10m.

John Finnie: Do you have concerns that the ecosystem has been impacted, albeit that it is 20 or 30m down?

Professor Tett: It depends how precautionary I want to be.

John Finnie: I want to be very precautionary.

Professor Tett: There is an urgent need for more evidence about it. One study—a detailed statistical investigation—that was commissioned and carried out, with funding from the Scottish aquaculture research forum, has led to a suggestion that there is correlation between decline in the benthic community some distance from fish farms and the amount of emamectin that is used on the farms. The difficulty is that the data that was compared was not collected for the purpose of looking at the effects of emamectin, so we probably need a proper study of its effects on benthic communities.

John Finnie: Thank you for that. On all the committees here that I have sat on, I have never heard academics who have not suggested that the world would be a better place for more research, which is perhaps not surprising. Have the research gaps for all the issues that people have concerns about been mapped out? It may that research could allay some concerns, but people have concerns, and, indeed, you have expressed some. Is there a template anywhere of what would require to be done to fill those research gaps?

Professor Tett: The ECCLR Committee's report has a summary of the areas connected with salmon farming that need more research.

John Finnie: Do you concur with that summary?

Professor Tett: Broadly, yes. The committee might also ask the Scottish aquaculture research forum to give evidence on that, because it is the body that has tried to bring together funding sources from Government and industry and to identify which areas of research should have priority. It has a small budget, so it is strongly focused on what it sees as being the priority areas.

Professor Bron: There are also areas of research that are not identified in there, so the subject needs a larger discussion with academia and industry and, indeed, Government and non-governmental organisations to identify the key gaps in knowledge that need to be filled. As the committee will see from the report, there are many such gaps—especially for Scotland.

Professor Migaud: I add that the Scottish Aquaculture Innovation Centre has been providing a critical link between industry and academics on key concerns that impact on the industry and challenges in it. Therefore quite a lot of different issues have already been mapped out, some of which are being researched today in a number of co-funded projects through SAIC and the industry. A big initiative has also started recently, which is supported by the Biotechnology and Biological Sciences Research Council and the Natural Environment Research Council, and which is called ARCH-UK—the Aquaculture Research Collaborative Hub UK. It focuses on aquaculture and salmon farming and brings together scientists around the UK to identify all the gaps in knowledge that need to be addressed, such as levels of production and the environmental and nutritional challenges that we are discussing. A lot of meetings and forums are happening so that we can create the critical mass to address those.

John Finnie: Thank you very much.

The Convener: I have to admit to struggling with time, probably because I have let everyone say as much as they want. I will have to be a bit tighter on time now, for which I apologise. I ask panel members to work with me. I have tried to sign to them a couple of times but they have studiously ignored me. I have to ask them not to do so now.

Donald Cameron: One of the concerns of the ECCLR Committee was that freshwater ecosystems perhaps deserve a little more focus. The SAMS report quite plainly focused on the marine environment in the majority of the areas that it looked at, but does the panel have any observations on environmental impacts in freshwater systems?

The Convener: Who would like to answer that? Everyone is looking the other way. I will let Paul Tett speak on that and then I will move on to a question from Peter Chapman because I see that no one else wants to come in.

Professor Tett: I will just say that, as a marine biologist, I have no direct expertise. One of the concerns in the industry is about the supply of fresh water—particularly for hatcheries, which require a reasonably large and constant supply. Even recirculating systems have to replace some of their water each day. That in itself is an issue that might need to be taken into account, especially in the context of the water framework directive and its transposition into Scots law.

Peter Chapman: My question is about cleaner fish, such as lumpsucker and wrasse, and the increasing demand for both of those species. My direct question is this: how effective are they in addressing sea lice? Given the increasing demand for them, can we farm them? If we cannot do so, what effect will that have on wild populations of such fish, given that we now catch them in large numbers in order to feed the industry?

Professor Migaud: Yes, we can definitely farm them. Some large collaborative projects have been running over many years now. I am not saying that there are no challenges there. Both Ballan wrasse and lumpsucker are entirely new species for aquaculture, so the process has been about fast-tracking the investigation, which took a

long time for other species. A lot of progress has been made over the past seven years. I can give you an example. It was only in 2013—less than five years ago—that the first eggs were obtained in captive broodstock in a commercial hatchery. That is a short time considering all the different things that we need to look at.

A lot of work has been done on how to feed the fish, breed them and keep them healthy, and now there is a focus on looking at the pathogens and bacterial infections that need vaccines to be developed. Vaccines have already been prototyped and they are being tested at present.

I do not want to go into too much detail, but yes, it can be done, as with most marine species. When Atlantic cod was produced in the UK, some of the hatcheries were producing 2 million or 2.5 million juveniles, and they were healthy. There is no reason why we will not be able to produce enough healthy farmed wrasse to supply the industry. The question is when we will be able to do that, and I am not even going to try to tell you that. I think that it will need a bit more time, because a few challenges regarding the robustness of the fish still need to be addressed before they are deployed.

Peter Chapman: In the meantime, we are catching wild wrasse and lumpsucker. What effect is that having on the wild populations of those fish?

Professor Migaud: I cannot comment too much on the wild fish impact. What I can say is that it is not just that the industry will have farmed wrasse and lumpsucker in the future; it is already a reality. A percentage of the total cleaner fish that have been supplied, especially over the past two years and this year, have come from farming operations. The aspiration for the industry is to be able to have a full supply from commercial farmed cleaner fish as soon as possible. As I said, that will probably take another couple of years at least, but we are already well advanced. I say “we” because this is a good example of collaboration between industry and academia. At the institute, we have been working with a lot of the farmers to develop all the protocols and understand the biology of the species.

Peter Chapman: The basic question, then, is how effective the cleaner fish are in addressing the sea lice issue.

Professor Migaud: That is where we started our research seven or eight years ago. That was the key question. Everybody was concerned about whether they are effective—they are extremely effective. Ballan wrasse are very impressive in the way in which they can prey on the sea lice. That does not mean that they are effective all the time when they are deployed in cages, however, because there are many other factors that can impact on the fish. That is where the environmental factors can come in, and it took a long time to understand the requirements of the species when they are in the cages. A lot of new methods have been developed—for example, to provide shelters, to provide feeding that is appropriate to the species and to understand their behaviour.

Ballan wrasse is extremely effective. We have done a lot of experimental tank challenge work and we have been demonstrating and publishing it for many years. Cleaner fish can also be very effective, although maybe not as much as Ballan wrasse. That explains why the ratio of lumpsucker that are introduced to cages is a bit higher than the ratio that we use for Ballan wrasse.

The other thing to consider is that the temperature requirements or preferences are different. Lumpsucker are extremely active in winter and the cold months, while Ballan wrasse are very active and efficient during the summer months. Together, the two species provide very good biological control in the industry. The last thing that I would say on the subject is that full production cycles have been done in the industry without any treatments whatsoever, just by the use of the cleaner fish.

12:15

Mike Rumbles: I will focus on the appropriateness of the current regulatory system for the industry. I was most impressed by the Environment, Climate Change and Land Reform Committee’s effective report. I will cite a few sentences from it:

> “The Committee is not convinced the sector is being regulated sufficiently or regulated sufficiently effectively ... There are too many regulators and too little effective regulation ... 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.”

Those are very strong sentiments from that committee’s members. What is your reaction to that?

Professor Tett: Those are strong comments. I am an ecologist, not an expert on regulation. I have been co-ordinating a European programme called AquaSpace, which concluded that the general feeling across Europe is that regulation is too complex and too time consuming. Clearly, both sides perceive the need to improve on regulation to make it not only effective but simple and efficient.

I am interested in ecological effects on the environment. Regulation must deal not only with

those effects but with public perceptions of what the issues are. We need the regulators to act as the police, but we need to bring the public more into the process of monitoring and involve them in what we call "Adaptive Management" in the report.

I am trying to distinguish between whether the regulators are doing a good job and what the public perception is of them.

Professor Bron: This is not my area of expertise either. I cannot speak to oversight, but the availability of treatments for sea lice is key for the salmon industry. There needs to be more careful consideration of what the best outcomes are for the environment if certain drugs are allowed to be used and others are prevented from being used. The wider question of whether you can protect—or give longer protection to—the environment by using a drug that is normally more harmful needs to be engaged with. That has not been done.

Mike Rumbles: The report says that the committee

"is not convinced SEPA (or any other agency) is effectively monitoring the environmental impact of salmon fisheries."

Do you agree or disagree with that? A yes or no response from all four of you would be very helpful.

Professor Bron: I fear that it is not that simple.

The Convener: There are always three answers that can be given: yes, no or abstain. That is the choice that we are given in the chamber. I would be delighted if the witnesses want to give one of those three answers.

Professor Tett: There is a lot of monitoring, but we do not synthesise the results. The agencies used to do that, but not any more—I do not think that they have the resources to do that properly now.

The Convener: That is a qualified yes. Is that right?

Professor Tett: Yes.

The Convener: What about you, James Bron?

Professor Bron: In some areas, there is too much activity; in others, there is too little. I cannot make a single statement on a general picture.

The Convener: I do not want to put you all through the pain of that response—

Professor Migaud: I am probably in the same position, so I would be tempted to say no. I do not agree entirely with the statement; it is a simplification. In some areas, there is a lot of monitoring—perhaps there is even too much—and in others, there is not enough. The amount of data generated is so high that it perhaps becomes difficult to look at it all properly.

The Convener: Does Steve Westbrook want to comment?

Steve Westbrook: I abstain.

The Convener: You got some of your answers, Mr Rumbles. We need to move to a topic that is never far from everyone's mind at the moment.

Fulton MacGregor: Steve Westbrook mentioned Brexit earlier and was promised that we would come back to the issue. I will keep the question brief. What are the most significant implications of Brexit for the salmon industry?

Steve Westbrook: There are two aspects to it: the impact that Brexit might have on exports and the impact on labour supply.

If we look at current production or the relatively modest increases in production that might happen in the next few years, there should not be an issue of not being able to continue to sell to world markets all the salmon that we can produce. However, Brexit is likely to mean a slight reduction in company profits. For example, rather than selling to France where, as I said earlier, some of the premium products are sold, it will mean selling to another country and not making quite as much margin on the sale. That could have a small effect on employment. It has been interesting that, in the past few years, Marine Harvest has twice announced redundancy programmes that were purely based on the overall profitability of the company. It said that it needed to reduce its UK staff by such-and-such a number because it wanted to get back to the profit level, and then it tried to work out how to do it. There is some link but, mainly, the impact on employment will be small.

There might be a different scenario if we look further ahead. If the industry manages to double current production, or just to increase it by 50 per cent, most of that will be exported, because the home market will be saturated by that time. If there is an increase in production, the challenge of Brexit and of the way in which international companies manage it will grow. However, by the time an increase happens, we will know a lot more than we do at the moment, and companies will have their mechanisms in place. The most stable aspect for the Scottish industry is the question of demand exceeding supply, and the growth of countries such as China and others, where more and more people now buy products such as salmon, is likely to more than compensate for the Brexit effect on exports.

However, the issue of labour supply is more worrying, particularly for processing, but also for other activities that are relatively poorly paid and

where conditions do not necessarily make jobs popular with the Scottish workforce, so there is a lot of worry that jobs will be lost. As we show in our report, there have been a lot of productivity improvements in processing in recent years and the momentum for that will grow with the impacts of Brexit on labour supply. There will be more automation—more use of robots and suchlike—which will help to sustain those operations, even if employment falls. If we look at it from our perspective in Scotland with the employment of Scottish people, those mechanisms will sustain jobs into the longer term and there will be less requirement to bring people in from other countries. Nobody knows what mechanisms will come about but, as an economist, looking across the board, my view is that more people will come from African countries to do a lot of the lower-paid, less popular jobs that people from, say, Romania fill at the moment. Mechanisms will come along; they always have done. If you look at the past 100 years, we have always had inflows of workers, whether from Ireland or the Commonwealth. Mechanisms are always found, but there could be a transition period.

There has been a fairly interesting, although not major, trend with more overseas people working on farms than, say, 20 years ago. To a large extent, I put that down to an increased reluctance of British people—not just Scottish—to work outside, which I found in other sectors such as forestry, nurseries, fishing, agriculture and construction. People want to work inside, even though rates of pay are not necessarily as good. Therefore, Brexit will have some impact on salmon farms, but salmon farms in Scotland perhaps employ only a tenth of the number that the salmon industry as a whole does, so the impact will be a bit less important than for some of the other sectors.

That brings us back to the question of who will fill those jobs. The fact is that it is not easy to put people up; problems have arisen in a lot of outlying areas where people are most needed for these jobs, because there is really no housing even for the locals who might want to work there. The accommodation of people is an issue, too.

Fulton MacGregor: Thank you for that very detailed response about the possible implications of Brexit. I realise that we do not have time to discuss this issue today, but I am concerned about the issue of working conditions, particularly in processing, that you highlighted. As I have said, we do not have time to explore that in full today, but I hope that the committee will look at it a bit more. I am sure that everyone around the table will agree that, no matter where people come from, their working conditions should be spot on. Perhaps, with the convener's permission, that issue can be pursued in questioning at future meetings.

The Convener: I have noted that comment, and we will see if we can work on it.

We are short of time, so I want to wrap things up with this final question. My understanding is that, in 2016, 163,000 tonnes of salmon was produced, and the target for 2020 is 200,000 tonnes and the target for 2030 is 400,000 tonnes. The SSPO has said that it is determined to see that growth achieved without detriment to our wider environment. My very brief question for each of you is this: are you convinced that these targets can be met without detriment to the wider environment? I am happy to start with Professor Tett.

Professor Tett: Yes, they can be met, but there will need to be radical changes to the management and regulation of farming.

The Convener: I wonder whether Professor Bron can match that very brief and succinct answer.

Professor Bron: I cannot, convener. I think that the growth can be achieved, but a lot of problems will need to be solved first. However, the industry is working very hard on that.

Professor Migaud: I, too, believe that the growth can be achieved, but it will have to be done on a sustainable basis, and some of the challenges that are being addressed today will also have to be addressed tomorrow.

Steve Westbrook: The industry has been talking about 200,000 tonnes for 15 years now but has not got there yet. Even 10 years ago, in fact, it was expecting to get there long before now.

Our analysis of all the different work that we have done is that 50 per cent growth is much more likely than 100 per cent growth—in other words, getting more like 300,000 tonnes, if everything is favourable, rather than 400,000, which we find hugely overoptimistic.

The majority of that growth will probably be achieved by developing further offshore, what with the larger volumes involved. If technology enables that to happen, a lot more farms might be generated in those offshore areas, and that might get us to the target. Interestingly, given what has been said, if those sites become much more economic, there will be less need to continue to operate more inshore sites, as it were, which are unpopular in communities. More of those sites might close; indeed, some of them have closed already over the past 10 years. If the technology and the economics work, the majority of production will happen further offshore, and in that different scenario, a lot of the issues that have been discussed today will fade away.

The Convener: I thank Paul Tett, James Bron, Herve Migaud and Steve Westbrook for their extremely useful and detailed evidence. I appreciate the succinctness of your answers as we became pressured for time towards the end of the session.

As we have concluded our business, I close the meeting.

Meeting closed at 12:29.

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