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

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L'Honorable juge /
The Honourable Justice
Bruce Cohen

Commissaire

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Vancouver (C.-B.)

le mardi 23 août 2011

APPEARANCES / COMPARUTIONS

Brock Martland Jennifer Chan Kathy L. Grant	Associate Commission Counsel Junior Commission Counsel Junior Commission Counsel
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")
Matt Keen	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")
Don Rosenbloom 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.

Tim Dickson Nicole Schabus	Sto:lo Tribal Council Cheam Indian Band ("STCCIB")
No appearance	Laich-kwil-tach Treaty Society Chief Harold Sewid, Aboriginal Aquaculture Association ("LJHAH")
No appearance	Musgamagw Tsawataineuk Tribal Council ("MTTC")
Lee Schmidt	Heiltsuk Tribal Council ("HTC")

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Vancouver, B.C./Vancouver (C.-B.)
August 23, 2011/le 23 août 2011

THE REGISTRAR: The hearing is now resumed.
MR. MARTLAND: Mr. Commissioner, I'll just indicate at the outset two things: First, if I could just remind all the witnesses to please speak directly into the mike and position it towards them if they can. I gather some people couldn't hear everything yesterday.

Secondly, with respect to the times, we've had some -- Ms. Callan was to have had 15 further minutes. We've had some sharing and transfer of time, so she'll have a further half hour this morning. That keeps us on schedule.

MS. CALLAN: Mr. Commissioner, Callan, C-a-l-l-a-n, initials T.E., appearing on behalf of Her Majesty the Queen in Right of the Province of British Columbia.

CROSS-EXAMINATION BY MS. CALLAN, continuing:

Q Dr. Kent, you've identified bacterial kidney disease or *R. sal* as a high risk bacterium?
DR. KENT: That's correct.
Q It affects both sockeye and Atlantic salmon?
DR. KENT: Yes, and it affects sockeye salmon more severely than -- given the same dose, it would be a more acute severe disease in sockeye salmon than Atlantic salmon.
Q Okay. And it's quite common in the wild?
DR. KENT: Quite common in the wild, particularly in chinooks. In wild caught chinook salmon, it's quite common. For the work that we did, this was a number of years ago, if I recall, about ten percent of the sockeye salmon that we collected in ocean survey were infected. So, in general, it's more common in chinook salmon than sockeye salmon, but it would occur in both species.
Q Is the paper you're referring to at the Province's Tab 10?
DR. KENT: Which? Is that the Kent et al Journal of Aquatic Animal Health?
Q It is. It's called "Survey of Salmonid" --
DR. KENT: Yes, that's correct.

MS. CALLAN: If we can mark this as the next exhibit?
THE REGISTRAR: Exhibit 1478.

EXHIBIT 1478: Kent et al Survey of Salmonid Pathogens in Ocean-Caught Fishes in B.C.

MS. CALLAN:
Q Now, the incidence level in Atlantic salmon is somewhat low.
DR. KENT: From this survey? I'd have to go back and look at it. Yeah, it looks like right here that we -- where are we here? Yeah, it's pretty low and that's what I would expect. My experience back from the 11 years I worked with DFO and doing a lot of work on Atlantic salmon fish farms, it was really a very low level disease problem. Much more common in Pacific salmon than Atlantic salmon.
Q And would you agree that the prevalence level of the BKD in farmed fish has been declining in the last nine to ten years?
DR. KENT: I have not been examining fish in the last nine to ten years. Maybe one of my colleagues might want to expand on BKD levels in the farms in the last ten years. I left British Columbia in 1999, so I have less direct contact with the fish farms after -- in the last ten years.
Q Do any of the other panel members want to address this point?
If you could turn to Dr. Korman's report at 5A which is provincial Tab 19, and it's page 19. Would you agree that this indicates that the incident level of BKD appears to be declining since 2002?
DR. KENT: It appears that of a trend. One would have to run statistical analyses to see if there's a statistically significant difference in that, but just subjectively, I would say there appears to be a reduction in BKD.
Q And I take it you wouldn't be in a position to know how many Atlantic salmon are along the sockeye migration route in 2007?
DR. KENT: No. No, I wouldn't be the one to answer that.
Q Would you agree, based on Dr. Korman's report, that BKD is unlikely to explain the difference between poor 2009 run and the extremely large 2010

run?
DR. KENT: Yes, based on the data that we have right now, as far as -- this is work looking at BKD on fish farms, I assume, this, what I'm looking at right here?
Q That's right.
DR. KENT: Yes, that's right, yeah. So as far as relating to bacterial kidney disease and *Renibacterium* on fish farms, I would objectively put that at a pretty low priority. One is it's not that easily transmitted; and secondly, the fish farms are mainly Atlantic salmon; and third, as we see, even if there's not a statistically significant reduction in BKD, it's really an incidental disease in the Atlantic salmon.
Q Now, you rated furunculosis as a high-risk bacterium noting the bacterium has potential to be lethal to juvenile and adult sockeye salmon in both fresh water and sea water.
DR. KENT: That's correct.
Q And you would agree that the bacterium has never been diagnosed in B.C. wild sockeye salmon?
DR. KENT: That's my understanding.
Q As well, most occurrences of furunculosis at fish farms since 2002 have been on the west coast of British Columbia (sic)?
DR. KENT: I can't answer that question. I don't know about the distribution of furunculosis in fish farms.
Q Okay. If you could turn to Tab 21 of the Province's book of documents. It's page 28 that I'm looking, and this is Dr. Noakes' report. This will be a technical report that the Commission will be putting in, in the next few days, as well. Specifically I'm looking at the first paragraph starting midway through. It says [as read]:

> A few more cases of furunculosis have been reported on farms since 2003. Most of the furunculosis cases have been from farms located on the west coast of Vancouver Island.

Then it sets out the numbers, 9 out of 10 in 2010, so that means that one was not on the west coast. One in 2008, 'cause they have 4 out of 5 are on the west coast, and then 1 in 2007 and 2 in 2004.

Then there's a higher number in 2003.
Do you have any reason to disagree with Dr. Noakes?

DR. KENT: No. I don't know where the source of his data are, but I have no reason to disagree with that. There is a vaccine for furunculosis. It's used with Atlantic salmon, and therefore -- in general, with that efficacious vaccine being available, we would expect to see less furunculosis on the farms.
I put this furunculosis as a high pathogen -- or *aeromonas salmonicida* as a pathogen of concern that would be one that you would be looking for in the fish. I'm not saying that we -- I didn't allude to any relationship with farms being the source of this. I'm just putting that as a general risk. We know furunculosis occurs in hatcheries and occasionally in wild fish, and when it does occur, it can be very lethal to fish, including sockeye. So therefore that's why I included it in my high risk.

Q Now, I'm turning to the issue of salmon leukemia virus or otherwise known as plasmacytoid leukemia.

DR. KENT: Yes.

Q When was the last time you saw evidence of salmon leukemia virus or plasmacytoid leukemia?

DR. KENT: Okay, so as I discussed yesterday -- and I probably need to reiterate this a bit again today, because it's a complicated story. We were looking at fish, let's say, starting in the late 1980s, early 1990s, that had histological presentation which we described as plasmacytoid leukemia, an excessive proliferation of immature plasma cells - it's a white blood cell type - in chinook salmon from certain - and farms - and that was the fish that we did our work on, on isolating viruses, cell-free transmission, basically collecting the evidence that was most suggestive of a viral ideology.
That work was done in the early 1990s. After that, we continued to see fish that presented with that histological change, basically lesions, the proliferation of white blood cells that fit that diagnosis. In further cases, almost all those were infected with a parasite called *Nucleospora salmonis*. We didn't continue to look for viruses after the early 1990s. The virologist I was

working with, Dr. Bill Eaton, who was at Malaspina College at the time, he left Malaspina around that time and basically the work actually specifically looking at the virus was gone.

However, we continued to see, through the '90s, fish with lesions that -- from chinook farms and occasionally in wild fish that had changes consistent with that. Dr. Stephen might be able to address when the last -- a little bit more. He did a lot of survey work on the condition of farms, so maybe he might be able to add a little bit to that.

DR. STEPHEN: Well, as science goes, my Ph.D. ended, my funding ended and I didn't look at the disease after that. So I have no real data on trends after my doctoral work.

Q Now, my understanding of plasmacytoid leukemia or salmon leukemia virus is that this is a disorder that primarily affects chinook and coho salmon?

DR. KENT: Primarily chinook. We were able to experimentally infect sockeye salmon, but in the field, chinook salmon.

Q Have you ever known Atlantic salmon to display pathology consistent with plasmacytoid leukemia or salmon leukemia virus?

DR. KENT: No.

Q And it has not been identified in sockeye in the wild?

DR. KENT: That's correct, to my knowledge.

Q Now, IHN, sea lice and specifically *Caligus clemensi* and *L. salmonis*, BKD, *Ich*, furunculosis are endemic pathogens and have probably been present on B.C. marine ecosystems for centuries?

DR. KENT: Yes, that's correct.

Q Are you aware of any pathogens that would increase pink salmon survival and, at the same time, decrease sockeye salmon survival?

DR. KENT: No.

Q Are any of the other panellists aware of such a disorder?

DR. JOHNSON: No, I'm not.

DR. STEPHEN: No.

DR. MacWILLIAMS: No.

Q Okay. Dr. Kent, I understand -- and I'm going to be switching subjects to Dr. Miller's work. I understand that marine anemia or plasmacytoid leukemia is sometimes associated with an

accumulation of abnormal cells behind the eye.
DR. KENT: That's correct.
Q Dr. Miller, I understand, provided you with histological samples from sockeye salmon brains to examine?
DR. KENT: That's correct.
Q Were you aware of whether or not these samples were positive for the genomic signature?
DR. KENT: No. I knew that they evolved from that study. I can't recall specifically. We just ran the tissues for histological examination and just evaluated them independently. I can't recall which numbers of them were positive or negative. I assume some of it came from that group that was positive.
Q I understand in your review from the fish, you found no significant pathological changes in any of the samples?
DR. KENT: That's correct.
Q And now onto my one question about salmon alpha viruses. Would you agree that none of the three salmon alpha viruses in other parts of the world have been diagnosed in British Columbia?
DR. KENT: Can you clarify what you mean by alpha viruses? What types of viruses?
Q If you could turn to the Conservation Coalition's list, I'll just get the document reference. Actually, if we could just move on past the question.
DR. KENT: Okay, that's fine.
MS. CALLAN: Mr. Lunn, could you turn to the letter to Mr. Tyzuk from Tim Yesaki? I'd ask that this be marked as the next exhibit.
THE REGISTRAR: Exhibit 1479.

EXHIBIT 1479: Letter from Tim Yesaki to Boris Tyzuk dated May 25, 2011

MS. CALLAN: If Mr. Lunn could also open the letter from myself to Mr. McDade? If this could be marked as the next exhibit?
THE REGISTRAR: Exhibit 1480.

EXHIBIT 1480: Letter from Tara Callan to Gregory McDade dated May 27, 2011

MS. CALLAN:
Q My next and my last group of questions will be directed towards Dr. Johnson. Oh, actually, I've been handed a note with respect to the salmon alpha virus. He's talking about pancreas disease.
DR. KENT: Yeah, pancreas disease. Before I came to DFO in 1988, I worked in Washington for Patel Laboratories and there we did a lot of work with net-pen farms down in Washington State, and we did write a report on histological changes in Atlantic salmon smolts in Washington State that were consistent with pancreas disease. We never isolated the virus, just showing histological changes that were consistent with pancreas disease.
Q So then the disease has never been actually confirmed?
DR. KENT: That's correct.
Q So over to Dr. Johnson now. Yesterday when I asked about Price's 2011 paper, that's Exhibit 1476, I noticed that you mentioned his 2010 paper which is at Tab 21 of the Salmon Farmers' binder. This document is entitled, "Evidence of farm-induced parasite infestations on wild juvenile salmon in multiple regions of coastal B.C."
I understand you have some criticisms of the 2010 paper. Could you outline them for me?
DR. JOHNSON: Well, my criticisms are tied together -- from yesterday, tied together both of these papers. I pointed out that if you compare the sample sites and you compare from the information that's given when they supposedly obtained these samples, that in the case of one study, there are sites that are classified differently than they are in the other study.
I then went on to question whether - because we're talking about an animal that produces a planktonic lifestyle, a life stage, the infectious stage - whether you could actually say that sites which were north of salmon farms were downstream and sites which were south were really upstream because of the tidal mixing in that area, which I believe encompasses at least that whole area, although I'm not a physical oceanographer.
Q So I'll try to break it down now to specific points.
DR. JOHNSON: I paid more attention to the sockeye

paper to be honest with you. I think what we see is fish, when they enter the marine environment, become infected with sea lice. So if we're talking about fish of Fraser River origin, at least based on our work in 2010, we see that there is a gradual accumulation of sea lice on these fish as they migrate northwards.

There also was a fair number of sea lice found on fish that were residing within the Gulf Islands.

The other thing that I had some concerns about these two papers is that they talk a lot about *Caligus clemensi* and there are a lot of different wild hosts for that parasite in our marine environment which do not necessarily associate themselves with salmon farms. The authors, I feel, didn't really take into consideration the amount of information, especially for related caligen (phonetic) species which are known to occur on these wild coasts. So there's no reference really to wild coasts as being a source of these.

I understand that we do have limited data and what data we have is somewhat simply observational, that when you catch herring, they tend to have lots of *Caligus* on them, and observations by salmon farmers that when the herring come by, often *Caligus* levels increase on fish.

So those were sort of my major areas that I remember when I read these papers, that sort of came to mind.

Q Now, I understand that this paper suggests that sea lice levels on salmon were greatest closest to the salmon farms.

DR. JOHNSON: Yes.

Q However, the site choices for the reference sites were quite unusual?

DR. JOHNSON: I can't remember where the reference sites were.

Q I understand that the authors used Bella Bella as a reference site.

DR. JOHNSON: Yeah, again, as I say, if it's related to how long the fish were in the sea water, it depends what the source of the fish would be, both in Bella Bella and in the Skeena area. If these fish recently entered the marine environment, then

they would have only been acquiring marine life for a shorter period of time. I'm not an expert on residence time of fish in these two areas.

Q And salinity was an issue as well?

DR. JOHNSON: I don't remember offhand what the salinity of these various areas -- there is some -- we do know that sea lice under low saline conditions are not as effective at infecting their host. They do not survive as well.

Q If you could turn -- oh, we are at the right document. If you could turn to Table 1 of this document, you would agree that based on this, the sea lice level -- or, sorry, the salinity levels are 27.6 for the low exposure and 21.5 for the high exposure site in the Broughten and, as well, the salinity level is 24.9 and 27.6 in the Georgia Strait and the Finlayson is 25.2 and 26.3.

DR. JOHNSON: Yes. But we also don't know whether this was a single salinity measurement or there was an average of many measurements. Salinity and things such as temperature are going to depend a lot on how the water is mixing at the time that you're actually collecting these samples and whether there's strong tidal flows and things like that, so if this is the salinity -- surface salinity at the time of collection.

We also don't have any information on how deep these salinity layers go. I don't remember at what depth they were collected from this paper.

Q All right. You would agree, though, that the surface -- the salinity measured, even though you do have concerns about how it was measured, was only 20.1.

DR. JOHNSON: I would think that 20.1 is getting to be fairly low salinity for sea lice. Now, that's for *Leps. salmonis* which is the only one that we've really done these experiments on. How *Caligus clemensi* functions in these lower salinity waters, we really don't know.

Q Okay. And why is the salinity level significant?

DR. JOHNSON: Well, sea lice basically have no mechanism to osmo-regulate. Or they have poorer mechanisms to osmo-regulate, so basically they become the salinity of the water that they're in, and in certain salinities, the water basically just becomes not salty enough to maintain them.

The difference would be for animals which are

attached to their hosts, because there's some evidence that sea lice, once they're on the host, can obtain some buffering from these low salinities simply by being on the host. So, for example, you can find sea lice alive on salmon in freshwater rivers, provided the fish recently entered the river.

But for the larval stages, which they're simply drifting around, the lower salinity does have a significant impact on their physiology and ultimately their survival, and probably on their ability to infect host.

Q And my next set of questions are going to compare the 2011 paper at Exhibit 1476 with the 2010 paper. I understand that some of the high exposure sites were changed to low exposure sites for the 2011 paper?

DR. JOHNSON: I just remember that there were differences between the two papers. I don't know if it's going to be very easy -- there was one site that was marked as being a farm, I remember, on one of the papers, which is not marked on the other papers being a farm site. There were some sites, especially along the northern sort of border in one of the papers which -- so I don't know how we can do this comparison because I don't remember what sites they were offhand.

Q Well, perhaps it would be easy if we could have a split screen with Figure 1 of both papers side by side.

DR. JOHNSON: If that would work.

MR. LUNN: Did you say Figure 1 or Table 1?

MS. CALLAN: Figure 1. That's -- it's the two maps.

MR. LUNN: Thank you.

DR. JOHNSON: And we only need really Section B of the maps, Section B and Section C of the maps, that map.

MS. CALLAN:

Q Now, my understanding is that one of the fish farm sites in the 2011 paper was removed, and I think becomes obvious if you look towards the bottom of the Table B, and look to the second "X" from the bottom which is somewhat in the middle.

DR. JOHNSON: Can we go to image C on the one you're adjusting now, please?

Q Is my understanding correct that --

DR. JOHNSON: Yes, B.

Q -- in the 2010 paper, the second "X" from the bottom has been removed for the purposes of the 2011 paper which is marked as B.

DR. JOHNSON: There is an extra "X" on the chart which is marked C, which I believe is the -- that is in the lower right-hand corner with the mouse essentially on it now. That's -- it appears to me not to be in the chart given in Figure B.

Q Are you aware of which of the sites were changed from high exposure to low exposure?

DR. JOHNSON: I would have to look, and we'd have to scroll up a bit so I could see the legend. So low and high, okay, active salmon farming. Okay, so we can go -- if you blow C up again, please? And can I see the legend for B, please? I'm sorry this is taking so long (indiscernible).

There is -- okay, I don't know how to point out differences.

(BRIEF OFF-THE-RECORD DISCUSSION)

I'm sorry this is taking so long.

MR. MARTLAND: Mr. Commissioner, I'm just going to alert, mainly for counsel, that Mr. Blair is now complicit -- Mr. Blair is now willingly sharing his time with Ms. Callan. This is by consent, for the record, so that as she goes on, his time is adjusting accordingly. Thank you.

DR. JOHNSON: Yeah, that's a missing salmon farm. We've discussed that. So this -- indeed, if I remember properly, the salmon farms which are circled in the circle are ones which are considered to be downstream sites, and if you go to section C, or Figure C, some of the -- there are a variety of sites that are considered to be downstream in this other paper that are marked as basically low impact sites for that analysis, and those low impact analysis sites on C also include sites that are further upstream from the salmon farms.

So I'm assuming that their classification of circles in the bottom left, the bottom right, as well as those ones that are sort of on the upper right along the margin with the mainland are all given, in that paper, as being low impacted sites. But in the other paper, they're basically listed

as being sites which are included in their analysis because they're downstream sites. So I think that that's probably the best way to explain it.

MS. CALLAN:

Q Thank you. What is the significance of the change from high exposure to low exposure?

DR. JOHNSON: It's extremely difficult for me to tell because it would depend upon -- I think probably will have an impact on the way they do the analysis. So if you've classified them -- and it wasn't really clear to me - and again I'm going on memory - exactly how these two analyses were done. So how were these sites selected? Were they selected prior to the analysis or were they selected during the process of the analysis?

Q And what is the significance of removing the salmon farm site?

DR. JOHNSON: I don't know. Perhaps it's just an oversight by the authors.

Q Now, I understand that the weight of the fish at the downstream sites in the 2011 paper were also larger than the upstream sites in Exhibit 1476.

DR. JOHNSON: I'll have to take your word on that. I can't remember from the paper. But it would make sense because these animals are migrating northwards, that they would be growing. But I don't think the residence time is -- the time it would take them to pass through that area is that long, at least the Fraser sockeye.

Q If we could turn to Table 2 of Exhibit 1476. Does that confirm that they are larger at the downstream sites than they are at the upstream sites?

DR. JOHNSON: Again, there's no standard errors on these numbers, so they're close in size, but without some indication of the amount of variability, I wouldn't want to guess, because it could be pure chance that you obtained a smaller fish at one site.

These fish were also, if I'm not mistaken, collected over a period of time, so I'm not exactly sure what proportion of fish, say, from the earlier samples contributed to these different sizes. So, of course, if the fish had only been in seawater a short amount of time, they might be actually smaller, regardless of where they were.

So I don't think there's enough evidence here to sort of look at whether there were significant differences in length upstream or downstream of salmon farms.

Q And my last question is are you aware of any controlled laboratory studies with sea lice and coho salmon?

DR. JOHNSON: As part of my Ph.D. thesis, I did conduct some studies with sea lice and coho salmon, looking at susceptibility of coho salmon to infection in comparison to Atlantic and chinook salmon as well as looking at the role of processes such as inflammation and the ability of coho salmon to remove sea lice.

Q And what were your findings?

DR. JOHNSON: It was found that coho salmon, of all the salmon species that we've examined, are very resistant to infection, and this is a single pulse infection within the laboratory when compared to Atlantic or chinook salmon.

MS. CALLAN: Thank you. Those are my questions. Sorry, I'd also like to mark BCSFA Tab 21 as an exhibit.

THE REGISTRAR: Will be marked as Exhibit 1481.

EXHIBIT 1481: Document entitled "A Review of Diseases Identified in B.C. Aquaculture Company Databases"

MR. MARTLAND: Mr. Commissioner, next on the list I have counsel for the B.C. Salmon Farmers Association until ten minutes past 11:00.

MR. BLAIR: Good morning, Mr. Commissioner, members of the panel. I was pleased to have Mr. Martland clarify what was going on when the Province was using more time. I wasn't so pleased to hear him use the word "complicit". I would have thought he might have gone to "generous" but I guess either way, the Province has used some time.

I do just want to take a moment, Mr. Commissioner to speak about the sharing of time. I know that practice has been developed over the last several months and it has worked efficiently. I do want to say that I was allocated 50 minutes for this particular panel. The coverage of the key issues, key to my client's perspective, have been well covered by Mr. Martland, Mr. Taylor and

Ms. Callan. So I will take much less time as a result of that which is why I was in a position to be able to share so generously, or complicitly with the Province.

I do want to point out, however, that I think the way the process has developed is to the extent that I don't use the 30 minutes I've been allotted, I made it clear to Mr. Martland that I think it's an efficient use of the remainder time, if there is remainder, that I continue to be permitted to share it, and I would, in the course of events if there is time, with the federal government for reply. I think if there's a need, if there is time for the federal government to be able to reply -- many of these are their witnesses, and so that is my preference, if there is extra time left, that it go to the federal government for reply and not be otherwise allocated.

We've been told how we could share time, and I keep waiting for time to come my way. Hasn't happened yet; I'm okay with that. Mr. Martland, that's fine with you?

MR. MARTLAND: It's a hypothetical issue. Let's wait till we get there.

MR. BLAIR: Thank you.

CROSS-EXAMINATION BY MR. BLAIR:

Q Dr. Kent, my questions are for you.

MR. BLAIR: Mr. Lunn, I wonder if you'd be kind enough to pull up his report, Exhibit 1449.

Q Dr. Kent, in a very general way, I'd like to ask you if you're familiar with the egg importation for salmon aquaculture?

DR. KENT: As it stood when I left B.C. about ten years ago. I'm not aware of any significant changes since then.

Q Can you describe generally the history of egg importation in British Columbia in a large overview, please?

DR. KENT: Basically there's been an eggs-only policy for bringing in salmonid eggs from outside of the province. When the salmon-farming industry was developing, that's when I came in 1988, there were a few net-pen farms, but that's when the industry really took off, in the early 1990s. Dorothy

Kieser, Gary Hoskins and others at the Pacific Biological Station were involved in developing a policy for quarantine, avoiding introduction of exotic pathogens with the importation of salmonid eggs. They had a pretty rigorous program in that.

I can give you a broad brush overview of it and some others may be able to expand on some of the details of that. Maybe Dr. MacWilliams might know a little bit more.

Correct me if I'm wrong on this, but basically it's a very rigorous program. It actually has served as a model for other agencies for introduction of fishes into a given geographic area. The beauty of salmonids is that their eggs take a long time to hatch and so one can screen the eggs, the ovarian fluid, the brood stock where they originated from, for pathogens before they're imported or hold them in quarantine once they become imported. So that's basically what the policy was.

Then once the eggs were hatched, they were held in quarantine and examined periodically for specific pathogens. To my knowledge, it's a negative result so you can't say the eggs-only policy prevented introduction of any exotic pathogens that we're aware of, but along with this rigid eggs-only policy, we have not seen any introduction of any exotic pathogens. There would be a big concern with this, because they were bringing in eggs from eastern Canada, basically with the potential for bringing in pathogens such as ISA and other pathogens that do not occur in the province.

Q In the introduction of your paper --

MR. BLAIR: Pdf page 8, Mr. Lunn.

Q Just in the second paragraph starting with Sindermann's name, you make reference to the strict import and quarantine programs. It's just above the paragraph starting, "The following is a review of pathogens," near the bottom of the page.

DR. KENT: Okay. Right to it there, okay. Yes, that's right. There was a paper there we wrote in 2003. So that's what I'm saying. I'm referring to -- Dorothy Kieser and I wrote this review paper which I just summarized there. That was based on my knowledge of the policies up to that -- that was about eight years ago when we wrote that paper.

Q And so the point that I'm just highlighting for your recollection is that you state here:

> ... it should be noted that to date --
>
> As of that date.
>
> -- no exotic salmon pathogen of significance has been documented to have been introduced into British Columbia.

DR. KENT: Right. And I would say it would be hard for me to even think of an exotic pathogen that's of less concern that's been introduced. I can't really recall any.

Q Dr. Kent, you may know that in the production of documents, my client produced a couple of reports that you probably had an opportunity to review. One is a report prepared specifically at the request of our client for these hearings, prepared by Dr. John Lawrie who's, I'm told, is an independent aquaculture consultant.

MR. BLAIR: It's at our Tab 5, Mr. Lunn, if you could put that up on the screen, please.

Q Again, Dr. Kent, looking at the cover sheet, maybe you had an opportunity to review the documents which were produced by various participants?

DR. KENT: I don't recall seeing this particular document. What happened was I received some documents early on, and then a barrage of documents about a week ago, and then even following up a few days ago. As I said, I was teaching back in Maine all last week, and it was difficult for me to access a number of these documents. So this particular document I don't recall. I reviewed as many documents as I can. I don't recall reviewing this particular document, but I'd be happy to try to answer some questions as it pertains to the exhibit.

Q To the exhibit. Thanks for that clarification. I'll just take you through it briefly. You'll see from the title that it was prepared in this year, and Mr. Lawrie has presented Atlantic salmon importation into British Columbia, 1985 to 2011, as a history, and we'll just go over to page 4 in the document. That will be pdf 3.

MR. BLAIR: Section 2.0, Mr. Lunn, you can highlight

that bottom two paragraphs? Thank you.
Q If you could just take a moment, Dr. Kent, to review these two paragraphs that have been highlighted.
DR. KENT: Yes.
Q Does that accord with your recollection --
DR. KENT: Yes. Yes.
Q -- when you were directly involved, and in fact up to the present status to the extent you're able to comment on that?
DR. KENT: Yes.
MR. BLAIR: And if you, Mr. Lunn could go to page 9. I believe that'll be pdf 10. It's 6.0. It'll say page 9. There we are. Scroll to the top, thank you.
Q Now, Dr. Kent, Section 6.0, there's a list of Atlantic salmon importations for the entire period from 1985 through to 2009. After you have a moment to just get familiar with the table, I'll ask Mr. Lunn to scroll to the bottom. It's two-and-a-half pages.
MR. BLAIR: So when you're ready, you can just scroll along, Mr. Lunn.
DR. KENT: That's fine, you can scroll along now.
MR. BLAIR:
Q So you'll see it's set out by year and refers to where the fish came from and the number of eggs and which company was importing them.
DR. KENT: Right.
MR. BLAIR: And, Mr. Lunn, if you just -- after you get to the end of the scrolling, you get to Section 7.0 which is a summary. Thank you. If you can just highlight the 7.0 to the bottom of the page, please?
Q In particular, Dr. Kent, my question is with respect to the bottom paragraph which starts:

> A complete list of all Atlantic salmon importations...

Do you see that on the screen at the bottom of the page?
DR. KENT: Yes.
Q So it's referencing back the table that we just scanned quickly through. There's a reference to:

> Only eyed Atlantic salmon eggs have been

approved by DFO for importation from 1985 to date.

Is there a significance?

DR. KENT: Yes, it's extremely significant in that by having an eggs-only policy, not allowing importation of live salmonid fishes into the province, that you're going to avoid a tremendous number, variety of pathogens to enter the province. So that was our logic behind that. There are vertically transmitted diseases and these are screened for -- there is still some risk of maternal transmission either in the egg or outside of the eggs, but at least you're confining it to a much -- you're basically narrowing the bottleneck significantly, tremendously, as far as preventing the introduction of pathogens.

So this idea of the eggs-only policy in my opinion, and the opinion of many others, is that you are dramatically reducing the opportunity of introduction of an exotic pathogen into the province.

MR. BLAIR: Mr. Commissioner, could we mark this as the next exhibit, please?

THE REGISTRAR: Exhibit number 1482.

THE COMMISSIONER: Mr. McDade?

MR. McDADE: I've notified the Commission I object to the admission of this document, and I object even stronger after listening to the witness say he has no knowledge about any of these matters.

My friend is trying to put in a whole bunch of facts from a document that was prepared solely for him from a witness who's not going to testify and containing a number of facts that we contest as being accurate. This witness isn't testifying to those. I don't think this -- we've been very loose with exhibits throughout the Commission, but this kind of document, prepared solely for the salmon farmers, containing contested facts, should not be put in this manner through the witness.

We do have a day later next week where we're dealing with the salmon egg importation. Perhaps we can revisit that now. But this document shouldn't be marked.

MR. BLAIR: Mr. Commissioner, I'm happy to respond to that, although does Mr. -- thank you.

The process for calling witnesses is well

known to all of the participants. My client, concerned with the shortage of time and the bulk of witnesses that needed to be called, recognized that Commission counsel had the right, really, in first instance at least, to decide which witnesses would be called before the Commissioner, and we respect that as do all of the other participants.

That notwithstanding, I'm sure we've all advocated that certain people be called to bring their particular expertise on a subject. To that end specifically, my client had a number of reports prepared, yes, specifically for this Commission so the Commission would have current and up-to-date information. We described them as expert reports because indeed they in fact are expert reports prepared by people with special skill and experience and knowledge in the area.

We produced them to the Commission counsel and to all participants in the time frame necessary if we were to call them as experts, which is a disclosure earlier in time than if we're merely producing documents to be tendered, so the Commission counsel documents to all of us two weeks before the panel, and all of our documents to everybody one week before the panel. The requirement for an expert report is some 30 days in advance of all of that.

We had discussions with Mr. Martland and the Commission counsel generally, and we said we're preparing several of these reports. This one I've just referred to is but one of them, and we would like to have these witnesses called. Commission counsel, in electing who could be available in a limited time period indicated that, for example, Mr. Lawrie, there's no time for him.

So we call them expert reports because they were prepared that way. We were prepared to call Mr. Lawrie had there been time to call him, and the same will be of my next document and several others that we intend to enter.

I see no distinction whatsoever between these documents and all of the other many exhibits which experts on various panels have been asked to review, sometimes in a very cursory way. This is relevant information for the Commission to hear. We have no other recourse, if we have no time for witnesses, but to prepare a written report

summarizing the evidence and providing an opportunity for witnesses with the skill and experience of, for example, Dr. Kent, to comment on them, and that's what he's done.

So the document speaks for itself. Dr. Kent has explained that it's consistent with his recollection and knowledge of the importance of egg importation quarantine, and therefore we have no way of getting this evidence in, but for filing it. It's completely consistent with the approach taken by all counsel in entering a host of documents before the Commission so that you'll be well informed.

MR. MARTLAND: Mr. Commissioner, from Commission counsel's perspective, I'd suggest this ought to be marked as an exhibit. First, as Mr. Blair said, there's not a distinction between documents for which notice is given, and documents for which expert report notice -- this isn't a document that I don't think he's -- I don't hear him to say this document has a special status or calibre or quality to it.

With respect, broadly speaking, we have taken a very liberal approach to the introduction of exhibits. If it's been used for a question, very often the document would be made an exhibit. I don't understand the objection framed here to identify an exclusionary rule in the sense that there's something improper about the document.

At the end of the day, of course, all of these documents with respect to whatever weight or use can be made of them, will be the subject of one's understanding of all of the evidence and counsel's submissions. Counsel may say that where the witness had never previously read the document, that evidence or that document is entitled to weight or less weight accordingly.

With respect to the broader question of documents prepared for the Commission, that has occurred on some occasions. There have been other examples of it. Mr. McDade, in his own list of documents for this panel at Tab 42, includes a document which I would suggest is of a similar character in being prepared really in anticipation of this process today.

So unless he's prepared to accept that documents like that are not to go in, generally

speaking, there should be a fair and equitable rule for all participants.

MR. LEADEM: I don't want to protract this unduly, Mr. Commissioner. Leadem, initial T., for the record.

You may recollect that I endeavoured to do more or less what Mr. Blair has attempted to do, or is attempting to do with Mr. Langer's reports, some of which were prepared expressly for the Commission, and they were marked for identification purposes. I have an outstanding request to call Mr. Langer.

I would suggest that in the interests of similarity, that we mark this for identification purposes akin to what we did with Mr. Langer's reports.

THE COMMISSIONER: Well, Mr. Leadem --

MS. GAERTNER: Mr. Commissioner, perhaps just before you respond, I have one more (indiscernible - microphone not on).

THE COMMISSIONER: Yes, Ms. Gaertner.

MS. GAERTNER: I'm sorry. The suggestion that there's a similar rule being applied to all these documents throughout the Commission is inaccurate. In my submission, there's a list of documents that are listed for identification that have been adjusted for one or different reasons, and the rules are not applied equally to all these documents.

So if there's going to be a tendering of the documents, as Mr. Martland has suggested, and the way that he suggested, I suggest we review all those lists of identification. I've had difficulty getting documents in that are referenced in a document. I mean, there's all kinds of ways that there's been difficulties, and no similarity of approach.

THE COMMISSIONER: Thank you, Ms. Gaertner. It goes without saying that there is a wide variety of documents that have been marked in these proceedings. In some cases there have been objections. Those objections are often specific to the nature of the document that is attempting to be entered.

In this particular case, it's going to be marked for identification purposes. I will leave it for counsel at another stage of this process to make their arguments with respect to its admission

as an exhibit, but that's not to say that Mr. Blair is not entitled to ask the witnesses questions about this document. To the extent that Dr. Kent has knowledge in relation to the questions that are being put to him that relate to this document, he should be permitted to answer those questions. So that's how we'll follow this particular process today with this particular document.

THE REGISTRAR: Reference to Exhibit 1482, reference to this document will now be marked for identification NN, double N.

EXHIBIT NN FOR IDENTIFICATION: Lawrie document entitled "Atlantic Salmon Importations into British Columbia 1985-2011"

MR. BLAIR: Thank you, Mr. Commissioner. We'll get right back to the issue again, Mr. Lunn, if you could produce Tab 7.

Q My question again is for you, Dr. Kent, and again with the same preamble for all of the parties today. This document was also prepared at the request of our client for the same purposes of informing the Commissioner with respect to the issues addressed in this report.

I'll start, Dr. Kent, do you know Dr. Larry Hammell who is the author of this report?

DR. KENT: Yes, I do.

Q Have you known him for some time?

DR. KENT: I've known him as a colleague for probably 15 years or so. I don't know him really well, but I know who he is and I've met with him at conferences and things like that.

Q This document is described as "A qualitative assessment of risk and mitigation of importing exotic diseases through eggs". Certainly you have a familiarity with that topic and can speak to it knowledgeably yourself?

DR. KENT: I could talk about the topic. I'm not that familiar -- I looked at this document very quickly amongst all the other documents that I was given. But I can talk about more at a subjective level about the ideas, as I already mentioned, about screening pathogens, avoiding introduction of pathogens with eggs or gametes by screening, et cetera.

MR. BLAIR: Dr. Kent and Mr. Lunn, I'd like to take you to page 5, pdf 5, as well, of this document.
Q My question for you, Dr. Kent, is really what measures can be undertaken to reduce the probability of pathogen introduction, and I direct you specifically to the paragraph in bold, "Comments regarding risk mitigation", where Dr. Hammell describes the risk from egg importation being reduced to low to extremely low, and he lists three methods for doing that. Could you take a moment to read that paragraph?
DR. KENT: Okay. Yes, I've read it.
Q Do you agree with it?
DR. KENT: Yes, I do.
Q Thank you. And the only other reference to this particular document, Dr. Kent, is the summary which is immediately below.
MR. BLAIR: Mr. Lunn, if you could bring up the paragraph, "Summary"? Thank you.
Q Again, Dr. Kent, you indicated you had a brief opportunity to review it so I'll give you an opportunity to read this full paragraph and then I'll ask you a question, please.
DR. KENT: Okay, I've read it.
Q Thank you. So having read this passage, and knowing Dr. Hammell as you have for a number of years, do you agree that the importation and quarantine programs used in British Columbia have reduced the risk of importing exotic diseases through egg transfers?
DR. KENT: Yes, I do.
MR. BLAIR: I'd like to have this marked as the next exhibit, please.
THE COMMISSIONER: It will be similarly marked, Mr. Blair.
MR. BLAIR: Thank you.
THE COMMISSIONER: For identification purposes.
THE REGISTRAR: Marked as OO.

EXHIBIT OO FOR IDENTIFICATION: Hammell document titled, " Qualitative assessment of risk, and mitigation, of importing exotic disease through eggs"

MR. BLAIR: Thank you. I have no further questions. I'm not sure what happens to my time, Mr. Commissioner, as a result of finishing early and

having a discussion on evidence, but I'll leave that to the good graces of the Commission and Mr. Martland.

THE COMMISSIONER: I may apply to have your time, Mr. Blair.

MR. BLAIR: Well, not that I could deny it from you, but you're certainly welcome to it.

MR. MARTLAND: Mr. Commissioner, Mr. McDade is next on the list. He has 75 minutes, indeed it may be a further -- it may be 80 minutes. I'm not sure if the Commission's preference is to begin with his questions now or take the morning break.

THE COMMISSIONER: No, I think he's ready to go, so we'll let him start.

MR. MARTLAND: All right.

THE COMMISSIONER: Mr. McDade?

MR. McDADE: Gregory McDade for the Aquaculture Coalition.

CROSS-EXAMINATION BY MR. McDADE:

Q Dr. Kent, if I might start with your report, report number 1. As I understand it from reading it, you've been away from B.C. for 11 or so years?

DR. KENT: Yeah, 12 years.

Q Yes. And so it was primarily based on published literature and published studies?

DR. KENT: My report was -- yeah, primarily based on published literature and published studies, yes.

Q You haven't done any original research into the 2009 decline, have you?

DR. KENT: Not directly.

Q So these -- and as I understood both you and Dr. Stephen to testify yesterday, most of the published studies available on disease are related to diseases on fish farms or hatcheries.

DR. KENT: That's correct, captive fish, with some -- there are a number of studies that have been done on diseases in wild fishes but not -- but comparatively, much fewer on wild salmonids in particular in the marine environment.

Q In particular, your work, for much of your career, is based on -- been reviewing fish farms and the diseases that affect farmed fish.

DR. KENT: When I was working in British Columbia, most of my work was on working on diseases in hatcheries and in fish farms. That was up to

1999. I moved to Oregon State University at that time. There's not active net-pen farming industry and the aquaculture is quite minimal in Oregon.

My research with salmonids shifted at that time to looking at largely to impacts of diseases in wild salmonids, and then of course it's going to be in stocks of importance in Oregon such as working with impacts of parasites on -- associated with over-winter mortality in coho salmon and coastal rivers of Oregon and, more recently, in the last three years, we've been working quite extensively on trying to assess the role of pathogens and pre-spawning mortality in chinook salmon.

So I have been continuing to work -- the work in B.C. was mostly with captive fish. The work in Oregon in the last ten years is mostly with wild salmonids. That's one aspect of my research.

MR. McDADE: Could we have Dr. Kent's c.v. up on the screen, page 27.

Q Dr. Kent, I took a look through your list of published reports, and this is -- this seems to be the part of your resumé dealing with the early 1990s. As I scroll through these studies, they're almost all involving net-penned or farmed fish, aren't they?

DR. KENT: Those are. Actually, I'm surprised that you'd go to this part of my c.v. These are non-peer-reviewed papers. The peer-reviewed papers would be found earlier in my c.v.

Q So if we go to page 20, for instance, that would be peer-reviewed papers, I think, from the same period?

DR. KENT: That's correct.

Q Those are also all about farmed fish and net-penned fish.

DR. KENT: Mostly, yes. That's right.

Q And could we go to page 24? I see you've written two books, and those are in the middle of the page.

DR. KENT: That's correct.

Q And those are both about diseases of net-penned fish?

DR. KENT: That's correct.

Q So you're primarily an expert in diseases in fish farms.

DR. KENT: No. I disagree with that.

Q All right. Well, while you were in B.C. that was primarily your --
DR. KENT: That's correct.
Q -- expertise. All right. And that's the basis upon which you've been called to become an expert at the Commission, I would presume.
DR. KENT: I disagree with that. Actually, when I had -- my conversations with Dave Levy were -- and my c.v. was twofold, why I think I'm appropriate for this. One is my past experience with DFO working with the net-pen farms, and my present experience working with diseases in wild salmonids.
Q It's fair to say, though, that you -- as I read your report number 1, you haven't really looked at the question of diseases found in fish farms that are transferred to wild fish.
DR. KENT: No, I have not worked much in that area.
Q You ignored fish-farm disease in the preparation of your report 1, didn't you?
DR. KENT: No, I discussed -- most of the pathogens I discussed actually occur in fish farms.
Q Yes, but you haven't talked about the risk of -- the increased risk of their transfer by the fact that they're in fish farms, have you?
DR. KENT: No, I didn't address that much in my report.
Q And there are a number of diseases found in fish farms, both in B.C. and throughout the world, that could be quite risky to wild salmon that you don't discuss in your report, aren't there?
DR. KENT: The main disease that has been of most concern in B.C. has been with sea lice, and that's been discussed in a separate report, so I did not give much emphasis to that.
MR. McDADE: Can I go to page 55 of the report, if I could?
Q Now, page 55, there's the comments of one of the peer reviewers of your paper, are they not?
DR. KENT: That's correct.
Q And I'll just show you to the bottom -- the comment at the bottom of the page, starting:

> A really looming question that hasn't been covered in the report surround the questions relating to fish farms and the potential of this component of [in] their disease history...

You'd agree with that, wouldn't you?
DR. KENT: I agree that that was what was written there.
Q Well, no --
DR. KENT: I don't agree that that's a big looming question, though. I agree that was written in the document, that that's what a reviewer stated. I disagree with that.

If you want my subjective opinion on this, I agree that that is not the looming question as the demise of the sockeye salmon. In my opinion, I think it's certainly on the radar, but it wouldn't be the most looming question and concern.

I think where -- I see where you're going with this, that you're trying to emphasize that fish farms are a much more important role in the sockeye salmon than I've particularly -- based on my experience and knowledge, would believe. And that's basically -- of course the bias in my report is directed towards my general feeling, that the fish farms are not the primary source based on the evidence at this point, of the demise of the sockeye salmon.
Q It might be best if you didn't try and guess where I was going and just answered the question direct.
DR. KENT: Well, you're guessing where I'm going.
Q The question I'm asking you is whether your report didn't cover the problems from fish farms, regardless of the reason why.
DR. KENT: That's correct.
Q It didn't, did it?
DR. KENT: It did not. It did not cover -- when I talk about each particular disease and its role, I did not include a section saying what the risk of the diseases emanating from fish farms. In each particular disease, I did not talk about what the role of fish farms would be in transmitting it to sockeye salmon.
Q Okay. And this reviewer's comment, you'll agree, was that you should have.
DR. KENT: That's his comment, yes.
Q And your answer is in the bold, there, at the top of page 56.

Fish farms and sea lice are dealt with in more depth in another report.

DR. KENT: That's correct.
Q And which report is that?
DR. KENT: That's with the various fish farm -- the Report 5, and at that -- now I realize there are several reports that are coming out on fish farms, so that's where it was being dealt with.
Q But you were the disease expert contracted to deal with these questions, and they're not disease experts, are they?
DR. KENT: I don't know their expertise.
Q So you didn't do this fish farms in your report because you felt they were being done at another time; is that fair to say?
DR. KENT: And this was following discussions with the Commission. When I had this review back, I discussed this with Dr. Levy about should I expand this, based on the limitations in my report and the time, and then following the discussions of Dr. Levy, that was the decision, to leave this for the fish farm issues.
Q Well, before this review ever came in, you'd already decided consciously to ignore fish farms, hadn't you?
DR. KENT: No.
Q But you didn't do it.
DR. KENT: That's right, because I did not find great evidence of diseases being transmitted from fish farms in -- being in the (indiscernible) of sockeye salmon.
Q Well, according to this comment, you didn't do it because it was part of --
DR. KENT: Other than -- other than the sea lice. So the other pathogens, I found no dramatic evidence -- strong evidence that they would be transmitted from fish farms. And the sea lice is a huge issue. That could have encompassed my whole report. So aside from sea lice -- sea lice was being dealt with in another report. The other pathogens were not -- as far as the evidence to date, other pathogens I don't see as a big risk of being transmitted from farm fish to the wild fish.
So, for example, with IHN, I discuss IHN, but there's -- it occurs -- the sources of IHN, in my opinion, for the sockeye salmon, would probably be mainly from other sources than the fish farms.
MR. McDADE: If we could go over the page to page 57, please, Mr. Lunn. If we could scroll down to

number 5.
Q Again here, you'll see, Dr. Kent, there was a comment from a review suggesting that:

> Issues surrounding the linkages between fish culture (and, specifically, fish farms), disease and the potential/likely-unlikely cause of the collapse of Fraser River sockeye.

Is a big question. You comment is, again, this is for the fish farm report?
DR. KENT: That's correct.
Q And you're saying that was something the Commission told you or something you decided yourself?
DR. KENT: In consult with the Commission, this is what -- the direction that I went with.
Q So you're saying the Commission told you not to deal with fish farm disease?
DR. KENT: No, they gave me the okay. No, they did not say not to deal with fish farming diseases with sea lice, not to deal with sea lice.
Q If I could go to page 38 of the report? This is a statement of work you were given from the Commission, is it not?
DR. KENT: That's correct.
Q So this is the outline of what you were supposed to do.
DR. KENT: Yes, that's right.
Q And under 2.1, it says [as read]:

> To study and document the potential effects of parasites and diseases on Fraser River sockeye salmon and their role in the 2009 run failure.

DR. KENT: That's correct.
Q But you didn't -- so there's nothing there saying you should exclude fish farms from your analysis.
DR. KENT: No.
Q And under 3.1, it says you'll take a broad view of sockeye diseases and parasites and evaluate the full spectrum -- the full spectrum of diseases. That doesn't say you should ignore fish farms in favour of Project 5, does it?
DR. KENT: You keep on flipping between fish farms and

disease. There is -- there'd be something like -- it would be equivalent to say emphasizing hatcheries. It's kind of like you're comparing these as apples and oranges. You keep going fish farms, I didn't address the role of fish farms in disease.

I talk about the diseases specifically, and then if there was a direct link to fish farms -- we're talking about the directive is to look at the impacts of a number of diseases. My directive was not to look at the role of fish farms and the impact on sockeye salmon.

Q But let's just be clear. You didn't spend any time studying the role of fish farms in the causation of disease.

DR. KENT: I disagree.

Q Did you look at the Fish Health Database?

DR. KENT: Which exhibit is that one?

MR. McDADE: Mr. Lunn, could we have up the list of documents that I referred to as the Fish Health Database?

MR. LUNN: Yes, one moment.

MR. McDADE:

Q Dr. Kent, that's the actual spreadsheets and reports of the fish health auditing and the reports that the fish farms make to the province around fish health. Did you look inside those documents?

DR. KENT: I look at -- I scanned them. There's quite a few of them. If I believe -- are these the Excel sheets that -- in the form of an Excel sheet?

Q Yes.

DR. KENT: Yeah, I've looked at them. They came to me quite late. I actually reviewed them this morning. I scanned through them. They're pretty extensive, but I didn't go through them in all sorts of detail.

Q So did you see -- did you have them when you did you report?

DR. KENT: No, I didn't.

Q Well, wouldn't they be relevant to your report if there's diseases that are all over those spreadsheets?

DR. KENT: They'd be useful. It's not peer-reviewed literature, but they would be useful.

Q Well, what's the distinction from peer-reviewed

literature?
DR. KENT: It's been validated by professionals. It would be of use, but I -- given the limitations that I had with my time, the most useful data were peer-reviewed papers for the study.
Q And so if DFO hasn't studied a matter, if there's no peer-reviewed paper on it, for you, it didn't exist?
DR. KENT: No, I said it has less significance to me.
MR. McDADE: All right. This might be an appropriate time, Mr. Commissioner.
THE COMMISSIONER: 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.

CROSS-EXAMINATION BY MR. McDADE, continuing:

Q I understand, Dr. Kent --
THE COMMISSIONER: Your microphone, Mr. McDade. Your microphone, thank you.
MR. McDADE: Sorry.
Q As I understand it, Dr. Kent, then, the databases that are listed on the screen are ones that you did not have at the time of writing your report, but you have subsequently reviewed.
DR. KENT: I did not have them at the time of my report. I can't remember which ones I reviewed and which ones I haven't. Just based on names like DCPO001645, I don't -- my memory's not that good to remember every single report. The names are very similar, so I can't -- I can't, in honesty, tell you which ones of these reports I've looked at carefully and which ones I haven't. If you want to pull any of these specific reports, I'd be happy to review them with you.
MR. McDADE: Yes. Can we have then, the first document on the screen up on -- well, before we do that, Mr. Commissioner, I'd just like to mark this list as an exhibit, because I think it will make things a lot quicker and easier in the future.
THE COMMISSIONER: I'm not going to stop you from doing that. I just would prefer if you go through it a

bit so I understand what it is, Mr. McDade, and then we'll deal with the marking of it.
MR. McDADE: All right.
THE COMMISSIONER: Thank you.
MR. McDADE: Well, let's take the first list, the first document on the list, and --
MR. MARTLAND: Sorry, Mr. -- I just rise because Ms. Callan's here I presume to object. I don't know that Mr. McDade noted that.
MR. McDADE: Oh, sorry.
MS. CALLAN: Yes. I propose that we put off marking any of the databases until Dr. Marty gets a chance to give evidence, because some of these databases are going to be used for an upcoming publication. And I think in all fairness to Dr. Marty so he can actually speak about this issue and inform the court, any decision on whether they're marked as an exhibit should be put off until that time.
MR. McDADE: Well, I'm not proposing to mark it at this point.
MR. TAYLOR: And I'm up trying to shorten things. This, unless Mr. McDade says otherwise, is his list of documents for what he wants to do now, and it can be marked for ID and nothing more.
MR. McDADE: I have no problem with that.
THE COMMISSIONER: All right. Well, let's do it that way, then. Thank you.
THE REGISTRAR: The document will be marked as for identification PP, double "P".

PP FOR IDENTIFICATION: List of Fish Health Databases produced to Cohen Commission by Aquaculture Coalition

THE COMMISSIONER: Mr. McDade, if you could just for the record identify what the document is.
MR. McDADE: Yes. This is a document listing 20 separate Ringtail numbers -- Ringtail documents that I contend are the list of B.C. databases relating to fish health. The first one is a spreadsheet relating to the BCMAL audits. The second is related to the fish that are submitted by the fish farms to BCMAL, and most of the rest of these are Dr. Marty's, or BCMAL databases of various animal health reports that he's prepared.
THE COMMISSIONER: Thank you very much.
MR. McDADE: So I guess we have 2864 up on the screen.

Can we have it up as an Excel sheet, Mr. Lunn.
MR. LUNN: I have that version, certainly.
MR. McDADE:
Q This is a spreadsheet -- if you could scroll down, Mr. Lunn, I think it goes from number 1 through many, many hundreds of reports. As I understand it, Dr. Kent, these are a summary of the various audits that are taken from time to time by BCMAL. of the four or five fish that are taken and analyzed. You've seen that before?
DR. KENT: I just looked at this very quickly.
Q Yes. And Mr. Lunn, if you could go to the abbreviation section, which is the Tab -- fourth tab. You will see the -- on the right-hand side, the -- in text the various summaries, three-letter summaries, for the cause of death in alphabetical order. And if we could just scroll down to "ISH", for instance. Are we able to -- "ISH" stands for interstitial -- and maybe you can pronounce that for me. Can you read that?
DR. KENT: Where are we at, -- oh, interstitial hyperplasia of the kidney.
MR. McDADE: And if you could just read what it says there, if you could highlight that, Mr. Lunn.
MR. LUNN: I can only do so much with magnification in Excel, but I'll do my best.
MR. McDADE: I think if you just click on that -- that cell, it will show up at the top, and the next cell over, yes.
Q "ISH" -- I think what it says there is [as read]:

> ISH is evidence of increased demand for erythrocytes or white blood cells sometimes in the body. In chinook salmon this lesion is often associated with the clinical...

Can you scroll over on this?
MR. LUNN: I'm trying.
MR. McDADE:
Q

> ...the clinical diagnosis of marine anaemia.

So ISH is a lesion associated with marine anaemia, according to the authors of this document.
DR. KENT: That's correct.
Q Yes. Now, if we could go back to the Pacific Tab, these would be Chinook salmon. And if you could

scroll across to the ISH column, which is I think the AT column. Yes. So if you could highlight the AT column, Mr. Lunn. Do you see that there, Dr. Kent?

DR. KENT: Yeah, I see that.

Q And so fish-by-fish, you'll see that there's an indication in the ISH column of marine anaemia.

DR. KENT: No, that's not right.

Q Well, the symptoms associated with marine anaemia.

DR. KENT: Interstitial hyperplasia of the kidney can be caused by a vast number of organisms, including plasmacytoid leukemia, or referred to as marine anaemia. When we -- when we worked with this disease and came up with a diagnosis, a diagnosis for plasmacytoid leukemia would require seeing a proliferation of immature lymphocytes, particularly plasma cells. It's pretty difficult to differentiate by histopathology in other organs that go beyond the tissues where hemopoieses occurs, that is when blood formation occurs.

So the kidney in fish is where blood is formed. It's basically equivalent to our bone marrow. So you could have a hyperplasia, increased numbers of cells in the blood forming organ, which would be the kidney interstitium, caused by a vast number of organisms. When we make a diagnosis of marine anaemia is when we see these immature cells, basically a leukemia-like condition occurring in organs outside of blood-forming organs.

So that would not be inconsistent with marine anaemia, but would not be pathognomonic for marine anaemia.

Q But you see how this database works. It's a list of various symptoms.

DR. KENT: Yes.

Q And you would depend on the diagnosis for the -- eventually the diagnosing veterinarian?

DR. KENT: Yes. And this is -- if this was prepared by Dr. Marty, or his group, as a histopathologist he described the lesions and eventually the typical pattern would be then a veterinarian, a clinical veterinarian, taking information on knowing the species, the history, other information about the fish, in conjunction with the pathological changes would make the diagnosis. And sometimes the diagnosis is made very strongly based on

histopathology, sometimes in this case, this -- like, for example, interstitial hyperplasia, if they had run a test and found bacterial kidney disease in the same fish, you know, by another test, a molecular test or a culture, you would say -- the veterinarian would probably say the diagnosis would be bacterial kidney disease, not marine anaemia.

So it's part of what a veterinarian uses for making their diagnosis, and sometimes it's very strong. Sometimes it's the major part of making the diagnosis.

Q And sometimes you might have two or three symptoms of a disease and not a fourth, and not be able to make any diagnosis at all.

DR. KENT: Fish don't develop symptoms. They develop clinical signs, but that's just some vernacular use of it. But anyway, you can have multiple lesions and sometimes you can have multiple diagnoses, for sure.

Q So did you review these documents to determine what diagnoses were?

DR. KENT: No, not in any extent. I'm aware of the diseases that are occurring. I did not review these extensively for the fish farms. And I guess to take a little step back on what your accusations were before we had the break, that I deliberately ignored the role of fish farms, I generated my list of what was the most important diseases that we had. We've gone over those the last couple of days. And for any of those diseases, where there was an indication of a role of fish farms being a major source, or any source of these diseases to those sockeye salmon, I certainly would have addressed it.

So I guess I could have done, if this probably would have made your group happier, if I had a separate category of role and diseases with each one of these particular high priority diseases, I could say -- I could have stated "No direct evidence at this time" and maybe that would have clarified the situation, where you contend that I just deliberately ignored the role of fish diseases, if I did not find from my information a concrete role of fish farms in these particular high risk diseases as far as transmitting to wild salmon, I would have put it in there.

Q But how would you know without looking at the diagnosis what role fish farms were playing? Wouldn't you have to know how many times these diseases have been diagnosed?

DR. KENT: Some of these diseases, this would be helpful information but we know the nature of transmission of these diseases, et cetera, and some of the sources of these, like *Ichthyophthirius multifiliis*, that's a disease that occurs in freshwater that would not have any relationship to the occurrence in these -- in the wild fish. So basically it's from a general knowledge. Of course this would be -- this would be a useful additional knowledge for some very specific hard data on the prevalence. And I assume that these -- and the prevalence and the distribution of these pathogens. I'm not saying that this would not be useful information, but it was not required for me to do my report.

Q So you didn't look at how many times the disease marine anaemia has been diagnosed in B.C. fish farms over the last ten years.

DR. KENT: No, I didn't, and I don't see -- and I don't see a diagnosis of marine anaemia on here.

Q No. But that's my point. You don't know how many times marine anaemia has been diagnosed, do you?

DR. KENT: No, I don't.

Q You don't know how many times IHN has been diagnosed, do you?

DR. KENT: That information is from other reports, et cetera, where -- where other data report that there has been no outbreaks of IHN. That's from other grey literature data that were given to me. So I'm not relying on the absence of IHN outbreaks in B.C. farms, based on this database. I was basing that on summaries from other documents that I had available for me when I was preparing this, when I was preparing this overview.

Q Summaries of other documents, that is, something that the people who prepared these documents have summarized for you?

DR. KENT: That's my understanding.

Q So you have to rely on their accuracy.

DR. KENT: I don't have to rely on those. That's what I used. As I said, this particular - I don't know who I should address this to - when these documents became available, I'm not quite sure.

You probably could answer that.
Q So, yes, I understand these documents weren't even available at the time you prepared your report; isn't that right?
DR. KENT: That's my understanding.
Q So you had to rely entirely on what you were told about whether these diseases appeared.
DR. KENT: And the peer reviewed literature.
Q Could we have Aqua 30 up on the screen. Do you see the chart at the bottom of this document. What I suggest to you that is, is a list taken from the document we just looked at, 2864, of the number of times these various clinical signs appear in that document.
DR. KENT: Okay.
Q Would you consider that relevant?
MR. MARTLAND: And I wonder, Mr. Commissioner, as you indicated previously, if Mr. McDade's in a position to explain what we're looking at, what its provenance is, what it describes.
MR. McDADE: I was about to -- I was doing that.
Q As I understand this, this is a list prepared by Dr. Morton from the document we just looked at of the number of -- just a simple arithmetical calculation of the number of times these various clinical signs appear in each of those columns.
DR. KENT: And I would -- I see this thing and I would be interested, and she's not a veterinarian, how she came up with a -- if it specifically said "Marine Anaemia" and Dr. Marty gave a diagnosis of marine anaemia, or was this interpretation of interstitial hyperplasia and assigning the diagnosis of marine anaemia. I don't know that.
Q You'd have to know the answer to that to be able to give an opinion, wouldn't you.
DR. KENT: That's right.
Q So this document is essential to being able to give an opinion about whether marine anaemia exists in fish farms or not.
DR. KENT: And how -- and how the diagnosis was achieved.
Q And if I could go up to the chart, which is just a straight arithmetical preparation from the documents below, if I suggest to you that there are some 1,100 references in document 2864 to ISA, to classical signs -- classical signs of ISA, what do you say about that?

DR. KENT: I'd like to hear -- I'd like to hear how this diagnosis of what they mean by classical signs of ISA lesions are. Who came up with assigning this to say these are ISA-like lesions? Did Dr. Marty call these ISA-like lesions?

Q Yes, I think he did. If we could go back to 2864. If we could go to the abbreviation section, and if we go to say, "HEM", and if we could scroll over to see what it says there on that cell. Again I think we have that same problem [as read]:

> HEM is often associated with VHSV and bacterial infections.

And then he says [as read]:

> Renal congestion and haemorrhage is one of the classic signs of infectious salmon anaemia, ISA, but ISAV has never been isolated from fish in B.C.

Do you see that?

DR. KENT: Yeah, I see that. Thank you. Thanks for clarifying that ISA has not been seen in B.C.

Q Right. But these are classic ISA lesions, are they not?

DR. KENT: They're not pathognomonic for ISA.

Q How do you know that?

DR. KENT: How do we know it's not pathognomonic?

Q How do you know that?

DR. KENT: I know it's not pathognomonic for ISA because haemorrhage and congestion of visceral organs could be caused by a variety of different pathogens and non-infectious agents. So it's not pathognomonic for ISA.

Q But it could be ISA.

DR. KENT: It could be ISA, sure.

Q Right.

DR. KENT: It's a histopathological change that's not inconsistent with ISA. So just jumping to saying that it's ISA-like lesions is really misrepresentation of a histopathological report, because there are many other causes of these non-specific lesions.

Q But those are Dr. Marty's words.

DR. KENT: He list ISA as one of the causes and he also -- you notice his first thing is a non-specific

result of endothelial damage.
Q All right. And, actually, yes, if we go down there. Can we go down to SES -- "SSC", sorry, sinusoidal congestion. Again, if we could look at what it says at the end of that. Again Dr. Marty said "Classic lesion of ISA".
DR. KENT: Also, I would -- it is a classic lesion of ISA, but let's talk about a pathogen that we know occurs in B.C., it's a classic lesion of *vibriosis*, as well, too.
Q So for each of these samples, one would want to test for either disease.
DR. KENT: Yes, of course.
Q And if there's an open diagnosis, when one doesn't know which of the diseases it is, it could be either, isn't it?
DR. KENT: It could be, but if the -- yes, of course, it could be either. You have not ruled out that if you see a lesion like this, you have not ruled out that it's ISA and you haven't ruled out other things, as well, too.
Q So my question, Dr. Kent, is without reviewing this document, how could you rule out ISA in B.C.?
DR. KENT: Based -- there's no additional evidence that ISA is occurring. These lesions are too non-specific to make me go to a conclusion that based on the viral screening which has not found the virus, when I see these two lesions -- I haven't reviewed the histopathological slides, but I know that Gary Marty is a very competent, Board certified pathologist, and that these particular lesions are just way too broad that I would be suspecting ISA, particularly because the virus has not occurred here. It would be like if you had a human that came to the hospital here in Vancouver and showed excessive haemorrhaging. You wouldn't say, well, that excessive haemorrhaging is consistent with Ebola virus. Well, you didn't test for Ebola virus so therefore we're going to say it had Ebola virus. That's kind of the way I can see that you're kind of going with this -- with this discussion.
Q Well, actually, I'm just trying to examine your report.
DR. KENT: Okay.
Q It seems to me it was you that said --
DR. KENT: No evidence.

Q -- that the risk is -- there's no evidence of ISA.
DR. KENT: That's correct.
Q And you're basing that on the fact that there's no published literature that says there's a case.
DR. KENT: And there also, whatever the documents that were given to me, I did review another document. I'm not sure exactly what the number was, where they've actually screened with a specific test for the virus a number of fish somewhere in the hundreds, and then not found the virus. I don't know if you could address the Province, if they've been looking at these. If anyone's done any virological examination on these specific fish, I have no knowledge of that. But they have screened fish and they not have detected the virus. And so that's what I'm basing -- I'm not basing -- we could ignore these histopathological changes. I'm basing there is no record of ISA virus in B.C. based on the limited -- on the fishes that have been screened for the disease, and with a specific test.

These tests are far too non-specific to ascribe ISA and in light of -- if ISA had been actually isolated in B.C., then I would add a little bit more weight to these particular lesions and my diagnosis would go up a little bit higher as far as ISA being a differential diagnosis. But if we have these types of changes that we see here and are known pathogens and known conditions within B.C. that can cause these, ISA would be pretty well on my list.

MR. McDADE: Mr. Commissioner, I'd like to mark that chart and graph for identification.
MR. TAYLOR: No. I'm not sure which one Mr. McDade is referring to, but I take it that he's referring to as one thing the document that was on the screen a few moments ago.
MR. McDADE: Yes.
MR. TAYLOR: This is something as I understand it Ms. Morton prepared. She is not an expert in this area. This falls in the same camp, and worse, than the document that came up when Mr. Blair was speaking. This is equivalent to or akin to someone coming in and giving their own unexpert view of expert material, and that should not happen.
MR. McDADE: I'm asking to mark it for identification

on exactly the same premise that the previous documents were marked for identification.

MR. TAYLOR: Well, for identification, I mean, I can't really object to that. But it is simply there for the bare identification, and nothing more.

MS. CALLAN: The Province also would support the federal government's objection and notes that any identification or any reference to it should be put off until Ms. Morton testifies.

THE COMMISSIONER: We'll mark it for identification, Mr. McDade.

MR. McDADE: Yes, thank you.

THE REGISTRAR: That document will be marked for identification QQ, double "Q".

QQ FOR IDENTIFICATION: Graphs of BCMAL Audit data (BCP002864) Region 3 only (excludes west coast Vancouver Island)

MR. McDADE: And the previous document, the Excel spreadsheet, can I ask that that be marked as an exhibit.

THE COMMISSIONER: Mr. McDade, just so I understand, there was the spreadsheet, but prior to that there was another document on the screen. Are they both the same document?

MR. McDADE: They're both -- they're different tabs of the same document.

THE COMMISSIONER: Oh, I see. Thank you.

MS. CALLAN: And the Province would object to this being marked as an exhibit until Dr. Marty testifies, because of the upcoming publications.

THE COMMISSIONER: We'll mark it for identification, then, thank you.

THE REGISTRAR: Which is marked as RR, double "R".

THE COMMISSIONER: Thank you.

RR FOR IDENTIFICATION: Marty, Histopathology of Atlantic salmon sampled as part of the BC Auditing and Surveillance Program

MR. McDADE: Sorry, Mr. Commissioner, I don't understand the basis of the objection. This is a document prepared by the Province. It's not prepared for this hearing. It's an accurate document. It should be an exhibit.

THE COMMISSIONER: I'm not saying it won't be, Mr.

McDade. I'm just -- Dr. Marty is coming to testify, we can deal with the marking of it as an exhibit when he appears.

MR. McDADE: All right.

Q Now, Dr. Kent, let's move to a slightly different topic. I take it you'd agree with me that fish farms can cause a significant change in the environment that wild fish swim through in relation to potential risk of disease.

DR. KENT: I don't agree with that. There is a potential for risk, but "significant", that has yet to be proven. There is -- that would be a concern, but I wouldn't say they are a significant risk. It's one of the areas of risk that would need to be addressed.

Q So you say it's a risk but not a significant one, or of unknown significance?

DR. KENT: Unknown significance would be more accurate.

Q All right. I'm referring to an earlier paper that I think you wrote in which you said that the two ways in which fish farms can impact fish are either a new disease or to take an endemic disease and make it worse. Is that...

DR. KENT: That's correct.

Q So there are a lot of ways in which a fish farm can make an endemic disease or an endemic pathogen a higher risk for disease.

DR. KENT: That's correct.

Q Yes. And fish farms by their very density are great places for the emergence of disease, aren't they?

DR. KENT: Well, there's the densities, there are -- densities would play a role in directly transmitted diseases. This is kind of a -- there's an assumption that's made out there that farm fish are under more stress and more disease than wild fish, and actually, if you look, wild fish have a higher prevalence and abundance of pathogens than farm fish. Density is one thing that would be in a negative favour towards fish in net pens, but there's many other factors that are basically, and they're positive for there to be less disease, such as controlled diseases, as a control of freshwater diseases as they're put into the pens. The opportunity to vaccinate, remove sick fish from -- dead fish quickly from the environment, et cetera.

So, yeah, crowding would be one that would be shifting more towards more diseases, but this should be put in context because there's a lot of other factors that would actually be in the favour of farm fish to have less diseases.

Q But they can increase the rate of pathogens that wild fish are exposed to?

DR. KENT: Yes.

Q And particularly when a fish farm is undergoing a disease outbreak, they greatly increase the risk of pathogens to wild fish.

DR. KENT: They greatly increase the numbers of pathogens in the environment, making the assumption that they're greatly increasing the chance of infection of these pathogens. That's really a large unknown because we don't know very much about the survival of many of these directly transmitted pathogens in the marine environment. So, yes, that would be a reasonable assumption to say that there's generally numbers of pathogens in and around the pen are going to be increased. How this would increase the exposure and infection in wild fish, that's -- that's really an important question that has to be answered for most diseases.

Q Fish farms can get a disease from wild fish and then incubate it or amplify it, can't they?

DR. KENT: That's correct.

Q Fish farms can take a disease that's present in an avirulent form in wild fish, and have it mutate to a virulent form. That's been seen as well, hasn't it?

DR. KENT: I'm not aware of that. Maybe you could tell me about which document referred to that one.

Q You don't know anything about increases of --

DR. KENT: Virulence in a fish farm from a wild -- no, I don't know of a specific example of that.

Q Dr. Stephen, would you agree with that comment?

DR. STEPHEN: Oh, I'm not aware of a case of that, either.

Q What about ISA in Norway? No?

DR. KENT: Actually, Dr. MacWilliams has done -- who has done a lot of work on ISA, maybe she could respond to that.

DR. MacWILLIAMS: There is a recent publication that proposes that that has happened, that the avirulent form may have in a farm mutated to a

virulent form of ISA.
Q In Chile?
DR. MacWILLIAMS: I haven't read a paper on Chile. I've read a paper on Norway, by Lyngstad.
Q Well, Dr. Kent, it's fair to say there's a whole body of literature, is there not, on how fish farms increase the risk of disease for wild fish that you haven't referred to.
DR. KENT: I'm not really familiar with -- give me some specific references that you're talking about.
Q All right. Let me -- can we go to Aqua 17. And if we could just blow up the first line or two of the abstract. You'll see this is a paper by Rimstad published in -- what's the name there, the journal of *Aquaculture Research*. You're familiar with that journal, aren't you, Dr. Kent?
DR. KENT: Yeah, I'm familiar with the journal. I'm not familiar with this particular article, though.
Q All right. The first line is:

> Aquaculture can offer close to ideal environments for the spread of infectious diseases.

Do you agree with that statement?
DR. KENT: I think that's an overstatement. I would say -- I would write:

> Aquaculture can provide an environment for the spread of infectious diseases.

This idea, this is kind of sensationalized, "close to ideal environments". There would be much more -- poorly run aquaculture with no disease control would be more appropriate. But aquaculture in general I wouldn't say offers close to ideal environments for spread of infectious diseases. So I would agree with the statement proper, but I would -- I would modify it. It's slightly incorrect.
Q The next statement says:

> Owing to high-density monoculture of hosts, numerous possible routes of transmission and suboptimal protection by available vaccination for several viral diseases, viruses may thrive in modern salmonid

aquaculture.

You'd agree with that statement, wouldn't you?

DR. KENT: Yes.

Q All right. If you could go to the next column across the -- if you see the middle of the first paragraph:

> The history of modern aquaculture indicates that farmed fish are susceptible to new and emerging diseases, and factors like fish density and suboptimal environment are important in this respect.

Would you agree that fish farms have been subject to new and emerging diseases?

DR. KENT: Yes. The farms have.

Q Yes. And many of the current diseases known to wild salmon have first shown up in fish farms.

DR. KENT: They were first detected in fish farms, and there should be some clarification on this. And this is some from direct work that we've done. Often these viruses don't spontaneously emerge in these farmed fish. What happens is -- or pathogens in general, what generally happens is that the scenario would be that these pathogens are occurring in these wild fish. They're not being detected. Particularly the pathogens that would be occurring in the marine environment, no one's looking at diseases in the marine environment of salmonids, or very little has been done. And then the -- then the fish are starting -- are raised in captivity, as you said, under more close scrutiny, under denser conditions, and then these pathogens emerge. Subsequently we -- the general scenario would be you go back and actually these diseases occurred in the wild fish.

A good example is the ISA virus, which was first detected in the Atlantic, I believe in Norway, then Scotland. Subsequently they went back and determined that there was -- that it did occur in the wild marine salmonids and other fishes. So it needs a little bit of clarification. Yeah, that's -- yes, you're correct in saying the first detection or description of diseases that affect wild fish often are first described in farm fish. But

jumping to the conclusion that then they're -- what often happens is a mistake, is that people say, well, oh, so then subsequently we went back and looked at the wild fish and it was in them, and therefore it must have come from the wild fish.

And this is where we can -- I can contend in my Recommendations part about this understanding of the baseline, having baseline information would help this situation a lot more.

Q If we could scroll down the page -- that will do, where the mouse was right there in the middle of that paragraph:

> Properties of the virus like virulence, infectious dose and routes of transmissions are factors that are important determinants of whether a disease will emerge or remain sporadic.

Do you agree with that?

DR. KENT: Can you put the mouse on that particular statement that he read. Okay.

Yes, I agree with that.

Q And so a disease that may be present at a very low rate in wild salmon can enter into fish farms and cause significant problems.

DR. KENT: That's correct.

Q And if you go over the page, if I could, to:

> In Norwegian farming of salmonids --

- where you're at in the middle of the page there -

> -- the diseases pancreas disease (PD) and heart- and skeletal muscle inflammation (HSMI) are both regarded as emerging.

And these are two examples in Norway. You've heard of them?

DR. KENT: Yes, I have.

Q Right. And ISA, pancreas disease, HSMI, were never heard of in wild fish in Norway until they had fish farms, right?

DR. KENT: That's correct. That's just what I was discussing.

Q And if a disease like HSMI shows up in Canada, your conclusion would likely be that it came from wild fish?
DR. KENT: Yes.
Q Over the page, please. The same with the section on ISA. If ISA shows up in Canada, are you going to conclude that it came from wild fish?
DR. KENT: Yeah, based on what I know. And Dr. MacWilliams might be able to expand on that, because she's an expert on ISA. My understanding of ISA when they do the genetic typing, when it moved from Scotland, when they observed it first in Norway, and then they saw it in Scotland, the first assumption was that, oh, it must have come with fish farming activities between Norway and Scotland. Genetic typing of the virus showed that they were quite distinctive and it was confined to the marine environment. And actually they occurred independently in Norway and Scotland.

I believe I'm just going to -- I'm not an expert on ISA and I think Dr. MacWilliams might be able to expand on this, as well, too, or correct me if I'm wrong on this, and I believe it's the same situation. I'm not sure about the situation in Chile, but I assume it's the same situation.

So based on what we've seen in the past, I wouldn't say that you just immediately conclude that it came from the wild fish, but I would say based on what we've seen with other diseases, the abundance in wild fishes here, that if ISA occurred in farmed fish in B.C., without having any further evidence, and you want me to answer, where do you think it came from? I think, and this is not proven, I would think that it came from wild fish. We would want to follow-up very closely looking at it, because this is an important disease, but that's basically my answer.

Maybe Dr. MacWilliams could expand on the coho situation, and down in Chile, I'm not quite sure on that one.
DR. MacWILLIAMS: I would say that I would disagree. If ISA were detected here, I would presume it came from a break in biosecurity, either at a farm level or through international transport. I would not presume it's coming from wild fish in B.C., because there have been tests, and people have looked for ISA with very sensitive micro tests and

it has not been found. So I would presume that that was an iatrogenic introduction, that a break in biosecurity somewhere along the line.

MR. McDADE: Can I have that study marked as the next exhibit, please.

THE REGISTRAR: Exhibit number 1482.

EXHIBIT 1482: Rimstad, Examples of emerging virus diseases in salmonid aquaculture, Aquaculture Research, 2011

MR. McDADE:

Q Can I have Aqua 18 up on the screen.

DR. KENT: Mr. Commissioner, I'd just like to follow up on Dr. MacWilliams' questions. This is a good example, as we kind of, we would disagree a little bit on this, but I think - at least I'll speak for myself - I'm not saying, oh, we're directly opposed to this. This would be an observation that we would make and then we'd say, okay, now, I have a hypothesis it came from the marine environment; Dr. MacWilliams has a hypothesis that it comes from a breach of biosecurity. We would immediately want to be doing more extensive examinations of the wild fish and immediately looking at where this potential breach of biosecurity. I wouldn't just say, "Oh, no, you're wrong. I'm just going to hold onto my opinion on this," that this would be the beginning of an investigation and trying to determine where the source is.

Q Have you seen this paper, Dr. Kent, from journal of *Aquaculture Research*?

DR. KENT: No, I haven't.

Q It's by a Dr. Robertsen, and can we scroll on the first line of that abstract:

> Viral diseases are a major problem in Atlantic salmon aquaculture.

Would you agree with that statement?

DR. KENT: Particularly in -- now, this is particularly in Norway it's a big problem, and Scotland, with ISA, that example. We see the viruses that they talked about here, ISA and pancreas disease. These aren't big problems in B.C. aquaculture, but in general these are a problem. Yeah, sure, viral

diseases are in aquaculture on Atlantic salmon on a global basis, viral disease are very important.

Q Even in B.C., combating viral diseases is a constant struggle for the fish farms, isn't it?

DR. KENT: That would be particularly with IHN, would be one that they would be constantly on the lookout for, and when it occurred would cause severe disease.

Q Can we highlight the first sentence under "Introduction":

> Farming fish in dense populations in the open sea inevitably leads to outbreaks of infectious diseases.

That would be a fair statement, isn't it?

DR. KENT: I assume that they're referring to in the net pens.

Q Yes.

DR. KENT: Okay. Yes.

Q And five or six lines further down you'll see at the end of, at the right-hand side:

> Without vaccines, Atlantic salmon farming would have been impossible due to bacterial diseases such as vibriosis, cold water vibriosis and furunculosis.

Would you agree with that statement?

DR. KENT: I think it's a bit -- in most part I would agree with it. I wouldn't say it's impossible. I would say it would be severely hampered. They would have to rely on antibiotics for those three bacterial diseases, but obviously vaccines have played a huge role in making Atlantic salmon farming economically viable.

MR. McDADE: Can we have that paper marked as an exhibit, please.

MR. McDADE: Exhibit 1483.

> EXHIBIT 1483: Robertsen, Can we get the upper hand on viral diseases in aquaculture of Atlantic salmon? Aquaculture Research, 2011

MR. McDADE:

Q Can we have Aqua 12 up. This is a paper by Dr.

Mennerat, Evolutionary Implications for Parasites and Pathogens, Intensive Farming. Have you seen that paper?

DR. KENT: No, I haven't.

Q That's in the *Journal of Evolutionary Biology*. You'll see, if we could highlight the second sentence of the abstract:

> New parasites (including pathogens) keep emerging and parasites which previously were considered to be 'under control' are re-emerging, sometimes in highly virulent forms.

Do you agree with that statement?

DR. KENT: Well, I'm not quite sure what they mean by "new parasites": newly recognized, newly described parasites? They're not going to be new, they're not going to -- I doubt they actually, the species evolved in the net pens, but let's try to assume what they mean by here is "newly recognized pathogens keep emerging". If I change the sentence and said:

> Newly recognized parasites (including pathogens) keep emerging and parasites...

Yeah, continuing on with the sentence, I would agree with that statement with that slight modification.

Q And you could go down another sentence or so:

> Intensive farming creates conditions for parasite growth and transmission drastically different from what parasites experience in wild host populations and may therefore alter selection on various traits, such as life-history traits and virulence.

Do you agree with that?

DR. KENT: I would agree that the first part of the statement for sure. I'd like to see a little bit more evidence on some empirical evidence on selection for various traits, such as life history traits and virulence. I haven't read this paper, and perhaps in this paper they go on to present empirical evidence. And after I read the paper, I might be willing to agree with the second

statement. But I'd certainly agree with the first statement.

Q Well, if we could just go over to the next column at the same location. I think if you'll see five lines from the top there, that's exactly what they're saying here, is they:

> ...present evidence that supports the idea that intensive farming conditions increase parasite virulence.

That's the purpose of this paper, I think.

DR. KENT: And I assume the parasite was sea lice, is that their model parasite here? I just -- I would like to -- I'm sorry if I sound recalcitrant to agree with their conclusion, but I haven't reviewed their methods or results, so I can't just offhand agree with their conclusions without reviewing the paper.

Q All right. Could we have --

DR. KENT: And maybe Dr. Johnson, he's the sea lice expert, perhaps he's read this paper and can expand on this.

Q Have you read this paper, Dr. Johnson?

DR. JOHNSON: No, I haven't.

MR. McDADE: All right. Let's just mark this. In the interests of time, I have to move on, Doctor.

THE REGISTRAR: Exhibit 1484.

> EXHIBIT 1484: Mennerat et al, Intensive Farming: Evolutionary Implications for Parasites and Pathogens, Journal of Evolutionary Biology, July 29, 2010

MR. McDADE:

Q Can I have Aqua 20 up on the screen. "Factors Involved in the Dissemination of Disease in Fish Populations" by Dr. Reno. Have you read that paper?

DR. KENT: I haven't read this -- I think I did actually read this paper, but it's been a number of years. I know Dr. Reno. He was at Oregon State University, and I'm familiar with some of the work that they've done on modelling. I'm familiar in some generalities in the idea of modelling transmission of furunculosis in a confined system. So I'm somewhat -- this paper is

not totally new to me, it's probably been years since I've read it.

Q So the point of that paper, you'll see in the first four lines is that generally microbial pathogens have established an overall equilibrium with wild hosts in the wild, but if we can go down ten lines or so, there, just six or seven lines up from that, where your mouse is:

> The artificial rearing of [fish] has led to the exacerbation of diseases that previously existed in wild populations.

That's an accurate statement, too.

DR. KENT: That's correct.

Q You didn't cite this paper in your literature review.

DR. KENT: I don't think I did.

MR. McDADE: Could we have that marked as an exhibit.

THE REGISTRAR: Exhibit 1485.

> EXHIBIT 1485: Reno, Factors Involved in the Dissemination of Disease in Fish Populations, Journal of Aquatic Animal Health, 1988

MR. McDADE:

Q In fact, you didn't mark, you didn't cite any of these previous papers in your literature review.

DR. KENT: Yes, that's because they deal with diseases in captive fishes, and we're concerned with the impacts of disease in a wild population.

Q Can we have Aqua 24 up on the screen. This is a paper by Dr. Walker and Dr. Winton. You know Dr. Winton, I think.

DR. KENT: Yes, I do.

Q And did you cite this paper?

DR. KENT: No, I didn't cite this. I'm familiar with this review, though.

Q And if I can highlight the middle part of that abstract:

> ...the rapid growth of aquaculture has...been the source of anthropogenic change on a massive scale.

Do you see that, right where the mouse is.

DR. KENT: Okay, I see that statement.

Q And if we could go four lines further down:

> Not surprisingly, the consequence has been the emergence and spread of an increasing array of new diseases.

Do you agree with that statement?

DR. KENT: In the context within aquaculture, I certainly would agree with that. I don't know what their context is, "the emergence and spread", if they're referring to spread from farm fish to wild fish. They say that:

> Not surprisingly, the consequence has been the emergence and spread of an increasing array of new diseases.

Well, certainly the emergence of new diseases. The spread, I'm not quite sure if I would agree with that, that comment, but certainly with the emergence part of it.

MR. McDADE: Can we have that marked as an exhibit, please.

THE REGISTRAR: Exhibit 1486.

> EXHIBIT 1486: Walker and Winton, Emerging viral diseases of fish and shrimp, INRA, EDP Sciences, 2010

MR. McDADE:

Q And again you didn't cite that document because you weren't concerned with fish farms in your report.

DR. KENT: Yeah, and I gave my statement right after the break on why I was not addressing -- specifically addressing fish farms in my report.

Q Can we have Aqua 14 up on the screen. Are you familiar with this study by Ford and Myers?

DR. KENT: No. No, I'm not.

Q This is a study out of the Department of Biology at Dalhousie in Halifax, which examines the relationship of fish farms throughout the world and disease. And if you're reading the abstract, can I suggest to you, Dr. Kent, that it is the fact that wherever you have aquaculture fish farms, you have found impacts on the wild fish populations.

DR. KENT: I'm not going to deny that, but also you should be aware that spatial and temporal co-occurrence does not mean cause and effect.
Q Right. But the reason why you can't often prove cause is because no one's studying the disease in the wild population.
DR. KENT: I agree with you on that. That's one of the few statements you've made that I totally agree with you on.
MR. McDADE: Well, we're getting somewhere then, Doctor, thank you. Can we have this marked as an exhibit.
THE REGISTRAR: Exhibit 1487.

EXHIBIT 1487: Ford and Myers, A Global Assessment of Salmon Aquaculture Impacts on Wild Salmonids, Department of Biology, Dalhousie University

MR. McDADE:
Q Doctor, let me switch gears and go to some of your early research in the '90s on plasmacytoid leukemia. Can we have Aqua 3 on the -- up on the screen. Sorry, Aqua 3, I think. That's not the document I'm looking for.
MR. LUNN: Do you have a title I might...
MR. McDADE: Experimental Transmission of a Plasmacytoid Leukemia, Kent, 1990.
MR. LUNN: Yes.
MR. McDADE: Oh, I'm sorry. I've got the wrong cover page. Can we go to the next page. Yes. That's the document I'm looking for.
Q You were the author of this document?
DR. KENT: Yeah, that's right.
MR. McDADE: Can we mark that as an exhibit, please.
THE REGISTRAR: Exhibit 1488.

EXHIBIT 1488: Kent and Dawe, Experimental Transmission of a Plasmacytoid Leukemia of Chinook Salmon, *Oncorhynchus tshawytscha*, Journal of Cancer Research, September 1, 1990

MR. McDADE:
Q That was published in the *Journal of Cancer Research*, was it?
DR. KENT: Yes.
Q If we could scroll down to the "Introduction", to

the second paragraph. Now, you said there in 1990 that:

> An apparently new disease of pen-reared salmon, referred to as "marine anemia"...has recently caused severe losses in chinook salmon reared at several sites in British Columbia.

So let me make a couple of points. The first point was there was an outbreak, a severe outbreak of marine anaemia back in the 1988 to 1991 time period.

DR. KENT: That's correct.

Q And as a result of that, you were studying that disease?

DR. KENT: That's correct.

Q Because of the economic impacts on the fish farm industry.

DR. KENT: That would be one of the reasons. Our mandate was it would be to investigate diseases and of course it's -- yeah, there's -- I would say not as much the economic, because the high losses in fish in general, we, as a group of -- in the Fish Health Section would be interested in causes of disease regardless of their economic impacts or not. But that's just splitting hairs there, yeah, more or less. It became a disease entity of significant interest brought to our attention that we investigated the cause of it.

Q And that had not been previously seen in any wild salmon?

DR. KENT: We eventually found lesions consistent with it in wild salmon, very consistent with it. But we first detected it in net pen farms.

Q It was a number of years later after it had been an outbreak in the fish farms for a number of years that you found those in wild salmon, isn't it?

DR. KENT: Actually a disease histopathologically indistinguishable from this was first reported in Washington State, by Dr. Yasutaki, and I think I cite that, that I would --

Q In fish farms.

DR. KENT: In hatcheries.

Q In hatcheries, all right. So but in --

DR. KENT: I believe in hatcheries. I'm pretty sure it

would be hatcheries, not in wild fish.
Q But in British Columbia it had never been reported in wild fish.
DR. KENT: That's correct.
Q And it wasn't for at least two or three years.
DR. KENT: I'm not going to disagree with you on the timeframe there. When we eventually did a survey and were able to detect the condition in wild -- in wild salmon.
Q Okay. And I understand that:

> The disease was first recognized in the fall of 1998...

It says that in the next line.
DR. KENT: Okay.
Q That's right?
DR. KENT: Yeah, I wouldn't disagree with that.
Q And it was found in market-size fish, the large grown fish.
DR. KENT: That's correct.
Q And they were dying.
DR. KENT: Yes.
Q And they had -- they had death, mortality rates of the 50 to 80 percent range.
DR. KENT: Yes.
Q And this term, plasmacytoid leukemia, this is -- this was invented by you and -- or this was (indiscernible - overlapping speakers).
DR. KENT: You can say "invented", that's fine. Yeah, yeah, that was the name we gave it.
Q That was used by you and --
DR. KENT: And my colleagues, yeah.
Q -- in this paper. If we could have Aqua 4 up on the screen. I marked that as an exhibit, did I not?
MR. LUNN: It was 1488.
MR. McDADE: Yes. Can we mark...
Q This was also a paper with you, Dr. Kent?
DR. KENT: Yeah, sure.
MR. McDADE: And can we mark that as an exhibit.
THE REGISTRAR: Exhibit number 1489.

> EXHIBIT 1489: Newbound and Kent, Experimental interspecies transmission of plasmacytoid leukemia in salmonid fishes, Diseases of Aquatic Organisms, May 9, 1991

MR. McDADE:
Q And this leukemia was a form of cancer; is that right?
DR. KENT: Yes.
Q So your identification at this time was that you found a form of fish cancer, but it was infectious.
DR. KENT: That's right. There were a number of -- most leukemias in the veterinary world -- a large number of leukemias and lymphomas, et cetera, are caused by infectious agents, particularly oncogenic viruses.
Q And this was -- you did a couple of experiments with -- at this time, and both the papers we've looked at were descriptions of those experiments.
DR. KENT: That's correct.
Q And what you found, if we could turn to page 162 of that paper. You describe carefully in this paper the kinds of tumours that were part of this disease?
DR. KENT: Yes, I carefully -- yeah, we described the lesions that would be occurring in the fish, in (indiscernible - overlapping speakers).
Q And under the "Discussion" section what you found in this laboratory -- this was a laboratory study.
DR. KENT: That's correct.
Q Is that all of the chinook that you infected with this disease and 18 of 25 sockeye experienced this leukemia when you transmitted it to them, right?
DR. KENT: Well, as seen here is:

> All of the chinook and 18/25...exhibited unequivocal gross and histopathological changes...

Yeah, that's correct. Yeah, so we did experimentally transmit the disease to sockeye salmon in the laboratory.
Q And in fact you found that sockeye salmon were susceptible.
DR. KENT: Yes, in this -- in this situation. We did not go on to do cohabitation experiments, but by injection of tissue homogenates, we were able to induce the condition in a large number of fish. So they were quite susceptible in this -- in this scenario, yes.
Q And if we go to page 165, if you could go --

scroll down just a bit, a little further, in the paragraph:

> Only 2 of 22 exposed Atlantic salmon developed [the leukemia], indicating that they are more resistant...

DR. KENT: That's correct.
Q They weren't immune, they were more resistant.
DR. KENT: That's right.
Q And this was a laboratory experiment involving 25 fish.
DR. KENT: That's correct.
Q If you put a million salmon in the middle of a net pen, you're going to have a lot more pathogen floating around, aren't you?
DR. KENT: Pathogens in general, yeah.
Q And if you have many millions of sockeye smolts swim back -- swim past, you're going to get a lot higher risk of the exchange of pathogens, aren't you?
DR. KENT: If you're talking about millions of -- let me just clarify your scenario that you're trying to set up here, is that you have a net pen with millions of Atlantic salmon and sockeye salmon are swimming by them, versus water with no other salmonids, would there be increased potential for transmission -- occurrence of pathogens, in the fish swimming by the net pens versus just open water? I would say yes.
Q Can I have Aqua 2 up on the screen. And this is another paper written by you, along with Dr. Eaton?
DR. KENT: That's correct.
Q And this is the paper in which you -- if we could go to page -- I think it's 6498, three pages in, in which you use the term salmon leukemia virus.
DR. KENT: That's right. Dr. Eaton came up -- and I was co-author on the paper. So we have a disease called plasmacytoid leukemia and this is where we have the strongest evidence of a virus being associated with it, and we named the virus salmon leukemia virus.
MR. McDADE: And can we have that paper marked as an exhibit.
THE REGISTRAR: Exhibit 1490.

EXHIBIT 1490: Eaton and Kent, A Retrovirus in Chinook Salmon (*Oncorhynchus tshawytscha*) with Plasmacytoid Leukemia and Evidence for the Etiology of the Disease, Journal of Cancer Research, December 1, 1992

THE COMMISSIONER: Would this be a good place for the break, Mr. McDade?
MR. McDADE: Yes, thank you.
THE COMMISSIONER: Thank you.
THE REGISTRAR: The hearing is now adjourned until 2:00 p.m.

(PROCEEDINGS ADJOURNED FOR NOON RECESS)
(PROCEEDINGS RECONVENED)

THE REGISTRAR: Order. The hearing is now resumed.

CROSS-EXAMINATION BY MR. McDADE, continuing:

Q Dr. Stephen, let me turn to you and a couple papers you wrote in the nineties on the marine anemia. Could I have Aqua 1 up on the screen. That paper, called Descriptive epidemiology of marine anemia that you wrote?
DR. STEPHEN: Yes, that's my paper.
MR. McDADE: Okay. Could I have that marked as an exhibit please.
THE REGISTRAR: Exhibit 1491.

EXHIBIT 1491: Descriptive epidemiology of marine anemia in seapen-reared salmon in southern British Columbia, by Craig Stephen, Carl Ribble and Michael Kent

MR. McDADE: And can I have Aqua 23 up on the screen. That's a paper called The effects of changing demographics on the distribution of marine anemia that you wrote in 1995?
DR. STEPHEN: That's right.
MR. McDADE: Could I have that marked as an exhibit.
THE REGISTRAR: Exhibit 1492.

EXHIBIT 1492: The effects of changing demographics on the distribution of marine anemia in farmed salmon in British Columbia, by Craig Stephen and Carl Ribble

MR. McDADE:
Q Now, looking at that paper, if we could go to the third page, page 559, could we look at the table at the top. Your purpose in doing this paper, Dr. Stephen, was to show how the identification of marine anemia moved over time as the sea farm -- as the fish farm industry was moving?
DR. STEPHEN: We were trying to just -- we were trying to look at the geographic -- look at the geographic spread and describe the pattern, yes.
Q And so this table shows how, from 1988 through '92, it moved from south coast to central coast to west coast to northwest coast, as the industry moved?
DR. STEPHEN: Yes, so what this table is showing us, is that as there was farms in a new area you would have an increased amount of submissions to the laboratory, and with an increased amount of submissions to the laboratory, you were more likely to have the area declared positive for the disease.
Q If I could go to the next page, page 560, scroll down the first column to the second-last paragraph. The other thing I believe that both these studies of yours, Dr. Stephen, showed is that when you relied upon the farms to tell you whether marine anemia was present, you got an incomplete answer?
DR. STEPHEN: I think that would be a mischaracterization of it. I think what we did is when you went out actively looking for the disease and sampled intensively, we could find it very regularly.
Q I see there, that's correct. You sent out a questionnaire to the farms, asking if they had the disease, and most answered that they didn't?
DR. STEPHEN: They hadn't diagnosed it yet, that's correct.
Q Right. But then, when you went out and exhaustively sampled, you found it?
DR. STEPHEN: We were able to find it, yes.
Q So in some cases the disease was diagnosed on the first visit to the farm, whereas others required bi-weekly visits for three months before a case of marine anemia was identified?
DR. STEPHEN: Right. So I would try to regularly go out to the farm, sample the moribund fish, as well

as the dead fish in the pens, and submit them for a histopathology to help with the diagnosis.

Q And if we could go to the previous paper, yes. And go to the third page of that, page 422, lower down on the second column. So this is referring, more or less, to the same phenomena:

> Prior to the project, marine anemia had not been diagnosed on 15 of the 23 farms we visited.

DR. STEPHEN: I'd have to recheck those numbers, but yes, there it is, that's correct, yes.

Q And:

> We later found cases of marine anemia in all but 1 of the 23 farms.

DR. STEPHEN: Yes. Anywhere we could find a farm that had chronic -- other chronic inflammatory diseases, we could find one or more case of this disease.

Q And it says, "On average," a couple of lines down:

> On average, 2 visits per site were required before the disease was diagnosed.

DR. STEPHEN: Correct.

Q Dr. Kent, one more paper to ask you about, and that is at Aqua 5. Did I mark that before the break?

THE REGISTRAR: No, it has not been marked.

MR. McDADE:

Q This is another paper of yours and Dr. Eaton's?

DR. KENT: Yes.

MR. McDADE: Can we mark that as an exhibit, then.

THE REGISTRAR: 1493.

> EXHIBIT 1493: Diseases of Aquatic Organisms, Biochemical and histologic evidence of plasmacytoid leukemia and salmon leukemia virus (SLV) in wild-caught Chinook salmon *Oncorhynchus tshawytscha* from British Columbia expressing plasmacytoid leukemia, by W.D. Eaton, B. Folkins and M.L. Kent

MR. McDADE:

Q Now, this was a study, as I understand it, that you and Dr. Eaton and Dr. Folkins did to look at -- to look outside the box.

DR. KENT: Look outside the box, you mean looking at wild fish, correct?

Q Right. If we could go to the bottom of the second column on that first page. I suggest this purely describes what you're trying to do. We look three lines from the bottom:

> This raises questions of some concern as to whether SLV is present in wild or wild-caught populations of Chinook salmon, whether it causes disease in them, and could any interaction between such fish and those in hatcheries or net pens contribute to an increase in PL.

Right? That's what you were trying to do here?

DR. KENT: I'm third author on this. I would agree that this was the idea of documenting the occurrence of this. I don't think we're going to -- this paper inferred any actual -- these types of interactions between farm and wild fish caught are of great interest, yeah. So, I mean, this is the idea, as I've said earlier, when we see a disease in the -- for the first time or first time a disease is described, I think it's very important to look for that disease in the wild fish as soon as possible. This will provide valuable information to start looking at the possible interactions between wild and farm fish, that's correct.

Q And that's found, if I can scroll down the column to the next -- a couple paragraphs down, just above the picture, seven of the -- I think you found seven of the 118 Chinooks you collected were mildly positive?

DR. KENT: That's correct. That's what I wrote in the paper. That's what we have there, yes.

Q They included it, if you go to the top of the next column, they had mild interstitial hyperplasia. And from this -- this paper didn't conclude either way, I suggest to you, that the plasmacytoid leukemia came from the fish farms or came from the wild?

DR. KENT: That's right.

Q If you could go over the page, if I might, to the -- sorry -- yes, to the bottom of page 149, second column:

> The origin of SLV is unknown and will likely be difficult to ascertain. However, it is possible that PL and SLV may have been present in both wild and cultured fish for years, but have been misdiagnosed...

And if we go over the page, down to the bottom of the first column, please:

> The presence of SLV in wild-caught fish is important...but does not answer the question of the origin...

You agree with that?

DR. KENT: Yes.

Q And at the top of the next column, to continue on, it's possible that the positive fish were escapees from the net pens, or it's possible that if horizontal transmission of SLV and PL has occurred, or it's possible that - further down in the next paragraph - it's possible that it's vertically transmitted. These were all just possibilities that you --

DR. KENT: Yeah, that's right.

Q -- expressed?

DR. KENT: As we read at the top, possible from the -- the origin of these fish captured in the wild, they could have originated from government hatcheries, they could have been escapees from net pens, or they could be what we mean as truly wild fish, fish that were actually originated from wild spawns and basically spent their whole life in the wild. So those are three possibilities that we put forward.

Q And so you found a very mild amount of disease in the Chinook that you -- what happened when you replicated that study on sockeye?

DR. KENT: We injected sockeye salmon -- if I recall, are you --

Q Sorry, if I could just ask my question more clearly, perhaps.

DR. KENT: Sure.

Q Did you go and do a study on how many sockeye were

infected back in 1994?
DR. KENT: Not in 1994, we did not. In 1998, in our overall survey of diseases in salmon, included a number of sockeye. We did not see any regions consistent with plasmacytoid leukemia in the sockeye salmon that we examined in that particular study. That would be the Kent, et al, 1998, I think, that was already entered in evidence.
So at this time we did not -- for this particular study we did not have a number of sockeye salmon that were negative or positive. We were just looking at Chinook in this study.
Q Right. So as I understood it, there's a disease that's killing salmon in 1988. You do a study in 1990 that calls it plasmacytoid leukemia. Your survey in 1991 finds that sockeye are highly susceptible to it. And you look at Chinook in 1994. You don't look at sockeye until 1998. Can you explain to me why you didn't do anything about this disease in relation to the wild sockeye for 10 years?
DR. KENT: It wasn't 10 years, but the reason why is we recognized this as a disease of Chinook salmon, so it was a disease of Chinook salmon. So if we're going to look at fish in the wild, the first fish we would look at would be Chinook salmon. We didn't look at chum salmon or coho salmon or sockeye salmon in this particular study.
The study in 1998 was not directed on, because there was severe disease problems, at any particular wild stock of salmon; it was a general survey along the lines of what I was promoting that really should be done is just general baseline information that we would have. So the study that we published in 1998 actually represented data that was not just collected in 1997 or 1998, but represented probably at least a half a dozen years of data that we, myself and my coauthors, compiled and tabulized and put into table form and basically reported as one document, which included some other survey work that we did opportunistically with collecting wild salmon from the ocean.
Q Dr. Kent, you didn't look, as we understand it, we've heard other evidence, that in the early nineties sockeye salmon were starting to show abnormal early entry behaviour into the Fraser

that was affecting pre-spawn mortality; you've heard about that?
DR. KENT: In the early nineties?
Q Yes.
DR. KENT: Yeah, I've heard about that, of course.
Q Did you, at that time, connect those two events in any way?
DR. KENT: No.
Q Were you, in the marine aquatic health branch, ever consulted about the expansion of the fish farm industry in relation to disease?
DR. KENT: Yes.
Q Did you discuss this early entry problem and the possibility that salmon leukemia virus was behind it?
DR. KENT: No.
Q Never occurred to you?
DR. KENT: No.
Q So today, if DFO finds a new virus that they haven't seen, is there anything different that's happening at DFO that would take less than 10 years to discover the impacts on the wild salmon?
MR. TAYLOR: I object. This witness isn't there. He's already testified he left in 1999.
MR. McDADE: Fine. Fair enough. Let me ask that question of Dr. Johnson.
Q Is there anything that would take less than 10 years to determine this kind of impact?
DR. JOHNSON: Yes. For example, we are conducting challenge trials with a virus which was recently identified in sockeye salmon.
Q Yes, but have you done -- did you do anything in terms of getting the fish farms out of the path of the migratory salmon, or did you just do more studies?
DR. JOHNSON: I, personally, don't do anything about getting the fish farms out of the migratory path, because that makes the assumption that the fish farms are a significant source of pathogens.
Q So DFO wouldn't react until there was scientific proof that connected the fish farms and the pathogens and the harm to the wild sockeye?
DR. JOHNSON: I can't answer how senior management would react. It's a question you need to ask of senior managers of DFO.
MR. McDADE: All right. Well, perhaps we will. I think that's probably the end of my time.

MR. MARTLAND: It is. I have Mr. Leadem, for the Conservation Coalition, at 40 minutes.
MR. LEADEM: Leadem, initial T., for the record, Mr. Commissioner, for the Conservation Coalition. I want to begin with Conservation document number 36, if I could, Mr. Lunn. And this question will be to you, Dr. Kent.

CROSS-EXAMINATION BY MR. LEADEM:

Q You may recognize this.
DR. KENT: Yes, I recognize this.
Q This is a golden oldie, as I call it. Can you roughly give me a timeframe of when this document was prepared?
DR. KENT: I would say roughly about, I would guess, about 1993. This was a result of a Canada/Norway -- a meeting between scientists between Canada and Norway that was held in Norway, and then we -- I prepared this document, which was basically a proceedings of this meeting. I see I have that in press, and I, frankly, would have to search back and see if this document that I wrote as proceedings was ever actually published in that particular journal, but that's where it was destined to be. But yeah, I wrote that paper.
Q All right. I'm going to ask you to research back. If you're like most scientists, you may keep records of papers that have been published before, your papers, specifically?
DR. KENT: Yes, for the most part.
Q All right. We could not find a copy of this.
DR. KENT: Okay.
Q When I say "we", my clients couldn't find a copy of this. I note that on the front of it, it says, Fisken og Havet, which I assume is a Norwegian journal, and I'm going to ask, through Commission Counsel, that if you do find a copy of it that you produce it to Mr. Martland in due course --
DR. KENT: Sure.
Q -- and we can perhaps tender it.
DR. KENT: Yeah, and I agree with that. I don't recall, you know, this was sent off back to the Norwegians and they were going to -- that when preparing this document they said, "We're going to put this in as a special issue of this particular journal," and as far as I know, it hasn't

materialized. But obviously this has been circulated quite a bit.

Q We found it.

DR. KENT: Oh, okay. So was it published in there?

Q We haven't found it published, and that's why I'm asking you.

DR. KENT: Oh, okay.

Q Essentially, I wanted to take you to the abstract on the next page. And if I can -- I'm just going to quote something that you wrote back then, towards the middle, maybe the third sentence in. You say:

> Diseases of captive fish may pose a threat to wild fish when they are exotic diseases, have the potential to cause an increase in prevalence of an enzootic disease, or if their presence results in the use of drugs that are released into the environment.

So that's what you wrote back then. Are those still your opinion today?

DR. KENT: Yes, they are.

MR. LEADEM: Could we have this marked as the next exhibit, please.

THE REGISTRAR: 1494.

> EXHIBIT 1494: IN PRESS: Fisken og Havet 13: The Impact of Diseases of Pen-Reared Salmonids on Coastal Marine Environments, by Michael L. Kent

MR. LEADEM: Now, I want to now turn to Conservation document number 14, when you have the opportunity, Mr. Lunn.

MR. LUNN: Thank you.

MR. LEADEM:

Q And the next questions are going to be primarily to you, Dr. Kent, and to you, Dr. Stephen, and they're going to relate to IHN outbreaks from fish farms, and the first one should be -- that's not what I hoped to find there. I'm looking for a document by Sonja Saksida, and I thought it was Conservation document number 14.

UNIDENTIFIED SPEAKER: You have two 14s.

MR. LUNN: Neither one seems to be the document.

MR. MARTLAND: There's an identical twin number 14

document. It's the second of the two, I think.
MR. LEADEM: I think that we confused everyone by submitting two lists. There's two 14s, Mr. Lunn.
MR. LUNN: Yes, neither 14 is the document that you're referring to by Saksida, though, as far as what I have, I'm sorry.
MR. LEADEM: All right.
MR. LUNN: The CAN number appears to be correct. I'm not sure.
MR. LEADEM: I'm looking for a document by Sonja Saksida, entitled, Infectious haematopoietic necrosis epidemic in farmed Atlantic salmon.
THE COMMISSIONER: 35.
MR. LEADEM: 35, thank you. It's not the same one. The other one was an actual peer-review journal article, Mr. Commissioner, and I'm not sure why there's some disparity in the numbering. Be that as it may, I'll deal with this unpeer-reviewed article first, because I think that the data, or what I'm driving at might be evident from it.
Q Dr. Saksida investigated an epidemic, an epizootic outbreak of IHN in farmed salmon for the years 2001 and 2002 and 2003, and both you, Dr. Kent, and you, Dr. Stephen, were aware of this outbreak, were you?
DR. STEPHEN: I was aware of some IHN outbreaks, yes.
Q Right. And are you familiar with her work and how she saw that there was transmission of the disease from farm to farm and some horizontal transmission of the disease in the water column?
DR. STEPHEN: In general terms I can recall some of it, yes.
Q Right. And she postulates in, I think, in this paper and perhaps in the journal article that I hope to find for you soon, that essentially, in her opinion, it's very likely, or it may be that the wild sockeye actually transmitted the IHN to the farmed Atlantic salmon; is that correct?
DR. STEPHEN: I couldn't tell you for sure if that was Dr. Saksida's hypothesis, but I've heard others have that hypothesis, yes.
Q Okay. And those, once again, were for the years 2001, 2002, and 2003; is that right?
DR. STEPHEN: Again, I can only vaguely remember the report, so I'll assume it's in this document, yes.
MR. LEADEM: All right. Could I ask that Conservation document number 15, which hopefully is a report

done by a Dr. St-Hilaire. If you've found that one, the one right before it should be Dr. Saksida's.
MR. LUNN: I think there just must be a file error, I'm sorry, and without internet I can't --
MR. LEADEM: Okay.
MR. LUNN: -- get the true file.
MR. LEADEM: Okay. All right. Maybe we can get that straightened out at some stage.
MR. MARTLAND: Our understanding, just to identify the error, without helping very much, is the ringtail number is what Mr. Lunn brought up. It correlates to what we were given in the exhibit list, but that doesn't -- that's obviously not the right document. We'll work to try to and see if we can find it.
MR. LEADEM: All right.
THE COMMISSIONER: Is this the one you want, Mr. Leadem?
MR. LEADEM:
Q Okay, this one, Dr. Stephen and Dr. Kent, perhaps you would be more familiar with, because both of you are listed as authors with respect to an epidemiological investigation of infectious hematopoietic necrosis virus in salt water net-pen reared Atlantic salmon in British Columbia, Canada. And obviously Dr. St-Hilaire was a colleague of yours; is that correct?
DR. STEPHEN: She was a graduate student and I was on her graduate committee.
DR. KENT: Likewise.
Q And so all of you, or both of you would then be familiar with the fact that there was an outbreak of IHN in Atlantic salmon in British Columbia for the years 1992 through 1996; is that correct?
DR. KENT: Yes.
DR. STEPHEN: That's correct.
MR. LEADEM: Might this be marked as the next exhibit, please.
THE REGISTRAR: Exhibit 1495.

EXHIBIT 1495: Epidemiological investigation of infectious hematopoietic necrosis virus in salt water net-pen reared Atlantic salmon in British Columbia, by Craig Stephen, Michael Kent, et al

MR. LEADEM: And I'm indebted to my learned colleague, Mr. McDade. I think I have a CAN number for the other document, Dr. Saksida's number. I could maybe straighten that out now. That's CAN474758. And I think it's Aqua 22.
MR. LUNN: If it's the same document in the Aquaculture list, then I can get it right now. There you go.
MR. LEADEM: Okay, that's the one.
MR. LUNN: Thank you.
MR. LEADEM: All right, that's the journal article that I was endeavouring to show you earlier, IHN 2001-2003 in farmed Atlantic salmon.
Q In the abstract, and I'm just going to take you to a passage in the abstract, she says, about two-thirds of the way down:

> Natural waterborne transmission may have played a role in the spread of the virus between farms located in close proximity to each other.

And then she goes on:

> The data collected from this epidemic are prepared with reports which examined the first reported epidemic in Atlantic salmon in BC (1992-1996).

And that's the one that both you, Dr. Kent, and you, Dr. Stephen, along with Dr. St-Hilaire, had investigated in BC; is that right?
DR. KENT: Right. That's correct.
MR. LEADEM: Okay. Might this now be marked as the next exhibit, the Dr. Saksida's peer-reviewed article, please.
THE REGISTRAR: Exhibit Number 1496.

> EXHIBIT 1496: Infectious haematopoietic necrosis epidemic (2001 to 2003) in farmed Atlantic salmon *Salmo salar* in British Columbia, by S.M. Saksida

MR. LEADEM: I now want to take you to Commission -- or Exhibit Number 1456, and if we can look at, I think it's page 3 or page 4 there's a bar graph, a histogram. There it is. Just blow that up.
Q You may recollect that some of you were shown this

by Mr. Martland yesterday, and these represent IHN prevalence in both the Weaver Creek spawning channel and Nadina River spawning channel. And I noticed, and I did not do any linear regression analysis, so you'll have to forgive me, because I'm not going to suggest that there's a correlation here, but I notice that there's some spiking going on between what we're seeing in the IHN prevalence in the wild stock, if I can suggest that term, in Weaver Creek and Nadina in the years 2001 and 2002 and 2003; would you agree with me, gentlemen?

DR. KENT: Yes. Without doing a statistical analysis, yeah, I see that there is -- there seems to be, in 2000, 2001, 2002, 2003, that time period there seems to be more IHN than later in the decade for sure.

Q And Dr. Stephen, you would agree, without doing a statistical regression analysis, that there appears to be some linkage here between what we're seeing in terms of IHN prevalence in the wild stock and the outbreak of a disease in the fish farm; is that correct?

DR. STEPHEN: I don't know if I'd use the word "linkage". I think you could say there's a temporal correlation, both events are happening at the same time.

Q Right. It would be useful to follow that up to see, in fact, if there were a correlation going on here; is that correct? Wouldn't that be of some interest to some scientists, to you epidemiological types?

DR. STEPHEN: Well, there's many phenomenon that are interesting to us, and the challenges are resources to look into it.

Q Right, right. We're not really sure, are we, Dr. Stephen, I'll turn to you, first, whether or not the disease is coming from the wild stock to the pens, or whether the disease is coming from the pens to the wild stock? We can't say with any degree of absolute certainty which one is which?

DR. STEPHEN: What I'll just do is quickly preface that with saying that in preparation for this I focused on the hatchery situation the government had recently reviewed the most current information for salmon farms. So just to preface that.

Q Yes.

DR. STEPHEN: Okay. So could you repeat your question again, then?
Q Well, what I'm interested in knowing is whether there's any degree of scientific certainty about whether or not the horizontal transmission from wild stock is from the wild stock to the pen fish or from the pen fish to the wild stock, or whether there's some going and to-ing and fro-ing between them.
DR. STEPHEN: You're asking the question of directionality of transmission?
Q Correct.
DR. STEPHEN: I can answer that by saying when we did our review for our technical report here we couldn't find convincing evidence of directionality that was definitive, to some degree, to a lack of both historical studies and a lack of molecular methods used to see if it's the same pathogen, so to speak, as well as the fact that the methodologies tended to be a cross section in times. It was hard to temporally relate exposure versus outcome. So the timing issue is hard. So I was unable to find literature that could really convincingly show me directionality. There are some case studies that are suggestive, because of detection in one sector before another, but I couldn't say that's a definitive outcome.
Q All right. So would you agree with me that there's some uncertainty in the science around how these diseases are being transmitted, whether there's some horizontal transmission or not?
DR. STEPHEN: There's always reasonable uncertainty, and I think as I said in my document, a hatchery's understanding that exposure scenario is, I think, a critical gap in our understanding.
Q Right. Dr. Kent, do you have anything to add to that?
DR. KENT: I could add a little on that. I think that -- let's kind of start about what we know of where I feel there's more certain evidence. The story with IHN and the net pens, in my opinion, the most certain data are that the Atlantic salmon are becoming -- have become infected by a marine reservoir. That's about the only thing certain. And then the next thing, so it's coming in -- this is one plausible scenario is that marine fish are

carrying the virus. Another part of Dr. St-Hilaire's work show that Chinook salmon can carry the virus in the marine phase in asymptomatic condition jumps over into the fish farms and then we have an outbreak in the farm.

So one possible explanation, I'm not saying I'm promoting this as fact, but one hypothesis would be the reason why we're seeing a lot -- this temporal co-occurrence of lots of IHN in Nadina and Weaver Creek and the net-pen farms all at the same time is there was a lot of IHN in the marine environment --

Q Right.

DR. KENT: -- in that time period. That's --

Q And so there could have been some horizontal transmission back and forth between the wild fish and the Atlantic salmon in the pens?

DR. KENT: I think that that's probably how they became infected. The other scenario, from the pen-reared fish to the wild fish, that's a little bit more of an unknown area.

Q So in the absence of really being able to narrow this down, wouldn't -- if you're going to adopt a precautionary approach to this, wouldn't it be of some benefit, both to the farms, to remove their farms from the migratory pathway of sockeye, which may be carriers of this disease, and at the same time help the wild stock, which are coming by the farms, wouldn't - and Dr. Stephen, I'm going to come to you, because you approach it from a prevention aspect - wouldn't that be good prevention science to actually remove the possibility of horizontal transmission by taking the pens away from migratory pathways?

DR. STEPHEN: I think that to answer that question of siting of salmon farms based -- or of other activities based solely on one pathogen would make, I think, challenging public policy. I think as a generality, one of our goals of any disease prevention is we heard about bio-security at the hatcheries, is to try to avoid exposure to your pathogen, or to try to ensure that the fish are robust enough to deal with the exposure and challenge.

Q Yes. And I understand that you don't want to delve into public policy, but from a scientific aspect, I mean, if you, as an epidemiologist, are

simply advising a fish farm how to prevent the IHN transmission from wild stock to fish farms, wouldn't it -- it seems to make sense to me to remove that fish farm from migratory pathways of sockeye salmon.

DR. STEPHEN: Well, I think, for me, if I was to give advice to any population, I'd be looking at the more comprehensive approach than simply removal. I mean, you have to think of -- I guess my approach as a veterinarian has been to try to help people in the situation that they were in.

Q Yes.

DR. STEPHEN: And again, as you pointed to, for a precautionary perspective, if you were going to have that activity in the area, we've often focused on trying to build, as I say, those robust systems and bio-security in place.

Q Okay. I'm going to turn to a different topic now, and if I could have a look at your report, Dr. Kent, I believe it's Exhibit 1449. I think at page 9 -- on page 9 you deal with BKD, and I think you make the comment within the confines at the top of the page that there's rare occurrence of BKD in farms.

DR. KENT: In Atlantic salmon farms.

Q In Atlantic salmon farms.

DR. KENT: In Atlantic salmon farms it would be rare. Chinook salmon farms would be very common.

Q Okay. And I realize that you may not have had such access to the data that we've had recently by virtue of having obtained the data from sources, but I'm going to show you one dataset and ask you if you've had a look at it and if you saw it in preparing your report. If I could call up Conservation document number 10. And if you get to it, Mr. Lunn, I'd like the Excel spreadsheet. And if you go down to the, I think there's two tabs, if you go down to Tab 2, I think it's the one that I'm looking for.

Now, I'm looking for the column for *renibacterium salmoninarum*. I think it's about the fourth line over. I'm having a hard time reading that, Mr. Lunn, sorry. It's actually under "F". That's it. And if you look at, for example, line 37, there's a way that you could actually search for *renibacterium salmoninarum*, I believe.

MR. LUNN: Do you want to search throughout the document?
MR. LEADEM: Sure. And I think it will then segregate everything with respect to *renibacterium*.
Q And just while we're doing that, *renibacterium salmoninarum* is the actual name of the disease, or the pathogen.
DR. KENT: Yes, the pathogen that causes bacterial kidney disease.
Q All right. Obviously, if we look at down -- just scroll down to line 40, there's another incidence of *renibacterium salmoninarum*. Line 45. Line 47. Line 67. Line 98. I won't take you through the entire document, but obviously this type of information would have been of some benefit to you, Dr. Kent, in preparing your report in order to determine the incidents of BKD disease emanating, or incidents of that from fish farms; is that not correct?
DR. KENT: Yes, this is useful information. One thing that would be very useful, and I don't see it here, it might be on this Excel sheet, is to look at the species of fish that's infected and the number, a little bit more information about that, that would be important as far as, you know, the prevalence of the infection and the host species that was infected. Is that on this document?
Q Well, I'm advised these are all Atlantic salmon --
DR. KENT: Oh, okay.
Q -- by virtue of the research that my clients did. So that might be a better benefit to you as well.
DR. KENT: From my experience, I mean, I'm not saying that *renibacterium salmoninarum*, BKD, does not occasionally occur in Atlantic salmon. I would just be interested to know, I mean, this is useful and the next step would be really if -- how prevalent the infection would -- of *renibacterium salmoninarum* would be in these pens when these diagnoses are being made. Is it just a few fish or is it really an outbreak of the disease?
Q Right. And so having access to those records would have been some utility?
DR. KENT: Yes, of course.
MR. LEADEM: Might that be marked as the next exhibit in these proceedings, please.
THE REGISTRAR: 1497.

EXHIBIT 1497: 2010 BC Salmon Farming Database

MR. LEADEM: And then if I could take a look at 2008, once again for the same -- this would be, I believe, Conservation document number 6. And I apologize, Mr. Lunn, we haven't listed them in sequential order.

Q Once again, I'm simply screening for *renibacterium salmoninarum*. If I look at, once again going to Tab 2 and line 99, 100, 112, 117, once again we see some of the reports coming from some of the farms that there is an infection from *renibacterium R. sal*.

DR. KENT: I see that. If you go to the top, I thought I saw something referring to species, if you scroll all the way to the top of the document. I thought I saw something. Where's the host species, is that on here? Yeah, I thought I saw something referring to Chinook and Atlantic. I guess what I'm getting at is I would want to -- it's an interesting finding if you're finding a lot more bacterial kidney disease in the Atlantic, it would not be a surprise if it was with the Chinook farms.

Q Yes.

DR. KENT: From my experience, we would see lots of bacterial kidney disease in a Chinook farm.

MR. LEADEM: Okay. Could you we have the 2008 database entered as an exhibit in these proceedings.

THE REGISTRAR: 1498.

EXHIBIT 1498: 2008 BC Salmon Farming Database

MR. LEADEM: Now, Mr. Commissioner, I'm in your hands, but rather than, because of the interest of time, I was going to take Dr. Kent to 2007, 2006, 2005, and 2004, three and two. And rather than spend the time of the Commission, I'm going to seek to tender all of those databases into evidence, and I will provide in argument the exact line number where you can find evidence of *R. sal*. And all these databases. So I'm going to seek to tender those into evidence at this time.

THE COMMISSIONER: They're in the same format as the --

MR. LEADEM: They're in the same format. They're in

Excel spreadsheets.
THE COMMISSIONER: Very well.
MR. LEADEM: All right. I think the best way to do this, Mr. Registrar --
THE COMMISSIONER: In the interest of time --
MR. LEADEM: -- is to give you --
THE COMMISSIONER: Mr. Leadem, just in the interest of time, perhaps during the break you can just organize that and provide that --
MR. LEADEM: I'll do that with the Registrar.
THE COMMISSIONER: All right. Thanks very much.
MR. LEADEM: Thank you, Mr. Commissioner.
Q Now, Dr. Stephen, I want to turn to your recommendations, because I found a lot of them were very useful recommendations, and the one specifically that I'd like to focus upon is your sub-recommendation number 2a at Exhibit 1453 (sic), I believe. Your recommendations start at page 99 of your report. And if you can get 2a for me. Thank you.
DR. STEPHEN: Just one second here. Yes, got it.
Q All right.
MR. LUNN: Did you say page 99?
MR. LEADEM: It starts at page 99. It's actually on -- at the late page --
DR. STEPHEN: 100.
MR. LEADEM: -- 100 of the actual report. Thank you, Dr. Stephen.
Q So 2a is:

> Make information management and records systems consistent across facilities and accessible to fish health staff to allow for ongoing surveillance of trends in growth, morbidity, mortality, population information and environmental quality.

I take it you made that recommendation because you found no consistency between the reporting mechanisms from the hatcheries that you investigated; do I have that right?
DR. STEPHEN: Not no consistency, but there was a lack of consistency, particularly when we got to some of the community and public involvement programs where we were getting handwritten records and some challenging problems with that, as well as the interviews with some of the staff where they

didn't have routine access to -- we've segregated off the disease databases with some of the population databases, and people are reporting a challenge in trying to integrate those two together through the government systems.

Q If you scroll down, please, Mr. Lunn, under the recommendations, themselves, you have a bit of a discussion on that, which I found to be very informative. So if you just scroll, keep on scrolling, the rationale I thought was very useful. You say:

> Current fish health programs separate personnel, infrastructure and capacity by whether or not a salmon is privately owned, is publically owned but cultured or is wild.

And you want to understand the disease relationships of cultured and wild fish will require capacity and expertise. So I felt that your rationale really made a lot of sense, so you wanted to integrate the data and efforts across public and private and wild fish sectors. It makes a lot of sense to me to actually have one dataset that the scientists can actually call upon to make some conclusions about what's going on in these hatchery-raised and farm-raised environments. Is that fair?

DR. STEPHEN: I think not just only to understand. I guess I'm looking at it two ways. Back to your earlier question, too, about how to manage a problem in the absence of certainty, and I think that there's capacity for a good sharing of perspective and experiences between these different groups working on similar problems, which relates to one of my other recommendations of the Fish Health Management Committee, which was a body that existed a number of years ago where, you know, non-partisan people came together and shared their experiences, their challenges, and the absence of scientific certainty worked towards some agreed upon movement on fish health standards.

Q Thank you. I want to turn, now, to you, Dr. Johnson, and Dr. MacWilliams, and the next set of questions will be to you.

Dr. Johnson, you made a lot of commentary and gave a lot of evidence when you were questioned by

the Province with respect to sea lice. Would you not agree with me that Dr. Simon Jones of your department is a lot more versed with respect to the ongoing research in sea lice, and he'll be coming later to give evidence in these proceedings?

DR. JOHNSON: Dr. Simon Jones and I actually have an active research program. He's doing the laboratory component and I'm doing the field base component --

Q Yes.

DR. JOHNSON: -- of sockeye surveys in the Strait of Georgia.

Q Okay. But as I understand it, he's coming specifically to give evidence on the sea lice --

DR. JOHNSON: (Indiscernible - overlapping speakers) he was asked to come and give evidence on the sea lice issue because he's been in British Columbia, whereas I was absent for a few years.

Q Now, if I can have Conservation document number 13, please. This is not what I'm looking for, again. I'm looking for PAAR Project Proposal 2010/11, Canada 181911, Calls for Proposals. That's it. Thank you, Mr. Lunn.

Do you recognize this, Dr. Johnson? This is your Call for Proposals.

DR. JOHNSON: Yes, it is.

Q And specifically a research priority to study *Lepeophtheirus salmonis*?

DR. JOHNSON: No, it's a proposal to look at sockeye health, including counts of both species or all species of sea lice that we find on sockeye salmon, as well as to conduct some laboratory studies to look at the impacts of low levels of infection on sockeye salmon and other juvenile salmonids.

MR. LEADEM: Might this be marked as the next exhibit, please.

THE REGISTRAR: 1499.

EXHIBIT 1499: Program for Aquaculture Regulatory Research (PARR) Calls for Proposals (2010/11), PAAR Project Proposal 2010/11

MR. LEADEM: Thanks.

Q Dr. MacWilliams, recently Canada produced a couple of e-mails, and I'm going to ask you about one of them and then Dr. Johnson about the other. Could I have DFO document 598951, please. This appears

to be an e-mail exchange from Dr. Miller-Saunders to yourself, Dr. MacWilliams. Have you seen this before?

DR. MacWILLIAMS: Yes, I have.

Q And it appears that there was a meeting in Laura Richards office regarding your reasoning, I take that to be you:

> ...for not initiating any testing of aquaculture fish (specifically Atlantic salmon) for the Parvovirus we have recently identified in high prevalence in wild sockeye salmon populations. You stated that until such a virus is accredited as an OIE -

-- I'm going to come back to that and I'm going to ask you what that stands for --

> - rated disease, causing considerable observable mortality, and the molecular assay is validated and certified as such, one cannot ask industry to test their fish. Moreover, you stated that there is no benefit to testing, and if we were to ask industry to voluntarily submit fish for testing, that you would recommend to them that it would not be in their best interest to comply.

Does Dr. Miller-Saunders have your conversation accurate?

DR. MacWILLIAMS: No. I believe my statements at that meeting were misinterpreted, and I chose not to answer this e-mail.

Q Sorry?

DR. MacWILLIAMS: And I chose not to answer this e-mail.

Q So are you denying that you made those comments in the context of a meeting with Dr. Richards and Dr. Miller?

DR. MacWILLIAMS: I'm saying that those comments are misstated in this e-mail, the comments that I made.

Q All right. What comments did you make? Did you say, for example, that there would be no benefit to testing?

DR. MacWILLIAMS: No. I cautioned that asking industry to test in that species with a test that we're not

really sure what positive means, we don't know what negative means, the implications of the test are unknown, I thought it was premature to take that out of a research context into a surveillance-type approach. I think it's more appropriate to design an experiment and assess whether a hypothesis with an appropriate experimental design and controls in place, as opposed to taking a test with unsubstantiated, unknown results to an industry setting.

And the comments I made about OIE were, again, cautionary, saying that even in the interest of international trade, there are certain standards required of testing before it's applied, in that a test needs to be robust, repeatable, and that --

Q What is OIE? I'm not sure what it stands for.

DR. MacWILLIAMS: Office International des Epizooties, it's the World Health Organization that controls international trade perspectives in controlling aquatic animal diseases.

MR. LEADEM: Might this be marked as the next exhibit, please.

THE REGISTRAR: 1500.

EXHIBIT 1500: E-mail from Kristi Miller-Saunders to Christine MacWilliams, dated July 29, 2011, Subject: testing of Atlantic salmon

MR. LEADEM: Could I now turn to you, Dr. Johnson, and ask Mr. Lunn to pull up DFO 598950. It should be the document just right before. There we go.

Q This appears to be an e-mail from Dr. Miller-Saunders to yourself, Dr. Johnson. Did you, in fact, receive this e-mail?

DR. JOHNSON: Yes, I received this e-mail.

Q And it appears that it follows up on a conversation in Laura Richards' office. Would that be the same conversation that was -- you were present for --

DR. JOHNSON: Yes.

Q -- and Dr. MacWilliams and Dr. Miller?

DR. JOHNSON: And Dr. Garver --

Q Yes.

DR. JOHNSON: -- and Mr. Mark Saunders.

Q Okay. So in this case:

I am following up from our conversation in the office regarding your reasoning for not recommending that we initiate testing of aquaculture fish (specifically Atlantic salmon) for the Parvovirus we recently identified in high prevalence in wild sockeye salmon populations. My recollection of your reasoning was that there was no reason to test Atlantic salmon before we underwent large-scale screening of pink and chum salmon and understood the potential role this virus may have across multiple species of wild fish. Is this correct?

Did you answer her?

DR. JOHNSON: I never responded to this e-mail.

Q Does she have it accurate?

DR. JOHNSON: We were going to have a meeting subsequent to this. No, it's not accurate.

Q What's your version of it, then?

DR. JOHNSON: We discussed the possibility of -- because the Parvovirus has been found in both fresh and saltwater, we discussed the possibility of screening all salmonids in British Columbia, including ones that we'd collected as part of our sockeye surveys, which included pink and chum salmon, and if I'm not mistaken, I would consider farmed Atlantic salmon as one of the species of salmon that we have in British Columbia.

We also discussed the possibility of holding off on the screening of farmed Atlantic salmon until the results of the challenge trial being done with Parvovirus were completed. There was also some discussion about the specificity and the sensitivity of the tests she was using, which is a non-validated diagnostic test.

Q Does Canada have a plan to actually start to sample net-pen fish, Atlantic salmon specifically, for the incidents of Parvovirus?

DR. JOHNSON: Although I was not able to make the meeting because of Cohen-related activities, as I understand, the fish farms will be providing samples for screening for Parvovirus.

Q As of when?

DR. JOHNSON: I am not sure of the actual date. That could be something you could ask Dr. Miller tomorrow.

MR. LEADEM: Okay. I have a couple of other documents I wanted to seek to tender through this panel, and at the risk of my adulterated list, I'm going to ask that document number 22 from the Conservation documents be pulled up. Hopefully, it's what I think it is. It's a report by Vike and Nylund.
MR. MARTLAND: I wonder, just before we move on, if the document on the screen ought to be marked.
MR. LEADEM: Oh, sorry. Thank you, Mr. Martland. Might that be marked as the next exhibit. It should be 1501, by my calculations. That's an easy one to remember.
THE REGISTRAR: That's correct, 1501.

EXHIBIT 1501: E-mail from Kristi Miller-Saunders to Stewart Johnson, dated July 29, 2011, Subject: testing Atlantic salmon for Parvovirus

MR. LEADEM: All right.
Q I understand that -- Dr. MacWilliams, are you familiar with this paper, the ISA virus in Chile: evidence of vertical transmission?
DR. MacWILLIAMS: I have read it, yes.
MR. LEADEM: All right. Might this be marked as the next exhibit, please.
THE REGISTRAR: 1502.

EXHIBIT 1502: ISA virus in Chile: evidence of vertical transmission, by Siri Vike, Stian Nylund, and Are Nylund

MR. LEADEM:
Q And for the benefit of the Commission, could you explain the difference between vertical transmission and horizontal transmission?
DR. MacWILLIAMS: Horizontal transmission would be the transmission from a fish to fish basis; vertical transmission would be an inter-ovum transgenerational transmission from parent to offspring.
Q In this case, as I understand it, and correct me if I have it incorrectly, the fish virus here, the ISA virus that came into Chile was -- actually came in through the eggs that were transported from Norway as a source; do I have that right?
DR. MacWILLIAMS: That was their interpretation, yes.

MR. LEADEM: Thank you, those are my questions.
THE COMMISSIONER: Thank you, Mr. Leadem.
MR. MARTLAND: Thank you, Mr. Commissioner. I have counsel for the First Nations Coalition at 35 minutes now.
MS. GAERTNER: Thank you, Mr. Commissioner. Brenda Gaertner, and with me, Crystal Reeves for the First Nations Coalition.

CROSS-EXAMINATION BY MS. GAERTNER:

Q I'm going to start with Exhibit 1364 and questions of you, Dr. Johnson, and I'll move, immediately after that, to Exhibit 1461.
Dr. Johnson, have you seen the draft summary report that's before you? That's the summary report that we were provided of this meeting that DFO had on April 14th and 15th in which you were in attendance?
DR. JOHNSON: Yes, I assisted in the editing of the document.
Q And when this meeting occurred and the editing of this document, you were aware that these documents would be tendered by your counsel in this inquiry; is that correct?
DR. JOHNSON: We were asked to provide a summary of the meeting for this, along with all of the presentations for the meeting, which have all been given to the Commission.
Q And so all of the presentations that were done and this document were done in preparation for it being tendered as evidence in this Commission?
DR. JOHNSON: No, I believe that the original, or purpose of having this meeting was to have a meeting amongst ourselves to review the various hypotheses related to the possible declines of sockeye salmon.
Q But when the documents were completed and the reports were done, you were aware that they were going to be tendered as evidence today, or evidence at this inquiry?
DR. JOHNSON: Yeah, I -- they were asked for and they were provided.
Q And by my review of the attendees, your legal counsel in this inquiry were also present at that meeting; is that correct?
DR. JOHNSON: Yes, legal counsel was also there.

Q Okay. And at page 10 of 22 of this document is where you provide the overview on disease; is that correct?
DR. JOHNSON: Yes.
MS. GAERTNER: Mr. Commissioner, maybe I'll just take a moment. A number of times, off the record, my clients have been asked what their views on this topic are, and given the positions in this room and all of that, there seems to be a little bit of lack of clarity on that. I just want to --
MR. TAYLOR: I just want to get some clarity, first. There is no "off the record"; we're on the record.
MS. GAERTNER: No, well, I'm sorry, I've been asked in this room, when we're not at the podium, this issue, and given the positions in this room, I think it would be useful for you to know that in the work that we're going to do on disease and aquaculture, my clients have instructed us that we're seeking to find better information regarding the relationships of disease in aquaculture with the wild stocks, better framework for management of this information, the sharing of this information, and active steps for the precautionary protection of the migratory route, and these are the basis in which we are going to approach the questions, because it's my experience that people make assumptions about the positions that are taken in this, and I think those assumptions get in the way.
Q So I'd just like to pursue with you the information that you provided in the overview of the disease, and that's found at page 10 of the document, and that's the presentation that you've provided; is that correct?
DR. JOHNSON: That's correct.
Q And this is a very broad overview of the influences of disease on wild stocks; is that correct?
DR. JOHNSON: Yes. And the purpose of which was to inform those that are unfamiliar with the process of disease and the relationship between diseases and pathogens.
Q Just as a matter of interest, have you ever provided a similar type of report like that to First Nations in the Province of British Columbia?
DR. JOHNSON: I have worked with various First Nations groups to discuss fish health issues. I have not

provided this type of instructions. I've provided instructions of sea lice and sea lice interactions with First Nations.

Q All right. Now, in your view, if the ultimate cause of mortality in Fraser River sockeye salmon was disease resulting from a pathogen, we're not going to find that fish or that population, because Fraser river sockeye salmon don't tend to float, do they? So we're not going to find the disease or the death or the ultimate cause in that way, correct?

DR. JOHNSON: I would -- yeah, it's very difficult to find diseased and dying fish in the ocean, but not impossible to find them in lakes and rivers sometimes.

Q And if I heard the evidence correctly, it's also accurate to say that the effects of pathogens as a cause of mortality can be very population specific, and in the context of Fraser River sockeye salmon, we're talking about conservation units at that point in time; is that correct?

DR. JOHNSON: Based on what I know from other fish types and species, yes, different strains or different even families of fish can show different susceptibility to pathogens.

Q And what I also heard from the evidence is that given the increase in such things as changes in water temperature, exposure to toxic chemicals, emerging chemicals of concern, that the impacts for pathogens and the diseases caused by that are becoming increasingly more relevant to the long-term sustainability of Fraser River sockeye salmon?

DR. JOHNSON: I think that with -- given all of those various climate change and other insults, that we must be aware that there are pathogens that could possibly cause disease under those -- when water conditions are poor.

Q And so if we can't find dead fish, would you also agree that the increasing identification of en route mortality and pre-spawn mortality are indicators or potential indicators of increased susceptibility to pathogens and disease by Fraser River sockeye salmon?

DR. JOHNSON: I don't think it's necessarily increased susceptibility to pathogens or disease. What I think you see sometimes is not such -- not very

optimal water conditions, for example, which means that the pathogens that these fish are already carrying, or pathogens that they acquire once they enter the river, may have a different outcome than if the water conditions were perhaps more favourable.

Q Right. So if the water conditions are becoming more difficult and we have increased en route mortality or pre-spawn mortality, that could be an indicator that these salmon are now suffering from increased disease or mortality caused by pathogens?

DR. JOHNSON: Yes, I would say that's true. But the deaths could also be due to physiological factors.

Q Dr. Kent, do you agree with all of this so far?

DR. KENT: For the most part I agree with Dr. Johnson. I mean, I basically agree with him. I guess my interpretation of where we're going, we do a lot of work with pre-spawn and en route mortality in Oregon, and this is a question about the -- one of the -- it seems like one of your questions was relating to are they genetically more predisposed now. I would put that at a lower priority. It's more changes in the environment, fish coming back earlier than they used to be, and then given the pathogens and opportunity to cause more disease.

So the general school of thought with en route and pre-spawn mortalities are changes in the river environment and changes in the time that fish return are two major factors allowing for opportunistic pathogens or pathogens that are common in salmon to just cause a lot more damage than they normally would.

Q Right. So given those changes, the pathogens may --

DR. KENT: Yeah, right.

Q -- be causing the death --

DR. KENT: Right, yeah.

Q -- is what I'm saying.

DR. KENT: That's right.

Q You'll agree with me on that?

DR. KENT: Yes.

Q And Dr. Stephen, you'd agree with me, then?

DR. STEPHEN: Well, I take care confusing mortality with loss, first. You brought out the early point of finding them, so to make sure they died and not been captured or gone somewhere else, so that's

the first thing. And secondly, it's always challenging to equate mortality with disease, and particularly here we're talking about infectious diseases. But I'd agree that if you had increased mortality in a population, infectious disease would be impossible to investigate.

Q All right. And the First Nations that I represent along the migratory route of the Fraser River sockeye salmon, in addition to noting increased en route mortality, are also seeing increased stress in the fish's ability to swim, multiple changes to their skin condition and flesh conditions, like lesions and tumours, and very concerned about these skin and flesh conditions. Would you also agree that those are also other indicators of potential increased effects of pathogens on the salmon?

DR. JOHNSON: Skin lesions can occur from a variety of different causes of it than simply pathogens.

Q But can it be related to pathogens?

DR. JOHNSON: Some skin lesions can be related to pathogens, yes.

Q And would you also agree, given the climate changes and the increases in other stresses that are going on in our environment, that the acceptable level of risk that was determined in the 1980s and 1990s may no longer be acceptable standards of risk today?

DR. JOHNSON: And what levels of risk are you referring to?

Q Well, if decisions were made in the 1980s and 1990s, and we didn't have as much information about climate change and climate variability and en route mortality, now that we do have those, there would need to be a review of such decisions in order to determine whether there is an acceptable level of risk, given current environment?

DR. JOHNSON: Risk, what I -- excuse me, I don't understand, risk of what? What is --

Q Exposure to pathogens.

DR. JOHNSON: Okay. I'm not aware of what decisions were made in the 1980s and 1990s, as I was not part of DFO at that time. I don't have an answer to that question.

Q Dr. Kent?

DR. KENT: Can you be a little bit more specific about

what decisions from the '80s and '90s --
Q Well, I'm just going to use siting, for example. There is siting of fish farms --
DR. KENT: Okay.
Q -- that were made in the '80s and '90s in which decisions as to the impact of Fraser River sockeye salmon and climate change were not exactly at the top of the list of concerns that were being used when determining the location of these farms. So here we are, now, in 2010, there's a lot more information that we've had. Would you agree that the level of risk needs to be reviewed, given these changes?
DR. KENT: I would agree with you in the context that you're -- in making these decisions considering that the sockeye -- at that time there was not as much concern about the sockeye run, now there -- the sockeye population. Now that there is, so that would become a higher priority in making management decisions, including in how this might potentially effect sockeye salmon.
Q And given all the other potential impacts that are happening to Fraser River sockeye that we have now learnt about since that time, there may be different levels of risk that we can take today than we considered in the '80s or '90?
DR. KENT: Yeah, we're moving forward, but we'd still need a lot more information.
MS. GAERTNER: All right. Can I now go to Exhibit 1471, and page 10.
MR. LUNN: 1461, perhaps?
MS. GAERTNER: 1461, sorry. I said 71; I meant 1461.
Q Dr. Stephen, this is the -- Dr. Johnson, sorry, this is the deck that was presented at this meeting of DFO scientists in April of this year. And if you go to page 10 of the deck -- sorry, no, it's the page that has the map of the overlapping circles. I have it as page 10 of the actual...
MR. TAYLOR: I think it's page 2 or 4.
DR. JOHNSON: Yeah, it's very close to the front of the deck.
MS. GAERTNER: It's page 2. Thank you, Mr. Taylor.
Q I noticed these three overlapping circles, and I'm just wondering, Dr. Johnson, from your work, if you were beginning to study the present risks associated with Fraser River sockeye salmon and pathogens, which of those three would you focus

on? Would you focus on the host or the environment or the pathogen? How would you go about doing this?

DR. JOHNSON: Do you mean studying the pathogens or studying the disease? If I want to study disease, then the message here is you need to consider all three of these and the interactions that go on between them.

Q And Dr. Stephen, if you were trying to look at health, which one would you go after?

DR. STEPHEN: Well, I guess I'd add another circle, first. I'd want to make sure that they're talking about not just the biotic environment but also the social environment. And you couldn't -- if you're going to look at health, you must look at all of them together, and that's the significant challenge we're facing, I think.

Q All right. And so now I want to turn to some questions that I thought of last night, Dr. MacWilliams, when you're describing, well, when your counsel was asking questions about managing for pathogens, you responded by describing the biosecurity that happens in the salmon enhancement facilities, and you divided it into three categories for the whole panel. She divided that, keeping pathogens out of the facilities prevent the spreading and reducing susceptibility to disease, and I'm assuming reducing susceptibility to diseases makes stronger -- now, I want to make a transfer from the enhancement facilities to looking after wild salmon when they're in their migratory routes, when they're in the wild, and I want to take those three basic categories and say, if we're going to keep pathogens out we'd be looking at -- closely looking at the migratory routes. And then I want to hear from you on preventing the spreading, what precautionary steps we could take there. And then we'll go to health in a moment.

So if we were preventing the spreading of pathogens, would you agree that preventing the intermingling or exposure to other species, including other salmonids, would be a first step that -- species that may be carrying pathogens?

DR. JOHNSON: I would say that for any given pathogen, it doesn't matter what species is carrying it, yes, you would want to limit your exposure to

other fish which are carrying that pathogen.
Q And in the case of Fraser River sockeye salmon that are operating in the wild, what human activity can we do to prevent their exposure to other fish or other species carrying pathogens?
DR. JOHNSON: We could continue to maintain high levels of biosecurity associated with our aquaculture activities.
Q Could we also move net-pen farms so that they weren't in the migratory route? Would that be a way of minimizing exposure to pathogens?
DR. JOHNSON: If pathogens were being sent by a salmon farm, yes.
Q Well, it's not a question of "if" as I've heard it today. I heard all kinds of different ways that it's clear that we understand that there's comingling. We don't exactly know which comes first, the chicken or the egg argument may be something that I would characterize it as. It's not a question of "if", it's a question of "how" and "when" as I've heard it. We could spend a lot of time, as I've also heard it, looking at that question, but if, in the meantime, we wanted to protect wild stocks from being exposed to pathogens, what human behaviour could we do? We could move net farms, is that agreed?
DR. JOHNSON: That's one thing that I guess you could do, yes.
Q Is there anything else that you're aware of that we could immediately do, particularly in the marine, to prevent exposures to pathogens by Fraser River sockeye salmon?
DR. JOHNSON: Other sources of pathogens are pretty much out of our control.
Q Thank you. All right, Dr. Kent, I wonder if I could take you to your report and go to page 24, which is Exhibit 1449. And I'm looking at your recommendations, because our clients are very interested in how we can move forward. By my read of those, they appear quite linearly, like you do one step, then you do the next, then you do the third, and I particularly picked that up when I got to recommendation number 3, the environmental factor. And you're suggesting that only after a pathogen is shown to be associated with mortality, and that was like after several years of further research, that's number one, then you do all the

data analysis, could you then conduct investigations to elucidate which factors influence the distribution and abundance of these pathogens, do we really need to do it that way? Do we really need to do it so linearly? Can we be more iterative about this?

DR. KENT: Yeah, we could, and I guess a good clarification for item 3, I would make the assumption we're talking about from an infectious disease approach what my recommendation is. Probably a good clarification, in hindsight, would be good to put in there that these mathematicians, ecologists, fisheries biologists would be looking at environment and other, you know, other -- collecting those data independently before we start plugging in the pathogen data.

So I think that that would be a caveat I'd change there. I'm not saying that if we look at this in total that we'd just have the statisticians and modellers and ecologists sitting doing nothing on these environmental conditions, waiting for us to come up with a pathogen, then we'd start working with them, but they would be working independent at the same time the pathologist and other fish disease experts would be undertaking items 1 and 2. Do you follow me on that?

Q Yes, I do. I'm just looking at my next question, actually.

DR. KENT: Okay.

Q I apologize, but I was listening. Now, if you agree that we're not managing pathogens but, rather, we're not managing -- and we're not actually even managing Fraser River sockeye salmon, we're managing human behaviour, that's essentially what humans get to do when it comes to wild stock, and if you look at the environmental factors that you've listed in the brackets there and you accept for a moment that DFO doesn't have jurisdiction over the human's use of fossil fuels and doesn't have much jurisdiction over logging practices and other land use practices, would you agree, again, that this is another way of saying that we're going to have to focus on pen farming?

DR. KENT: Yeah, certainly in conducting the analyses you would include net-pen farming along with these other factors. Even if DFO cannot directly affect

land use practices, I would assume that if DFO and other scientists correlated impacts of land use practices on causing significant disease on our sockeye salmon, that there are other means to change logging practices and agricultural practices if those really were playing a significant role. If the scientists ended up demonstrating that.

So yeah, I agree, I assume the net-pen farming would be something DFO would be able to control directly. So, on the other hand, I wouldn't expect that the scientists should just ignore these other potential anthropogenic factors that might be affecting the overall prevalence of a particular disease.

Q Thank you. And Dr. Johnson, you've heard -- you've mentioned that you've actually worked directly with some First Nations. I'm sure you're aware that First Nations have raised, over the years, concerns around disease and concerns around aquaculture and net-pen farming relationships to disease, correct?

DR. JOHNSON: Yes.

Q Are you aware of any steps that the industry has been asked to take to provide research into addressing that concern, the industry, itself, providing studies around the relationship between their activities and wild stocks, or is this something that DFO takes on, themselves?

DR. JOHNSON: There are some, I believe, a program in the Broughton that involves sea lice and the variety of different groups, to look at the potential impacts of sea lice.

Q That's one study.

DR. JOHNSON: That's one such study.

Q Is there any other work that industry has been doing to assist you in addressing this concern?

DR. JOHNSON: The industry contributed some money in the first year of our Fraser River sockeye survey, along with the Salmon --

Q That's it so far?

DR. JOHNSON: -- Foundation.

Q And that's it so far?

DR. JOHNSON: That's what I -- that's the two that I can remember. Maybe --

Q And would you agree with me that if we've got difficulties regarding funding within the

Department of Fisheries and Oceans and if the concern is with an active industry who's making a very significant profit, that it might be then that needs to address some of these concerns?

DR. JOHNSON: I think that the industry could be asked to contribute to addressing some of these concerns, as well as some of the other user groups, such as the sports fishermen benefit a lot from these salmon, and others that utilize the resource.

Q Thank you. I'm going to turn, now, to fish health for a moment, and I'm going to ask my next set of questions to Dr. Stephen for a moment. Dr. Stephen, in your report and in your evidence yesterday, I know you were talking about it as it relates to enhancement facilities, but I think the discussion about risk assessments can go broader than that, given your experience. You spoke of two matters of import; one is acceptable thresholds of risk, and refocusing on fish health.

I'd like to take you, now, to page 98 of your report, and that's the section on the state of science. And midway through it, you make a statement that was of much interest to my client. It begins, "Little research," and it says:

> Little research has been done to define socially and ecologically tolerable levels of disease associated with salmonid enhancement.

Dr. Johnson, would you agree that this is also applicable to the levels of disease in Fraser River sockeye as it relates to other exposures to pathogens?

DR. JOHNSON: I would agree, especially for those stocks that are, you know, very threatened.

Q And Dr. Stephen, would you agree, in order to do this type of research, i.e. defining socially and ecologically tolerable levels of disease, you're going to need a broad group of people who care about this resource involved in it, and from my client's perspective you're definitely going to need First Nations being involved in helping to define socially and ecologically tolerable levels of disease.

DR. STEPHEN: Yes, and I think we featured that in our recommendation as prominently as well.

Q And Dr. Johnson, would you agree that this is something that should not be done by DFO scientists in silo, or industry, but rather this has to be done more broadly?

DR. JOHNSON: I think that it has to be done more broadly, and input from First Nations is welcome. In fact, any time that we have -- receive concerns from First Nations groups, we try our best to investigate those concerns. And we're having worked on the Alberni Inlet sockeye with some of the groups there. And there's a lot. I learned that they, for example, that they've long known that these sockeye came back to the river carrying sea lice scars and wounds. So I think there is a great deal of value, because the First Nations groups are essentially on the river. We do not have the staff to be everywhere on these rivers. And so if people pick up the phone and phone, then we try our best to accommodate or to investigate people's concerns.

Q In fact, if we were looking at systematic monitoring and evaluation of fish health and fish health services and programs, you would agree that that would need to happen at a local and regional level, and First Nations involvement would be extremely useful?

DR. JOHNSON: I think everybody's involvement, including First Nations, is useful, provided that those individuals involved are adequately trained and they're given the resources to do that work.

Q Now, Dr. Stephen, your recommendations also included attempting to help to focus more on fish health, public accountability and transparency. That's what you were getting at in -- as it related to enhancement facilities, correct?

DR. STEPHEN: Yes.

Q And one of those recommendations, and I'm going to take you to them right now.

MR. MARTLAND: I'd just point out, Mr. Commissioner, this is the usual time for the break. I think I have another 10 minutes for Ms. Gaertner's time. I'm not sure if she'd -- what your preference is or what her preference may be in that respect.

MS. GAERTNER: I'm happy to take the break.

THE COMMISSIONER: All right, thank you.

THE REGISTRAR: The hearing will now recess for 10 minutes.

(PROCEEDINGS ADJOURNED FOR AFTERNOON RECESS)
(PROCEEDINGS RECONVENED)

THE REGISTRAR: The hearing is now resumed.
MR. MARTLAND: Mr. Commissioner, by way of housekeeping, at the break we conferred with Mr. Leadem, as well as the Registrar in relation to the documents Mr. Leadem addressed through his questions and to which no objection was made relating to past years of records. So what's proposed by way of marking these as exhibits, and I'll do this in quick form just to place it on record, would be that first the 2002 document, number 8 on Mr. Leadem's list, would become Exhibit 1503. Next, the 2003 document from number 3 on the list is 1504. Next, the 2004, number 5 on the list becomes 1505. That the 2005 document, number 7 on Mr. Leadem's list, becomes Exhibit 1506. For 2006, number 9 on the list, that becomes 1507. For 2007, which is number 4 on the list, that becomes 1508. And we have the 2008 in already. The 2009, number 2 on the list, would become Exhibit 1509. I don't understand there to be objections identified on those. I proposed those exhibit numbers please be assigned.
THE COMMISSIONER: Thank you.
MR. MARTLAND: Thank you.
THE REGISTRAR: They will be so marked.

EXHIBIT 1503: 2002 B.C. Salmon Farmer Database

EXHIBIT 1504: 2003 B.C. Salmon Farmer Database

EXHIBIT 1505: 2004 B.C. Salmon Farmer Database

EXHIBIT 1506: 2005 B.C. Salmon Farmer Database

EXHIBIT 1507: 2006 B.C. Salmon Farmer Database

EXHIBIT 1508: 2007 B.C. Salmon Farmer Database

EXHIBIT 1509: 2009 B.C. Salmon Farmer Database

CROSS-EXAMINATION BY MS. GAERTNER, continuing:

Q I'm going to return to your report, Dr. Stephen, and I'm going to go to page 101. And that's recommendation number 3, which is I think the recommendation you were referring to earlier when you were talking about getting different people in the room and looking at risk assessments and otherwise. And in particular, I'm just going to make sure I understand what you mean. First of all, in your rationale, you say, "Private sector DFO and FFSBC." You don't specifically reference First Nations there. Was that an oversight on your part?

DR. STEPHEN: Yeah, I think even broader than First Nations, there are other aspects of society as well, yes, that could be included in there.

Q But you'll agree with me that given First Nations have as constitutional protected right particularly as it relates to Fraser River sockeye salmon that they will have insights, capacities, methods and additional insights provided to these types of groups?

DR. STEPHEN: Yes, to the best of my knowledge.

Q And if you go to sub-recommendation 3(b), you speak about reinstating a federal/provincial fish health management committee. Recognizing there are concerns that have been raised regarding transparency of information and ensuring the right people are at the table, would you agree that First Nations participation in such an advisory body would be useful going forward?

DR. STEPHEN: Just to tell you the background of that body was people who had expertise both inside and out of government in fish health matters. And I think people who have that expertise should be welcome to that sort of committee.

Q In fact, if you were looking at that committee to determine things like risk assessments, properly looking at the data, reflecting what type of research we need to do, all of those types of things, it would be recommended that First Nations have a part at that table, would you agree?

DR. STEPHEN: You're describing a slightly broader

mandate than it had historically but given that mandate I would agree.

Q Thank you. Now, the next recommendation I want to take you to is recommendation number 4. And you refer there to "developing consistent and transparent processes". And I'm just trying to understand better how we can make data and information more transparent. And I heard yesterday a little bit of concern about making it public. My clients have been saying that they are not a member of the public and that they should be getting the information at the same time as other governments. What other ways can we look at to determine and improve transparency of information regarding such matters as disease and pathogens? What can we do to improve this?

DR. STEPHEN: Well, I think there's two types of transparency. One is I think the one that perhaps you are alluding to was making the results and process accessible to a wide suite of the public and that's again a governmental decision. I think I was thinking more about being more explicit on the criteria and the systems that are used for decision release.

We certainly got some explanations from people like Dr. MacWilliams and Sherry Mead about some of their decision but I guess this recommendation somewhat reflects our frustration with trying to document how the decisions were clearly made in each case. So our recommendation was to have some sort of, as you see with 4(a), a more detailed idea of thinking about how we can -- almost a decision algorithm, if you like, that would be standard and consistent so that people would understand both within an organization, between organizations and outside, that, yes, we agree we've met our standard for precaution from releasing these fish.

Q Dr. Johnson, I'm wondering, in your work whether or not the use of protocols between Science and First Nations would be a useful way of improving transparency of data information and interpretation of that data information, as it relates to pathogens?

DR. JOHNSON: Can you define what you mean by "protocols"?

Q So if the Department of Fisheries and Oceans and,

in particular, Science, had a protocol directly, for example, with the First Nations Fisheries Council, which is the provincial organization, which provided how information would be shared, when information would be shared, those types of specific protocols, would that, in your view, increase the transparency and sharing of information?

DR. JOHNSON: I believe it would, yes.

Q Would you make that as a recommendation to the Commissioner when he's considering transparency of data?

DR. JOHNSON: If First Nations were involved, any partner that's involved in research programs, should be able to share the data -- who's actively involved within the research program.

Q And then the last thing I wanted to talk about was the communication of complex issues. These are extremely complex issues, as we've already discovered sitting here, and as we continue to do the work. Dr. Johnson and Dr. Stephen, I'd ask for both of you, what recommendations could you make to improve the communication around these complex issues with First Nations and then with the public?

DR. JOHNSON: I guess in one area -- there tends to be a lot of misinformation and a lot of misinformation with respect to diseases, causes of diseases, relationships between pathogens and disease that are out in the public domain. I guess it's the responsibility of all of us who are fish disease experts or fish disease specialists or veterinarians to work more to help the public and First Nations understand these issues and thereby potentially reducing the amount of this misinformation that goes around. I think that's a really important thing to start with.

DR. STEPHEN: I'm actually quite glad you asked this question because after the discussion yesterday about my recommendations, a couple more sprung to my mind, without upsetting our colleagues from Canada there who want to be done with recommendations. And I think you've hit on a key thing where, well, one thing I was thinking was actually this body is a nice microcosm of moving forward where we have a variety of parties with a variety of interests with a variety of

perspectives. And as I understand it, Mr. Commissioner, it will be your job to try to pull these together to move forward. And the question I had in my mind walking home last night was, who's going to do that after the Commission? And I can see a role for, you know, the Salmon Health Commissioner, whose job it is to link, whose job it is to share information, share perspectives, integrate people so we have -- and even earlier on, ma'am, when you brought up the idea that this wouldn't be within DFO's mandate to look at land use, I hope that we see broadly an all-government approach to a species is affected by many aspects that fall outside our jurisdiction.

So to me, that I think would be one very important thing to have a person whose job it would be to still be the knitter together and the communicator and linker. And I think on a more pragmatic level, there's a very big push in Science these days for knowledge and knowledge translation where we have people whose job it is to take complex issues and try to communicate that to other stakeholders, other scientists and other groups. And this is an area we see a lot in the human health field, less so in the biological fields, about getting the information to the people who need to know to make decisions. And I could see that as a strong recommendation going forward as a very important role for government to play to help to facilitate that sort of communications to the broad stakeholders worrying about sockeye salmon.

Q And would you agree that it may not be just one individual given the varying approaches to risk and the varying ways in which we look at risk and even how we ask questions of scientists, it may be more useful to have a body of people representing different perspectives?

DR. STEPHEN: I think it would be very important to make it somebody's job just so that it's their task to do it but I agree. Maybe we'll call it a secretariat but I very much agree that developing some of the participatory approaches that we see in population health can be applied to an issue of salmon health and that includes a broader body of consultation.

Q Thank you. I realized I missed one question on

recommendation 2 of yours. You mentioned there under sub-recommendation 2(e) at page 100 that you "create the capacity for fish health staff to visit facilities on a regular basis". I'm wondering if also you would suggest unscheduled site visits to facilities, both in terms of enhancement facilities in this case and also as it relates to fish farms?

DR. STEPHEN: That would have two different jobs. To me, one of the most important things for building a good veterinary client relationship so people will take your advice is to build a trusting relationship. And that I think should be separate than an audit and inspection role so that we'd see more collegial development of fish health plans. So I would separate out those two types of visits.

Q But you would do both?

DR. STEPHEN: I think if you had the objective of ensuring, as you say, some degree of public insight, and this would be unique to food-producing areas if we're looking at the salmon farms and similarly with the hatcheries, but if that is a management goal to have a degree of external auditing, you would have to have some unscheduled visits as well.

MS. GAERTNER: Those are my questions.

THE COMMISSIONER: Thank you, Ms. Gaertner.

MR. MARTLAND: Thank you, Mr. Commissioner. I have counsel for the Cheam and Stó:lō at five minutes. Thank you.

MS. SCHABUS: Thank you, Mr. Commissioner.

THE COMMISSIONER: Thank you, Ms. Schabus.

MS. SCHABUS: Nicole Schabus, co-counsel for Stó:lō Tribal Council and the Cheam Indian Band.

CROSS-EXAMINATION BY MS. SCHABUS:

Q Listening to the panel over the past two days it seems that even on the panel when you look at the issues of pathogens and disease, you look at it from a compartmentalized lens almost from the specialization that you're working from and that you are working in. Now, sometimes when it comes down to terms, when you were talking, for example, about risk, you even had a slightly different interpretation looking at it from that lens. But one of the things that I think I heard you all

saying is that it is very important to develop a more holistic way of actually looking at fish health when we are dealing with the issue. And I'd just like to put that to you. So when we are dealing with fish health that includes looking at the impacts of pathogens but also the impact of environmental conditions, pollution, et cetera, on the overall fish health and also the increased presence of pathogens, you'd agree with that on the panel?

DR. KENT: I would agree.

DR. JOHNSON: I would agree.

DR. STEPHEN: I would suggest that that still is insufficient (indiscernible - poor sound quality) from thinking about health. I mean, health is not the absence of these hazards that you're talking about. Health isn't the pathogens that you're able to describe in your environment. And that includes giving them the needs for daily living, appropriate food, appropriate water. It includes being able to deal with stressors and hazards like we've talking about, and it also includes our ability to meet our expectations. So I think it's an even broader picture than you've provided.

Q I agree with that. And so in the end, what you're seeing is the way forward in dealing with issues of fish health, as you are suggesting and recommending it, to actually have a more comprehensive approach that deals with overall fish health and brings all these experiences and expertise together. I'm putting it to you, Dr. Stephen.

DR. STEPHEN: Yes, I would agree that we'd like to have a holistic view of health.

Q And an approach, a comprehensive approach of dealing with fish health in light of that?

DR. STEPHEN: Absolutely. With the proviso, of course, that we don't really do that well or know how to do that well. Some of the scientific methodology for putting together complex socioecological systems and studying those and understanding the change in systems that are often unpredictable, there's a lot of both cultural change in science and methodological development that has to go into really doing that successfully.

Q And what I'm going to suggest to you is exactly that. My clients, as an Indigenous people and

Indigenous peoples generally have a more holistic world view and a way of looking at issues that way. And so specifically when it comes to fish health, my clients being Indigenous peoples, they live along the river, my client specifically along the lower Fraser River. And they have a very close relationship with salmon. They're very concerned about the overall decrease in fish, in fish health. So when you're looking at Indigenous knowledge and Indigenous concerns, the way Indigenous peoples articulate those concerns in a holistic manner, I'm suggesting to you that this is actually a very important element that will have to be at the key of developing a more comprehensive approach to dealing with fish health.

DR. STEPHEN: I think if we develop an eco-health approach to fish it will take into the account of not only First Nations but other groups who have knowledge of the system for sure.

Q Exactly. But when you're looking at Indigenous knowledge, you're looking actually at the most long-term knowledge about fish health and the fish in this very ecosystem and the ecosystem. And I'm putting it to you, Dr. Stephen, but I think also Dr. Kent, you were talking about the necessity of developing a baseline and finding that historic baseline of what a healthy fish population is but also what fish health is. Indigenous knowledge is key to that. Would you agree with that?

DR. KENT: I agree with that and I guess I think it's beyond -- I see where you're going with this and I see that this would be a very useful integration of Indigenous knowledge with kind of the scientific method, if you will, and I don't think that they have to be really kept separately and I think there's a way of interacting with the two of them with this obtaining knowledge. Basically, what I'm hearing for the last two lawyers is that we have this opportunity where we have basically field biologists. They may not be trained in a traditional way but you have eyes and ears out there in the field and integrating well with the scientific method. I don't think it would be against the Indigenous way of doing it that this could be a very useful endeavour.

Q And not trained in the traditional western way but

very much trained in their own traditional way?
DR. KENT: That's correct. That's right.
Q And just taking it from there, my clients speak and have a concern about the overall decline in health of the Fraser River sockeye salmon stocks. And putting that question to you, as the panel, I suggest to you that you also share in that overall concern about the decline of health of the Fraser River sockeye salmon stocks.
DR. STEPHEN: Yes, I certainly do.
DR. MacWILLIAMS: Yes, that's correct.
DR. JOHNSON: I also do.
DR. KENT: And I do, too.
Q And having sent that decrease over the last years and decades, that is a concern that you would agree with me is best approached by actually integrating Indigenous knowledge and finding a more comprehensive way of overall planning for fish health.
DR. STEPHEN: If I may, I think the importance here is not to start thinking about primacy of information about whose might be more or less important but to actually build that collegial trusting relationship where we can see the evidence and how it contributes to different parts of this complex problem.
MS. SCHABUS: Very much so. Thank you. Those are my questions.
MR. MARTLAND: Mr. Commissioner, Areas D and B had requested time, although not within the period for time. Still permitting for Mr. Taylor and the short re-examination that I have, I do have five minutes. I'd like to ask counsel, Katrina Pacey, for Areas D and B to use that for her questions.
MS. PACEY: Thank you, Commissioner. And thank you to Mr. Martland for accommodating me at the last minute.
THE REGISTRAR: Your name, please?
MS. PACEY: Katrina Pacey, P-a-c-e-y, first initial K. Thank you.

CROSS-EXAMINATION BY MS. PACEY:

Q Dr. Stephen, I have a few questions for you. We have heard over the last two days a great deal about the approach that's been taken to the study of disease in salmon stocks and the gaps in that

research in British Columbia. And so my question to you is regarding the focus of that research and the way in which some of that research has been undertaken. So I suppose you would agree with me if I suggested to you that a lot more fish are actually infected with a bacteria or a virus than the number of fish that actually die as a result; is that correct?

DR. STEPHEN: Depending on the pathogen but as a generality I'd say that's true, yes.

Q And so when we look at other flus, and I'll draw by way of example perhaps the Avian flu, we don't just look at the mortality rates but we look at the number of actual carriers, the rate of illness. So it could be that 30 percent of human beings and 30 percent of animals are sick and then 2 percent die, just by way of example.

DR. STEPHEN: Generally, in research but not in ongoing monitoring and surveillance. There it's generally looking at morbidity and mortality, whether it's humans, cattle or other species.

Q Would you agree with me, though, if concern is regarding the health of salmon stocks in British Columbia, and if our concern is regarding the actual transmission rates, it's important to continue to focus on those actual sick fish, as opposed to just those fish that pass away because obviously transmission itself is more likely from fish that are alive and continue to transmit that virus.

DR. STEPHEN: You go and look at the healthy, the infected, the sick and those who are recovered.

Q In that case then, would you agree with me that the focus on mortality or on dead fish, as we have seen in the research evolving out of fish farms and so forth, that if we want to focus on transmission rates and the likelihood of transmission from those facilities, that we should refocus our attention and our research efforts in order to look at rates of disease itself and the rates of virus, pathogens and so forth among those stocks, as opposed to just focusing on mortality?

DR. STEPHEN: I think if we all want to understand the transmission dynamics and movements of pathogens we have to look at more than mortality, yes.

Q And so would you agree with me then that the approach that's been taken in terms of the audits

that take place in certain facilities that do focus on mortality should shift away from that pure focus and be looking at actual rates of pathogen, as they exist in the facilities themselves?

DR. STEPHEN: The challenge that we have with a lot of fish disease is most pathogen tests require a dead fish. So we've got a methodological problem of having tests that good for live fish that are easy to do and reliable for a number of pathogens, not all of them.

Q Perhaps you could give me some more detail in terms of why it is? Is it an accessibility issue? Is it a methods issue?

DR. STEPHEN: I think it's a combination of a methods issue and a historical approach issue. I mean back in the history of fish disease, the fish sort of didn't count in some ways and most of them were interested early in just getting the bug and describing the bug. And fish tend not to be like a dog or a cat or a human, looked at in sort of that value of the individual. So they're more like poultry farms where the same thing, they euthanize some chickens and they can get now a more comprehensive suite of diagnostic tests. They can get the physical exam. They can get the bacteriology, the histopathology in a larger suite. So part of it, I think, reflects the history of practice and the way they can access samples.

Q So that in light of the concerns in terms of salmon returns on the Fraser that have caused the government to call for a public Commission inquiry and the obvious importance of that issue, would you say that it's appropriate then to refocus research efforts and start taking perhaps a different paradigm in how the lives of those salmon are valued in terms of the disease itself and start looking at the rates of illness, as opposed to just mortality?

DR. STEPHEN: Rates of illness, rates of infection, all these things are important. The only caution I put into it, I agree with the importance. Again, we get to the methodological issue of how do you calculate a rate when you can't find the underlying population? Rates require you to know the denominator of the population, as well as the

numerator over time. And we know that sometimes the way we capture fish creates a bias in the numerator and how we see the population creates a bias in the denominator. So while we agree, your premise is absolutely right for understanding the full epidemiology of disease, there are significant methodological challenges, not just in the diagnostic tests but in how we actually access, follow and track population to get those numbers that you're talking about.

Q Okay. I'm just going to ask one further clarifying question and then I think my time is probably up. And pardon me if I'm not understanding correctly but when we're dealing with populations that are actually contained, the historical approach has been the sort of audit approach where you have a death within the population that prompts everyone's attention to then go in and see what was the cause of death and then perhaps we'll unveil that there is an infection. When we're dealing with contained populations, could it not be that the actual surveillance that occurs could be more attune to live fish and just overall health, as you've discussed in your evidence?

DR. STEPHEN: Well, I think there's two different things to think about, that I don't think it's just mortality. Certainly, people look at morbidity or sick animals as well. And for some of the problems like I think again in general, the sea lice monitoring program, they're looking at healthy fish and doing a sample of the entire lot. And again, we have to look at how we're monitoring the population. On the one hand, you could have an external party going and looking and they can decide to look at sicks or deads or whatever. Or you can have the ongoing looking of staff.

So as we described, and you heard Dr. MacWilliams talk about, they have staff in the hatcheries who are ongoing observing these fish for their feeding behaviour and for their positions in the pans. I mean that's a form of surveillance, not an external auditing but certainly a form of surveillance. So we do have a comprehensive view of what's going on in contained fish populations that might be different than what is being audited for by external parties.

MS. PACEY: Thank you. Those are my questions. Thank you.
MR. MARTLAND: Mr. Commissioner, Canada for re-examination.
MR. TAYLOR: As I understand re-examination, I may re-exam Dr. Johnson and Dr. MacWilliams. I don't think I have a right with regard to Dr. Kent or Dr. Stephen and, therefore, my re-examination should be taken in that regard and anything left undone with the two authors of 1 and 1A, is not anything other than I can't re-exam.

CROSS-EXAMINATION BY MR. TAYLOR, continuing:

Q I think my questions are of just you, Dr. Johnson, but we'll see as we proceed over the next few moments. You were asked a question by Ms. Gaertner about whether industry could do more in research or that sort of thing and you answered to do with sea lice. And I think you spoke of sea lice monitoring. Can you very briefly just say what is it that you were thinking of is the work that industry is doing there?
DR. JOHNSON: I guess, upon reflecting upon my answer, there are a variety of programs that industry can become involved in and has become involved in, which can relate to fish health, such as programs within the ACRDP. The ones I was thinking of is support that we've received from the industry, for example, to monitor the fish in 2010 in the Strait of Georgia, and industry participation, industry participating with me on a west coast chum salmon survey by providing the fish and the logistics to obtain these fish, as part of an ACRDP program. So that's the sort of industry participation I was speaking about. As well as some financial contributions to some of these programs.
Q All right. Are you aware of fish health database upgrades that industry is working on?
DR. JOHNSON: I'm not familiar with fish health database upgrades.
Q Or any genetic research?
DR. JOHNSON: Now, I would leave that for the genetics group to answer. Sorry.
Q Okay. And what about any work with respect to a workshop on BDK?
DR. JOHNSON: BKD?

Q Sorry, BDK, yeah.
DR. JOHNSON: BKD.
Q You say it.
DR. JOHNSON: Okay. On bacterial kidney disease, yes, there was a workshop sponsored at the American Fisheries Society fish health meetings recently, which had industry participation, and I believe some industry sponsorship, although I didn't --
Q What?
DR. MacWILLIAMS: (Indiscernible - overlapping speakers) salmon.
DR. JOHNSON: (Indiscernible) salmon.
Q You were also asked a question or two about the April 14/15 workshop that DFO scientists had. What was the purpose of that workshop?
DR. JOHNSON: Purpose of the workshop, in my opinion, was to basically get all of the people within DFO around the table to talk about what they've been doing with respect to learning more about declines of Fraser River sockeye salmon. So it was an opportunity for people to get together to discuss the results that they've obtained and possibly to even generate new hypotheses and to see how our view had changed from the subsequent meeting that we held about a year earlier. If it had, then how our view, whether it was still in alignment with the workshop that was held by the Pacific Salmon group. I can't remember.
Q Pacific Salmon Commission?
DR. JOHNSON: Pacific Salmon Commission workshop.
Q All right. And when you say "people", are you referring to scientists?
DR. JOHNSON: Yes, it was scientists.
Q All right. Was justice counsel there as an observer or a participant?
DR. JOHNSON: Justice counsel was there as an observer.
Q Then you were asked a question by, I think, Mr. Leadem about knowledge on sea lice. And the question was put to you as to whether Dr. Jones was the expert in DFO and you answered by saying that Dr. Jones is doing some lab work and you're doing some fieldwork and that is in conjunction with each other. Are you someone who is knowledgeable on sea lice?
DR. JOHNSON: I am someone who is knowledgeable on sea lice.
Q And do you consider yourself to be an expert in

that area?
DR. JOHNSON: I'm an expert on sea lice especially their interactions with hosts.
Q And then finally, you were asked some questions quite a while back about Mr. Price's paper and you made some comments about his paper. Are you working on a paper yourself further to Mr. Price's paper?
DR. JOHNSON: We have discussed producing a paper in response to the two papers by Mr. Price. However, due to a large work commitment and things related to the Cohen Commission, I haven't gotten very far in producing that document.
Q All right. If it were to proceed, what is it that's prompting you to write a paper on Mr. Price's papers?
DR. JOHNSON: A large amount of it comes from those discrepancies that I felt and the fact that I felt that there was a large body of literature that was simply not discussed in those papers.
Q Is that usual or unusual for a scientist to feel compelled to at least consider writing a response paper to someone else's paper?
DR. JOHNSON: I would think that some people probably do that frequently. This is the only time that I've ever contemplated writing a response paper to somebody else's paper.
MR. TAYLOR: All right. Thank you.
MR. MARTLAND: I have two very brief areas, Mr. Commissioner, if I may? And I'll ask Mr. Lunn to bring up 1499, Exhibit 1499, for the second and I'll begin with the first.

RE-EXAMINATION BY MR. MARTLAND:

Q Dr. Kent, Mr. McDade in his questions that drew your attention to some fish health databases and asked in the preparation of your technical report whether you had incorporated a review of those. You can ignore what's on the screen for this question. In terms of the timing of the report that you prepared for the Commission, we can put together dates in due course. But is it right to say that your draft report was due to the Commission? Do you have any memory of that vis-à-vis the holidays last year in December of 2010?
DR. KENT: Yeah, we had a workshop. I believe that was

in early December. And then the draft of the report was due, I think, six weeks later. That would be in January, I believe; is that correct?

Q Was that the final date was the end of January and the draft report mid-December? Does that sound right, if I suggest those dates to you?

DR. KENT: That sounds right.

Q Do you know about the Commissioner's final ruling, which was also early or mid-December or the timing of the production of data? Do you know about the timing of that process?

DR. KENT: No.

Q Did you prepare your report without that data and not looking to incorporate that data?

DR. KENT: Which data are you referring to?

Q I'm talking about the databases that were produced.

DR. KENT: Oh, that we were going through, yes. I basically prepared my report based on my literature review and data that were a large number of grey literature documents that were provided to me by the Cohen Commission. And I don't recall seeing those at that time in late December/early January when I was finalizing the report.

Q And the Project 5 reports came some months or many months after yours; is that your understanding?

DR. KENT: That's my understanding.

Q Dr. Johnson, have a look, please, at the Exhibit 1499. And my question is whether you have awareness one way or the other as to whether First Nations were involved in developing the research agenda or working on this project?

DR. JOHNSON: This project is a laboratory-based susceptibility studies, which is part of the larger PARR projects that we have funded. And First Nations were not consulted in the development of this project.

MR. MARTLAND: Mr. Commissioner, I have no further questions. I just would like to extend my appreciation to all counsel for their cooperation in respecting our time and concluding this panel in the two days.

THE COMMISSIONER: Yes, I, too, would like to express appreciation to all counsel and particularly express appreciation to the members of this panel for attending the hearing and for cooperating and

providing your answers with counsel. Thank you very much. We'll adjourn then until ten o'clock tomorrow morning. Thank you, Mr. Martland.

THE REGISTRAR: The hearing is now adjourned till ten o'clock tomorrow morning.

(PROCEEDINGS ADJOURNED TO AUGUST 24, 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.

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Diane Rochfort

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.

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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.

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Karen Hefferland

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.

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Karen Acaster