Commission of Inquiry into the Decline of Sockeye Salmon in the Fraser River

Commission d'enquête sur le déclin des populations de saumon rouge du fleuve Fraser

Public Hearings

Audience publique

Commissioner

L'Honorable juge /
The Honourable Justice
Bruce Cohen

Commissaire

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Vancouver (C.-B.)

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APPEARANCES / COMPARUTIONS

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Mitchell Taylor, Q.C. Jonah Spiegelman	Government of Canada ("CAN")
Clifton Prowse, Q.C. Tara Callan	Province of British Columbia ("BCPROV")
No appearance	Pacific Salmon Commission ("PSC")
No appearance	B.C. Public Service Alliance of Canada Union of Environment Workers B.C. ("BCPSAC")
No appearance	Rio Tinto Alcan Inc. ("RTAI")
Alan Blair Shane Hopkins-Utter	B.C. Salmon Farmers Association ("BCSFA")
No appearance	Seafood Producers Association of B.C. ("SPABC")
Gregory McDade, Q.C.	Aquaculture Coalition: Alexandra Morton; Raincoast Research Society; Pacific Coast Wild Salmon Society ("AQUA")
Tim Leadem, Q.C.	Conservation Coalition: Coastal Alliance for Aquaculture Reform Fraser Riverkeeper Society; Georgia Strait Alliance; Raincoast Conservation Foundation; Watershed Watch Salmon Society; Mr. Otto Langer; David Suzuki Foundation ("CONSERV")
Katrina Pacey	Area D Salmon Gillnet Association; Area B Harvest Committee (Seine) ("GILLFSC")

APPEARANCES / COMPARUTIONS, cont'd.

No appearance	Southern Area E Gillnetters Assn. B.C. Fisheries Survival Coalition ("SGAHC")
No appearance	West Coast Trollers Area G Association; United Fishermen and Allied Workers' Union ("TWCTUFA")
No appearance	B.C. Wildlife Federation; B.C. Federation of Drift Fishers ("WFFDF")
No appearance	Maa-nulth Treaty Society; Tsawwassen First Nation; Musqueam First Nation ("MTM")
No appearance	Western Central Coast Salish First Nations: Cowichan Tribes and Chemainus First Nation Hwlitsum First Nation and Penelakut Tribe Te'mexw Treaty Association ("WCCSFN")
Brenda Gaertner Crystal Reeves	First Nations Coalition: First Nations Fisheries Council; Aboriginal Caucus of the Fraser River; Aboriginal Fisheries Secretariat; Fraser Valley Aboriginal Fisheries Society; Northern Shuswap Tribal Council; Chehalis Indian Band; Secwepemc Fisheries Commission of the Shuswap Nation Tribal Council; Upper Fraser Fisheries Conservation Alliance; Other Douglas Treaty First Nations who applied together (the Snuneymuxw, Tsartlip and Tsawout); Adams Lake Indian Band; Carrier Sekani Tribal Council; Council of Haida Nation ("FNC")
No appearance	Métis Nation British Columbia ("MNBC")

APPEARANCES / COMPARUTIONS, cont'd.

No appearance	Sto:lo Tribal Council Cheam Indian Band ("STCCIB")
Steven Kelliher	Laich-kwil-tach Treaty Society Chief Harold Sewid, Aboriginal Aquaculture Association ("LJHAH")
Krista Robertson	Musgamagw Tsawataineuk Tribal Council ("MTTC")
No appearance	Heiltsuk Tribal Council ("HTC")

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Vancouver, B.C. /Vancouver
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THE REGISTRAR: The hearing is now resumed.

BRENDAN CONNORS, recalled.

LARRY DILL, recalled.

JOSH KORMAN, recalled.

DON NOAKES, recalled.

MR. MARTLAND: Mr. Commissioner, Mr. Blair has 15 minutes remaining on his time. I'd like to advise the Commission and counsel, as well, that there's apparently an audio broadcast that is now being made on a live basis through a website, and I don't think that changes anything, but just to make folks aware of that. That was done, I gather, through arrangements with Commission staff, Communication staff. Thank you. Mr. Blair.

MR. BLAIR: Good morning, Mr. Commissioner, members of the panel.

CROSS-EXAMINATION BY MR. BLAIR, continuing:

Q Mr. Lunn, would you be kind enough to put up Exhibit 1540, the Dill report PDF page -- PDF 73, page 70 on the paper copy. And just for the clarity on the record, I'm referring this question to Dr. Noakes. I'm making reference to the Dill report, but this particular passage is part of the technical review of that report by Dr. Tony Farrell. And again for the record these papers are peer reviewed, and so these remarks are those of Dr. Tony Farrell's at the back of the Dill report, to be clear that they're not Dr. Dill's comments. And, Dr. Noakes, I'm looking at the top of the page on the screen which says:

The DR --

- which we know to be the abbreviation for the

Dill report -

-- leans far too heavily on the CTR --

- which we know from the index is the Connors Technical Report -

-- without providing a critique of the analyses contained therein.

And Dr. Tony Farrell goes on and expresses his concerns regarding the manipulation by Connors of some of the data, and specifically, Dr. Noakes, the removal of the out-groups, which increased the predicted direct effects of farm production on mortality. Can you explain that concept a little bit initially and briefly, and then indicate whether you agree with Dr. Farrell's observations found in this page.

DR. NOAKES: Yeah, briefly, if I'm reading this correctly, I think what's happened is that Dr. Connors included stocks from the Fraser, as well as these what are referred to as out-group populations. And then when they removed those and only looked at the 17 Frasers, then basically it changed the output from the analysis and predicted -- increased the directed effect from farm salmon. That's what that's saying.

Is there another -- I'm sorry, I was just -- I was trying to read and listen to your question at the same time, I apologize.

Q Yes. No, that's fine, Dr. Noakes, I wanted you to be familiar with the passage and I appreciate there's much for all of you to have read. And so again my question was Dr. Farrell comments that he sees and comments here that Dr. Connors had manipulated the data. And I say "manipulated", I don't mean in an untoward way. I mean that's a word he's using. He has looked at the data, perhaps a more neutral word, to remove -- to specifically remove some out-groups, which Dr. Farrell comments, appears to have increased the predicted direct effects of farm production on mortality. So my question for you, Dr. Noakes, is do you agree that the effect of the removal of the out-groups has that effect? Perhaps we're all asking to wake you up on statistics too early in

the morning.

Dr. Connors has his hand in the air, and to be fair we've always acknowledged when another panel member wishes to speak to the point. So go ahead, Dr. Connors.

DR. CONNORS: Perhaps I might be able to just provide a little context, or background context to this. So my analysis considered --

Q I have 15 minutes this morning.

DR. CONNORS: Okay. I'll be really quick.

Q Thank you.

DR. CONNORS: My analysis considered as a baseline both populations from the Fraser as well as other populations in British Columbia that have been shown to previously exhibit spatial synchrony and survival. And so these are populations that have been shown in the past to respond very similarly in a given year to oceanographic conditions. By including those populations in the analysis makes a much more powerful test of any association with aquaculture or sea surface temperature, or pink salmon.

And as a result of some of the comments from the external reviewers, they asked me to repeat the analysis without including those out-groups or reference populations, as well as including populations that expand even further and refer to the group of populations that Dr. Peterman identified as showing some similarity in a downward trend over the past ten to 20 years. So that's what I referred -- that's what refers to those different kinds, basically sensitivity analyses to the effects.

It's not necessarily surprising that the predicted effect of aquaculture might be stronger if we just look at Fraser stocks, but it's really important to also consider these other populations that are also exposed to very small amounts of aquaculture, because if they're also declining the same way the Fraser stocks are, then that provides a very important reference population or control or test for that effect.

Q Thank you, Dr. Connors. Dr. Noakes.

DR. NOAKES: Yeah, I see what you're getting at now. It's true, I mean, that the -- the correlation with respect to pink salmon and the different stocks can certainly vary. The other thing that

could possibly be going on here, and I touched on it in mine, is that when you have these multiple variables in the model and if it happens to be over-parameterized or you've multicollinearity, what can happen is you can get erratic behaviour in the model where you can get the signs changing for various variables depending on what kind of a model you have. So this is the -- it could be either -- either a difference in the correlation between pink salmon and in the various stocks, or equally likely it could be an artefact of the model simply because it's over-parameterized.

Q Thank you, Dr. Noakes. Mr. Lunn, Exhibit 1536, the Noakes report, PDF 43, paper copy 34. While you're finding it, this is the "Recommendations" section in Dr. Noakes' report, and specifically I'm referring to recommendation number 2, and I'll read it into the record. Dr. Noakes, you suggest as a recommendation:

> Develop long-term disease monitoring programs for wild fish to provide data to the same level of quality and detail as available from the aquaculture industry. Monitoring should include the abundance and prevalence of sea lice and pathogens of concern for salmon.

That's your second recommendation in your report, Dr. Noakes?

DR. NOAKES: It is.

Q A bit of a motherhood statement. Looking for some agreement here, I assumed that the other three panel members all agree that this is a valid recommendation and would be worthwhile?

DR. KORMAN: Yes.

DR. CONNORS: I do. I agree.

DR. DILL: And it is a recommendation in my report, number 11.

Q Thanks for adding that comment, as well, Dr. Dill. Is it fair to say, and we'll go left to right quickly, if we may, is it probably fair to say that given the nature and the difficulty of monitoring wild fish stocks that we're probably never going to get the high level of data from the wild stocks that we've found that we can get from the captive aquaculture stocks, to use Dr. Korman's word, the "impressive" data that he had

an opportunity to review. Do you agree with that principle, Dr. Korman?
DR. KORMAN: No, I don't think that's an accurate statement, at all. I mean, if you look at some of the genetic testing that's done now to differentiate among stocks, if we look back at that 15 years ago, we would have thought that was never possible, so...
Q So you think it's possible to get the same information -- the same quality and quantity of information from wild stocks?
DR. KORMAN: I think the fish could be sampled when they're -- during the test fisheries as they are for genetics that there could be a disease profiling done on that. I don't know what the costs are, whether the Department can afford it, but...
Q I'll just stick with you on that thought, then. So you think you can get better information, perhaps approaching the quality of the aquaculture industry, but it hasn't been done yet.
DR. KORMAN: You're not going to be able to sample the same fraction of fish just due to the magnitude of the runs and the cost of individual samples, but that's not to say that you couldn't develop a statistically representative sample of those populations.
Q Dr. Connors, do you agree with that qualification by Dr. Korman?
DR. CONNORS: I do.
Q And, Dr. Noakes, do you agree, as well?
DR. NOAKES: Yeah. I think it's a little bit more difficult than that, because when you're looking at sampling for fish disease, you have to look at sampling not only in the marine environment, but you also have to look at it in the freshwater. Because some of these diseases will kill the small fish before they -- you know, that they are in the marine environment very long. So it's a huge problem, and certainly you can probably get some idea about diseases in the wild, but not -- it's going to cost a lot of money.
Q Dr. Dill?
DR. DILL: One think that will make it difficult is the fact that unlike in the net pens where the dead fish remain and can be sampled, a lot of -- and Dr. Kent pointed this out the other day, a lot of

the wild fish that succumb to a disease will fall to the bottom and never be seen.

Q Thanks, Dr. Dill. This next question, Mr. Lunn, requires Exhibit 1540. Again this is the Dill report, PDF 27 and 28, at the bottom of 27 and the paper copy, bottom of 24 and 25. My question is firstly to you, Dr. Noakes. This is in Dr. Dill's report under the heading "Infectious salmon anaemia" or ISA, and it's a very brief passage I'll just read in. Dr. Dill speaks to this, he says:

> This is an important viral disease of farmed Atlantic salmon in some parts of the world (Europe and Chile in particular). No records of it can be found in the BCMAL or BCSFA records, and according to M. Sheppard...there have been "no suspect cases of ISA in BC since sampling began in 2003".

And Dr. Dill, to be fair, goes on to talk about "classic symptoms of ISA" that Dr. Marty comments in some of his reports and we're going to hear from Dr. Marty later this week.

Dr. Noakes, we've heard from Drs. Kent and MacWilliams, who also confirmed that there had been no ISA or ISAV found in B.C. You also noted it in your report, as did Dr. Dill in the passage I've just referred to. Can you explain how from a statistical perspective testing for ISA and getting negative results increases confidence that ISA has not been introduced into British Columbia? Dr. Noakes.

DR. NOAKES: It's a matter of looking at the accuracy of the test. So if the test is very accurate, if you're testing many, many samples, then there's a probability that again, again depending on the accuracy of the tests, there's a probability that you could miss diagnosing that particular disease. But typically if the test is good, I mean, it's a small percentage. So as you sample more and more and more fish, then the probability of missing a diagnosis in say hundreds of fish, becomes very, very small.

Q Thank you.

DR. NOAKES: It's simple probability.

Q Thank you. Mr. Lunn, B.C. Salmon Farmers, Tab 43,

and as you're bringing it up it's the B.C. MLA Annual Report, Fish Health Program for 2009, and it's PDF 10 as well as page 10. Under the heading "3.2.4. Sampling and Sample Selection", there we are. The first two paragraphs in that section. Gentlemen, I'll take a moment to read this. This speaks to the issue of the farm audits, and the question of whether you're sampling from -- in part from live fish or from dead fish. And at the beginning it refers to:

> Farm audits are conducted in conjunction with the farm's regularly scheduled carcass removal, facilitating staff access to the dead fish. The approach of targeted disease sampling on recently dead fish increases the likelihood of finding disease (compared with random sampling of all live fish at the farm - most of which would be healthy).

And then it carries on describing fresh silvers and the work that was done.

And my question for you initially, Dr. Noakes, is isn't it true that targeting disease sampling increases the likelihood of finding diseased fish when comparing it to random sampling of live fish? You need --

DR. NOAKES: I'm sorry. I believe so.

Q Anybody else offer a view on that, Korman first, Dr. Korman?

DR. KORMAN: Yes, that's right. And with regards to this issue of the sort of precision of the sampling, one thing that might be worth in that context, there were seven cases of IHN farm-level diagnoses between 2002 and 2007. Now, if you look at the random testing in the BCMAL audit files, there's actually only two cases of documented IHN for the random testing. So what's going on there is that the vet is using multiple sources of information to make a diagnosis, just like a doctor does, a human doctor. The testing is one, but so is the histopathology, and so are other signs shown on the farms. But what that -- so it shows two things. One they're being conservative. The vets are actually calling some of these farms, calling it a disease event, even though the virus testing doesn't actually document it. But they're

using other information to do that, so that's kind of a good thing, and then being conservative.

But it also demonstrates that these virus PCR tests aren't -- there should have been a seven -- a one-to-one correspondence, right? But there wasn't, because they're sampling and there's error. So I guess the point is that it's not as precise as I think I hear some of the discussion alluding to and documented in Dr. Dill's report.

Q I have a question for Dr. Dill. I wonder if we could bring up B.C. Salmon Farmers Tab 14. It's the Hammell et al paper from 2009, PDF page 11, also page 11. Dr. Dill, the question is for you, and it's you referred in your report, it was a draft at the time, a Salmon Aquaculture Dialogue Report by Dr. Larry Hammell. I understand there's now a final version available, but I don't believe it's changed in any significant way as it relates to this particular question. My question really referring to page 11, Mr. Lunn, there's a paragraph commencing:

> Biosecurity remains a cornerstone of disease risk reduction.

And it's on the screen now. Take a moment if you would, Dr. Dill, I think you have a moment, or I do, do you agree with that quote that:

> Biosecurity remains a cornerstone of disease risk reduction.

DR. DILL: I believe when they're talking about biosecurity they're referring to what they describe in the following paragraphs, and it's mostly related to movement of disease from farm to farm and there are many steps taken to prevent that. So I agree with that statement.

Q You agree with the principle, and if you can quickly read through that paragraph, just so we can all find it later if we wish to refer to it. It refers to the kinds of things that they mean by biosecurity on both a local, regional and international level. They may not be practised exactly the same at all levels and all jurisdictions, but that's essentially what biosecurity means.

DR. DILL: Yeah, I agree with that.
Q Thank you. I have 30 seconds left. I'm going to ask the last question to Dr. Noakes. If he can explain what belief-oriented science is, and if he could provide an example of that in the context of the decline of the Fraser River sockeye in 2009. And if it assists you, I'd like you to have Exhibit 1536, PDF 41, paper copy, page 32. It's found in your "Concluding Remarks", Dr. Noakes, while Mr. Lunn's bringing it up, and it refers to "Debates over potential impacts" and the effect of "belief-oriented science". What do you mean in that paragraph, please?
DR. NOAKES: Yeah, what I mean by "belief-oriented science" and Ray Hilborn calls it something else, but essentially what it means is that when you're looking at data and it goes back to a comment or question that I had from the Province in terms of setting the bar in terms of the evidence that you need. And basically what happens is if you -- if you aren't rigorous in terms of your assessment and again evaluating the information that you're getting it from, you let your own personal biases either come into setting your assumptions, or interpreting the results so that in fact it's not as rigorous as it could be, and in fact you basically have the outcome is more of your belief, rather than totally based in evidence.
MR. BLAIR: Thank you. In my haste, Mr. Commissioner, I moved past marking two documents I referred to as exhibits, and if we could go in the order that I referred to them, B.C. Tab 43, which was the B.C. MLA Annual Report, Fish Health Program of 2009, been referred to, could it be marked as the next exhibit.
THE REGISTRAR: Exhibit 1561.
MR. BLAIR: And my next question referred to the Hammell report, which Dr. Dill referred to in his report on the issue of biosecurity. If it could be marked the next exhibit.
THE REGISTRAR: Exhibit 1562.
THE COMMISSIONER: Thank you, Mr. Registrar. Thank you, Mr. Commissioner. Thank you, panel.
MR. MARTLAND: Thank you, Mr. Commissioner. I have Mr. McDade for the Aquaculture Coalition at 75 minutes.
THE REGISTRAR: Mr. Commissioner, I need to correct the

last two exhibit numbers. We ended on Exhibit number 1559. So the number just called for Tab 43 should be 1560; for Tab 14 should be 1561. Thank you.

EXHIBIT 1560: B.C. Ministry of Agriculture and Lands, Annual Report Fish Health Program 2009

EXHIBIT 1561: Hammell et al, Salmon Aquaculture Dialogue Working Group Report on Salmon Disease, DRAFT March 3, 2009

MR. McDADE: Gentlemen, my name is Gregory McDade, and I appear for Dr. Morton and the Aquaculture Coalition. It may seem like a lot of time with -- but there's a number of things I want to cover in this data, so I want to move quickly.

CROSS-EXAMINATION BY MR. McDADE:

Q Firstly, you've all done a yeoman's job of crunching a lot of numbers and trying to make sense out it, and I'm certainly not going to criticize the math. I must admit, though, that the debate between Dr. Noakes and Dr. Connors in terms of methodology, even though I'm a math major, eluded me for most of it in terms of the methodology. Rather than get into that debate, I thought what I might do, though, is in terms of methodology ask Dr. Korman. You probably understand more than I do what this debate is about, what do you have to say about Dr. Connors' methodology?

DR. KORMAN: Well, for one thing I think that when you look at the bottom-line conclusions of Dr. Connors' report, he's not making claims of very strong effects. So the argument between Noakes and Connors in the end as far as conclusions is Noakes saying, you know, no effects shown, Connors saying weak effects in the case of the longer-term dataset only. So from a decision point of view, you know, that the justice may have enough information right there without getting into all the minutiae about how they come to that argument.

In terms of what Dr. Connors did, I think a lot of his rationale is well justified in terms of

using variables that other researchers have suggested in terms of the modelling framework that he did, and in terms of his interpretation. And while there is some speculation or assumptions made in his modelling, that's a totally normal part of the scientific process to basically begin with a set of assumptions, evaluate the data. There are some limitations to that result, which he I think adequately stated in his report as being limited. But that's -- it would be irresponsible of us not to do the analysis that Dr. Connors did, in my opinion. So I don't have a problem with it because he was quite cautious in his interpretation.

Q Thank you for that, Dr. Korman. The -- now, in statistics, as far as I can see, there's two fundamental limitations to every statistical analysis, and I think you'd agree, Dr. Korman: one is it's only as good as the data that underlies it, and if there's any falseness or bias or inadequacies in that data, then that would be carried over into the analysis; the second is, and the reason why statisticians can sometimes disagree and you have some of the jokes and quotes that I'm sure you've heard many times, is that it also matters what you choose to compare to what, and that's a choice that one makes. So let me start there, because there has been some differences between the various analyses in terms of what's being compared to what.

But in terms of the mortality comparisons, which is just a simple comparison of mortality according to the number of fresh silvers that are reported on the farms, and seeing whether there's any trends on that basis, I noted that none of you really did a mortality analysis that broke down the -- the area that we're most concerned about, that is, the Fraser River sockeye migration route. That's correct, isn't it, Dr. Korman?

DR. KORMAN: So that would be on the first part of his analysis, using the shorter time series, and I'm -- did you -- you'd have to actually refer that to Dr. Connors. Did you break that out by zone, or...?

DR. CONNORS: I did break it out by zone, but you're correct, I didn't make any assumptions about specific migration routes at a finer scale than

the fish health zones that fish need to migrate. And I think that's a limitation of it. I was concerned that I would be criticized if I made further assumptions about finer scale migration routes on one hand than if I didn't, and so you are correct, though I didn't break it down at a finer scale level than the inside of Vancouver Island in that case.

Q Well, where statistics really seems to have helped in the study of disease, I think, is by looking at oddities in subpopulations. For instance, the way in which AIDS was discovered is by looking at specific populations in San Francisco and certain age groups and them having an unusual amount of disease. And what you've done here is you've aggregated the 120 farms that you were given into much of the analysis that you've done.

DR. CONNORS: I agree that for that shorter term analysis there was very much a coarse level of aggregation.

Q Now, Dr. Korman, you did two spreadsheets, as I understand it. Can we have Aqua 2 up on the stand, Mr. -- or up on the screen, Mr. Lunn. This is spreadsheet CCI00l187, I believe. And this is what I would call stocking data, right?

DR. KORMAN: The sheet we're looking at right here are the farm-level diagnoses, I believe, from the audits.

MR. McDADE: Sorry, this is the wrong -- the wrong document.

MR. LUNN: You want Tab 2 in your Project 5 folder; is that right?

DR. KORMAN: Yeah, that looks more like what you're referring to.

MR. McDADE:

Q Right. So what this is, is you have a spreadsheet of population data and that is what fish went into what farms when, basically.

DR. KORMAN: Yeah, and what the -- the column K is the "Balance_Inventory" is what's in the pens by -- you know, or what's in the farm by time period.

Q So it's actually possible to break out the specific area if you know which farms you're looking at and evaluate when they were stocked and what level of mortality they had.

DR. KORMAN: Yes. You can do it on a farm-by-farm level somewhere in the spreadsheet, yes.

MR. McDADE: Can we have that spreadsheet marked as the next exhibit.
THE REGISTRAR: Exhibit 1562.

EXHIBIT 1562: Fish farm population data spreadsheet

MR. McDADE:
Q And can we have Aqua document 8 up on the screen, please.
MR. MARTLAND: And, Mr. Commissioner, I'm just mindful that it may or may not be clear to everyone whether it's not perfectly clear to me, I'll confess, that last document, how that connects to the databases versus Dr. Korman's spreadsheet, which was put in as an exhibit already. Mr. McDade may just simply clarify what it is that we were looking at and are looking at just to connect the dots, please.
MR. McDADE:
Q Well, Dr. Korman, you took that data and put it into your other spreadsheet, right?
DR. KORMAN: Yeah, I think we could probably even find this spreadsheet within the other one, exactly.
MR. McDADE: Well, we will move to that spreadsheet. Maybe we can do it when we get there.
MR. MARTLAND: And the other spreadsheet, I take it, we're referring to Exhibit 1544, which is Dr. Korman's spreadsheet used for his report. Thank you.
MR. McDADE: Okay.
Q So the -- now this is a chart --
MR. TAYLOR: I have an issue with this document, Mr. Commissioner. This, I understand to be something Mr. McDade's client prepared specifically for this inquiry proceeding. It's in the same camp as a number of documents that have come up and I don't think it can be admitted as an exhibit proper. The most it could be would be an exhibit for ID, and I raise to make that point.
MR. McDADE: Well, when I get there.
Q Now, so what we have here, Dr. Korman, have you seen that document before? Did you get a chance to look at that earlier?
DR. KORMAN: I haven't seen this, no.
Q If what I'm suggesting to you is this is just a spreadsheet done straight off yours that evaluates

the mortalities for the Area 3, as compared to Area 2, and then -- now, none of you actually did that analysis, right?

DR. CONNORS: There are fish health zones, is that right, Area 2 versus Area 3?

Q This is just Area 3 data.

DR. CONNORS: Okay. And that's correct, I did not relate just Area 3 data to any of the sockeye salmon productivity data.

MR. McDADE: So if for the sake, we'll just, I'm content to mark this for identification, Mr. Commissioner. Can we mark that tab.

THE REGISTRAR: That Tab 8 will be marked for identification XX, double "X".

XX FOR IDENTIFICATION: Area 3 mortality data spreadsheet

MR. McDADE:

Q So if in fact this document is accurate, and then it's produced entirely off your records, but assuming it's accurate, by breaking out just the Area 3 documents you begin to see a different pattern than you saw before, and in particular in the yellow line, you see a big spike of mortalities in 2003 and a big spike in 2007. Now, we've heard some evidence that the 2003 spike may be related to the IHN outbreak. Do any -- did you have an explanation for what the 2007 spike would be?

DR. KORMAN: No.

Q And if one was looking for a disease pattern in relation to the Fraser River sockeye, this would be a valuable piece of information, wouldn't it?

DR. KORMAN: Potentially. Well, one thing I'd want to know is are those mortalities, those could include predation losses, or -- so are these -- first I'd ask if they're fresh silver mortalities, is that the case? And then it would be a little more relevant than if they were total mortalities, I don't think it would be very relevant.

Q All right. I'm informed it's fresh silver mortalities.

DR. KORMAN: Okay.

DR. NOAKES: It could also be, I think, Rensel had one on toxic algae and I seem to recall there was a bloom in '07, so that may or may not be an

explanation, but...
Q All right. But this would -- this would be a sign that statistics could give us to start looking for something?
DR. KORMAN: Right. Like, you could conclude, well, something was different about 2007, maybe leading to the poor 2009 return. I guess that -- that's the logic here. But although then I would -- it would be helpful to see a really unusually low disease pattern in 2008 to explain the really high 2010 returns, which is, you know, maybe a little bit apparent in this figure, I suppose.
Q Can we have Aqua 6 up on the screen. Now, this is a map of the fish farms. It's a Living Oceans Map, but these are the maps of the farms in the Discovery Islands, which is called by some people the "wild salmon narrows". There are in fact nine farms that are circled here in blue that basically as the -- the fish have to run the gauntlet through a very narrow passage and past all of those farms. Did any of you run those numbers related to those farms?
DR. NOAKES: The only thing I did was I actually looked at the fish health and audit events on a farm-by-farm basis. And I only included those that actually had data associated with them. So I didn't include all of those, but certainly some of them had some disease outbreaks associated with them, either in the audit or in the fish health events that were reported by industry.
Q And so we don't have a mortality or disease relationship between these nine farms, and the Fraser River sockeye. Dr. Connors.
DR. CONNORS: Yeah, that's correct. I do want to get it clear. I did not do an analysis that just considered these farms here.
MR. McDADE: Can I have that map up as the next exhibit.
DR. NOAKES: I should point out that a lot of these only have a single data point so it's kind of hard to even imagine what kind of analysis you would do on a single data point. As I say, a data point mean a disease, a reported disease.
MR. McDADE: Yes. Can I have that marked as the next exhibit, please.
THE REGISTRAR: Exhibit 1563.

EXHIBIT 1563: Living Oceans Salmon Farm Migration Map

MR. McDADE: Thank you.
Q Now, let us turn, Dr. Korman, to the issue of the fresh silvers, which is, as you've said, was -- you took as a fundamental point in terms of terms of mortalities. You used fresh silvers as if they were the maximum amount of disease mortalities that were occurring in these farms, did you not?
DR. KORMAN: Yes.
Q And I think, Dr. Noakes, I heard you in your testimony last week saying that in your view those were the only fish that could have died of disease.
DR. NOAKES: I said that they were the fish that were most likely to have -- if you were testing them, those are the ones that you would want to test for disease, that the other ones if you weren't seeing any signs of disease, then -- and you could randomly test them. But as I think we said just a few minutes ago, you have a much higher likelihood of detecting a disease in the fish that have just died rather than fish that are in the pen. And of course I think you probably heard Dr. Kent explain that testing a fish and finding a pathogen doesn't necessarily mean that the fish is diseased in terms of pathology.
Q Well, I just want to get to the assumptions that were behind your report, Dr. Korman. So I'll direct the rest of these questions to you. If we could go to Tab 8 of Dr. Noakes' report, which is at page 27 of Dr. Noakes' report. Page 27, yes, there we go. This table, I understand, Dr. Korman, came straight out of your spreadsheet.
DR. KORMAN: Yes, I believe that's the case.
Q And our spreadsheet is 1182. Could we -- we'll come back to this. We'll look at this table in your spreadsheet. So could we call up the 1182.
MR. MARTLAND: I think this is Exhibit 1544, if it's Dr. Korman's spreadsheet.
MR. McDADE: Yes, that's correct. Sorry. And if we could go to the "Mortality_Summary" tab -- the next one, the "Mortality_Summary". Yes, that's the sheet, as I understand it, Dr. Korman, and those are the numbers up top?
DR. KORMAN: Yes, and the percentages down below, some

of which, yeah, line up with Noakes' table. Correct.

Q So the 2 percent number, which is at line 32, it looks like, is the fresh silvers divided by the total -- the total population, right?

DR. KORMAN: Yeah, you're taking -- you're taking the percent mortality from the overall population, all causes and then determining what fraction of those is fresh silvers, and that's basically it's .12 times .22 equals .02 there, so that's how that's calculated in line 32.

Q Well, the biggest -- the biggest total of these four lines, "Fresh Silvers", "Environmental", "Predators" and "Other" is "Other". There's some --

DR. KORMAN: Right, yes, correct.

Q And "Other" included what, Dr. Korman?

DR. KORMAN: Well, I think a big -- I'm not exactly sure of the breakdown. I never looked at it. A big factor would be unknown.

Q Well, if we could scroll up, Mr. Lunn -- or can we -- can we just for a second, see the under "Other" the number, say, the 2 million number, the fourth number down. Could you just put the cursor on there and click it. Up top you'll see. Dr. Korman, that you added the lines from up above.

DR. KORMAN: Yeah.

Q Okay. So now we can scroll up above and see what lines you added for the "Other", if we could. I suggest to you that you added those numbers at the top other than the "Environmental", "Fresh" and the "Fresh 'Silvers'".

DR. KORMAN: Yeah.

Q And so the other, the largest portion of "Other", as I could see it, in my analysis was under the "Old" category.

DR. KORMAN: Yes, it looks that way.

Q Now, old, the "Old" category, what was your understanding of it? Because fish farm fish don't die of old age.

DR. KORMAN: Yeah, I'm not -- I'm not super familiar with the exact detail of how they classify it as "Old" versus something else.

Q Well, let me suggest this to you, Dr. Korman. The term "Fresh Silver" is used for a fish that's recently died and is floating belly up.

DR. KORMAN: Correct.

Q The term "Old" is for a fish that's been dead a little longer and is no longer of diagnostic value. So it's floated to the bottom or it's starting to rot and it's not of -- it's not of histological use.
DR. KORMAN: Right. So you're arguing that the "Old" column should be -- would be in some functional sort of -- it would increase the maximum number of fish by some amount.
Q The only difference --
DR. KORMAN: Yes.
Q The only difference between old and fresh silver is when you collect them; isn't that right?
DR. KORMAN: Well, as I said, I'm not -- I'd have to go back and look at the details to see -- that makes sense to me, but I would like to see the documentation on that. I can't confirm that. But I take your word for it, if you've looked up the definition.
Q Yes. And so the old would die of exactly the same proportion of disease as the fresh silvers. There's no distinction in terms of their cause of death, is there?
DR. KORMAN: No, so what's the percentage difference here, if you add in -- you've likely done this, if you add in the old, does it change the numbers a lot?
Q It does.
DR. KORMAN: The percentagewise?
Q Yes. There's over five million fish in the "Old" category.
DR. KORMAN: Per year.
Q Oh, no, your total of that column is 5.2 million, I suggest to you.
DR. KORMAN: Right. But I think the numbers you're -- the numbers you're talking about in terms of the percent -- if you scroll to the left and look at the total number of fish on salmon farms.
Q Yeah, the total number of fresh silvers are 9 million. The total number of all, they're 5.- something million.
DR. KORMAN: So it would change that 2 percent number to --
Q Three and something.
DR. KORMAN: Yeah.
Q Okay.
DR. KORMAN: Okay.

Q What about poor performers? Do you know what that heading "Poor Performers" means?
DR. KORMAN: Yeah, I imagine fish that weren't thriving, that weren't growing well.
Q So presumably fish that were diseased, or possibly fish that were diseased.
DR. KORMAN: Or not, or their makeup is such that they're not feeding well on pellets. I mean, you'd actually have to -- would be another alternative. You'd have to really talk to the -- someone with real expertise in growing fish to determine why those poor performers are poor performers. But that's a possibility that they had disease, but...
Q Well, it's reasonably likely to expect the sick would be poor performers, isn't it.
DR. KORMAN: No, I could also assume that some fish, you know, don't jump for pellets, and therefore don't thrive in high-density conditions and it could have nothing to do with disease, actually. But that would be a -- it may be a combination of the two. Again, you'd have to ask a vet or someone who farms fish for a living to answer that.
Q So what I'm suggesting to you is that is -- that this assumption that you and Dr. Noakes made, the fresh silvers are the only fish that are dying from disease, it's a mistaken assumption, isn't it.
DR. KORMAN: Well, I think, like any assumption, it should be looked at and questioned and that's legitimate that you're doing that. I don't think it's fair to say that all old fish or all poor performers died of disease at all. But I do agree with your argument that the percentage could be larger than what's in the report. That's a possibility. There's also some of those fresh silvers that could have died due to other reasons due to disease, though, right?
Q Fair enough.
DR. KORMAN: So they're all estimates.
Q Yes. But you've -- your assumption and, Dr. Noakes, I believe, you said as much to an answer to Mr. Taylor on last week, that fresh silvers were the maximum theoretical number of fish to die from disease. That's wrong, isn't it.
DR. NOAKES: I don't recall saying it's the maximum.

He may have -- I remember counsel for Canada saying that, but I...
Q So if we add in those poor performers, or some percentage of them, and the old and the matures, the number of -- and add them to the fresh silvers, the number that are dead or possibly dead of disease doubles from 2 percent to 4 percent.
DR. KORMAN: Just glancing at this spreadsheet I could see that being possible. And then you'd have a set of assumptions in there with the caveat that all old fish and all poor performers are assumed to have died from disease, as are fresh silvers. So you'd have a number, 4 percent that was bigger with a set of -- one set of assumptions. We have a lower number with another set of assumptions. You know, is your number better than the number -- you know, it's higher, but I'm not actually sure it's more accurate.
Q Well, let's come back -- let's come to "Environmental", because that's the next major category. These -- and I should point out, these are all self-reported headings from the fish farms, right?
DR. KORMAN: Yes.
Q And so some veterinarian or manager at a fish -- at each fish farm files a report that he puts the mortalities in one or another of these categories.
DR. KORMAN: Correct.
Q And that may vary from farm to farm in terms of what category you put something in.
DR. KORMAN: Yeah, I mean, if you're -- yeah, there could be some biases potentially going in there, although they do have to answer to the audit to some extent in terms of -- in terms of their farm-level disease. If they have a lot of fish dying of really blatant disease and they are misleading in terms of how they're classifying their mortalities, then that may show up in terms of a discrepancy with an audit they're likely to get that year, or in --
Q Well, I'm not suggesting anybody's misleading.
DR. KORMAN: Okay.
Q What I'm suggesting is if you have a bunch of people putting something in a number of categories, there's a lot of subjectivity as to which category it gets put into.
DR. KORMAN: That, yes, that seems that way.

Q And on environmental causes, if you have, say, 5,000 fish that die on a farm with 500,000 fish of some sort of oxygen event or algae event, that would be something that would go into the "Environmental" category.
DR. KORMAN: That's right.
Q But what we've heard is that fish that are diseased are the most likely to succumb to that kind of matter, isn't it -- aren't they.
DR. KORMAN: Yes, in some -- in the wild, certainly, that situation occurs, so...
Q So when you have a -- when fish who are diseased die of an environmental cause, that's the category that it would be put under.
DR. KORMAN: That's -- a fraction of those fish could have been diseased, right, which would further increase your number.
Q And it could possibly increase it to 6 percent.
DR. KORMAN: Sure.
Q All right.
DR. KORMAN: I guess the value of this information to me it seems is in the temporal trend. So it's all -- so if you have this increased percent of mortality due to diseases, with your set of assumptions you're tripling the number. The issue isn't the absolute number, it seems to me, although that's certainly of interest, it's the temporal trend in that number compared to some of the trends in the survival rates of wild stocks. And so I guess I'd be more interested in how that changes, for example, if when you do this analysis, does it change the trend? And if it does, then that's -- that would, you know, be of more interest to me than a 2 percent versus a 6 percent number, I guess.
Q Yes. And you haven't done that trend using these other numbers because you only used fresh silvers.
DR. KORMAN: Yes.
Q Okay.
DR. KORMAN: And just so you understand the role of my reporting, my reporting was to provide a really -- to get the data together and provide -- not to totally get myself off the hook here, but just so you're clear on how we just set these reports up. Mine was to just summarize the data in a fairly coarse way, mainly provide the database, then let the main PIs, you know, Dill and Noakes, basically

come up with their particular analyses where they could use the same data in any way. So just so you may want to broaden -- I'm happy to answer your questions, but you may want to broaden that.
Q Oh, no, and I'm sorry if the tone suggests otherwise --
DR. KORMAN: No, no, not at all. But I'm just saying that --
Q -- I'm not being critical.
DR. KORMAN: -- that's how we sort of split this thing up, so...
Q Right. But people draw subjective judgments from these numbers.
DR. KORMAN: Yes.
Q That's why I'm -- it's important to me to be clear what you did and didn't do. So that if there's a subjective judgment that 2 percent is low or high, that number turns out to be inaccurate.
DR. KORMAN: Yeah, I wouldn't say -- like, it's a number based on a certain set of assumptions. Frankly, if I had a discussion with your client, and she was able to review this report, I would have been happy to put in sort of a range of numbers with the different assumptions associated with it. Unfortunately we didn't have that review process in place, but I'm not disagreeing, I guess, with your statement, there can be a low number or a number with one set of assumptions, a different number with another, set, and it would have been nice to have both of those in the report. So I agree with you. But I don't think the number you're providing is the only number.
Q No, but --
DR. KORMAN: It's a different number.
Q "Fresh Silvers" are the only category that's actually audited by the Ministry, isn't it.
DR. KORMAN: Yes.
Q Those are the only fish that are actually evaluated for disease.
DR. KORMAN: Yes, that's -- yes.
Q So these other fish in these other categories may or may not have disease and we just don't know.
DR. KORMAN: Right. But it just seems to -- yeah, and that's -- that's true what you've said. The issue is in their some odd, let's just say, 500 fish that they randomly sample a year, the incidence of disease in those is so low, I mean, as I cite it,

and so it brings into -- I guess you can argue that two ways, is as I suspect you will in a second, but the thing is if it's so low they're going to fish that would seem to have a lower likelihood of disease would only dilute that statistic, if you had a limited sample size.

Q Okay. Well, we'll come to the question of what diseases these fish had later, but the point is --

DR. KORMAN: Yeah.

Q -- you only dealt with fresh silvers, and in fact all those other, that "Other" category, potentially has as much disease in it as the fresh silvers did.

DR. KORMAN: Yeah. Sure.

Q And --

DR. KORMAN: Under some assumptions.

MR. McDADE: Now, Mr. Lunn, are you able to get Province document 16 from the regulatory panel 2, it's the supplement to the document that Mr. Blair put in a few minutes ago. It's a supplement to the Fish Health Report 2009.

MR. LUNN: Is this the same as your Tab 41?

MR. McDADE: No.

MR. LUNN: I don't believe I have documents for Province's regulatory panel 3 yet.

MR. McDADE: Well, let me come back to that, and perhaps if I have a minute or two after the break, I'll put the exhibit in then, because it describes how the fish are chosen by these categories, and I thought it would be useful.

Q But let me do this. This absolute number 2 percent, Dr. Noakes, in your report you seem to suggest that 2 percent was low. And that's a subject opinion, isn't it.

DR. NOAKES: Yes, 2 percent generally that would seem pretty low.

Q Well, 2 percent a year of disease or death, and we're not talking about disease, we're talking about death from disease potentially, if in a population that is regularly fed, that's protected from predators, that seems quite high to me. So 2 percent compared to what? Maybe that's the right question.

DR. NOAKES: Well, 2 percent compared to, say, a 3 percent mortality of wild fish per day.

Q Well, the 3 -- aren't we comparing apples and oranges there, because the wild fish die from

predation and looking for food, not from disease.
DR. NOAKES: Well, I mean, you just wanted to -- you just wanted a comparison, so...
Q Well, you're a respected scientist, and you're saying 2 percent is low. Do you have any basis for studies to suggest that that's the norm, or less than the norm or more than the norm?
DR. NOAKES: I haven't looked at other aquaculture or agriculture in terms of mortality. So, for instance, I don't know what the average mortality is on a chicken farm, for instance. Again, completely different system, but 2 percent to me seems to be low in terms of an annual mortality rate.
Q Well, let me suggest this to you. I looked up the Spanish flu on Wikipedia last night. Spanish flu killed 80 million people and that was 2.-something percent of the population. And that's considered one of the greatest epidemics in our history. That's a very extraordinary amount of death, isn't it, for a disease.
DR. NOAKES: That's true in terms of human populations. But I guess, I can't recall, did the Spanish flu run over -- was that a one-year event, or...
Q Well, the temporal aspect is also something to talk about. This is 2 percent mortality per year, right? So if you're talking about a fish that lives for four years, it's four times as much as that. it might be 8 percent over the course of their lifetime. Right?
DR. NOAKES: The 2 percent applies to, it's my understanding, this applies to fish that are -- that go into marine pens. So I don't think it's -- I think it's less than four years. I think it's about 18 months that the fish spend in their net pens, rather than four years.
Q Okay. Well, if it's -- if it's two years, let's call it 4 percent over two years. Right? That's what -- that's what you said was low.
DR. NOAKES: I said 2 percent was low.
Q Right. And if it's -- now that we've added up the numbers in a different way, and it may be 4 or 6 percent, you'd have to double that, wouldn't you.
DR. NOAKES: I mean, that's an upper limit. And as Josh is pointing out, I mean, the whole thing has to be ground-truthed in terms of your fish -- your fish disease checks. I mean there's independent

of what fish health events are mandatorily reported by the industry, there is an independent audit that's done by the Province. Now, again, they're only looking at fresh silvers, but the incidence of disease in there was quite low.

Q You're putting a lot in there on that, that the fresh silvers had no disease, in your view, but they're all dead fish, aren't they.

DR. NOAKES: I'm putting a lot of confidence in the people who are actually doing that monitoring in terms of being able to make the proper diagnosis, because they're the experts.

Q Well, I just wanted though, I want to get the grounding for your comment in your report that 2 percent mortality per year was low. And let me suggest this to you. If in fact the expected mortality on a healthy fish farm is less than 1 percent, would that change your opinion about whether 2 percent was low?

DR. NOAKES: Well, I need to know where the expected mortality of 1 percent came from, how that calculation was done.

Q Well, that's just a hypothetical.

DR. NOAKES: Well, I mean --

Q You were the one who said 2 percent was low.

DR. NOAKES: Yeah, and that's -- I mean, that's my opinion, 2 percent is low, and again it's based on looking at, say -- and again most of my experience has been with wild salmon and other marine populations. And when you look at the natural mortality there, it's about 3 percent per day. So relative terms, 2 percent per year is a pretty low mortality rate.

MR. McDADE: Well, I'm going to have to find this document. Mr. Lunn, the Ringtail number I have for it is BCP000334. Will that help you?

MR. LUNN: Can you tell me the tab number one more time, please, from the --

MR. McDADE: 16, the Province's documents. It's entitled "Supplement to the Fish Health Report 2009".

MR. MARTLAND: And is that the, just by assistance, Province's list of documents for the second regulatory panel; is that right?

MR. McDADE: I think so. That's the note I have.

MR. MARTLAND: Thank you.

MR. McDADE: So let me move on and we'll come back to

that when the document is available.
Q Now, Dr. Korman, you didn't measure how many fish were sick in fish farms, no way to do that.
DR. KORMAN: Right. Correct.
Q But it would be a -- Dr. Noakes, I take it you'd agree, that when for most fish diseases there's fewer fish that die than fish that get infected and fish that get sick.
DR. NOAKES: Certainly there are fish that have disease that die of other causes.
Q Well, in the Spanish flu example that I gave you, 2 percent died, 28 percent were infected. That's a fairly standard split in disease, wouldn't it be?
DR. NOAKES: I don't know what the standard is, but there are certainly fish that contract a disease and survive it, and there is a fraction that dies, as well. And that probably varies by disease. I'm not an expert in fish health, and I would defer to Dr. Marty or some of the other veterinarians.
Q Well, Dr. Dill, can you add anything to that? When you have a disease, more fish are sick than die?
DR. DILL: That would be correct.
Q And does that 28 percent and 2 percent number resonate at all?
DR. DILL: No, I don't know of those details.
Q Okay. But for some diseases, chronic fish diseases, very few die when a lot of fish have that sickness, don't they, Dr. Noakes?
DR. NOAKES: There are a number of diseases in terms of looking at mortality and what I relied on, and I think the others relied on, in all four reports, was the evaluation by Dr. Kent in terms of what he went through a number of diseases and listed what the likelihood was of mortality. And he listed four as high risk, and then he had some medium risk and some low risk, and he went through the various categories whether it was a viral, bacterial or parasitic type. So, yeah, there's all sorts, there's a whole range there, and as I said, I relied on the reports from those experts.
Q But if when you said 2 percent was low, if in fact 30 percent of the fish were sick or had the pathogen and were shedding pathogens, that would be high, wouldn't it.

DR. NOAKES: All I can go on is in terms of what the data tells me, and the data, as I say, that we had available was the fish health diagnostics from the reports from the B.C. Salmon Farmers and from the provincial audits, and that's all I have to go on.
Q So will you at least admit to me that your statement in your report that 2 percent is low is a completely subjective opinion without substantiation?
DR. NOAKES: It's certainly my opinion, and I wouldn't say it was without substantiation, in the sense that I'm relaying that 2 percent on my own experience in terms of dealing with other kinds of fish populations, and in particular in terms of what the natural mortality would be on say wild salmon in the ocean, which is about 3 percent per day when they're in juveniles.
Q And would you say 4 percent was low?
DR. NOAKES: I mean, I'm not going to set an upper limit. All I'm going to say is that these are the data that I had, and based on the information that I had, I had 2 percent and my judgment on that is again based on my experience, was that 2 percent in my opinion was a low number. And I admit that that's my opinion and others may have their opinion. You might ask the other panel members, for instance, if they think 2 percent is low.
Q No, what I'm asking you, Dr. Noakes, is whether you changed your opinion in any way now that the evidence has come out that it might have been as high as 4 percent.
DR. NOAKES: No, I haven't changed my opinion, and again --
Q No, of course not.
DR. NOAKES: -- it's based on the data and based on my own experience.
DR. KORMAN: So just to comment, I mean, I agree with your -- one of your premises of your argument is that the level of disease as far as risk to wild fish could be higher than what these percentage are because there could be a bunch of fish, for one thing, that didn't die that have the -- that have the pathogen, right, and therefore the risk to wild fish is greater than what these numbers suggest. So that that argument is sound, but it's -- it's based on a series of assumptions that are no better than the assumptions in here, but it's a

possible argument and it shouldn't be discounted. And I think Dr. Dill does a good job in his report of describing that, so no argument there.

The only caveat I'd say is that we have these farm-level diagnoses that are done during the audit and by the salmon farmers, okay, and they actually include fish that aren't dead, right? They're just fish that are diseased and showing signs of a pathogen. They show signs of disease and they're treated. And so if there was a whole bunch of disease that wasn't resulting in mortality, then it would show up as many farm-level disease events, which, you know, in Dr. Noakes' reports, once he splits those out by area, we don't see a lot of those farm-level disease events, you know, in the Inside Passage. So that's -- that's the only caveat to indicate on your remarks.

Q But we don't audit for sickness, we audit for death.

DR. KORMAN: Yeah, that's a limitation.

Q And that's not true in chicken farms, that's not true in cattle farms, is it.

DR. KORMAN: Yea, I don't know, but --

Q Okay.

DR. KORMAN: -- I'll take your word for it.

Q All right. Let's go to then the next point that I'd like to make. And that is the way in which you organized your database, Dr. Korman, and the assumptions you made around the cause of death. In order to determine -- let me just as a follow-up to the last point, though, say in order to determine how many fish were sick, when you were looking at dead fish, the fresh silvers, one would want to look at what symptoms they had, wouldn't you.

DR. KORMAN: Yes.

Q And so you might see a fish dying of one cause, but had a disease or symptom of another disease, as well, right?

DR. KORMAN: Well, if, again, there's no data, right? You know that. So it's all pretty theoretical, isn't it?

Q Okay.

DR. KORMAN: And in a perfect world, if we had information on every individual fish, then we could do that analysis. But, of course, this is

the real world and we don't have that kind of information.
Q All right. Well, can we go to 2864, that's the large disease database, Mr. Lunn, 1549, I think it is. And the Excel spreadsheet, which is 2864. No, that's not the one.
MR. LUNN: I understand, I thought you were asking for Exhibit 1549.
MR. McDADE:
Q Yes. All right. Now, if I can just understand -- I'll tell you what I think this document is, and you tell me if I'm wrong. I think this document is a list of all the fish that were audited by BCMAL, lumped together by farm, and then in this tab is the Atlantics are put together and then there's another tab for the Pacifics, and another for the sablefish. And if you scroll across, Mr. Lunn, and if we can scroll to the right and just a little further. If we stop there. This is all of these columns in this heading are -- in this particular selection for the liver, and then the various -- and they're all lumped by various symptoms.
DR. KORMAN: Correct. My understanding is this is Dr. Marty's results from his histopathological analysis of those randomly selected fresh silvers.
Q And so --
DR. KORMAN: And they may include other fish, as well.
Q And then if we kept scrolling, we'd find another group for kidney and another group for heart and that sort of stuff. So if there's an entry in these columns, that's a sign that Dr. Marty's found one of these symptoms, as shown in that column?
DR. KORMAN: Yes.
Q Now, you didn't do -- you didn't count up the symptoms you found, you just counted up the final diagnosis, right?
DR. KORMAN: Yes. And would you like the rationale for that, or...
Q Well, let's -- no, let's just --
DR. KORMAN: Keep going?
Q Let's just keep going, and perhaps I'll ask you about that. I think what I want to do is just understand what this sheet shows. So if we could go to the "Abbreviations" tab, Mr. Lunn. Now, this is a longer list of symptoms as shown in

those sheets, and a description of what they are, right?
DR. KORMAN: Yeah, I believe this is Dr. Marty's -- we discussed this. This is kind of his unique classification system that he's in the process of publishing or has published.
Q All right. So let's go back to Tab 1 and let's scroll down. If we can go back to the left-hand side. So first of all, let's take the first six fish, and there's a line underneath that. My understanding is that would be the six fish that were taken from that particular audit, right? Those would all be from the same farm.
DR. KORMAN: You know, if you -- you see, those are six different -- yeah, those are six different slides. I'm not sure if they're -- I'm not sure if they're from the same fish, but it probably doesn't matter if we're --
Q Well, I think we heard that there was 496 audits, and on this sheet I think there's 2,259 fish, and on the Pacific sheet there's another 400 and something.
DR. KORMAN: Right. So that would include -- of course, this is a multi-year sheet.
Q Right.
DR. KORMAN: Right. Okay. So you're saying, yeah, it's about -- it's about 600 a year, or 500 a year, right.
Q Right.
DR. KORMAN: Yes.
Q So there's about 500 over a five-year period, and in your other spreadsheet you show about 800 -- 794 over an eight-year period. So that's about 100 a year of actual audits.
DR. KORMAN: There's 100 to 120 farms audited a year.
Q Right.
DR. KORMAN: At each one of those audits there are, you know, what is it, five to eight fresh silvers taken and analyzed.
Q Well, if I divided the number of fish that were analyzed, from the audits by the number of audits.
DR. KORMAN: Right.
Q If we took 2,600 fish divided by 500 audits, we get an average of about 5.5 fish per audit.
DR. KORMAN: Okay.
Q Right. And so that's -- as you go out to a farm which has half a million fish, and you take five.

DR. KORMAN: That's right.
Q And then these are the results from Dr. Marty's analysis of those five.
DR. KORMAN: Right.
Q And if we can look at the column "I", that's "Most significant Lesion" and there Dr. Marty has listed the abbreviation that relates to each of these lesions, right?
DR. KORMAN: Yes.
Q And then in column "J", he lists his diagnosis as terms of "Cause of Death". Right? So let's just scroll down a bit and look at the fact of the lesions and the cause of death. Let's take -- go to line 53. So if we just highlight line 53, what we see there is that's a 2006 audit of an Atlantic salmon farm in Area 2.3, and so -- and there's a lesion that's identified as VHSV, that would be a disease, right?
DR. KORMAN: Probably referring to VHS, we could probably go -- and RTN would be -- we should actually look at those, because those might be two different diseases. So what he might be identifying here is two potential -- two potential causes, I'm not...
Q And do you know what -- and how did you determine what diagnosis you were going to apply to your spreadsheet?
DR. KORMAN: Right, exactly, that's a great question. So what you've got is a vet who is determining the farm-level diagnoses, just like your doctor does. You're going to send in a biopsy sample, and the pathologist is going to look at those results. But you may also get a CT-scan, you may also get some blood work done, and then the doctor's going to look at those three bits of data and he's going to make a diagnosis. So that's what a doctor of veterinary medicine does, which I am certainly not.

So what I did was I relied on the vet's diagnosis for the farm, and not on these individual histopathological results, because those are only one element of his diagnosis. And I think it would be equivalent to, let's say, going into an elementary school, seeing a bunch of kids with runny noses, and that symptom may be consistent with swine flu, but they don't all have swine flu. And I'm not in a position to judge

that. So I just went on what the doctor said.
Q Fair enough. I understand that, and that's what I thought you were doing. But can we scroll up a little, Mr. Lunn. Let's look at line 53, fish 34. Now, there the most significant lesion is KRS, and we'll -- but the diagnosis is "none". Now --
DR. KORMAN: What does KRS stand for, sorry?
Q KRS, if we --
DR. KORMAN: On the other sheet.
Q Can we go to the abbreviation sheet.
DR. KORMAN: Not that I'll be able to help you much with this, because it's just -- I'll have to --
Q I think what that is is kidney with -- I can't pronounce.
DR. KORMAN: *Renibacterium*, so is that --
Q Yeah, it's BKD.
DR. KORMAN: -- BKD.
Q BKD. So what we have -- we can go back to that fish. What we have is a lesion related to BKD, but no diagnosis. Right?
DR. KORMAN: Okay. So you're -- well, we have to go back and trace that audit sample back to the farm-level diagnosis for -- of that was made by the vet and there's a -- to see that if he classified that as a farm-level disease event.
Q Sorry. These, I understand are the audits. These are not the ones that the farm sent in.
DR. KORMAN: Right. But the audit consists of multiple bits of information. Histopathology, PCR, bacteria, as well as an examination of conditions of the fish during the audit, and all those go the vet to make a diagnosis. I summarized the diagnosis. And so the fact that you've got *Renibacterium* there, I mean, if that's the case, we should go to the diagnosis sheet and confirm that it's a -- that that farm was given a BKD classification. It may not have been. That's -- I haven't, basically I've trusted the vets in my analysis and assume that they've interpreted all these bits of information correctly and not, you know, so that's my assumption. I haven't gone, like, one-to-one records like we're doing now to see if it's lined up.
Q So your analysis, your numbers are only as good as the vet's diagnosis.
DR. KORMAN: That work for the Province. So Mark Sheppard, and there's another vet there, and --

Q So if a fish had symptoms of a disease --
DR. KORMAN: Right.
Q But in the vet's opinion it isn't sufficient to diagnose it as a particular disease, you've counted it as nothing.
DR. KORMAN: That's correct.
Q Even though it's quite clear that fish had the symptoms of at least some symptoms of a potential disease.
DR. KORMAN: Yes. But I can't -- what I can't speak to is what fraction of cases - what you would really like to know and it's a legitimate question - is what fraction of cases do we see disease in a fish but the farm wasn't diagnosed as having that disease. The only cases, you know, and I haven't gone on a case-by-case basis, I'm not -- you would probably want a vet to do this type of, you know, re-analysis to see if their diagnosis is fair. The cases that I have seen are cases where the tests like these have shown negative results, at least on the PCR testing, and yet they've given the farm a disease event. So I've seen it go the other way, but I can't really speak to the histopathological results that we're looking at here.
Q Well, let's -- we are running short of time, but let's just scroll across on line 53, just to see how many symptoms of disease this has. So keep scrolling, Mr. Lunn. So if we go to column "AF", there's a "2" there. That's a more severe lesion, as I understand it.
DR. KORMAN: Okay.
Q Can we scroll up to see what column "AF" is? Column "AF" --
DR. KORMAN: SSC.
Q -- is SSC, sinusoidal congestion, I believe that is. Can we go to the abbreviation and see what that is. Can we go to the abbreviations. So if we scroll down on "SSC" on the right, and then click on the description there, if you double click that, we'll be able to read it, I think.
DR. KORMAN: Yes, just keep scrolling along so we can see.
Q I think you have to double-click it, Mr. Lunn.
MR. LUNN: I tried.
MR. McDADE: Okay.
MR. LUNN: I'm sorry, I'm not sure what's going on with

the spreadsheet, but I'm doing the best I can.
MR. McDADE:
Q All right. It's a potential, according to this, it's a potential -- it says indicator, a potential indicator for VHS, or if one goes further --
DR. KORMAN: Just move your -- oh.
Q Oh, can we -- it says [as read]:

Potentially classic lesions of ISA.

Right? Now, I accept that doesn't mean it has ISA, but it has a symptom of ISA. And there's sufficient symptom that the vet would send this for a PCR test.
DR. KORMAN: Right. Of which it would have tested negative.
Q Right. But it wasn't a healthy fish. It had sinusoidal congestion.
DR. KORMAN: Yeah, and --
Q And it was dead.
DR. KORMAN: Yeah.
Q So that isn't a fish that you would say was a healthy fish.
DR. KORMAN: No, that individual fish was not healthy. But we weren't summarizing the status of individual fish. We were looking at farm-level disease events.
Q All right.
DR. KORMAN: But, you know, this fish was not healthy. What disease it has, ask a vet (indiscernible - overlapping speakers).
Q So can we go back to Tab 1, and again back to line 53 and scroll over some more. Let's see what else this fish had. There's under "AM" could we scroll up and see what "AM" is. "AM" is [as read]:

LRS - Liver *Renibacterium salmoninarum*.

All right. Can we go further down and scroll again some more over into the kidney. Under "AT" we see -- "AS" and "AT", let's scroll up and see what they are.
Oh. I'll pass on the "AS", that's a -- I don't think that's an indication of a disease.
But ISH is [as read]:

Interstitial (hematopoietic) cell

hyperplasia.

That's a sign of marine anaemia, that's one of the first diagnostics that Dr. Kent told us about, right? So that's a sign it could be marine anaemia.

DR. KORMAN: So let's just get the list straight. So BKD, ISA and IHS (sic), is that...

Q Right. And so if we could go further down -- we have to go back and see where we're at. Under "AY" and "AZ" there are indications. Let's go up. And "AY" is [as read]:

HEM - Interstitial haemorrhage/congestion.

That's a sign of disease, as well, isn't it.

DR. KORMAN: I guess so, which it says --

Q It's not a healthy fish.

DR. KORMAN: No, you convinced me of that a long time ago.

MR. MARTLAND: Mr. Commissioner, this isn't an objection, necessarily, to the questions. I just do want to highlight, I think that sort of an answer reveals the fact that these may be questions that perhaps above and beyond what this witness is in a position to say. I think some of his answers are deferential to veterinarians, generally speaking. In some cases he's not in a position to, I'd suggest to you, to give you evidence with respect to whether something is or is not a disease.

MR. McDADE: Well, fair enough. But I'll get to my question about what he did with this information. I recognize this is long, but I think this is important to understand.

Q Can we go to the abbreviations for HEM. Can you read that one. Sorry, I can't read it when the cursor's on it, Mr. Lunn, although we lose it when the cursor's off [as read]:

HEM is probably an endothelial damage. HEM is often associated with VHSV and bacterial infections, and renal congestion and haemorrhage is one of the classic signs of infectious salmon anaemia, but ISA have never been diagnosed from fish in B.C.

So can we at least agree on this. It's a sign of disease, even though it doesn't prove it.

DR. KORMAN: Oh, yeah, no disagreement.

Q So let's go back to Tab 1. So that fish, if we can scroll back to the left again, that fish has what Dr. Marty says, the most significant lesion is the kidneys, *Renibacterium salmoninarum*, but he makes no diagnosis of a particular disease. Now, I suggest to you that's because either it could be one or more diseases, or he's not sure which one it is. It isn't an indication that the fish is fine.

DR. KORMAN: Absolutely. The fish is not fine.

Q Right.

DR. KORMAN: The fish was actually dead, so we knew that by just the fact that it's in the spreadsheet it wasn't fine, it was dead in the first place, right, and obviously this shows that the fish has disease. But just like your doctor would not say, oh, I've got the pathology results, you know, he would look at all the information before he made a diagnosis. And that's why these are just suggested diagnoses by the pathologist, and it's waiting for the vet to look at all the rest of the information to make a...

I think the real heart of the debate is farm-level diagnoses, which is what we focused our analyses on, or my summary, and the health of individual fish, which is kind of where your question is lying. And they're just different things. So I don't think we're really -- I don't really see the argument, you know. It's an apples-to-oranges type of argument.

Q Well, okay. I'm not disagreeing with you at this point. Can we scroll over and just look, though, scroll over a bit back to, say, line "AT" or so, Mr. Lunn. Just scroll to the right, please, just randomly, really. All right. So just stop there. When I look at every line of this spreadsheet of 2,259 fish, almost every fish has one or more lesions, in most case two or three, and it's a question of which is the most significant. There are no healthy fish in this spreadsheet; isn't that fair to say?

DR. KORMAN: I'm not a vet. But I would suggest that you could take -- however you define healthy fish, you open one of us up, you may see a little

cirrhosis in our liver, right? But we're still kicking around, doing, you know -- so for all I know, and I'm not a vet, if you open up a perfectly healthy fish, you're going to get some scores like this. I mean again, ask a vet, but I'm not sure these fish are unhealthy. In other words, they may not show any signs of disease, if that's how we're defining health, but yet they may have some histopathological conditions.

Q Now, the trouble I had with what I thought your testimony and Dr. Noakes's testimony was on Friday and Thursday was I think you said the vast majority of these fish that are audited are healthy. I think you said that. That's wrong, isn't it.

DR. KORMAN: What is the vast -- the vast majority of audits have no diagnoses of disease at a farm level, nor do the individual fish that are sampled score positive in any of the PCR or bacteriological testing. I can't define -- this, to me, the fact that there's some scores there doesn't tell me these fish are unhealthy. It's showing me that they've got some lesions on some of their organs, and I can't determine whether or not that means they're unhealthy. I mean, the vets certainly didn't call them that.

Q Well, no, no, the vet just wasn't able to come to a diagnosis. The vet found many, many signs of disease.

DR. KORMAN: Okay. Well, I would have to defer you to Sheppard and Marty this week.

Q All right. But for your purposes, you treated a "none" diagnosis as if it was a healthy fish didn't you.

DR. KORMAN: Yes.

Q And Dr. Noakes, did you do --

DR. KORMAN: A healthy farm -- healthy farm. I never even dealt with fish, but, okay.

Q Dr. Noakes, did you do the same thing?

DR. NOAKES: No I didn't treat it as a -- I didn't treat it as a healthy fish. I mean, what I looked at was the diseases, that the diagnostics that came out of that. I mean, Dr. Korman's right in the sense that there are many bacteria that you're going to -- I mean, if you checked one of our bodies, I'm sure you'd find lots of things. So there are many pathogens you're going to find in

these fish, but again if you go back to probably, I'm sure you heard Dr. Kent and others say the presence of a pathogen doesn't necessarily mean that there's a disease.

So I treated these fish, I mean, I looked at the data, and when I was looking at it was what fish died and what did they have in terms of diagnostics. And again I have to defer to the fish health professionals and the veterinarians for those diagnostics. As I say, there's -- as Josh was saying, there's lots of these pieces of information that come together in making that diagnostic.

Q So let's just go to the left again and look at that fish at line 53. So this fish had haemorrhaging, it had interstitial hyperplasia, which is a sign of leukemia, and the diagnosis was "none", and simply because the veterinarian was not able to come to a firm diagnosis, you wouldn't -- you wouldn't say that fish was healthy, would you, Dr. Noakes?

DR. NOAKES: Well, as Dr. Korman pointed out, all of these fish are dead, so I mean it could be an infection that came after the fish died. We have no idea. As I say, the column there just says "Cause of death". And as I say, I have to defer to the fish health professionals in saying what caused that fish to die, and not rely on just what pathogens are there. Because, as I say, the presence of a pathogen, my understanding from a fish health professional does not necessarily mean that fish is diseased.

Q Can we go down to line 131. There in column "I", I suggest to you is the first "none" that we see, in other words, this fish has no signs of disease, right? And so there's no diagnosis. Dr. Korman, I've sorted that column "I", and I'll suggest to you that there are six fish that have "none". And all the rest have a significant lesion of some type, and in most cases more than two or three; is that right?

DR. KORMAN: I haven't done that, but I'll take your word for it. And as I said, you're asking the wrong guy. Whether that means that any of these fish are showing any signs of external disease is a vet's call, and they're coming in a couple of days, so...

Q Fair enough. Fair enough. But let me point out that if one sorts column "J", the "none" diagnosis is there 1,304 times out of 2,259 fish, 58 percent of the time.
DR. KORMAN: Right. But what you're not looking at is the PCR results and the bacterial results so they'll take that material and they'll say, okay, well, it's got lesions and such that are consistent. Now, so let's send this off to culture to see if we get BKD out of this thing, and let's send it off for some PCR to look for VHS through the --
Q Fair enough.
DR. KORMAN: -- and then they take that information and then on a different spreadsheet the diagnosis is made. So it's just that you're -- it's just that his job is not to make a diagnosis because the pathologist doesn't have all that information. That's my understanding, so, you know.
Q So we will, we'll ask the veterinarian. But if you have an unknown disease, Dr. Korman, a new disease, then you're not going to have an entry for it on that sheet, are you?
DR. KORMAN: Yeah, I don't know how Dr. Marty handles that.
Q All right. Well --
DR. KORMAN: But he -- but I --
Q If 58 percent of the fish that are audited have signs of disease but don't have a diagnosis, that doesn't mean they're healthy, does it?
DR. KORMAN: Well, your statement that they don't have a diagnosis is just plain inaccurate, so I can't agree with it, because the diagnosis will be done with the vet when he gets the other information. They don't have a diagnosis in this histopathology sheet, that does not mean they won't be diagnosed.
MR. McDADE: Well, in -- can we go to spreadsheet 2850.
MR. MARTLAND: Mr. Commissioner, I just note that we would often break at about this juncture. I have about five minutes remaining in Mr. McDade's time, although he may be seeking contributions, if you will, over the break. I wonder if I could suggest we take perhaps a ten-minute break, if that's agreeable, or a 15-minute break.
THE COMMISSIONER: Thank you.
MR. MARTLAND: Thank you.
THE REGISTRAR: The hearing will now recess for 15

minutes.

(PROCEEDINGS ADJOURNED FOR MORNING RECESS)
(PROCEEDINGS RECONVENED)

THE REGISTRAR: The hearing is now resumed.
MR. MARTLAND: Mr. Commissioner, Mr. McDade has up to 45 minutes. He's received contributions from colleagues for which I thank them.
MR. McDADE: Up on the screen, Mr. Commissioner, is the document that I was searching for earlier in the examination.

CROSS-EXAMINATION BY MR. McDADE, continuing:

Q You see that, Dr. Korman? That's a supplement to the fish health report from the province.
MR. McDADE: Can we have that marked as the next exhibit?
MR. REGISTRAR: Exhibit 1564.

EXHIBIT 1564: Supplemental Appendices to the Annual Report - Fish Health Program

MR. McDADE:
Q And if you would look, Dr. Noakes, down to the bottom of the page, under "Silvers", you see the statement from the Province that:

> In a healthy robust population, silvers should generally represent less than 1 percent of the dead group.

Do you see that?
DR. NOAKES: Yes, I do see that.
Q All right. So there's some benchmark for you that you'd agree with me that the diseases that you saw in the global population that you looked at, which averaged 2 percent of fresh silvers and perhaps 4 percent in total was double or quadruple what should be present in a normal population?
DR. NOAKES: I think the 2 percent referred to the fresh silvers. And what I was looking at was the disease which were either from the reported fish events or the audits.
Q Okay. Let's move back into 2850, Dr. Korman.
MR. McDADE: This is one of the documents on Exhibit

1549, Mr. Commissioner. And we'll figure out its number later. Can we have BCP2850 on the screen? It's another Excel spreadsheet with numerous tabs at the bottom.

Q Dr. Korman you recognize this, right?

DR. KORMAN: Yes.

Q And this was part of the material that you put into your spreadsheet, which is Exhibit 1544?

DR. KORMAN: Yes.

Q What's your understanding of this spreadsheet? What's it include?

DR. KORMAN: That tab we were looking at before was the farm level diagnoses. Yeah, this is the BCMAL audit and information and this is the farm level diagnoses sheet that I've been talking to just before the break.

Q So the distinction between the two is that the last spreadsheet we looked at was the individual fish. This is farm level diagnosis based on the audit?

DR. KORMAN: Correct. So this is where we would go. And once we saw that BKD and IHN and they didn't make a diagnosis because they couldn't sort out, for example, in one of your examples, which of the three it was so it said "diagnosis none", you should be able to cross-reference that here and see what the actual vet finally decided. That's my understanding of how that would work.

Q And so as I understand it, there might be six fish that were audited. Two would show one disease, one would show another and so this is where we'd look to, to find whether the vet was diagnosing one global disease or not?

DR. KORMAN: That's my understanding, yes.

Q And that would be in Column F?

DR. KORMAN: Yes.

MR. McDADE: And if we could just highlight that a bit, Mr. Lunn?

Q So as we go down that sheet, we see BKD, IHN, rickettsiosis, BDK, IHN, IHN. Then we see "open". And now what I understand "open" means is that the diagnosis is undetermined yet.

DR. KORMAN: Right. I assumed it was like the file is still opened.

Q Right. Those of who watch detective shows on TV would understand that this is a cold case.

DR. KORMAN: If it's 2002 and it's still open, yeah.

Q So to use the criminal law analogy, we might have somebody lying on the floor with bullet holes through his chest but because we haven't identified who their murderer is, we have an open case?
DR. KORMAN: Correct.
Q Right. So this is not a diagnosis of no disease; it's a diagnosis of that it's open and uncertain yet, right?
DR. KORMAN: Correct.
Q And now, as I scroll through there, if we could scroll a little further, we see cardiomyopathy, IHN, BKD, Loma, septicaemia. We see quite a bit of opens.
DR. KORMAN: Yes. In Figure 6 of my report on page 20, it'll actually plot the percentage of opens. But just ball-parking that figure, you know, it's at least 50 percent.
Q Well, let me tell you, I've counted them and there's 347 out of 485 and that would be 60 percent.
DR. KORMAN: Okay. I was just ball-parking it off the graph.
MR. McDADE: There are, though, if we could keep strolling down, Mr. Lunn. Further. Just go back a bit. There is one that's an algal bloom. And then keep scrolling down. I'm not sure if that appears again. There's a marine anemia at line 155. Scroll down some more. I don't see any diagnoses of no significant finding. I thought there were a couple. Let's go to your spreadsheet, Exhibit 1544. And if we could go to under the "BCMAL Audit Data Summary" which is --
DR. KORMAN: Yes, scroll to the right.
MR. McDADE: -- a few more tabs to the right. No, sorry, on the bottom there, yes. Second-last tab, I think there. Yes.
DR. KORMAN: Yes.
MR. McDADE:
Q All right. So there you've summarized I think there's 795. No, just a second.
MR. McDADE: Oh, sorry, if we could go back to the BCMAL Audit DX tab? Yes.
Q So under Column G, you've summarized all of these. It includes what we saw at 2850 plus some other audits, right?
DR. KORMAN: Yeah, a couple other years. It was in two

separate files. I've just combined them into this one sheet here.
Q Because you have some 805, I think, that you've shown there?
DR. KORMAN: Yeah, there was two groups of years in individual files.
Q And again, the open diagnoses are still 60 percent or higher.
MR. McDADE: And if we could go back to the BCMAL Audit tab and scroll to the left. Yes. Now, Mr. Lunn, I understand there's a chart in the middle of that table. The chart will move if you click on it or drag it so that we can read the underlying table. Yes, thank you.
Q So under that table, you list all the findings that were made and there's 794 of them.
DR. KORMAN: Correct.
Q And 495 are open?
DR. KORMAN: Yes.
Q And just above the open are no significant findings. That was an available diagnosis. And there were how many?
DR. KORMAN: Two.
Q Two. The others were, therefore, presumably significant.
DR. KORMAN: Okay. Again, you know, this is all vet questions.
Q Yes, all right.
DR. KORMAN: But that makes sense, logic-wise.
Q So measuring just the four diseases that were actually diagnosed that were identified by Dr. Kent doesn't tell us an awful lot about how much disease there was in the farms, does it?
DR. KORMAN: If you're referring to my report, I reported on more than just four high-level, high-risk diseases. For example, in Figure 6 on page 20, go into all the others, including VHS, Loma, ricketts, so it would be inaccurate to say that I only reported on high-risk diseases.
Q Now, Dr. Korman, you've heard that this Commission has heard about a potentially new or unknown disease being present in the sockeye?
DR. KORMAN: Yes.
Q You didn't measure for that?
DR. KORMAN: No, the difficulty, and I think Dr. Dill does a nice job in his report in pointing out is there's a whole bunch of things that could be that

we don't have diagnostics for yet. And therefore, of course, the salmon farmers or the Province wouldn't be able to measure things that they don't even know exist yet or certainly don't have the techniques to measure them yet. So it would be unreasonable to expect them to be able to do that. But I do concede the point, or not concede it, but I do agree with the point that there could be all sorts of diseases these fish have that we haven't identified yet.

Q So wouldn't it make sense, or isn't it a reasonable proposition that one could look at charting the symptoms of a particular disease?

DR. KORMAN: I'm not qualified to say how reasonable it is because like I say when we were looking at all those histopathological results, I don't know how many of those a normal fish with no disease would have presence so I just can't say whether that's reasonable or not.

Q And because you didn't know, you didn't do it?

DR. KORMAN: No. Yeah, I relied completely on the vet's analysis and I think what you're asking, and it's a fair question is, should we be auditing the BCMAL system? Do we trust those vets and their diagnoses? Or you know, if the Commission wanted to check that, then they would have needed to hire an independent vet to go through and see what they've done is reasonable. That's not what I was hired to do so I'm not qualified to do that so, therefore, I just trusted the vets and took their diagnosis and took it at face value. But I'm not saying that there's no merit any of your arguments or anything like that.

Q No, and you may be missing my point. This is not a question about the competence of the vet or not. This is the fact that 60 percent of the diagnoses are open. And we have an unknown disease or potentially an unknown disease. And if there was a rise in one or more symptoms over time, that would be something that would be statistically valuable to know?

DR. KORMAN: Sure, yeah.

MR. McDADE: And so if we could go back to 2864? So Mr. Lunn, if you could scroll across a bit to the ISH tab, Column AT?

Q So let me say, as I understand this, Dr. Korman, if you scroll down that column, you see a lot of

zeros and some ones. You see? And I suggest to you that there are about 180 fish that have an indication of a one or a two or a three in that column. And on the left side you have dates, years, when those appear. So it would be a reasonable arithmetical exercise simply to count the number of ISH symptoms by year, isn't it?

DR. KORMAN: One could do that.

MR. McDADE: Yes. And similarly, one could go to the SSC column and count those. Let's just go, for interest sake, to the Pacific tab, and go over to Column AT. Now, can you scroll down there? Thank you, Mr. Lunn. Just scroll down there slowly. Now, let's just stop for a second.

Q Do you see the difference in those two columns? Let me suggest to you there's a lot more entries and a lot more threes and twos under this Pacific tab. And even on a visual to a layperson, it looks like it would be highly statistically significant, right?

DR. KORMAN: Yes. I don't know what exactly we're measuring here but let's just say for argument's sake that there's a difference between Pacific and Atlantics with respect to that column. The issue is what does that column represent, right? Because it could be a --

Q Well, right. But if one was just doing statistics, one sees there's a very distinct difference between the Atlantics and the Pacifics on ISH.

DR. KORMAN: Okay.

MR. McDADE: All right. Now, if we could have Exhibit QQ up on the screen? Now, if we could focus in on the numbers at the bottom?

Q Again, if one took that Column ISH (sic) and excluded all of the Area 2 salmon from it, one could count just the number of times these appear by year in salmon that were along the Fraser salmon migration route, right?

DR. KORMAN: Yes.

Q And if I suggest to you that that's what this table does and that it takes it straight off of your spreadsheet, that's a reasonable exercise, isn't it?

DR. KORMAN: Well, I guess it depends how you're -- if you're just simply reporting on what was in the spreadsheet, it's reasonable. If you're making

some inference about a diagnosis then I don't know if it's reasonable anymore because I would feel more comfortable that a vet was looking at all the information. But certainly you can add the numbers up but how you interpret that is another story.

Q And I agree with you on that. But if we don't call these particular diseases but we call them symptoms or we call them by the name of the columns, that would be a relevant exercise?

DR. KORMAN: Yeah.

MR. McDADE: Could we just scroll up to the actual chart itself?

Q Now, that's a graph prepared straight from those numbers that come straight out of your sheet. Do any of you see anything of significance here?

DR. KORMAN: Well, it looks a little higher in 2007, I suppose, for the ISA-like lesions and whatever that is, marine anemia symptoms. Is that what you're wanting me to say?

Q Well, you're the expert on stats.

DR. KORMAN: Well, I'm just reading the graph that you prepared. As I said, I mean I hate to keep repeating myself but I've got to defer to the vet's diagnosis.

Q All right.

MR. TAYLOR: Mr. Commissioner --

DR. KORMAN: I think this is a great line of questioning but I just wish you could direct it at the vets and not me and not -- I just think it's just not productive because I just can't give you the answers you're looking for because I don't have the qualifications.

MR. TAYLOR: Mr. Commissioner, I've risen. Mr. McDade put to the witness just now, "You're the expert." The witness has repeatedly said he's not the expert on this and said that just again. And I think it's unfair to the witness for Mr. McDade to keep putting to him matters that call for veterinary expertise and the witness to keep having to say, "I'm not a veterinarian."

MR. McDADE: I'm sorry, Mr. Commissioner, I understand that these gentlemen are not veterinarians but they are statisticians and they're the ones who interpret charts and graphs and rises in numbers. If there's nothing they can say, then that's fine. Can we go to the next page of that document, QQ?

Q Now, these are just the ISH columns charted against the SSC and HEM columns. And what it appears to me to show is that the two sets of symptoms are spiking in concert together. Is that a reasonable interpretation?
DR. KORMAN: They look pretty well correlated.
Q And does that suggest any further inquiry to you?
DR. KORMAN: Well, I do like your general line of questioning about making sure that the farm level diagnoses is lining up with the histopathology and I think it's a great line of questioning to ask the vets in a couple of days. Why those things are going up and down together, again, there could be an underlying condition in diseased fish that causes a series of symptoms to appear or it could just be that when you die, there's a certain fraction of fish that will have that regardless of whether you caught -- like I just don't know.
Q Well, this is the sort of thing that statistics can help to identify for us.
DR. KORMAN: No, no, it's not a statistical issue; it's an interpretation of what the variables going into the statistics. That's where you need the real skill of the vet. All we can do is say, yeah, it's correlated. I mean we do other things with fish but as far as statistics go, we can only tell you about the correlation between two variables, not what those variables are supposed to represent. And I don't know what the fact that marine anemia symptoms, ISA symptoms, why they correlate. I can't help you interpret at that at all.
Q No, no, and I understand that.
DR. KORMAN: Just simply that these do appear to be correlated.
Q Yes, and that would suggest further inquiry.
DR. KORMAN: Yeah, that would, sure.
MR. McDADE: All right. Can I have document 41? That's the new document, Mr. Lunn.
Q Now, this, I understand, Dr. Korman, is an email from Gary Marty.
MS. CALLAN: I'm just rising at this time. The Province has provided a clean copy without the initial redactions earlier this morning and I'd ask that the clean version, if it ultimately gets marked as an exhibit, be put in rather than this one with my comments on it.

MR. McDADE: I have no problem with that, Mr. Commissioner, but can I ask my questions from this document and then we'll arrange for the right document to get in as an exhibit? So just scroll down so we get rid of the black lines.

Q And now, Gary Marty is the veterinarian that was preparing these sheets, Dr. Korman. And what I'm going to suggest is, if you could read with me in the middle of the second paragraph there -- well, first of all, the first paragraph identifies that the audits only identify an infectious disease in about 20 percent of the farms.

DR. KORMAN: Yes.

Q Now, I think the numbers we saw were closer to 40 percent but in any event there's a recognition here that it's not every farm. And he then says, in the next paragraph:

> In B.C., VHSV is the most common identified cause of hepatic sinusoidal congestion. Often the cause is unknown and I am confident that some and perhaps many of the unknown causes are infectious diseases.

So there is the vet himself, Dr. Korman, suggesting that some of these cold cases, or some of these open diagnoses may, in fact, be infectious diseases that haven't been identified yet.

DR. KORMAN: Right. And that's why they're representatives sort of other or no diagnosis in -- I mean it's not like we haven't reported on that.

Q No, no, absolutely you have.

DR. KORMAN: Right.

Q But you have, I thought, today made what I thought were relatively subjective statements that there was lots that the fresh silvers that were audited, except for a very small percentage, were all relatively healthy.

DR. KORMAN: Well, it wasn't subjective. It was based on the 800-and-some-odd samples from the PCR testing, which includes VHS. I think there were only two cases from the random testing of fish, I think I was referring to that, so it was very rare. So that wasn't subjective. That was based on pure numbers.

Q So a PCR test *per se* is specific to the particular disease you're looking for?
DR. KORMAN: Yeah, and it was quite rare in that particular sample.
Q So if you do a PCR for VHS and a PCR for ISA, that doesn't mean that there's no disease. It just means those two diseases aren't present.
DR. KORMAN: Right. And only in the fish that were sampled. In fact, if you're only sampling eight fish from a farm with hundreds of thousands of fish, it's also possible that it may be on the farm and you weren't able to detect it just due to sampling error.
Q Right. We'll come back to that in a couple of minutes. But can we read together the next paragraph?

> Marine anemia is probably better characterized as a syndrome, a set of symptoms that occur together, rather than a specific disease.

Now, your spreadsheets, Dr. Korman, were entirely reliant on Dr. Marty's diagnosis, right?
DR. KORMAN: No, well, Dr. Marty was, I understand, the pathologist. It would also be, for example, Dr. Sheppard as the vet would be using his results, results from the lab so my results were not entirely relying on Dr. Marty's exams.
Q But if the vet who's doing the diagnosis doesn't believe in the disease, then it's not going to show up in the diagnosis column, is it?
DR. KORMAN: I suppose that's right.
Q It'll show up in the symptoms in the histopathology but it won't show up in the diagnosis.
DR. KORMAN: For the farm, you mean?
Q Yes.
DR. KORMAN: I can't speak to whether, for example, Dr. Sheppard, what his thoughts are on marine anemia. And wouldn't he be the person we worry about rather than Dr. Marty? It would be the veterinarian who's making the final farm level diagnosis that we'd be interested in, I would think.
MR. McDADE: Can we go back to 2850 for a minute? And can we look in Tab 17? And can we scroll down to

line 231? Sorry.
Q Now, in that document, we see the diagnosis in 2006, the fourth quarter in Farm P3-24 was marine anemia, right?
DR. KORMAN: Yes.
Q Now, I'm going to suggest to you, Dr. Korman, that when you trace that back with your stocking data, that's the Conville Bay site in Discovery Islands.
DR. KORMAN: Okay.
Q This is a fourth quarter of 2006 diagnosis and those fish remained in the farm until mid-2007. Do we need to go to the document to establish that?
DR. KORMAN: I can't recall that kind of detail off the top of my head.
MR. McDADE: No, of course not. Can we go to what was 1187? It was put in as an exhibit this morning.
MR. LUNN: I'm sorry. The 1187 reference is just not clicking for me.
MR. McDADE: Sorry. The other Dr. Korman spreadsheet.
MR. LUNN: I'm told it's 1562.
MR. McDADE: Yes. Must be 1563.
MR. MARTLAND: 1544 is what we've referred to in shorthand as Dr. Korman's big spreadsheet. I don't know if that's what Mr. McDade wanted.
MR. McDADE: No, the other. The stocking one. The first spreadsheet we looked at. Did we not mark that as an exhibit?
MR. LUNN: 1562.
MR. McDADE: 1562, yes. All right. So if we could go to the left-hand. And in Column G is the name of the farms. Can we go down to the Conville Bay? Oh, I see, this isn't sorted.
MR. LUNN: What's the name of the --
MR. McDADE: Conville Bay? I'm not going to take any more time on this, Mr. Commissioner. I'll provide the references later. My suggestion is that that farm was stocked until late 2007 so that the 2007 smolts went by it when it had a marine anemia outbreak. And that after that, the chinooks were taken out of there and so that in 2008 there were no chinooks in the Discovery Islands. Now it's sorted, yes.
Q You can make that interpretation from this document, can't you? You can figure out when chinooks were stocked and when they weren't.
DR. KORMAN: Yeah.

Q Now, does that fact have any significance to any of the rest of you?
DR. NOAKES: I believe the marine anemia was from an audit, wasn't it? It wasn't a fish health event?
Q I think that was the farm diagnosis.
DR. KORMAN: But the farm level diagnosis doesn't mean -- I think there may be confusion here. It doesn't mean the salmon farmer made that diagnosis. A farm level diagnosis could be done by the provincial auditors. It just means that they use that term to distinguish that it's not just a disease on an individual but that it's substantive enough that it affects the health of the farm. And that's what a farm level diagnosis means. And yes, it was done by provincial auditors.
Q But was it at the farm level?
DR. KORMAN: What we were looking at was the tentative sheet. And the next sheet was the actual final diagnosis that was reported and so I don't know. Was it showing up? I don't think it was because I don't think they have marine anemia as a disease.
Q That's right. And I'm suggesting that's because Dr. Marty doesn't believe in it.
DR. KORMAN: Or whoever, yes.
Q That goes from a marina anemia diagnosis to an open diagnosis.
DR. KORMAN: Right. I'll believe that.
Q All right. So that farm was experiencing the problem with the symptoms that at least someone thought was marine anemia and it's still an open diagnosis. But what I was asking was this. If there were chinook farms experiencing marine anemia in the Discovery Islands in the Wild Salmon Narrows in 2007 but none at all in 2008, wouldn't that be a significant matter you'd want to investigate? And that's the information that I get off these spreadsheets.
DR. KORMAN: Just a comment on that. Yeah, that does line up with your class survival or that pattern that you described that there's so many steps that one would have to then do to determine that that was actually a big factor. Does that disease cause death in wild fish? Is it transmitted? Does it cause death? Does it cause a significant fraction? All those steps we've been talking about over the last four days weren't established

but certainly it's a hypothesis that's not unreasonable. There's just not a lot of support for it at this time.

MR. McDADE: All right. Thank you. I'll just shift gears for a second and go back to the farm audits. Can we have document 1645 up, which is the third document in the fish -- in our fish health database list?

Q Now, do you recognize this document, Dr. Korman?

MR. McDADE: Could we go to the Fish Health Audit Notes and Diagnosis tab, which is the third one?

DR. KORMAN: Yeah, I recognize the pattern in it. The file names that I work with are different but yeah, it looks very familiar.

MR. McDADE: All right. Can we have that marked as the next exhibit? It's not presently been marked.

MR. REGISTRAR: Exhibit 1565.

EXHIBIT 1565: BCP001645 Spreadsheet

MR. McDADE: And if we could scroll over to the right under Tab P, there are a number of comments. So if we could look at, say, the second one, "All fish off feed, all kidneys swollen, brain congested, spleen had cyst-like lesions," et cetera, et cetera, "heart". If we blow that up a little bit, Mr. Lunn. Clearly, a fair degree of matters. And then if we can scroll over:

> Low number of mortalities and all samples were on feed. BKD was confirmed in one sample but no consistent findings across the five samples. There's no evidence of active, infectious disease at the population level.

Now, that's a statement that's repeated in this column in a number of places. So am I understanding this correct? There's BDK confirmed in some fish but there's a conclusion that it isn't an active, infectious disease at the population level.

Q And how did you count that in your spreadsheet?

DR. KORMAN: That it would have been given an open.

Q So we can have open diagnoses that the fish, or some of them, have clear diseases?

DR. KORMAN: Right. But not a farm level event, I guess. This is a distinction that I think we've

been grappling with. A lot of the lining of your questioning is whether an individual fish is unhealthy versus what was summarized here, which were sort of farm level diagnoses. And I guess you're suggesting, I think, that we should be looking at the individual fish health data rather than just the farm level diagnoses.

Q Well, I think what I'm understanding now is that the documents that you prepared and the document that Dr. Noakes and Dill relied upon treated the open diagnosis without doing anything with it. And yet in fact, within that open diagnoses there are clearly fish who are diseased. It's just not at a farm level outbreak at that stage.

DR. KORMAN: Yeah, I'd agree with that.

Q So that there's a lot more disease than what your spreadsheets are showing.

DR. KORMAN: Yeah, just like if you were to say, well, we've got a bad flu in Vancouver this March. That's one statement. Another statement would be there were 50,000 children that came down with the flu. It's the same thing. It's just recorded at an individual level versus a population level, to some extent.

MR. McDADE: So when we go to line 6 there under "Diagnosis", we see the opposite. There is active infectious diseases to population level. And then we see the next one, "No active infectious disease." The next one, "No active infectious disease." And next one, "No active infectious disease." And then we go to the next one and it says, if we could go to line 10 there, there is active infectious disease at the population level and it's cited as "bacterial kidney disease". So that's how this document works.

Q Now, by my calculations, something like a quarter to a third of these conclude there is active infectious disease at the population level. Right?

DR. KORMAN: Yes.

MR. MARTLAND: Mr. Commissioner, I'm going to make this point because Mr. McDade, on a few of these occasions, has put propositions that derive, and I take it in good faith, I don't question that, from his own analysis of the number in the databases. Dr. Korman, on some occasion, has said yes to a proposition put to him. It may be of assistance

to the Commission, though, for the distinction to be made between when he's accepting something a the premise of the question and the further distinction of whether he's, in fact, gone through the databases and made the same analysis himself.

MR. McDADE: I think that's fair. That's fair. Fair comment.

Q When I'm suggesting that there's a third to a quarter, you haven't counted them.

DR. KORMAN: No, I'm just taking your word for it but you're showing a little bit of support for what you've done.

Q And that's what you found when you went through the database is that there was roughly a quarter of the time from these audits, there was infectious disease at the population level.

DR. KORMAN: Yes, that's what's in my report.

Q And I think I understood your report to say that that's roughly 30 or so high-risk events per year.

DR. KORMAN: Yeah, that's how I recollect it. Go to the page and confirm that.

Q That's in 120 farms.

DR. KORMAN: Let's just find the page. Thirty events per year high-risk, correct.

Q So you're not saying the other farms don't have disease; you're saying it's only 30 or so that have high-risk infectious disease at a population level?

DR. KORMAN: That's correct. Well, those 30 events is a fish health event actually so now we're getting into a difference between the BCMAL diagnoses versus fish health event classification which is actually done by the farmers themselves. So I just want to be clear that we're talking about two different sources of information here. Now, a fish health event could be made by a call from their veterinarian. So that's their vets making that call basically.

Q One of the striking things I found about your paper between the two tables, one which was prepared based on what the farmers told you, and one which was based on the audit because on the audits you had about 60 percent open, as a diagnosis, from the farmers practically none at all. Right?

DR. KORMAN: Right.

Q So that the correlation between those two is

pretty low.
DR. KORMAN: Well, I think the Ministry actually tracks that in their reporting and I think in that 2009 document that you had up there, I think on an annual basis they kind of look on a region-by-region basis at how their frequency of disease lines up from the audits the farmers do and they even do some statistics on that. And I think the conclusion is it generally lines up pretty well.
Q But if 60 percent of one table is different, and there's only 2 or 3 percent of the other table, then there's a whole bunch of diseases being identified by the fish farmers that aren't being confirmed by the audits, right?
DR. KORMAN: Not every farm in every quarter is audited. So the fish farmers are obliged to report, every farm every month. So to try to compare those numbers with a random sampling of a subset of those farms and say that they don't line up, it's a bit, again, apples-to-oranges. I think what you --
Q But it's fair to say they don't line up; it's apples and oranges.
DR. NOAKES: Just to add to that, the fish health events actually there's a trigger which people have to report. And a fish health audit, it's my understanding, is a random sample. So yeah, you wouldn't necessarily expect them. I mean they have to report fish health events and there's a trigger there so you'd expect a very high confirmation of whether it's disease or application of therapeutants for sea lice sampling and whatnot whereas the audits, it's a random sample so it's a picture of what's on the farms that they're auditing. So you wouldn't expect them to line up just based on that simply because the samples are being triggered by two different mechanisms.
Q All right. I just want to take one more point, two or three minutes, and then I'll close. And I want to discuss the matter of auditing because, Dr. Korman, I heard you say that you found it to be impressive or quite encouraging. So I just want to examine that a little bit. First of all, and I think you averted to this. If a disease is present in 6 percent of a population, as marine anemia was, how many fish do you have to sample to

have a reliable chance of finding it? That's just a straight probability analysis, isn't it?

DR. KORMAN: Yeah, I'm not sure. Are your numbers sort of theoretical so you'd have to sort of better define that. You'd have to define how many fish in the population, what the frequency of disease is and what the reliability of the test is and then you could get an answer to what you're asking.

MR. McDADE: Well, let me put up Aqua 9 on the screen and ask that this be made an exhibit. This comes out of the Fish Health Regulations Manual from DFO. And if we could go to page 17? Or sorry. Can we blow that up? That's a table indicating how many fish you have to sample.

Q With an assumed prevalence of detectible infection of 5 and 10 percent and a population over 100,000, you have to sample 60 individuals, don't you, before you can say that they're free of that infection?

DR. KORMAN: That's what it looks like in here.

MR. McDADE: And could we have Aqua 22 up on the screen?

MR. MARTLAND: Just to ensure we get an exhibit number, please, on the first document.

MR. REGISTRAR: Yes, Aqua 9 will be marked as 1566.

EXHIBIT 1566: Fish Health Protection Regulations Manual of Compliance

DR. KORMAN: So you're talking here, just to be clear, is this PCR sampling for a virus? We're trying to move quickly through this and I don't really have a full chance to absorb this. So is that a population level diagnosis or are you looking at just being able to detect it from PCR sampling?

Q Well, we heard a witness earlier this week talk about the protocol for determining freedom from disease. And this is a protocol, I suggest, that says in order to be able to say that a farm is free from disease, you'd have to sample 60 fish to have a 95 percent certainty of that, right?

DR. KORMAN: Okay. From a PCR testing perspective. I just want to know what we're talking about, that's all.

Q This document comes from an ISA document, Infectious Salmon Anemia. And I understand that

it uses the same manual. And if you'd go to the top under "Sampling", so again 60 fish should be selected from any population over 300 individuals to tell you anything about disease.

DR. KORMAN: At a 5 percent level.

MR. McDADE: Yes, and if we go down to the bottom of the first column, perhaps that helps more.

> However, if ascertaining the presence or absence of the pathogen is the determinant for testing, a statistically relevant number of fish must be tested to maximize the probability of detection in a population.

Q So would you agree with me that a statistically relevant sample for a disease that's at the 5 percent level would have to be 60 fish?

DR. KORMAN: According to this document, yeah.

Q And yet, as I understand this particular audit program, it goes out from a fish farm that might have 600,000 or a million fish and takes an average of five fish once a year.

DR. KORMAN: Could be more than once a year.

Q Well, it could be less than once a year. If there's 120 farms and there's an average of a hundred random tests a year, it's roughly once every year-and-a-quarter.

DR. KORMAN: Well, but there's only about 60 or 70 active farms so you could almost cut that number. The ten-year number isn't right. So they're going to sample a farm a couple times a year is what will probably occur.

Q Five fish, do you consider relevant?

DR. KORMAN: Well, that's a pretty low sample size. I guess there are cost issues associated with that that are driving that. However, the fact that it doesn't show up, for example, with ISA virus testing, which they do. So you're right. From this document, it looks like their sample size at each farm should be larger to make a firm statement about that farm. However, because they do so many audits, you'd still expect that if that disease was prevalent, even if they got it wrong at one farm, the fact is, after six farms they would have enough fish sampled.

Q If it was present in every farm. If it's only present on one farm, you're going to miss it,

aren't you?
DR. KORMAN: Yeah, if it's only present on one farm but I mean one of the issues is, is this thing spreads and that's why it caused such devastating losses. So would it be reasonable to expect to only find it on one farm? I mean probably not, right?
Q Well, it's marine anemia that I'm talking about. Do you know how that spreads?
DR. KORMAN: Oh, I thought you were talking about ISA.
Q And my final question is, when you said this was impressive compared to other industries, do you know anything about how often they check chicken farms that have huge masses of chickens?
DR. KORMAN: The industries I was thinking of were sort of industries that potentially affect Fraser sockeye salmon and just management regimes in general. So that was the context. Not as far as the dairy or chicken or meat.
Q The CFIA investigates or regulates 14 different industries, as I understand it and they have inspectors that go out. This would be the least inspected industry of any one of those, wouldn't it?
DR. KORMAN: Is that from a human health perspective type? See, I was thinking of inspecting from an environmental quality perspective. I'm not sure what that organization. Is that from a human health perspective?
Q Really, all I'm asking you to do is to withdraw that statement because you really don't know. You haven't compared it to anything, have you?
DR. KORMAN: Well, I've compared it to all the industries that affect the environment that I've worked with over the last 20 years. But let's just be clear. I think your things are about human health issues and the quality of the meat that we're eating. I mean my statements, just to be clear, had nothing to do with that. It was to do with logging, hydro, mining or monitoring fish health in hatcheries. That's what I was making my comparison to.
MR. McDADE: All right. Thank you very much.
MR. REGISTRAR: Mr. McDade, did you wish your Aqua 22 to be marked?
MR. McDADE: Yes, could we mark that, please?
MR. REGISTRAR: That'll be 1567.

EXHIBIT 1567: International Response to Infectious Salmon Anemia: Prevention, Control and Eradication

MR. REGISTRAR: Also, document 41 you referred to. Ms. Callan, we have a clean copy. We could mark that.
MR. McDADE: Oh, you have a clean copy? Oh, yes, please mark that.
MR. REGISTRAR: That'll be 1568.

EXHIBIT 1568: Email from Gary Marty to Kristi Miller re "Final Unblinded FR sockeye histopathology results 2011 - 2111"

MR. MARTLAND: Thank you. Mr. Commissioner, I have counsel for the Conservation Coalition with 60 minutes.
MR. LEADEM: Thank you, Mr. Commissioner. For the record, Leadem, initial T., appearing as counsel for the Conservation Coalition. I hope I won't disappoint too many of you when I say to you that not many of my questions will delve into the realm of statistics. And I'm actually reminded why I dropped out of biology because I couldn't stand the math.

CROSS-EXAMINATION BY MR. LEADEM:

Q So I'm going to actually ask a lot of questions based upon some of the background information to your studies, Dr. Dill and Dr. Noakes. But I can't leave that last discussion with Dr. Korman and Mr. McDade without asking you, Dr. Dill, whether, after hearing all of that discussion that took place, whether or not that may or may not affect the opinion that you gave when you wrote your report because, as I understand it, you relied upon Dr. Korman's analysis when you came to some of the conclusions that you reached in your report.
DR. DILL: Yes, if anything it strengthened my conclusions. I've always been convinced that we're a little bit too sanguine when we say there's no health issues with farm fish. And the reason I say that is because we're not testing for everything, we're not testing all the dead fish. There may be live fish in the pens that have

disease and all these things make me just more cautious, I think, than perhaps Dr. Noakes would be about the issue and suggest that there needs to be a lot more work done on it.

Q And I should be fair to you, as well, Dr. Noakes, since you prepared a report as well. After listening to the protracted discussion that took place earlier...

DR. NOAKES: I don't think it would change my mind in any significant way and I say that simply because as we went through all of this information, it was all veterinary medicine and I do have to rely on the veterinarians and the fish health professionals and Dr. Kent's assessment of what diseases are important for Fraser River because that was really the focus of the study, is how is it affecting Fraser River sockeye. So I mean there's probably some variability in the data but, by and large, there is not enough to make me concerned enough that I would change substantially in my thoughts on it.

Q You were the director of the Pacific Biological Station from the years 1995 to 2003; is that not correct?

DR. NOAKES: That's correct.

Q Right. And during that time, you basically relied upon a lot of the fish health professionals within the Province to make sure that what was making sure in the aquaculture industry was proper and that there were healthy fish; is that not correct?

DR. NOAKES: Yes, that's correct. The veterinarian in Abbotsford, I think it was Ron Lewis at the time, and occasionally our own fish health staff at the Biological Station would be asked to provide diagnostics.

MR. LEADEM: I'm going to ask that Conservation document number 7 be pulled up.

Q This appears to be a memorandum from yourself, Dr. Noakes, to a number of individuals. And the title of it is "DFO Fish Health Submissions to EA Review".

DR. NOAKES: Yes, that's correct. The "EA" is the "Environmental Assessment" review that was conducted by the Province of British Columbia. It was an 18-month process where it was different from this process in the sense that the public were allowed to submit any documents and we, as a

department, were encouraged to provide a document addressing a number of issues. And this particular attachment was developed by the fish health staff and was forwarded to me by Dr. Mike Kent and I was sending it to, at the time -- can you just scroll up just slightly? I believe it was John Davis, who is the regional director of Science at the Institute of Ocean Science.

Iola Price was the -- I can't remember her full title but she was associated with the Aquaculture. She was the director of something in Ottawa. And Ron Ginetz was the regional Aquaculture coordinator. And the purpose of the memo, as we did with all of the parts of our submission, was to send them to these three individuals to get their personal feedback but also an idea of who in the Department should be sent copies of this for review and comment before it was submitted as a public document.

Q All right. So this was in draft form. What follows is in draft form?

DR. NOAKES: Yes, what follows is in draft form and the final version would be published through the Environmental Assessment Office in the Province of British Columbia.

MR. LEADEM: All right. I wonder if we can just flip the page and just look at the lead paragraph of Dr. Kent's fish health draft.

Q And am I right in assuming that it was Dr. Kent who prepared this?

DR. NOAKES: Dr. Kent gave it to me but he probably had input from other fish health professionals at the station who provided some of the writing for it. So it could have been -- for instance, we had Garth Traxler, who was a virologist, we had Dorothy Kieser, who was a fish pathologist and also dealt with fish health protection regulations. Leah Margolis was a parasitologist. And the other person that may have had input to it was Director Trevor Eveland (phonetic), who was a microbiologist.

Q All right. Your memory for people and places is amazing.

DR. NOAKES: They're all dear in my heart.

Q The lead paragraph says:

The Department of Fisheries and Oceans has a

mandate to protect and promote the health of wild fisheries resources, both truly wild and enhanced stocks --

We heard a lot of evidence about hatchery stocks.

-- as well as a mandate to promote aquaculture in the Pacific region.

That was true then and it's true today, is it not?

DR. NOAKES: Yes, in the mid-1980s, the federal government launched what was called the Federal Aquaculture Development Strategy and that had three main components to it. It was a $75 million five-year program. The first component was to do science and for environmental protection. The second was regulatory reform. And the third was what was called an Aquaculture Collaborative Research and Development Program. It was modelled after a program in the Department of Agriculture, which instructed us to work with industry and others in a partnership in a cost-sharing way to conduct research that could increase the competitiveness of Canadian Aquaculture because this was a national program, or improve the environmental sustainability of that. So there was the three parts of that.

Q Right. And then at the back end of that paragraph, I see this sentence:

Two of the prime concerns are avoidance of the introduction of exotic pathogens with imported stocks and minimizing the amplification, release and transfer of indigenous pathogens between farm fish and wild fish.

And there's a reference there to Kent, 1994. You see that?

DR. NOAKES: Yes, I see that.

Q And that was a paper that Dr. Kent prepared concerning minimizing the amplification, release and transfer of indigenous pathogens; is that right?

DR. NOAKES: It may be. I'm not familiar with the Kent '94. He was a prolific scientist and he probably had a dozen papers in 1994 so I'm not sure exactly

which one that one is.
Q And up until the time that you left PBS in 2003, that would also have been a concern to you in your role as manager of PBS, correct?
DR. NOAKES: Oh, absolutely. We were quite concerned about the importation and with respect to salmon, we had two policies in terms of importation and transfer. One was with respect to Atlantic salmon and one was with respect to Pacific salmon. And essentially, they were dealing with importation of surface disinfected eggs only. And then in specific cases, it also required quarantine for a certain length of time to ensure that no disease had accidentally come in with the eggs.
MR. LEADEM: All right. Might that be marked as the next exhibit, please?
MR. REGISTRAR: Exhibit 1569.

EXHIBIT 1569: DFO Fish Health Submissions to EA Review

MR. LEADEM:
Q Dr. Dill, I'm going to turn to you for the next set of documents and hopefully we can run through these a little bit quickly. I'm going to show you Conservation document number 1, which hopefully you will recognize. It's a letter to the editor. The journal is Aquaculture.
DR. DILL: That's correct.
Q And you authored this, did you not?
DR. DILL: I am one of four co-authors.
Q And we had Dr. Beamish up on the stand earlier I put this comment to him as well. I take it that you still stand behind your comment to the editor with respect to the Beamish article that's referenced in the title there?
DR. DILL: I do. And I have not yet seen a response to it.
MR. LEADEM: I have a note that this may be Exhibit 1341.
MR. REGISTRAR: That's correct.
MR. LEADEM: Conservation document number 2. Now, this is Exhibit 11, Mr. Commissioner.
Q This was the SFU think tank that took place in December 2009 after the decline. Did you participate in this think tank, either Dr. Connors or Dr. Dill, do you recall?

DR. DILL: I did not.
DR. CONNORS: And I participated in the form of taking notes for the convenors.
MR. LEADEM: All right. I'm going to drop down to the paragraph that says "second". Maybe we can just blow that up.
Q It says:

> We need to compile historical data on the abundance and health of farm salmon along the sockeye migration route in order to better understand the potential for transmission of disease and parasites to wild salmon.

Do you agree with that finding from the think tank, Dr. Dill?
DR. DILL: I do.
Q Dr. Connors?
DR. CONNORS: I do.
Q And Dr. Noakes, do you agree with that as well?
DR. NOAKES: Yes, I agree.
Q And that brings me to the question of data and datasets and information. Do I have it correct that the data from the fish farms and the fish health records have not always been freely available and accessible to scientists who wish to study and report on pathogens and the like that may be emanating from the finfish aquaculture industry in this province?
DR. DILL: I can speak to that with respect to one pathogen, and that's sea lice. And your statement is correct, it's not been freely available.
Q All right. Do you have any knowledge of that, Dr. Noakes?
DR. NOAKES: No, not since I left 2003. I've really had no interest in data to do with the salmon farms.
Q All right. And Dr. Connors, do you have any comment on that?
DR. CONNORS: I can just say that personally I have never made a request to the salmon farm industry for any data so I can't comment on whether or not it was made available to me or not.
MR. LEADEM: Can we now have Conservation document number 5, please?
MR. REGISTRAR: Do you wish number 2 marked?
MR. LEADEM: I think 2 is Exhibit 11 already.

Q Now, this is a journal article, "A Global Assessment of Salmon Aquaculture Impacts on Wild Salmonids". Are you familiar with this article, Dr. Dill?
DR. DILL: I am.
Q In fact, you cite it in your report, do you not?
DR. DILL: I do.
Q And Dr. Noakes, you did not cite this particular article in your report, did you?
DR. NOAKES: No, I didn't. I did receive it as one of the articles sent by the Commission staff, though, so I have looked over it.
Q All right. Do you have any comment on that finding by Drs. Ford and Myers from Dalhousie, Dr. Dill?
DR. DILL: Well, the strength of it, I think, is looking on a worldwide basis at aquaculture in a variety of different areas, the world and the impacts that it has. So it's kind of a meta analysis. And the conclusion I draw from it is that wherever there is aquaculture practice there is evidence from population records of declines in wild salmon.
MR. MARTLAND: Could we have this marked as the next exhibit, please?
MR. REGISTRAR: 1570.
MR. MARTLAND: You might want to check but I have a note that this may be Exhibit 1487, Mr. Lunn, and, if so, I'll ask, Commissioner, to withdraw this one.
MR. LUNN: Yes, it is.
MR. MARTLAND: All right.
MR. REGISTRAR: That number will be withdrawn.
MR. MARTLAND: My mistake. I made the mistake in asking that it be marked.
MR. LEADEM: Could we have Conservation document number 9, please?
Q This appears to be an article or a paper authored by you, Dr. Connors, is that right?
DR. CONNORS: That's correct. It looks to be a draft of it at some point. I'm not sure when.
Q Has it been published, to your knowledge?
DR. CONNORS: Yes, it has.
Q All right. And do you know the journal to which it has been published?
DR. CONNORS: It was published in the Journal of Applied Ecology. And I can provide you with the

actual reference.
Q All right. This is the only copy and version I have but I will ask that you do that to Commission counsel and in due course we'll mark the journal article.
DR. CONNORS: Okay.
Q And I'm assuming that the Journal of Applied Ecology is a peer-reviewed journal?
DR. CONNORS: That is correct.
MR. LEADEM: Could we have this marked as the next exhibit, please?
MR. REGISTRAR: That will be marked as 1570.

EXHIBIT 1570: Predation intensifies parasite exposure in a salmonid food chain

MR. LEADEM:
Q Now, Dr. Connors and Dr. Dill, both of you are authors along with Dr. Hargreaves and Dr. Jones. Both of those are scientists within the Department of Fisheries and Oceans; is that right?
DR. CONNORS: That's correct.
MR. LEADEM: Could we have Conservation document number 11, please?
Q Now, Dr. Dill, I take it that you're familiar with this because you cite this particular journal article by Dr. Costello in your report, do you not?
DR. DILL: Yes, that's correct.
Q And are you familiar with the paper? Can you give us a brief synopsis of the paper?
DR. DILL: It's one of hundreds of papers I probably read in the process. And just based on the title you can kind of conclude what the --
Q I could take you to the abstract on the next page.
DR. DILL: That would be helpful.
Q I think that would help you.
DR. DILL: That would be helpful.
Q I'm just going to stop at the first paragraph because the finding from this author from the University of Aukland in New Zealand says:

Sea lice are the most significant parasitic pathogen in salmon farming in Europe and the Americas, are estimated to cost the world industry 300 million Euros a year and may also be pathogenic to wild fishes under

natural conditions.

Do you agree with the conclusions reached by the author, Dr. Dill?

DR. DILL: In that first paragraph, I couldn't say. I'm not familiar with the cost of the aquaculture industry.

Q All right. Do you agree when he says that:

> Sea lice, copepods of the family *Caligidae*, are the best-studied example of this risk.

DR. DILL: That's correct. And of those, *Leps* is the best studied.

Q And then he goes on to say, "Epizootics". I'm just gong to get you to give me a definition of epizootics. We heard some mention of that when we had disease experts last week.

DR. DILL: Again, not being a disease expert, a little bit cautious. My understanding of an epizootic is spread of a disease through an animal population. That's the "zootic" part.

Q And later dropping down in that abstract, Dr. Costello says:

> Sea lice thus threaten finfish farming worldwide, but with the possible exception of *L. salmonis*, their host relationships and transmission adaptations are unknown.

Would you agree with that?

DR. DILL: I do. One species of *Caligus*, *Caligus rogercresseyi*, I think it is, has been a huge threat to farm fish in Chile but almost no work has been done on it. And even the *Caligus* species that we have locally, we know almost nothing about host relationships and transmission.

MR. LEADEM: All right. Could that be marked as the next exhibit, please?

MR. REGISTRAR: Exhibit 1571.

> EXHIBIT 1571: How sea lice from salmon farms may cause wild salmonid declines in Europe and North America and be a threat to fishes elsewhere by Mark Costello

MR. COMMISSIONER: Mr. Leadem, I just note the time.

This would be a convenient place.
MR. LEADEM: Can I get one more question in?
MR. COMMISSIONER: Yes.
MR. LEADEM: It's a real simple one. Trust me on this.
Q Dr. Noakes, you did not cite this particular journal article in your paper, did you?
DR. NOAKES: No, I can't recall citing this one. I remember probably looking at it but again there were many papers from Europe that I didn't cite because there was just not enough time. And as I said, I tried to focus on the Pacific.
MR. LEADEM: Thank you.
MR. COMMISSIONER: Thank you very much.
MR. REGISTRAR: The hearing is now adjourned until 2:00 p.m.

(PROCEEDINGS ADJOURNED FOR NOON RECESS)
(PROCEEDINGS RECONVENED)

THE REGISTRAR: Hearing is now resumed.
MS. CALLAN: Mr. Commissioner, Callan, C-a-l-l-a-n, initials T.E., appearing on behalf of Her Majesty The Queen. The province has some happy news for all of the members of the Commission. We have decided to withdraw our objection with respect to the private exhibits and while the province still has concerns relating to the release of releasing confidential information about farm-specific data, it still remains, but the province doesn't have a problem with providing the form in aggregate. We believe that the effective management of animal health in the province is greatly facilitated by the assurance of confidentiality and this information between veterinarians and farmers; however, in this case the salmon farmers have provided their farm-specific information and they have taken no position on the release of the province's databases, so our public concerns are less in those circumstances.

In addition, Dr. Marty has contacted his publisher at the *Journal of Fish Diseases* and he's advised them of the situation that arose in this commission and they still say that in general they don't allow publication of materials in circumstances where it's been made public, but based on the breadth of the work that Dr. Marty has created, they've agreed to make an exception

in this case.
THE COMMISSIONER: Thank you very much.
MR. MARTLAND: Mr. Commissioner, from our point of view, we wish to appreciate -- our appreciation for the position that the province has taken and their change of view on this. It's very helpful.

With respect to a few housekeeping matters, I want to just indicate that vis-à-vis Exhibit 1549, that's the exhibit which has a number of sub-documents to it that was previously marked as being non-public. I believe that can now be marked as a public exhibit as the ordinary exhibits are.

I have a few other quick housekeeping matters. I expect Mr. Lunn will be able to put on screen something that the witness, Dr. Connors, referred to in questions from Mr. Leadem, which is Exhibit -- this is the final version of the document that was previously mentioned as Exhibit 1570. It's the *Journal of Applied Ecology* articles that Dr. Connors co-authored. So with Mr. Leadem's agreement, unless other counsel have a different suggestion, I'd suggest, in fact, this final one substitute in place of 1570, being the final version. And I don't see any objection to that taking place.
THE REGISTRAR: So recorded.
MR. MARTLAND: With respect to, very briefly, for the record, the document that was referred to as 2864, which is the B.C. Production 002864, that is now Exhibit 1549 subdocument 217. I'll just confirm that that document had been previously marked for identification as RR. And so we don't need to do anything more than simply note that RR has become subdocument 217. Likewise, I'll just indicate that the document that was referred to as 2850, in other words BCP002850, is now in evidence as Exhibit 1549 subdocument 206. So I'm simply putting those points on the record.

Mr. Leadem has 38 minutes remaining within his time. Thank you.
THE REGISTRAR: This document is to be so marked.
MR. LEADEM: Thank you, Mr. Commissioner.

CROSS-EXAMINATION BY MR. LEADEM, continuing:

Q Prior to the break, Dr. Dill, we had been

discussing the Mark Costello paper and I wanted to just review that paper briefly with you with respect to migratory allopatry. Essentially, and I'm going to give you a statement and then you can correct me because no doubt I may get it wrong, essentially, before there were fish farms which could be host to *Leps*, we had a situation where the adult sockeye would come back at a different time when the migratory smolts were outgoing; is that right? They weren't passing one another?

DR. DILL: No, that's correct.

Q And so there may have been some transference before there were fish farms of *Leps* with respect to maybe some fish that might have been over-wintering and so forth, that did not necessarily go out with the usual flow of fish, but by and large, what happens is that fish farms really exacerbate the problem. They intensify the problem with respect to infection of the *Leps* pathogen onto the outgoing smolts; do I have that right?

DR. DILL: That's essentially correct, yes. They close the loop, if you like, between the adults and the juveniles and so now there's something that connects them over the winter and that would be the farmed fish in the pens and in addition, because of the number of hosts there, it can amplify the number of potential pathogens to infect the juveniles when they come out in the Spring.

Q Okay. So I want to move on from *Lep. salmonis* as a problem in and of itself and then focus upon the potential for the lice, for the *Leps* being a carrier, or being a vector of disease, and there's some interesting work that's been done and I think you reference that in your paper. If I could have Conservation document number 12, please? It should be a paper by Barker in British Columbia. You're familiar with this paper, are you, Dr. Dill?

DR. DILL: Yes, I am, and I've also spoken with Duane Barker.

Q This is preliminary work, as I understand it, right?

DR. DILL: Yes, it is.

Q But right in the abstract, the authors say:

These preliminary results have led to a comprehensive, multi-year study where we plan to examine the possible role of sea lice as a vector for disease.

So it appears as though, to your knowledge this is an ongoing study that's happening now?

DR. DILL: Those studies were underway. They were done by students working under Dr. Barker. Some of that work was reported at the Sea Lice Conference last year, but most of it -- he wasn't willing to go into great detail about it because it was his student's data, but those studies are underway.

Q All right. And do you have any more information that you can share with us as a result of the conversations that you may have had with Dr. Barker?

DR. DILL: Could I refer to the notes that I made of that meeting with him?

Q Certainly. These were a meeting that you had prior to preparing your report?

DR. DILL: That's correct.

MR. LEADEM: And while we're doing that, perhaps I can ask that this be marked as an exhibit.

THE REGISTRAR: Exhibit 1572.

EXHIBIT 1572: Preliminary studies on the isolation of bacteria from sea lice, *Lepeophtheirus salmonis*, infecting farmed salmon in British Columbia, Canada - Barker et al

MR. MARTLAND: While that's ongoing, it seems to me the notes should be marked as an exhibit, too.

DR. DILL: Those have already been submitted.

MR. MARTLAND: On that question we may have to do something old-fashioned and have paper documents put in as an exhibit. I don't believe those -- this has arisen entirely naturally. I don't see a problem with it.

I don't think counsel have given notice of those documents, so they wouldn't be part of the ringtail system. They may be part of ringtail, but they may not be at our fingertips, so perhaps we'll simply deal with this. My suggestion would be that depending on the questions and answers, if it's felt necessary to have the notes put in as

evidence in addition to the answers, counsel, of course, can look at what the witness has used to refresh his memory. If it's felt necessary to have them in as an exhibit then we can do that by having the paper document made the exhibit, please.

DR. DILL: So these are my notes from the meeting, that lice can pick up pathogen passively, but generally only if they're in a very high dose; that adult female *Leps* can pick up both a virus, that's IHN virus, and *furunculosis* bacteria from Atlantic salmon and they can transfer them to other Atlantic salmon, at least the bacteria. The virus, he was much less certain whether or not that could be transferred because of dilution. And it was only viable for about 48 hours, whereas the bacteria, that's the *furunculosis* bacteria *aeromonas*, was capable of infecting other fish for five days and they had not done any work on whether or not these could be transferred from Atlantic salmon to Pacific salmon. They were only looking at Atlantic-to-Atlantic and they had done no studies on *Caligus*, only on *Leps*.

MR. LEADEM: I'm content with Dr. Dill's having read his notes into the record. I'm not going to seek to tender it at this time.

MR. TAYLOR: I'd like them to be an exhibit.

MR. MARTLAND: If I might just take a moment, please? Mr. Commissioner, we should have an electronic copy of this so I wonder if I can suggest if we -- I don't see a problem with Mr. Taylor's request to have this made an exhibit. Perhaps what we can do at the break is we'll obtain this from Dr. Dill. We can either run a photocopy or sort through what part of the notes should be put in as an exhibit. I expect we can do that by consent after the break. Thank you.

MR. LEADEM: Thank you.

Q I'll move on, Dr. Dill, from your notes. I want to now pull up Conservation document number 25. This is a Norwegian study. You're familiar with this study, are you, Dr. Dill?

DR. DILL: Yes, I am. I cite that.

Q And this is cited in your report? You don't cite this in your report, do you, Dr. Noakes?

DR. NOAKES: No, I don't.

Q This is a paper detailing how ISA, which is a

problem within Norwegian Atlantic salmon farms, might be transmitted by way of the *Lep. salmonis*; is that right? Do I have that right, Dr. Dill?

DR. DILL: That's correct.

MR. LEADEM: Could that be marked as the next exhibit, please?

THE REGISTRAR: Exhibit 1573.

EXHIBIT 1573: Mechanisms for transmission of infectious salmon anaemia (ISA)- Nylund et al

MR. LEADEM:

Q My understanding is that ISA is a very serious pathogen that is causing -- that causes problems in the Norwegian aquaculture industry; is that right?

DR. DILL: That's correct, and at Chile, as well.

MR. LEADEM: Could we have Conservation document number 33, please? I think I have the wrong one.

MR. LUNN: Sorry, that was Tab 34.

MR. LEADEM: Should be a paper by Penston.

MR. LUNN: Yes.

MR. LEADEM: Or...

MR. LUNN: Mr. Leadem, I have it here.

MR. LEADEM: Okay.

Q Are you familiar with this paper by Penston from Scotland, Dr. Dill?

DR. DILL: I've looked at it.

Q And essentially they were looking at *Leps salmonis* before and after an Atlantic salmon farm relocation in Scotland. And if we could just look at the abstract together you'll see that there was a number of sampling done before or after the farm was removed in a particular location in Scotland and the last sentence says:

> The removal/relocation of the salmon farm significantly reduced the production of *L. salmonis* larvae, but did not significantly reduce the infection pressure, as represented by densities of the infectious copepodid stage, at the vacated farm site. This finding indicates that planktonic *L. salmonis* were transported to the vacated farm site from sources at a minimum of 5 to 8 km distant.

Were you aware of that paper and that result?

DR. DILL: I've read that before, yes.
Q It's my understanding that *Leps* basically can transmit itself from fish to fish in the copepodid stage; is that right?
DR. DILL: No. It's not correct. At the copepodid stage, they are tethered to their host and they don't move. It's at the pre-adult and adult stage that they are able to transfer fish-to-fish.
Q That's in the nauplii stage?
DR. DILL: No, the nauplii is a planktonic stage. It's in the water.
Q Right.
DR. DILL: And then they settle on the fish as a copepodid and then they go through chalimus stages and that's actually the stage where they're tethered, that's what I should have said, but the transfer from fish to fish is only when they become motile, later on in their life history.
Q All right. So when they're in that larval stage, in that planktonic stage, they're basically free-floating within the planktonic level; is that right?
DR. DILL: That's right.
Q And can they settle on a host when they're in that phase?
DR. DILL: Yes.
Q All right. And is -- generally speaking then, are what we're seeing here on the West Coast is that as the adult fish are coming back from the Gulf of Alaska and coming into the Fraser River, that the larvae from -- or the *Leps* is actually coming from those fish onto sea farms and the sea farms are then acting as a reservoir or sink, if you will; is that how it works?
DR. DILL: That's what we believe to be the pattern.
Q And then as the smolts are coming back out some months later, or some months earlier, they get infected by the sink; is that right?
DR. DILL: And they could be infected in two ways: either from larvae that are produced from adult gravid females on the farms; or from adult or pre-adult lice who as I mentioned at that stage can move from one host to another.
MR. LEADEM: All right. Could we have this Conservation document 33 marked as the next exhibit, please?
THE REGISTRAR: 1574.

EXHIBIT 1574: Densities of planktonic *Lepeophtheirus salmonis* before and after an Atlantic salmon farm relocation - Penston et al

MR. LEADEM: Now, could we now have Conservation document 34, which I believe has been marked as an exhibit. I believe it's Exhibit 1556.

Q No doubt, Doctors Connors and Dr. Dill, you recognize this document?

DR. CONNORS: Yes.

DR. DILL: Yes.

Q You're both listed as authors of it. The -- can I ask you what prompted this publication in the proceedings of National Academy of Science?

DR. DILL: This paper is a response to the paper by Gary Marty and his co-authors that appeared in the same journal in December of 2010. This is our re-analysis of those data and our conclusions that we come to from them.

Q Prior to that point in time had you had access to the data that Dr. Marty published in his journal?

DR. DILL: No, we did not.

Q I want to move on to your report proper, Dr. Dill. I believe that's 1540, and I found some of your management options that you detailed beginning at page 36 of your report to be somewhat instructive and I want to go over some of those with you.

The first one is you suggest that more frequent fish health audits and better diagnostic procedures could reduce the prevalence of disease on farms and its transmission to wild sockeye. I'm going to turn to you, Dr. Noakes. Would you agree with that recommendation as a management option?

DR. NOAKES: It would certainly increase your ability to detect them and assuming that there was appropriate action taken, yes, that would -- it would improve the fish health on the farms. Yes.

Q And your third recommendation, I want to jump over to your third one, Dr. Dill. You say:

> Scheduling of harvesting could be planned and coordinated regionally so that at least adult Atlantic salmon, who likely present the greatest risk to wild fish, are not present in the farms at the time most juvenile Fraser

sockeye pass them (May and June).

And obviously that's your recommendation and you stand behind it today. And we talked a bit about the *Leps* transmission or the potential for *Leps* transmission. Would that, in fact, rectify that to some extent?

DR. DILL: Yes, it would. The -- as we mentioned before at some point in the last couple of days, the fish go into the pens clean and so when they're small they have relatively low levels of lice on them. And as they get to the adult stage, they have progressively more. And it's throughout the winter that those numbers develop. And if they were harvested before the juvenile sockeye were passing, presumably the chance of transmission would be reduced. And I would think without any evidence that if this is true of lice, it may be true of other pathogens, as well.

Q Now, Dr. Noakes, turning to you, I understand that you're less likely to find that there is a risk of passage from *Lep. salmonis* from the farms to the smolts, but would you be in agreement that in an era of uncertainty and the science not being certain on this point, that that recommendation makes some sense?

DR. NOAKES: Well, actually, as it is now I think there's a trigger in terms of treatment so with respect to lice, it's probably not going to change the risk of transmission.

Q All right. So you're not -- are you saying that you're not in favour of this particular recommendation or you wouldn't make this?

DR. NOAKES: I don't know what's involved in terms of the scheduling the harvest and whatnot. But in terms of minimizing the exposure of juvenile fish to lice --

Q Yes.

DR. NOAKES: -- treating probably does the same -- it would probably do a similar reduction in the number of lice and it probably does right now. We can see that from the data that were in the database in terms of the average number of lice per fish.

Q And when you say treating, do you mean by SLICE?

DR. NOAKES: Yes. I mean, right now there's a trigger and they usually treat, I think, in February and

you can see there's a rapid decline in the number of lice per fish. So it would overlap in that window of time.

Q Well, that leads me to consider recommendation number 5, Dr. Dill, because there you make a recommendation:

> As was done in the Broughton Archipelago, coordinated and timely application of chemotherapeutics such as SLICE would reduce sea lice populations during the critical May/June wild sockeye migration period.

So I take it, Dr. Noakes, you would agree with that recommendation as a management option?

DR. NOAKES: In general, anything that will reduce the number of lice on the farmed salmon as the juveniles go past, and I think that's being done right now. You'd have to ask -- you'd have to ask the industry whether it's a coordinated effort or whether it's simply by the trigger, but again, I think a lot of the farms are treating it now in February and that's reducing it during the time period when those juveniles are migrating past.

Q In the body of this, of your recommendation or your management option, as you term it, Dr. Dill, you talk about a concern with respect to whether or not the *Leps* and the lice would be resistant or develop some resistance to the application of SLICE and you say that although that's not the case now, but it would still be something to watch for. Do I have that right?

DR. DILL: Yes, that's correct.

Q Now, would you agree with that, as well, Dr. Noakes? We're all aware that --

DR. NOAKES: Yeah. No, my conversations with Ben Koop at the University of Victoria in terms of genetics and whatnot, I mean, his take on it and I'm paraphrasing both from I guess my report and conversation is that essentially, because the lice are being brought back by the adult salmon and from the high seas and reinfecting the farms, the large pool or population of the lice that are -- where the lice are coming from is large enough probably that it will minimize the risk of them developing SLICE over time because you have naïve lice being introduced back into the system. But I

think one of the recommendations I make in my report is that you look at trying to minimize the application of SLICE for exactly this reason, so that you won't develop some sort of resistance to it and relax, perhaps, that trigger, so that you're protecting the juveniles when they go out but not necessarily treating during the fall because, of course, it's sort of like shovelling the snow during a blizzard. You've got all these lice coming back on the wild salmon and it doesn't really make a lot of sense to treat the farmed salmon at the risk of potentially developing some sort of resistance for really not a lot of benefit for the juvenile salmon.

Q Then I move on management option number 6, which you call the most obvious solution to the risk of pathogens, infection of wild sockeye is close containment, Dr. Dill.

DR. DILL: That's correct.

Q And you would stand behind that recommendation as a management option today, would you not?

DR. DILL: I would.

Q You reference some farms that are already in operation. I take it that these are closed containment farms. One is run by Larry Albright in Langley where he's raising sockeye; is that right?

DR. DILL: That's right, but in fresh water.

Q And another one is by the 'Namgis First Nation raising Atlantic salmon, that would be on Vancouver Island, I take it?

DR. DILL: That's correct. That's a pilot project. I'm not sure how far they've gotten with it.

Q And then you say it's my understanding that marine harvest is planning a pilot project of their own and no doubt we'll hear from some of that in due course.

Now, I'll turn it to you, Dr. Noakes. Do you agree with that management option of closed containment?

DR. NOAKES: Not at this time. I mean, if you look at the balance in terms of what the risks are, I don't think it warrants that drastic an action. I mean, it's useful that the companies are looking at closed containment solutions but again, it's a -- the evidence certainly from a disease risk perspective doesn't warrant that kind of drastic

action.
Q And then you end up, and I like this quote actually, like it so much I'm going to read it into the record. It's by a paper by Neil Frazer that you quote him:

> Declines of wild fish can be reduced by short growing cycles for farmed fish, medicating farmed fish and keeping farm stocking levels low. Declines can be avoided only by ensuring that wild fish do not share water with farmed fish, either by locating sea cages very far from wild fish or through the use of closed containment aquaculture systems.

So the fact that you quoted, I take it that you agree with that comment by Neil Frazer; is that right?
DR. DILL: That's right.
Q I take it you probably would disagree with that, would you, Dr. Noakes?
DR. NOAKES: I wouldn't agree with that particular statement but I agree that improvements in husbandry and management of health on farms is important to minimize as much as possible any impact on wild fish.
Q And -- sorry, yes?
DR. DILL: Sorry. I think its point is that those improvements in husbandry can reduce the risk but not eliminate it entirely. And the only thing that can eliminate it entirely is to get them out of the same common water.
Q So is that the distinction between elimination and reduction?
DR. DILL: Well, as he puts it, reduction and avoidance.
Q Avoidance.
DR. DILL: And Dr. Connors, do you have any thoughts on any of this discussion that we've been having about management options? I've been leaving the statisticians a little bit out of the -- to yourself over there.
DR. CONNORS: Well, I mean, I agree with Larry. I think that there are --
Q Dr. Dill?
DR. CONNORS: Sorry. Excuse me, Dr. Dill. I think as

we've learned in the Broughton that there are management options that can be taken that can reduce substantially the levels of lice on farmed fish and their contribution to infection levels on migrating juvenile salmon and that in turn appears to reduce any impact that might have on their survival and ultimately their dynamics. But at the end of the day, if one wants to completely remove any possible transmission from farmed wild fish, then if you put them in environments that they don't share, then it's simply not possible.

Q Do you have any thoughts on this, Dr. Korman?

DR. KORMAN: I mean, this isn't a unique problem in resource management. There's lots of uncertainty and there's big trade-offs in terms of what I presume are very large costs to the industry, perhaps, you know, making the industry for the most part non-viable, based on some, you know, possibilities but very little hard proof that it's worth incurring those costs.

On the other hand, if some of those, you know, bad scenarios come to fruition, then, you know, the consequences would be severe. So it's kind of a -- I think the scientists have said -- have laid it out and now it's up to society, our elected politicians, to kind of decide what, you know, where that -- how much risk adversity we want to take. You know, and it's not really my place to say as a scientist to sort of put those societal values about risk and the economic benefits in place. You know, I leave that to the politicians.

Q And I'm obviously not a scientist, so I come back to what I have learned from science and what I have read and one of the doctrines which I find logically and particularly attractive is the precautionary approach and the precautionary principle that was ratified by Canada actually in the Rio Convention some time ago. So if I were to apply the precautionary approach to this aspect of pathogens and whether or not pathogens are coming from fish farms and transmitting themselves to wild stock, then I would say that all of you speak from a degree of uncertainty. We're not really sure and you're nodding your head, Dr. Korman. We're not really sure if that's happening or not, right?

DR. KORMAN: Absolutely. So -- but when applying what you've just said, which I think you accurately describe it, to other Fraser issues like Cultus Lake sockeye, so we know that harvesting those fish along with the Late Run is exerting, you know, substantive impacts to that stock. So precaution would involve, in my view, for example, shutting down the Late Run, you know, fisheries which, you know, it has tremendous costs. So it's -- the precautionary principle makes sense, but then when you go to apply it there are some very high costs and again then it gets quite tricky, right?

Q Well, it does get tricky, but if you're talking about the extirpation of a genomic or of a conservation unit such as the Cultus Lake sockeye, you know, and you're saying that you're willing to take certain steps but then cost gets factored into it, aren't you really putting a price tag on extinction?

DR. KORMAN: I think you've said that pretty well, yeah.

Q And really when we're looking at this fish, the sockeye that's coming back into the Fraser River, what's brought home to me time and time again through an array of scientists who are all esteemed such as yourself, is that we just don't know. We just don't know. We don't know whether it's global climate change, we don't know whether it's aquaculture. We don't know if it's *Heterosigma*. We just don't know what the answer is.

And in that kind of a context, shouldn't we really be applying a precautionary approach and making some cautious decisions about perhaps we should just be leaving these fish alone for awhile and not necessarily subjecting them to all the fishing pressures and the pressures from farmed salmon and things of that nature. Do I have any nods on that one?

DR. DILL: Well, I mean, you're quite right to characterize all of us as being somewhat ignorant. We have this uncertainty around our conclusions and interestingly, the kind of statistical analysis that Dr. Connors did actually tries to measure the degree of that uncertainty around some of these relationships. So we are uncertain.

And how do we deal with that uncertainty? Well, the principle that you described is a good one, but Josh Korman is quite correct in pointing out that that does also have financial costs. And someone, not scientists, is going to have to weigh those costs and benefits against one another and make the decision.

MR. LEADEM: I think my time is up. Thank you, Gentlemen.

THE COMMISSIONER: Could I just ask a couple of brief questions before Mr. Leadem sits down? Exhibit 1556, Mr. Lunn.

MR. LUNN: Yes.

THE COMMISSIONER: Dr. Noakes, in your earlier testimony and it may be that Dr. Korman did, as well, but you referred to veterinarians often, as did Dr. Korman and others, and you also referred to fish health professionals. I'm not really sure that I know what a fish health professional is, but I noticed in this particular article that you look at the very top, just under the names of the authors, I see there descriptions of the Department of Zoology, Department of Biological Sciences, Centre for Mathematical Biology, Mathematical and Statistical Sciences, Department of Biological Sciences and so on and School of Aquatic and Fishery Sciences. Are all these folks' credentials fall within your description of fish health professionals? Or are you talking about a specific certification of someone who graduates from a professional school and with that qualification?

DR. NOAKES: I don't think any of these people would classify as a fish health professional. What I would call as a fish health professional who -- someone who has expertise and has taken formal training and undergone experience in terms of looking at viral, bacterial, and parasitic infections and is an expert in that area; not general biology, but very specifically in terms of diseases, assessing the diseases scientifically to determine what they are, knowing the modes of transmission and those sorts of things.

So, for instance, Dr. Kent, I would view as a fish health professional. I would view Dr. Simon Jones as a fish health professional, Kyle Garver as a fish health professional, Gary Marty is a

fish pathologist. But then the distinction between a veterinarian is somebody who is actually licensed veterinarian, a professional veterinarian, so that there's a professional distinction there. So those are the kinds of people.

So, for instance, and I don't want to pick on Kristi Miller, Kristi Miller is a genomist -- she's a genomic -- or a genetic scientist who looks at fish diseases, but she's not a fish health scientist. Okay? Does that make it clear?

THE COMMISSIONER: And the other question I wanted to ask the panel is something that Dr. Korman raised and I think it was in answer to a question from Mr. McDade, but he said he was talking about fish health but wasn't looking at it from the human health perspective. Do I take it that the regime in British Columbia that you've been addressing and drawing your statistical analysis from is all aimed at determining fish health, but is there a separate regime, either federally or provincially, from the human health perspective that also does sampling and does testing and provides results of that kind of work? I wasn't sure I fully understood the nuances of your distinction.

DR. KORMAN: Right. And I can't -- I'm not sure about -- there may be, but I can't answer that question in terms of the human health issues.

THE COMMISSIONER: I'm talking about fish now, not about other creatures.

DR. KORMAN: Right. No, but as far as salmon, you know, farmed fish, in terms of the quality of the tissue for human health consumption, I know there are regulations associated with that. Almost all the things that we've been talking about have been associated with the effects of the farms on the environment rather than the effects on the tissue, although I think there -- certain aspects of the database, for example, does document antibiotic use, for example, and the timing of that, which is then used to determine when those fish can be harvested so that we're not ingesting high amounts. So there is probably some elements out of that database that is relevant to sort of human health issues, but there may be -- I assume there's more to it than what we've been talking about.

Does anyone -- can anyone add to that, 'cause...?

THE COMMISSIONER: Thank you very much. Thank you, Mr. Leadem.

MR. MARTLAND: Mr. Commissioner, I have counsel for the First Nations Coalition with 45 minutes.

MS. GAERTNER: Thank you, Mr. Commissioner, Brenda Gaertner and with me, Crystal Reeves. Two preliminary comments. One is I want to put on record our gratitude for the province's decision to not object to these documents becoming public. As you're well aware and as you will hear in the evidence going forward, First Nations really encourage the transparency of the basic data and so we're grateful that that doesn't have to be a fight. And second of all, I have to say that a number of the areas of questions that I had planned to do today appear to have been covered, so the next good news is that I may not take my full time. And so we'll see if we can finish. I always hate to promise that, but we'll see what we can do.

CROSS-EXAMINATION BY MS. GAERTNER:

Q Gentlemen, I want to thank all of you for the work that you've done to help our work here, because that's essentially what you are doing, is trying to help us with a very difficult problem.

My clients, the First Nations in many parts of this province, are ecologists, or using an English word or whole system thinkers and they've asked us to adopt a precautionary approach when looking at the information that's presented but also when looking at the models that scientists use because, of course, we've heard lots of good evidence about how models can be limiting in their understanding and Mr. Commissioner, I will be asking you to use this panel as an excellent example of how models can be limiting and how scientists can have different views depending on the models they use.

So we want to take this -- the other good thing, and I am not a scientist, but one of the things that I've learned with First Nations is they use the common sense indicator a lot and so we're going to talk a little bit about the common

sense indicators in my work today.
And I'm going to start, Mr. Korman -- or Dr. Korman, with you. I don't have a lot of questions for you, but as I read your report you've confirmed that 75 percent of the farmed salmon in B.C. is produced along the Fraser River sockeye migratory route; is that correct?
DR. KORMAN: Yes, that's in the report.
Q And that's pretty well 32 million fish in the net pens per year with at least three million of those dying each year? That's correct?
DR. KORMAN: Yes.
Q And it's possible and we've heard the evidence today, it's likely quite higher, but that at least 600,000 of those fish die every year from disease; that's what -- as a summary of your evidence. At least --
DR. KORMAN: Right. We --
Q -- 600,000. Now, taking aside the food chain impacts of the local footprints, is it fair to say that as a common sense indicator this many farms in this small location within the migratory route are likely to have some effect on smolts and migratory adults as they pass by them?
And I'll start with you, Dr. Dill, and then I'll ask others to -- and I'm starting with you, Dr. Dill, because you're the only one that's been qualified here as an ecologist.
DR. DILL: Interesting. I need to be very careful because common sense is not always a good guide to science. My common sense would tell me that that's correct, that if you put this many fish with that percentage of pathogen known or even more if we add unknowns, if there -- if they do exist, that there's a good chance that they could have some impact on migrating fish. And my concern is primarily the juveniles, who I believe would be more vulnerable. But I can only look at the data and tell you from the data that I've seen the evidence for that is there, but it's fairly weak and uncertain.
Q Anybody else want to add to that?
DR. NOAKES: Just to back up just a half a second, when -- just to correct -- when Josh Korman -- you said there were 600,000 died of disease? I don't think that's quite right.
Q Possibly. He said possibly 600,000 --

DR. NOAKES: Yeah. Okay. No, I thought --
Q -- annually died of disease.
DR. NOAKES: I misunderstood you. I thought you said 600,000. That would be an upper level, 'cause certainly the evidence suggests smaller than that.
Q Well, that quite depends, as -- you'll appreciate --
DR. NOAKES: Yeah. No, I appreciate the uncertainty. All I can deal with is the data that we have. But certainly, as I say, our project was limited to looking at Fraser sockeye, so what we were looking at was the risk exposure in terms of disease or pathogens from farmed fish to juvenile sockeye. So that's certainly where my report was. I haven't done the same kind of work that Larry Dill and others have done with pinks and chums, but certainly from a sockeye perspective in looking at the data, it certainly appears that there's a fairly low risk in terms of transfer of pathogens, given where -- and given the number of outbreaks of disease we have and the location of the farms that are having those, so there's always a possibility of some impact, but certainly the data doesn't suggest that it would be significant.
Q So you're moving from a holistic ecological ecosystem approach to looking for very specific data on about a very specific relationship, if I've got that correct, Dr. Noakes?
DR. NOAKES: Well --
Q That's a "yes" or "no" answer, I think.
DR. NOAKES: I -- well, it's not quite a "yes" or "no" answer in terms of -- I mean, when you look at ecosystems and looking at different kinds of models, it's not necessarily that when you go to say an ecosystem-based approach of assessing a system that you get a better answer. Because what happens typically is you have a lot of noisy data, ill-defined relationships so when you put things together, you can tell just about any story you want. So you have to be really careful in terms of interpreting data in an ecological model.
Some are good, but they're not necessarily going to give you a better answer than just a very simplistic and well-reasoned model that you can apply the data to.
Q Dr. Dill, you have your hand up again.
DR. DILL: I just wanted to comment that neither of us

really took an ecosystem approach to this problem at all. If we did, our report would be quite a bit different. But, for example, we might have considered what effect reduced sockeye populations would have on bear populations or something of that nature. I think the only place in either of our reports is probably the section in my report where I talk about the futility of looking for a single cause, where I try to put it into a broader ecosystem perspective, pointing out, for example, that there might be interactions with herring populations, if herring populations were decimated by *Caligus*, then perhaps predators would switch to sockeye and so forth. And it's only when you start to look at a lot of those other direct and indirect interactions between species that you're really taking an ecosystem level approach.

Q All right. Maybe I'll just turn to you, Dr. Connors, for a moment. As I understand it, after using the null hypothesis testing, you also did a multi-model inference approach in your work; is that correct?

DR. CONNORS: Correct.

Q And having looked at that carefully and to try to understand the differences in the models, it's our understanding that an MMI method is increasingly being used in science and ecology to take into account complexities of interactions within ecosystems and to assist in decision-making; is that correct?

DR. CONNORS: That's correct.

Q And an MMI is being used as an alternative approach to the traditional statistical null hypothesis testing in order to disentangle underlying trends and complex data; is that correct?

DR. CONNORS: That's correct.

Q Especially if you're using short-term time data when you -- based on the ecological approach; is that correct?

DR. CONNORS: Sorry? You're going to have to re-state that.

Q Especially when you're using short, small-scale time data for some of the variables, you need to untangle some of that; is that correct? Have I got that right?

DR. CONNORS: Kind of. I mean, I wouldn't say that

multi-model inference is going to help us any more when we're limited in the actual data we have, but it's increasingly being turned to to confront uncertainty in what models best approximate reality and how to kind of account for uncertainty across those models.

Q And you agree that MMI is being referenced as a tool for adaptive management when ecological and conservation -- within ecological and conservation biology literature?

DR. CONNORS: I do.

Q And if I was to understand your report at its simplest, you had concerns around large uncertainties regarding direct impacts of the farms and you said that there are large uncertainties regarding the direct impacts, but did I get it right that there are less uncertainties regarding indirect impacts if you consider the contributing factors of the farms, the sea surface temperatures and the pinks?

DR. CONNORS: Yes. I would say that there was less uncertainty in the interaction between that pink salmon abundance and farmed salmon production versus the influence of farmed salmon production at average sea surface temperature and pink salmon abundance.

Q So using the common sense indicator again, if I've got that right, what you're saying is there's less uncertainties when you look at the impacts from ecosystem approach from all of the different impacts than there is if you only look at one impact?

DR. CONNORS: Well, what I want to be clear about is that in this analysis when I'm referring to uncertainty, I'm simply referring to the -- if you can remember back to that panel we looked at three days ago about the predicted mortality based on the associations that identify, I'm talking about how wide that grey region is around each of those estimates. And so my concern, and the reason I say that the uncertainty in these relationships precludes drawing strong inferences, because none of these relationships have such tight uncertainty around them that we can say with any real, strong certainty - I'm sorry, I'm going back and forth with uncertainty and certainty - of a relationship.

Nonetheless, that shouldn't preclude us from moving forward with acknowledging these relationships, acknowledging that they contribute to some of the evidence that we need to consider and to identify, you know, further work that can be done, as well as identifying the kinds of management and the kinds of policies that we want to have in place. I think we made it clear thus far today that our intention was to look at the available information, possibly not all of it. We always didn't do a completely exhaustive examination of all of it, but nonetheless, I think it's a place to move forward from.

Q And when you're doing that, when you get to those places where uncertainties are identified, Dr. Noakes, if I heard your evidence correct, this just earlier when Mr. Leadem was asking you questions, you felt that the risks of actually - and I'm not suggesting and my clients aren't suggesting that this happened, I'm just trying to understand your answer - that the risks did not show that we need to take more precautionary steps with the farms. And I just find that curious. How are you measuring that risk? From what vantage point are you measuring that risk? Because you'll appreciate that my clients might measure that risk differently.

DR. NOAKES: No, I appreciate that. But what I'm looking at is in terms of, as I say, when I went through my report I had four categories that I was looking at - escaped farmed salmon, waste discharge, and sea lice and disease, and when you look at all of those different areas in looking at -- for evidence of a relationship with Fraser sockeye you simply don't see it. There's no significant, there doesn't seem to be a significant relationship there. So on the basis of that evidence, it appears as though there's a fairly low risk. Again, risk, I appreciate that your client will have a different assessment because they have a different viewpoint.

Q And other scientists will have a different assessment because they'll have a different viewpoint.

DR. NOAKES: Absolutely.

Q All right. So that I want to just take you to your study for a second 'cause there's a couple

places in there that I was a little concerned about things. Just as clarification before we get to the absolute, you did what I understand is something in your analysis called pre-whitening the data; is that correct?

DR. NOAKES: Yes. It's the correct way of taking the trend and autocorrelation out of a time series so that you can appropriately look for causal links in correlation between two time series.

Q And you'll agree with it that within the scientific literature there are critiques and discussions around the limitations of pre-whitening data?

DR. NOAKES: I'm not -- I'm not so sure that I'd agree with that statement.

Q Dr. Connors?

DR. CONNORS: Well, I think it's well-recognized that when there are strong time trends in variables that pre-whitening or first differencing or removing that time trend can sometimes reduce the correlations that are actually present in the data and that's been shown by simulations and some other studies. And an intuitive or an illustrative example is that between -- you know, be very, very short, between carbon dioxide in the atmosphere and global temperature. If you look at the time trend since the 1950s and carbon dioxide in the atmosphere, it's increasing very strongly through time with very little inter-annual variation. If you look at global temperature, it's also increasing, but there's a lot of year-to-year variation.

Now, if we apply, as on first principles, the approach is that Don has -- Dr. Noakes has taken to removing those time trends, then we find no relationship between carbon dioxide, a greenhouse gas in the atmosphere, and global temperature. And that's despite the fact that there's a well-recognized causal relationship between the two that's not disputed and is recognized by all the international scientific bodies that have looked at that relationship.

So my point is not that there aren't different ways to look at the data, but that we can't always just remove the time trend before asking the question.

DR. NOAKES: I guess I'm relying on, you know, my 30-

plus years of time series expertise, so based on my -- on my own experience and training, that's the proper way to do it.

Q And then I'd like to go to page 24 of your report, Dr. Noakes. There you say no evidence that exotic pathogens and diseases have been introduced by salmon farming industry. Am I -- is it correct to read that sentence with an emphasis on the word "introduced" because it's clearly possible that pathogens and diseases have been transferred between salmon farming industry and stocks; is that correct?

DR. NOAKES: I believe I was talking about introductions, yes.

Q Okay. So that's an important qualification on that sentence.

And then I want to go back to the executive summary of yours at page 1. Just at the bottom of the page, I want to give you an opportunity. I read it and given all the information I've learned sitting listening to you, all of you, for the last few days, my reading of this is that it's speculation and I wonder if you can -- oh, sorry, Roman numeral (i) of the executive summary. At the bottom:

> The industry is highly regulated...

Starts there, and then you go:

> Overall, the evidence suggests that salmon farms pose no significant threat to Fraser River sockeye salmon.

Would you agree with me that based on the evidence and all of the challenges associated with it, that that is speculative?

DR. NOAKES: No. I'm basing this on my assessment of the data that I was provided with. So as I say, I went through and I looked at the threat or the risk associated with escaped farm salmon. I looked at the issues of waste, both in the benthic and water column, and then I looked at the lack of association between sea lice and production of Fraser River sockeye and also then in terms of the disease. And I was quite detailed in terms of going down to the farm level, looking at what

diseases on what farms and where they were located.
Q All right.
DR. NOAKES: So that statement is based on my assessment of that and I'm sure you appreciate that, you know, we wrote these independently, so I didn't have the benefit of discussing this before now.
Q So having heard the evidence over the last three days, having sat here, do you still --
DR. NOAKES: It doesn't --
Q -- do you agree with me that it's now speculative?
DR. NOAKES: No. I mean, again, it's my assessment and I had the same data and I haven't heard anything to convince me otherwise.
Q Sorry. Dr. Dill, would you -- if you took that sentence and read it, do you believe that that's speculative?
DR. DILL: I believe it's based on the evidence as Dr. Noakes analysed and assessed it. I don't agree with the statement.
Q And finally, Dr. Noakes, before we complete, when I looked at your recommendations, and we can go to them, I didn't notice whether or not you would recommend that the location and volume of the sites of the farms and their impacts to both smolts and adult migratory routes be reviewed, given the contributing factors that are going on both with respect to sea surface temperatures and pinks and other things that have changed since those farms were located. I'm wondering if you would like to comment on that.
DR. NOAKES: I don't recall making that recommendation, but --
Q Oh, you didn't. And I'm wondering, we will be --
DR. NOAKES: Yeah.
Q -- suggesting that that's a useful recommendation, given the change --
DR. NOAKES: Yeah.
Q -- in circumstances since many of those farms were located and the change of information. So I'm wondering -- giving you an opportunity to comment on whether or not it would be useful to review the location of the farms along the migratory route and the volume of those farms as -- in a go-forward basis.
DR. NOAKES: It's always useful to review those things

and I think in terms of the recommendations it would be useful. This is a unique panel in the sense that we had four reports and several recommendations which we really haven't had time to discuss but it's certainly worth -- I know Dr. Dill had several that were useful and it would be nice to combine those together and sit down perhaps.

Q All right. I just have two, I believe, two primary areas left to talk about. Given the challenges of competing scientific methodologies and models and the treatment of data, I'm referring now to Aquaculture Coalition Tab 5 which is an addendum to the technical report number 6, in which Dr. Farrell recommends that going forward the designing of the scientific studies, the questions that are being asked, the review of the outcomes, be not left to academic debate but rather that there be a group of individuals representing a broader perspective be involved right from the get-go regarding the design and questions and results of these studies. I'm going to open it up to the panel as to whether or not you would agree that as a go forward basis that would be useful.

DR. DILL: I think that would be very useful.

DR. NOAKES: Yeah, I would agree.

DR. CONNORS: Agreed.

DR. KORMAN: Yeah. I mean, certain stakeholders are going to provide -- they tell you what questions the public is interested in and the levels of risk and so it's -- they should drive the questions, and I think that's the value. Then the scientists will actually frame them and hopefully do a good job on answering the questions, but so, yeah, I agree.

Q All right. One of the things that I think is common amongst all of you is that there isn't quite enough research being done on the interaction and impacts between wild salmon and farmed salmon interactions. I'm just wondering, how would the scientific inquiry change if we presumed a possible impact and asked the industry to prove no negative impact?

DR. KORMAN: Well, things would basically -- I think there's plenty of common ground that we don't have, for example, when we look at just the salmon

farming data in relation to sockeye survival rates, the time series is too short, for example, to -- there's no power in it and therefore, we don't have enough information so the industry hasn't proven therefore that it's safe.

Q So if the industry was -- I'll start with you and then we'll continue. I want to hear from all of you. If the industry was coming today for the first time and they hadn't had a farm and the question was prove whether you don't have an impact, are you saying that at this stage they could not do it?

DR. KORMAN: Yes.

Q Anybody else --

DR. KORMAN: But I would also caution that there would -- we would have to do the same with the fishing industry and the logging industry and there would be a whole slew of players that would have to pass that same test.

Q I appreciate the complexities associated with the migratory route. We've been hearing many, many days of evidence of that. We're trying to focus on one right now.

So Dr. Dill, how would you answer that question?

DR. DILL: Well, sometime yesterday there was a document that was introduced in which it used the term "reversal of the burden of proof" and that would be an exact example of that, where instead of trying to prove that there is -- to disprove that there is an effect, you must prove that there is no effect. And to do that, you have to have much better data than we have now. This is exactly -- it's back to this problem of only having a few years of data and you cannot show that there is an effect but it's because the data aren't good enough to distinguish between an effect and no effect. And so the data quality would have to be much higher, over a much longer term, in order for any industry, including aquaculture industry, to have any hope of answering that question.

Q You'll appreciate that some other industries are -- new industries in the Province of British Columbia are asked to do that, for example, in the IPP industry or otherwise, they're being asked to prove no impacts in order to proceed. That did

not occur with this industry when they started; is that correct, Dr. Noakes?

DR. NOAKES: I wasn't involved when this industry started, but I don't recall that -- that's a -- the reverse -- you can't really prove a negative, so I don't -- I wouldn't see that as being put forward as a basis for deciding whether there would be this activity or any other activity in, for instance, development of a new fishery. So I don't believe it was done at the beginning but I wasn't involved in the...

Q Anything to add, Dr. Connors?

DR. CONNORS: (No audible response).

Q No. All right. I have been reminded that I need to ask that the addendum to technical report number 6 be marked as an exhibit.

THE REGISTRAR: Exhibit number 1575.

EXHIBIT 1575: Addendum to Technical Report 6 - Implications of Technical Reports on Salmon Farms and Hatchery Diseases for Technical Report 6 (Data Synthesis and Cumulative Impacts)

MS. GAERTNER:

Q I'll start with you on two more quick questions, Dr. Dill. When Dr. Johnson, who was here from the Department of Fisheries and Oceans a number of days ago to talk about the impact of pathogens, I was asking him what we could do if -- recognizing that we manage human behaviour and we don't really manage wild stocks, we manage our responses to them, if we were trying to limit Fraser River sockeye salmon's exposures to pathogens, is there anything that you can think of in addition to moving or containing the farms that is an obvious step that we could be taking to try to limit the exposure of Fraser River sockeye salmon to pathogens?

DR. DILL: The same ones that were mentioned earlier in relationship to the coordinated management plan in the Broughtons where you try to manage the production cycle so that you have routes fallowed at the time that the fish are migrating or use chemotherapeutants which certainly work in the short term. We don't know in the long term. People differ on whether resistance will evolve,

but those were the other two major options in addition.

Q One final question I have for you, Dr. Dill. A number of times my clients have raised concerns with me around the lights that are used in these pens and whether or not they're attracting fish to the pens. Can you comment a little bit more with respect to the concerns around lice and what we know or don't know about smolt behaviour as it relates to the lights?

DR. DILL: Well, we know in other parts of the world where aquaculture is practiced that lights do attract fish. I mean, you just need to go out with a light at night yourself in a boat and see that lights will attract organisms and fish. We don't know -- I don't know of any specific studies on whether sockeye are attracted to lights but it is a possibility and if they are attracted to lights along with predators, along with other kinds of food items or non-food items or parasites or anything else, there is a potential to increase a variety of interactions, some positive, some negative, and that's an obvious study that ought to be done.

MS. GAERTNER: I wonder if I could have our -- on our list document 52, Mr. Lunn. As I understand it, this is Canada's draft Pacific Aquaculture Regulations as it relates to the approach on the use of light and again, what you've just said, Dr. Dill, makes good common sense. So I want to take you to the bottom of page 2 of this document.

MR. LUNN: Did you say Tab 52?

MS. GAERTNER: Yes.

Q Are you familiar with this document, Dr. Dill?

DR. DILL: No, I'm not.

Q All right. Well, you'll have to --

DR. DILL: No, I'm not.

Q -- take my word for it as I understand it this is Canada's draft regulations as it relates to the approach on the use of lights, and I want to take you --

MR. TAYLOR: Well, I think it's a draft approach to regulations. I don't think it's the regulation.

MS. GAERTNER: Thank you for that distinction.

Q If I can go to the bottom of page 2, this is one of those, you know, reversals again. Apparently, as I read this paragraph:

There are currently no measures in place and there is no direct science to advise that lights are a concern and require management measures. Therefore, there are no specific measures at this time for incorporation of indicators...

Would you agree with this approach from a precautionary perspective or do you agree that we might want to take some steps?

DR. DILL: I think it's exactly backwards as written. The fact that there's no direct science to advise their concern is simply because there's been no science done.

MS. GAERTNER: Could I have this marked as the next exhibit?

THE REGISTRAR: Exhibit 1576.

EXHIBIT 1576: Draft of Pacific Aquaculture Regulations - Approach on the Use of Light

MS. GAERTNER: Those are all my questions, Mr. Commissioner. If I have not used up all my time, there is a matter that I'd like to address on another topic at the end of the day with you, if I could.

MR. MARTLAND: Mr. Commissioner, I'm going to suggest that perhaps we might move to break, but before doing that, I wonder if I could just canvass, Dr. Dill had referred to his notes in response to a question about his contact with someone in preparation of his report. At the break I'd ask for the -- if I might be granted leave by you, Mr. Commissioner, to speak with him exclusively for the purpose of identifying the relevant part of his notes so that we can run a copy and ensure that that's put in as an exhibit.

THE COMMISSIONER: Very well. Thank you.

MR. MARTLAND: Thank you.

THE REGISTRAR: Hearing will now recess for 15 minutes.

(PROCEEDINGS ADJOURNED FOR AFTERNOON RECESS)
(PROCEEDINGS RECONVENED)

THE REGISTRAR: Hearing is now resumed.

THE COMMISSIONER: Mr. Martland?

MR. MARTLAND: Mr. Commissioner, Mr. Lunn will be able

to put on screen the part of Dr. Dill's notes that arose during Mr. Leadem's questions. Unless someone suggests otherwise, I'll suggest those be marked as the next exhibit, please.

THE REGISTRAR: Exhibit 1577.

EXHIBIT 1577: Notes of Dr. Dill

MR. MARTLAND: Second, Steven Kelliher, K-e-l-l-i-h-e-r, appears as counsel for the Aboriginal Aquaculture Association. They're part of a standing group that includes the Laich-kwil-tach Treaty Society and Chief Sewid. Mr. Kelliher is next on the list with 20 minutes.

MR. KELLIHER: Mr. Commissioner.

THE COMMISSIONER: Mr. Kelliher.

CROSS-EXAMINATION BY MR. KELLIHER:

Q Gentlemen, let me say first of all that it's been a pleasure to have the benefit of your thoughtfulness, your -- and wisdom over the last few days. It's been an education for all of us and I, on behalf of my clients, are very thankful for your efforts.

My clients -- my client is an organization that represents First Nations who have in their own wisdom seen aquaculture as a means of addressing grievous economic circumstances in their communities. They have seen aquaculture as a means to solving social problems, providing jobs, training and a very hopeful future, as well. And so they have a very significant stake in these proceedings and in the advice that you gentlemen can provide. I expect that in your knowledge that you've accrued over the years of salmon, along with it has come an understanding of some of the issues that touch on First Nations life and in their relationship to this resource.

Now, I'm going to read to you, if I could, the mission statement for the Aboriginal Aquaculture Association and it's this:

> The mission of the Aboriginal Aquaculture Association is to promote aquaculture development that respects and supports First Nations communities, culture and values.

Now, if I can ask each of you, is that a realistic ambition? Is that something that this organization and these people can expect to meet with success in its pursuit? And what can you say individually with the benefit of your years of work that would assist in reaching that objective, of materializing that mission?

Can I begin -- I know, Dr. Noakes, that you've written in some degree, though it's not your specific area of expertise, about First Nations in the context of the fishery. Could I ask you to begin, please?

DR. NOAKES: Yeah. I haven't written extensively. There's probably two papers in which I touch on First Nations issues. And again, they're very tangential and they're not really related to this particular topic.

One was where I looked at the Pacific Salmon Treaty and it was more dealing with First Nations issues and rights with respect to the ***Boldt*** decision in the United States because of the parties involved in that. And I recently published a book chapter with Dr. Beamish and it's called, I think it's *Shifting the Balance Towards Sustainable Salmon Populations and Fisheries for the Future* and I make two references to -- to put it in context, it was a very broad paper.

The chapter we were asked to write and the hope is that we'll get a conference on -- a UN-sponsored conference on sustainable fisheries. It was managed out of the University of Michigan. And essentially in there in terms of First Nations, I mean, they asked me to make comments about the whole Pacific Rim, so it was Japan, Russia and very specific format in terms of how the paper was written because it was being written for policymakers and lawmakers.

And with respect to First Nations I think the only comments I really had in there was recognizing that the settlement of land claims would have significant impact on fisheries in the future and that it was an important issue that needed some attention.

With respect to aquaculture, again, very limited and not specific to here is the recognition that access to tenures was important for the aquaculture industry and that it was

important that the provincial and federal governments work with First Nations and industry to resolve those. And that was really the limit I had. It was, as I say, it was a very broad paper in terms of looking at salmon in general from around the North Pacific and dealt with all sorts of things. There was just a very minor mention of aboriginals, but that was the only thing that I've written really on aboriginals.

Q All right. Dr. Dill, do you have a comment?

DR. DILL: Well, I guess to say that, you know, I'm fairly knowledgeable about First Nations communities and very sympathetic to their economic circumstances and very much appreciate that they would see aquaculture as a possible economic driver of improvement. I would only caution them, however, that any aquaculture development that they undertake in their traditional territories needs to be done in a very cautious way so as not to have an impact on the wild resource on which they also depend for ceremonial purposes as well as economic reasons.

And I don't think it's impossible to have both aquaculture and wild fisheries but it has to be done in a very cautious way, perhaps using some of those management options that I refer to in my report.

Q All right. Dr. Connors?

DR. CONNORS: I would just add that I would encourage them to continue to advocate for participating and encouraging others to continue to fund and support rigorous examination of the interactions between farmed and wild fish and that it's only through that as we move forward that we can hope to have both aquaculture and wild fisheries that kind of coexist together.

Q Dr. Korman?

DR. KORMAN: I haven't given this a lot of thought, so this is a bit off the top of my head, but I mean the one issue is for them to be involved in a meaningful way, I guess, when the industry is probably structured -- I don't know how the wealth distribution of the industry is structured, but my image of it is that there's a lot -- for the most part, a lot of fairly minimum wage jobs and so I would encourage them to make sure that as they go forward in that that the wealth distribution can

go into the community in a more meaningful way than it may currently be going in, you know, so I -- that may be a challenging thing to do unless, perhaps, new tenures can be given, that they would have lots of control over.

Q A bigger piece of the pie?

DR. KORMAN: Yeah. That's what I guess in hearing what your objectives are, I hope they would be able to obtain that. And one way, I guess, would be to increase -- for them to have new tenures and they have total control of those companies. Then, of course, that leads to an expansion and, you know, some of the concerns that have been raised about the risks, so that's the --

Q Right.

DR. KORMAN: -- that's the conflict.

Q And so do I -- I have a sense that there's agreement that aquaculture can coexist with the continued survival and growth of the wild stocks. Is that your view?

DR. KORMAN: I guess -- sorry, we can go right to left this time. I mean, I'm more of an evidence-based person, so I haven't seen much in this hearing that suggests a major impact, although I do think there's a lot of things we don't know about and that we should be cautious but that there hasn't been very much evidence to show direct impact. So therefore, the next step to that would be, you know, a modest amount of expansion, should therefore not lead to any major conflicts with wild stocks, based on the evidence we've seen to date. So, yes, I think, is a long-winded answer to you.

Q All right. Dr. Connors?

DR. CONNORS: I'd encourage continued examination of the evidence and to move forward cautiously, but I don't think that there's anything to say that if done properly, aquaculture and wild fish populations can't coexist here in B.C.

Q Thank you. Dr. Noakes?

DR. NOAKES: I would agree that they can coexist both the wild and the aquaculture industries.

Q And Dr. Dill?

DR. DILL: I would agree. If managed properly, and steps are taken to reduce the interaction between them or the harmful interaction between them, I see no reason why they can't coexist but I do want

to broaden our consideration from just Fraser sockeye to other parts of the coast where there are other species and other circumstances and we know in the Broughton there have been some problems. These are being successfully addressed through the coordinated program there which shows that you can improve their situation with goodwill and, of course, funding and proper management.

MR. KELLIHER: Thank you very much, gentlemen. Mr. Commissioner, those are my questions.

THE COMMISSIONER: Thank you very much, Mr. Kelliher.

MR. MARTLAND: Mr. Commissioner, I have counsel for the Musgagmagw Tsawataineuk Tribal Council with ten minutes.

MS. ROBERTSON: Good afternoon, Mr. Commissioner. It's Krista Robertson for the Musgagmagw Tsawataineuk Tribal Council.

CROSS-EXAMINATION BY MS. ROBERTSON:

Q Good afternoon, panel. I think as some of you may know the Musgagmagw Tsawataineuk is a tribal council representing about 2000 members of First Nations people residing in the Broughton Archipelago.

Dr. Dill, I have some questions for you. As I read your report and, in fact, all of the Project 5 reports, what strikes me, and I think what is floating to the top in terms of the examinations on these reports as a theme is really the uncertainty about what we know about the impacts of salmon farming on Fraser River sockeye; do you agree with that statement?

DR. DILL: I do.

Q And we've talked quite a bit this morning about the limits on the data and the information and the reports are up-front about those limits, the short time series, the limits of the diagnoses of the mortalities, what we know. What I observe you doing in your report is you're looking at other jurisdictions. You're looking at Norway, at Ireland, where there's more information. There's been farming for longer periods of time in some cases. The information is still limited but there's been more studies about the interactions between farms and the wild stocks. Do you agree that that's one of the sources of information you

turn to?
DR. DILL: That is one of the sources and it was part of the mandate.
Q And when I look at the literature you've cited, I see there's a great deal of studies that you drew on in drawing your conclusions in the report?
DR. DILL: That's correct.
Q And you also looked at the Broughton Archipelago in British Columbia, a different -- and the pink stocks there which is different than the Fraser River stocks, I acknowledge, but there have been -- the reason you did that is because there's been more studies that have been done there about the interactions between the farms there, the great deal of farms there, and the wild stocks that are there?
DR. DILL: Yes, that's correct. That and the fact that I was actually -- my students and I were actually involved in many of those studies.
Q And could you explain why there have been more studies done there? What's driven that?
DR. DILL: Alex Morton. No, to be quite blunt, I mean, that was where Alex Morton first reported a problem with -- or what appeared to be a problem with sea lice on juvenile pink salmon and mobilized a lot of resources and people to get working up there and I was introduced to the problem and found it a fascinating one, both from a pure biological and an applied perspective, and so began working up there myself. But really, Alex Morton deserves a lot of the credit for that.
Q Is it also to do with the collapse of the pink stocks in 2002? In your opinion has that been a driver of a --
DR. DILL: Yes, that was certainly one of the drivers. The stocks go up and down, but there was that big crash in that year.
Q And in your opinion, in your report, just generally speaking, there have been -- you acknowledge there's again some uncertainty, some debate, but there has been demonstrated impacts in your opinion of -- on the wild stocks there from salmon farms; do you agree with that?
DR. DILL: I agree with that and I think that's most strongly shown in the paper that just came out that Dr. Connors and I are co-authors on.
Q Thank you. So in your report regarding the Fraser

River stocks, it is your opinion that the sort of larger pattern of the decline of Fraser River sockeye and the advent and increase of salmon farming along that migration route, it's difficult to know what exactly the mechanisms are, but in your opinion, disease transfer is the biggest culprit, it's the biggest risk?

DR. DILL: I think the wording I used was the most likely. And to a certain extent, that was sort of by elimination in that I didn't believe that escapes or sea lice directly or benthic or chemical input were likely to be causative; that if there was a relationship, it was most likely to be driven by disease.

Q Okay. And I'm hoping maybe we can get a little bit to what we do know, as opposed to what we don't know. Mr. Lunn, if you could bring up Dr. Dill's report, Exhibit 1540, and go to page 24 of that report?

So I just want to focus on that first paragraph there where you talk about -- this is your more in-depth analysis of disease. I'm going to read it into the record, because I think it's very important. You say that:

> Open net fish farms can provide an abnormally high focus of infection due to the large numbers of susceptible hosts, a process sometimes called biomagnification. Furthermore, the high density of hosts and the treatment of infections on fish farms create conditions for parasite growth and transmission that are very different from those found in the wild. These conditions are likely to select for fast-growing, early-transmitted and more virulent pathogens, including lice...

So I take it what you're saying there is having net pens, open net pens in the ocean, is -- it can be a game changer in respect of the disease environment; do you agree with that?

DR. DILL: Yes, for at least three reasons, two of which came up this morning. One is that it closes the loop in this migratory pathway allowing fish to transfer from one generation to another. The second one being the high density of hosts and

biomagnification, so building up large populations of parasites.

And the third one, and I'm glad this has finally come up, the fact that the net pen conditions provide a very different kind of environment in which there is likely to be selection, in other words evolution, of more virulent strains of pathogens and there are some warnings of that in the theoretical literature and more recently some actual demonstrations of that for both lice and potentially ISA.

Q All right. And maybe we can turn then. You cite a study in there - and again this is going to what we do know - to the Rimstad study, it's at Exhibit 1482, if you could bring that up, please, Mr. Lunn. And if you'd mind highlighting the bottom of the top paragraph on the right column there. And I know this document has already come up in the examinations of the disease panels last week. I'm just going to read to you the quote there. It starts with:

> The history of modern --

And this, I'll say, is a very recent document. You're familiar with this document. You've cited it in your report. It's a 2011 journal article and it's written by a veterinarian from Norway. And he says:

> The history of modern aquaculture indicates that farmed fish are susceptible to new and emerging diseases...

So he talks about new diseases. Is that something that you would agree with? I mean, in many respects, and particularly considering the evidence we've heard on viruses, would you agree that pathogens are -- they're kind of one step ahead of us. We can't identify them until they cause a disease. We certainly can't respond to them until we know that they're there; would you agree with that?

DR. DILL: Yes. And not only that, they're sort of one step ahead of us evolutionarily because of the huge population sizes, so if you put them under strong selection pressure, it's quite easy or

quite common for them to evolve strains that are resistant to our antibiotics, as you know from human health situations.

Q So the risks are huge, potentially.

DR. DILL: Potentially.

Q Would you also agree that protective measures that are taken to protect farmed salmon from disease, we have vaccines, culling, that kind of thing, they're not available to us to protect farmed salmon -- wild salmon, pardon me?

DR. DILL: They're not available for us to protect wild salmon directly, but if we do a good job of protecting farmed salmon from disease, we can potentially reduce the amount of transmission to wild salmon.

Q Thank you. But if there was an outbreak, I mean, we can control -- I've read other articles also that indicate, you know, we can control what's happening with the diseases on the farms, but really, once there's an outbreak and a transmission to a wild population, it's very, very difficult, if not impossible, for us to control what happens to those wild fish once there's a disease outbreak.

DR. DILL: That's true.

MS. ROBERTSON: Thank you. Those are my questions.

MR. MARTLAND: Mr. Commissioner, I don't have any questions arising in re-examination. Subject to any questions that you may have, I believe that concludes the evidence from this panel.

THE COMMISSIONER: No, I don't have any questions, thank you.

MR. MARTLAND: And the only last point was that Ms. Gaertner had asked for some further time. She did have some time remaining, I should add, and she had a point that she wished to address.

MS. GAERTNER: Sorry, Mr. Commissioner, this is nothing to do with the panel at all. This is about scheduling for the remainder of the week. Mr. Martland has done his best on trying to divide the time going forward; however, I've got a difficulty tomorrow that I need to raise with you which is the Policy and Practice Report for the regulation of aquaculture is almost silent as it relates to the First Nations and Crown relations around that and so I've got some work ahead of me to get things done so that you understand that

relationship as best I can. Mr. Martland was only able to give me 20 minutes to do the work and I had asked for 90 and so I'm really in your hands. I just wanted to give you a one-up that tomorrow there will be a fair bit of pressure.

I don't think I can adequately do my job in 20 minutes tomorrow so if there is something in your schedule that would allow for a little bit more time, that would be useful. And I'll just leave it at that.

THE COMMISSIONER: Thank you very much, Ms. Gaertner.

MR. MARTLAND: Mr. Commissioner, I do appreciate the constraints and everyone has been exceedingly cooperative and has worked hard and done very good job, I think, of moving to the key and the vital questions at the start of their questions. I appreciate it's challenging. The total demand for the first regulatory panel is just shy of three days if we were to give everyone the time sought and that's not within the parameters of what we're in a position to do.

I'll be suggesting that perhaps through collaborating with other counsel, because she's later in the sequence, if time frees up through the day if we're in a position to provide more time, I'll endeavour to do that. I want to respect the concerns that have been identified. I'm hopeful that -- I do hope and I will be asking counsel nonetheless to stick to the approach that we outlined at the outset that would see counsel really cede the microphone at the conclusion of their time and then speak to the question of what should happen if at the end of their time allocation there remains a necessary question that they haven't been in a position to address. That's hypothetical. I appreciate the concern. But it hasn't yet arisen. If it does, perhaps we can address it at that point.

The other point I took Ms. Gaertner to be canvassing was whether some adjustment to the schedule might be necessary for the first day of the regulatory panels. And I'm in your hands with respect to that question.

I have circulated the time allocations. I've given her 20 minutes. That is a little shy of the two levels of provincial government and ourselves; otherwise is as much as other participants. Thank

you.

THE COMMISSIONER: I want to thank Dr. Korman, Dr. Connors, Dr. Noakes and Dr. Dill very much for your attendance at this commission proceeding and for your patience in addressing all of the questions that were put to you. We're most grateful that you were here to provide those answers. Thank you very much to all of you.

(PANEL NO. 57 EXCUSED)

THE COMMISSIONER: And we are adjourned then until tomorrow morning at 10:00 a.m. Thank you.

THE REGISTRAR: Hearing is now adjourned until 10:00 a.m. tomorrow morning.

(PROCEEDINGS ADJOURNED AT 3:49 P.M. TO AUGUST 29, 2011 AT 10:00 A.M.)

I HEREBY CERTIFY the foregoing to be a true and accurate transcript of the evidence recorded on a sound recording apparatus, transcribed to the best of my skill and ability, and in accordance with applicable standards.

_____

Pat Neumann

I HEREBY CERTIFY the foregoing to be a true and accurate transcript of the evidence recorded on a sound recording apparatus, transcribed to the best of my skill and ability, and in accordance with applicable standards.

Karen Acaster

I HEREBY CERTIFY the foregoing to be a true and accurate transcript of the evidence recorded on a sound recording apparatus, transcribed to the best of my skill and ability, and in accordance with applicable standards.

Susan Osborne