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

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

Public Hearings

Audience publique

Commissioner

L'Honorable juge /
The Honourable Justice
Bruce Cohen

Commissaire

Held at:

Room 801
Federal Courthouse
701 West Georgia Street
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Thursday, July 7, 2011

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Cour fédérale
701, rue West Georgia
Vancouver (C.-B.)

le jeudi 7 juillet 2011

Errata for the Transcript of Hearings on July 7, 2011

Page	Line	Error	Correction
14	33, 42 and 47	MR. DICKSON	MR. TIMBERG
77	39	post studies	POST studies
77	44	post	POST
78	16	your post	your POST
84	7	disease an occur	disease can occur

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No appearance	B.C. Public Service Alliance of Canada Union of Environment Workers B.C. ("BCPSAC")
No appearance	Rio Tinto Alcan Inc. ("RTAI")
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No appearance	Seafood Producers Association of B.C. ("SPABC")
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No appearance	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")
Keith Lowes	B.C. Wildlife Federation; B.C. Federation of Drift Fishers ("WFFDF")
No appearance	Maa-nulth Treaty Society; Tsawwassen First Nation; Musqueam First Nation ("MTM")
No appearance	Western Central Coast Salish First Nations: Cowichan Tribes and Chemainus First Nation Hwlitsum First Nation and Penelakut Tribe Te'mexw Treaty Association ("WCCSFN")
Brenda Gaertner Crystal Reeves	First Nations Coalition: First Nations Fisheries Council; Aboriginal Caucus of the Fraser River; Aboriginal Fisheries Secretariat; Fraser Valley Aboriginal Fisheries Society; Northern Shuswap Tribal Council; Chehalis Indian Band; Secwepemc Fisheries Commission of the Shuswap Nation Tribal Council; Upper Fraser Fisheries Conservation Alliance; Other Douglas Treaty First Nations who applied together (the Snuneymuxw, Tsartlip and Tsawout); Adams Lake Indian Band; Carrier Sekani Tribal Council; Council of Haida Nation ("FNC")
No appearance	Métis Nation British Columbia ("MNBC")

APPEARANCES / COMPARUTIONS, cont'd.

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

TABLE OF CONTENTS / TABLE DES MATIERES

	PAGE
PANEL NO. 47 (cont'd)	
JASON HWANG (Recalled)	
Cross-exam by Ms. Gaertner	2/3/4/5/7/8/9/10/11/12 13/14/15/16
JULIA BERARDINUCCI (Recalled)	
Cross-exam by Ms. Gaertner	1/2/3/4/5/6/7/8/12/13/15/16
PANEL NO. 51 (Recalled):	
RICHARD BEAMISH	
In chief by Ms. Baker (cont'd)	18/22
Cross-exam by Mr. Timberg	29/32/38/42/43/50
Cross-exam by Mr. Prowse	61/62/63/69
Cross-exam by Mr. Blair	71/73/80
Cross-exam by Mr. McDade	89
DAVID WELCH	
In chief by Ms. Baker (cont'd)	21/25
Cross-exam by Mr. Timberg	36/43/48
Cross-exam by Mr. Prowse	61/62/68
Cross-exam by Mr. Blair	75/85/87
STEWART McKINNELL	
In chief by Ms. Baker (cont'd)	21/26
Cross-exam by Mr. Timberg	32/37/61
Cross-exam by Mr. Prowse	62/69
Cross-exam by Mr. Blair	71/73/87

EXHIBITS / PIECES

No.	Description	Page
1311	North Pacific Anadromous Fish Commission Special Publication No. 1	23
1312	Sciencexpress Research Article - Bottom-Up Ecosystem Trophic Dynamics Determine Fish Production in the Northeast Pacific	33
1313	Diet (% volume) for juvenile chinook salmon captured in July surveys in the Strait of Georgia	39
1314	Freshwater and marine migration and survival of endangered Cultus Lake sockeye salmon smolts using POST, a large-scale acoustic telemetry array	43
1315	North Pacific Anadromous Fish Commission - About the Convention	45
1316	Pacific Fisheries Resource Conservation Council Terms of Reference	45
1317	Plan for NPFC Bering-Aleutian Salmon International Survey (BASIS) Phase II 2009 to 2013 - BASIS Working Group	47
1318	American Institute of Fishery Research Biologists	48
1319	Chapter 29 - The Future of Fisheries Science on Canada's West Coast Is Keeping up with the Changes	61
1320	The cumulative impacts of climate change on Fraser River sockeye salmon and implications for management by Michael Healey	63
1321	Document entitled, "A possible reason for the poor returns of sockeye salmon to the Fraser River in 2009	82
1322	Document titled, "Changing the Balance: Interactions Between Hatchery and Wild Pacific Coho Salmon in the Presence of Regime Shifts"	83
1323	Early Marine Survival of Coho Salmon in the Strait of Georgia Declines to Very Low Levels	84
1324	Document titled, "Shifting the Balance: Towards Sustainable Salmon Populations and Fisheries of the Future"	85

EXHIBITS / PIECES

No.	Description	Page
1325	Document titled " Recent Salmon Declines: A Result of Lost Feeding Opportunities Due to Bad Timing?	86
1326	State of the Pacific Ocean 2009	87
1327	CSAS Document, " State of physical, biological, and selected fishery resources of Pacific Canadian marine ecosystems in 2009"	88
1328	Beamish et al, Persistence of the improved productivity of 2000 in the Strait of Georgia, British Columbia, Canada, through to 2001, October 2001	105

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THE REGISTRAR: Order. The hearing is now resumed.
MS. BAKER: Good morning, Mr. Commissioner.
THE COMMISSIONER: Ms. Baker.
MS. BAKER: Wendy Baker for the Commission, with Micah Carmody. Just to bring us back in time, we're completing our panel on gravel, with Ms. Julia Berardinucci and Jason Hwang, and the questioner, today, will be Brenda Gaertner, for the First Nations Coalition, and then I think that will be the completion of this evidence. Thank you.
THE COMMISSIONER: Thank you.

JASON HWANG, Recalled.

JULIA BERARDINUCCI, Recalled.

MS. GAERTNER: Good morning, Mr. Commissioner. Brenda Gaertner, for the First Nations Coalition. And I just wanted to take a moment, Mr. Commissioner, there are many things and many challenges in this inquiry, and I regret very much the tension that I created in the room earlier this week during the period of time of objections, and I appreciate that I didn't hear correctly the hockey metaphor that was going on, and so I overreacted, and so I just wanted to extend my apology to this room and to yourself for that reaction, and I'll do my best to try to understand the hockey metaphors as we move forward.

CROSS-EXAMINATION BY MS. GAERTNER:

Q I wanted to take us to Exhibit 1078. And Mr. Commissioner, I thought this would be a good place to start. I had a couple questions, but it will help me to frame the questions that I have. This is the present Management Committee and Technical Committee structure that is being used for the review and decision-making around gravel applications; is that correct?
MS. BERARDINUCCI: Yes, it is.
Q Thank you. And I notice there are two chairs, and I take it that those two chairs are actually

decision-makers in their own, respective responsibilities; is that also correct?
MS. BERARDINUCCI: You're referring to what's labelled currently as DFO --
Q Yes.
MS. BERARDINUCCI: -- and MOE chair, and they are two co-chairs.
Q And they're also decision-makers with respect to these applications?
MS. BERARDINUCCI: Under their own legislation, yes, federal and provincial. And then --
MR. HWANG: Could I just offer a small clarification on the DFO side, and I think I spoke to it during the earlier portion. I signed the ***Fisheries Act*** authorization for these works, but our decision process is vetted up through the regional director general and then back down for that kind of approval, so there's more structure there than is dictated by this org chart.
Q But in the context of this org chart, the two bodies that are actually required to make a decision are DFO and MOE?
MR. HWANG: Sometimes Transport has to make a decision if there's a navigable waters-related issue.
Q Okay. That was exactly my question: Why was Transport Canada there? So could you explain the to us, Mr. Hwang?
MR. HWANG: It's pursuant to the ***Navigable Waters Protection Act***, and sometimes the works that are proposed have structures like, say, a bridge crossing or something like that, that may require a permit under the ***Navigable Waters Protection Act***, so the purpose of these committees is to try to get the agencies with the relevant legislation together and coordinated so that the, I guess, the activities are permitted in a bit more of an organized way.
Q And Ms. Berardinucci, can you tell me why ILMB is there?
MS. BERARDINUCCI: Yes. And I don't know if we'd like to go back in time, but we have had organizational change and new names, so for clarity's sake, I'm happy to refer to the old labels, but ILMB is now Forest, Lands and Natural Resource Operations, as is MOE.
Q All right. And it's EMBC that's actually the proponent, as distinct from the agency that is

making a decision; is that a fair characterization?

MS. BERARDINUCCI: Emergency Management B.C. is a proponent. And just returning to your question regarding former ILMB, now FLNRO, that representation on the committee is regarding Crown lands and the ***Provincial Land Act***.

Q So this is a question for both of you; I don't know who best will answer this. It appeared from the science panel, in particular questions that were posed to Dr. Laura Rempel, that the fact that these request were made -- are being made from the province for public safety, weighed heavily in the consideration not so much for "if" but "how" these applications were going to be made. Who is responsible within the province or the Department of Fisheries and Oceans for assessing whether they're actually necessary for public safety?

MR. HWANG: Within Fisheries and Oceans, we consider that under the habitat side of our program, so the piece that I'm involved with and that Laura is involved with, and we evaluate the proposal as it comes forward, on the merit that it's brought to us under. So in this circumstance, because the project component is the provincial agency responsible for emergency management, we take that with a high degree of credibility and fairly seriously. We do review the rationale for the project, or the projects, as they're brought forward, but the basis for our validation of that, it's relatively limited. We tend to accept what's brought forward by this provincial agency at face value.

Q Has it -- sorry?

MS. BERARDINUCCI: Can I compliment that?

Q Yes, please.

MS. BERARDINUCCI: So in the responsibility for public safety in relation to Fraser River and Flood Hazard Management is provincial responsibility. The funding for delivering the program lies with Emergency Management B.C., and the river engineering hydrology expertise, as well as biologists and environmental impacts expertise lies with the Ministry of Forest, Lands and Natural Resource Operations.

Q Has there ever been an application by the province for gravel removal that's been refused in the,

let's say, the last five years or 10 years, to either of your knowledge?

MR. HWANG: To my knowledge, not in the last five. Over the last 10, I'm more uncertain. I'm not sure about that.

MS. BERARDINUCCI: My knowledge and memory is limited to my direct involvement, and the whole committee structure was really brought about in order to look at the literature coming in regarding potential sites and to select and move forward on sites that met our criteria regarding flood protection, and also minimizing impacts to the environment, so the whole point of it was -- is to try and have that discussion early so that we don't have applications come in that at the end of the day end up getting refused. So a lot of those discussions happen before the applications are actually finalized and submitted by Emergency Management B.C.

Q So First Nations who are weighing the potential implications of this, would like to assess, from their own perspective, the pros and cons associated with gravel removal, who's going to provide them the information necessary as it relates to public safety?

MS. BERARDINUCCI: Emergency Management B.C. has been providing the information directly as a proponent, but also working on behalf of the provincial government agencies in order to try and begin about some rationalization of all the communication coming from different agencies to First Nations, so they've been taking the lead in providing that information at very early stages.

Q And we're going to dive into that a little bit more.

Could I now go to Exhibit 1076, please. This is the letter of agreement that, as I understand it, is presently with the extension more or less in operation between the parties; is that correct? I know you're presently working on a revision, but do I have that correct?

MS. BERARDINUCCI: Can you please scroll down just a little further? Thank you, kindly.

MR. HWANG: I'm not actually sure if that's the current version or not. We are operating under a letter of agreement that has expired, but still follow it in terms of spirit and intent. I just don't

actually recognize this particular version of it, but it's reflective of the content of the letter of agreement as we understand it and follow it, I think.

MS. BERARDINUCCI: I would concur with my fellow DFO colleague. I'm struggling a little bit to place this particular version in the -- in comparison to the final, signed version.

MS. GAERTNER: Sorry, Mr. Commissioner, from the evidence earlier, that's how this exhibit was tendered, so that's my understanding of this exhibit. So let's proceed with that, and if I'm incorrect we'll try to correct the record on that.

Q I'd like to go to tab -- or bullet number 3 under item number 1. And that bullet recognizes the decisions on gravel removal must respect regulatory and consultative requirements of the federal and provincial government decision-makers, correct?

MR. HWANG: Yes, from the federal side.

MS. BERARDINUCCI: Correct, yes, from the provincial side.

Q Thank you. And you'll agree that that will include obligations to consult with First Nations who may have interests and impacts associated with these gravel removals?

MR. HWANG: Certainly from a federal side, that's a fairly standard expectation for any project that we're reviewing that has a regulatory decision, and this one's not treated particularly differently.

Q And from the provincial side?

MS. BERARDINUCCI: Agreed, absolutely.

Q All right. So then can I go to Exhibit 1093. This is the draft LOA, and it now says that EMBC will lead the consultation on this program, if I've read that right. And so I'm just trying to understand, as between DFO and EMBC, who's the primary lead agent for consultation with First Nations regarding potential impacts of gravel removal on s. 35 fishing rights? Who's the lead agent?

MR. HWANG: I think, from the DFO perspective on this, what we try to do is work cooperatively with the province and the parties that are in consultative exercises on this particular project, and we try not to duplicate or overlap with consultation on

issues or specific subjects that are already being attended to by the provincial government. So the approach that we take on this particular file is to understand what EMBC is doing in terms of their consultative effort, and then we do a follow-up before we issue our permit, presuming we're going to issue one, to make sure that the issues that a First Nation would have, have been adequately considered, and if there is something that has not been addressed to that point, that's our opportunity to hear that and to do our best to attend to it.

Q Do you have anything to add to that?

MS. BERARDINUCCI: Certainly. Yes from the provincial perspective there is a consultative framework for all the natural resource agencies that the province has brought forward. It's been in effect about one to two years, at this point, and it's available on the internet, as well, for all to see, and Emergency Management B.C. is working under that framework and has taken the lead on behalf of the provincial agencies in ensuring First Nations are communicated with on the applications and further discussions.

That doesn't preclude any of the individual agencies from attending meetings or participating in order to provide more information or drilling down and dealing with specific issues and concerns that are raised by the First Nations. So we're really taking a collaborative view, but -- or collaborative approach to the consultation, but having one lead contact to simplify the process for all the parties.

Q So who is that one lead contact for First Nations; is it EMBC?

MS. BERARDINUCCI: It's Emergency Management B.C., correct.

Q So that's the proponent?

MS. BERARDINUCCI: Correct.

Q Not the decision-maker?

MS. BERARDINUCCI: Correct.

Q Okay. So then, now, can you explain for the Commissioner and for myself, which of the agencies determines the list of First Nations that are going to be consulted and the basis on which it will consult?

MS. BERARDINUCCI: From the provincial perspective,

there is a standardized list of all First Nations and mapping of all the areas of interest that the First Nations - different First Nations have put forward for your consideration in ensuring that we consult with them in certain areas of interest to them. So that list is, again, it's available for the public to see. Emergency Management B.C., MOE and FLNRO are all referring to the same list, so the list is determined at a, I guess -- or clarified at a corporate level, and we deliver on that by ensuring that all the First Nations that have expressed an interest in that area are consulted with.

Q Expressed an interest --

MR. HWANG: And on the DFO side, I think we generally align with that, but there have been times when there have been representations by different First Nations entities that are reflected in the provincial list, and DFO's approach is to generally be open to whatever party wants to represent themselves in that regard and hear what their input is and attend to it as we're able and as is appropriate.

Q Perhaps, then, we can go to Exhibit 1096, page 5 of 9. I just, when I was reviewing these materials, I got concerned around - and if we go to the section on First Nations considerations - and where the concern was, and perhaps I'll just raise the concern and you'll see it reflected here, is are you using a determination of those First Nations who have either reserves or fishing sites, so geographical locations close to this, or are you keeping in mind that the salmon are migratory species and people, First Nations other than those close to the geographic site, will have an interest?

MS. BERARDINUCCI: Well, to speak from the provincial perspective, the Ministry of Aboriginal Affairs -- Aboriginal Relations and Reconciliations, sorry, have worked with all the First Nations and obtained maps and determined their areas of interest. In this particular area of the Fraser, the First Nations that have an interest in this area are also located on Vancouver Island. Everyone who has been identified as having an -- who has self-identified as having an interest in this area, and all the First Nations have been

contacted in order to create this database, are contacted in the course of the referrals and the discussions on these applications for gravel.

Q So if you then go to page 2 of 9 of the same document, there's a list of the First Nations who were consulted, as I understand it, and it seems like quite a short list, very much located -- and, for example, my client, the Chehalis First Nations, is not listed there and, of course, they have an interest in the migratory resources that -- or migratory species that may be using these gravel reaches. So could you help me understand that?

MS. BERARDINUCCI: Can I request that it just be scrolled down just a little bit further so I can see the first page? And could I see further of the complainants? Okay, thank you. If we could please return back.

I'm sorry, I can't answer that question directly. To the best of my knowledge and my understanding, is that we've been consistent with the list of First Nations that have expressed an interest in this area as worked through by the Ministry of Aboriginal Relations and Reconciliation.

MR. HWANG: And from the federal side, while I can't speak specifically to this particular document, the approach that we take is a very inclusive approach, and we recognize that there may be First Nations' interests that are not immediately proximal to where the gravel removal is happening that could have some kind of ancillary effect from these works. So I don't think we're sort of going up and down the entire coast, or within the provincial jurisdiction and asking everyone, but where the door is open and where First Nations, such as Julia mentioned, the Cowichan, have said, "Hey, we've got some interest here. Can you tell us what's going on? And we would like to be engaged prior to decisions happening," that door is open and we do our best to fulfil that interest.

So I think we're reasonably comfortable that any First Nation concern has an opportunity to be presented and to be addressed through the process that we have, and there's certainly no limitation by way of the processes we undertake right now, so

no one's excluded intentionally.
Q And, in your view, Mr. Hwang, do you think the existing processes and the timelines allow for sufficient time to engage meaningfully with First Nations?
MR. HWANG: To date, from the way we have seen concerns brought forward, they seem to have been reasonably addressed, the concerns that I'm aware of that First Nations have tabled. They have largely not been -- they've largely been addressed by way of their engagement through the EMBC lead, but I think, overall, whether it's First Nations or any other interested party, the timelines are very tight at certain phases of the permitting. But to my knowledge, at this juncture, there hasn't been a significant First Nations concern that has not been able to be addressed to this point.
Q I wonder if I could go, now, to Exhibit 1094. These are questions now for you, Mr. Hwang. This is a memo that you prepared; is that correct?
MR. HWANG: Yes, that looks familiar.
Q Yes. And my reading of that memo was it was an opportunity for you to gather context and some of the challenges associated with this program and make some recommendations around that; is that correct?
MR. HWANG: Yeah, it was basically a snapshot of the current status of the file for the basis of a discussion I was having with the program director.
Q So I'm wondering if you could help me with a couple of these bullets, or help us all with a couple of the bullets, because in the first two bullets you clearly recognize that there are late applications coming in, there is not -- not have been receptive to consultation with external interests in the past, and significant levels of concern regarding the lack of information, and onward. And I wonder if you could explain to us the nature of the concerns that you're having in the context of this program?
MR. HWANG: Those bullets, in particular, are with reference not to First Nations but to primarily environmental non-government organizations, and there has been an ongoing tension and difficulty in terms of the - at least in my view - that the provincial approach and the ambitions or expectations of these non-governmental

organizations, and I think the Federal Government and Provincial Government have agreed that we won't necessarily be perfectly aligned on this, and the points that are -- that these bullets are speaking to are trying to raise that as an issue of concern.

Because if DFO were to stand down and just kind of leave the scope of engagement at the level that the province is comfortable with, there would be parties, in particular these non-governmental organizations, that may not be as engaged as they would like, and that may pose some problems for DFO's regulatory decision-making. So in that regard, DFO recognizes that there's a gap and we do our best to, on our own accord, meet with these parties that don't feel they're getting the opportunities that they would like on the provincial side.

So that's the essence behind those points.

Q But perhaps you might agree with me that if you're getting late applications and there's challenges associated with the consultative process between you and the province in the exchange of information, that's only going to compound the consultative process with First Nations in a timely manner?

MR. HWANG: Certainly anything that constrains the timelines does make the consultative process more difficult. Again, I think, on the First Nations side, as far as we're aware, there has been a fairly active engagement from the province, particularly led through EMBC and, to date, we have not seen significant problems or unreconciled issues come about through the course of the projects.

Q Now, in this memo, you also - and for some reason my note doesn't have this - but you also make a note about that "this file" and by that I mean -- I'm assuming you mean this gravel process, "may follow new track for future EA's," and I want to just pick up on that, because I think that's important, given the best practices information we had during the science panel on gravel. And perhaps you can just briefly talk about the potential new track for future EAs that you're referring to?

MR. HWANG: The current EA, or environmental

assessment, pursuant to ***CEAA***, it is -- the approach that is being taken is to take the site-specific sediment removal projects at EMBC tables and look at those essentially as one-off, or as they come, year by year, independent projects, and one of the considerations that we have been evaluating is, are there more effective and more comprehensive ways to do those environmental assessments, recognizing there's a linkage between any individual sediment removal project and the other sediment removal projects that will happen within that reach and the projects that have happened before and the projects that will happen into the future, assuming that this work continues.

So we've been contemplating things like a more accumulative kind of environmental assessment. My counterparts in Ottawa, who we sought some advice on this, called it something like a -- I think they called it a super-***CEAA***, or something like that, that would be -- it would be -- or super-screening, that's what it was. It would be a screening that looked more comprehensively at a plan to remove sediment removal that may not have all the detail of any given year populated, but would provide more of a full context in terms of time, scope and scale of the works.

And we haven't arrived at a landing spot for that idea, at this point, but that's the concept, is to take the single site-specific current approach that these environmental assessments are done on, and try to make it more comprehensive to the timeline and the cumulative scale of these projects.

Q So in the science panel, we heard that there were suggestions by Mr. Church and otherwise in written form, and Dr. Rempel endorsed these, that a longer-term period for review and consideration of these gravel applications would be useful. In fact a minimum 10-year period was talked about. And I'm wondering whether or not this super-***CEAA*** or some kind of approach like that, would help us as a way in to develop a more tenure or longer-term plan that included better baseline data, measures for effectiveness, all of the kinds of things that have been talked about as a best

practices. Is this the way through it so that we can look at more cumulative and comprehensive ways?

MR. HWANG: It may be. And the points that you describe are the concepts behind considering that approach. Those are the kinds of advantages or benefits that not only DFO but, I think, EMBC and many of the stakeholders - I use that term generally - as well as First Nations, I think it would address points that a number of parties have raised over time in the context of this sediment-removal file.

Q And it would help in the consultative process so that we're not dealing with annual applications, would actually see -- well, we probably will have, still, some annual things to do, but we would see the overall picture and be able to have an understanding of the overall picture in a much more comprehensive way; is that correct?

MR. HWANG: I think that's the whole -- or that's the idea, if we were to land this that way, is there would still be site-specific project information to review on a year-by-year basis, but it would come nested in a more comprehensive plan framework that would have an evaluation based on a longer time scale and broader sort of reach level consideration of effects and impacts.

Q All right. I just have a couple more questions on this. Would you agree that in that context, and perhaps given the earlier comments this is already more clearly happening, it's the proponent that would be responsible for putting together the materials and ensuring that First Nations have a proper basis of being able to review a longer-term project? So it would be EMBC that would be doing that type of work?

MR. HWANG: Well, from DFO's end, I think they would be the primary starting point for that. It's not to say that that would be the entirety of that kind of information exchange, but they would be the first place, and probably the majority of information would start with them.

MS. BERARDINUCCI: And to add to that, I would say, again, that Emergency Management B.C., as an agency of the province, is doing that work, wearing the provincial agency hat and following the guidelines and so it -- and meeting those

requirements on the behalf of the agencies that are making decisions. So while Emergency Management B.C. is taking the lead on providing that information, they're certainly getting guidance from decision-makers as to where more information is required, or any other requirements that we need to meet as part of the decision-making process.

Q To the extent that DFO and EMBC and others are -- and other agencies are developing technical and monitoring committees to consider and review these, would it be useful to have First Nations representatives sitting on these committees directly, so that we have their input at the source and while you're considering these applications as distinct from responsive to applications?

MR. HWANG: From the federal side, it's an option that has been considered, and I don't think it's been ruled out as a possibility. I think until we develop the thinking further around what that framework would look like and how it would link into regulatory decision-making, I don't think we're in a position to make a final recommendation in that regard. But it's something that certainly it's easy to see the potential benefits and advantages of that, but it would still be necessary to do more thinking and work before we could decide if that was a viable approach or not.

Q And from the provincial perspective?

MS. BERARDINUCCI: It's one of a number of options that we're considering. Where we're going to land on that really needs to be an ongoing discussion with the First Nations. As you can see from the referrals, there's a considerable list of First Nations to engage, and even represent -- going back to the question that you asked regarding one particular nation, I failed to note that Sto:lo Tribal Council and the Sto:lo Nation represents, again, a number of nations under those umbrellas.

We've been having, and the EMBC has been having ongoing dialogue with the First Nations as to how best to engage and involve them in that process, and there's different ways that we could do it, and that's still under discussion.

Q So you're open to having them sitting on these monitoring and technical committees?

MS. BERARDINUCCI: I'm not altogether sure that these committees will continue on in their present form. That's part of the discussion, within the context of a longer-term plan. So that why I'm not saying definitively First Nations should be on those committees. We're not even quite sure that those are the right committees to bring us forward into the future in the longer-term plan, and we're discussing that, and also having that dialogue with the First Nations.

Q All right. I just have one final question, and it's a question related to Exhibit 1093. This is that draft letter of agreement, again. We've had it -- I was just curious about a line in this letter of understanding, and I'm not going to ask you for a legal opinion on it, but you'll see that at the last paragraph -- sorry, first page -- you're right. The sixth paragraph in, there's a suggestion that:

> ...this agreement will fetter or impair the statutory responsibilities of either agency, nor abrogates or derogates from any Aboriginal, treaty or other rights of Aboriginal People.

As people that have been working on this letter of intent and thinking -- what was your goal on that? What were you -- what was the concern or the goal that you were trying to achieve in that clause?

MR. HWANG: Well, as I can recall, it's been a while, but as --

MR. DICKSON: Mr. Commissioner, I'm going to object to that question. I think the statement speaks for itself, as to what it's about.

MS. GAERTNER: Well, then I'll have to pursue it, then. Again, this is a letter of agreement between the Federal and Provincial Crown as it relates to gravel applications, that have the potential for impacting First Nations' rights, so what was the goal in that clause?

MR. DICKSON: But Mr. Commissioner, the basis of the objection is that this is a legal opinion with respect to this agreement. It just speaks for itself.

MS. GAERTNER: No, I appreciate --

MR. DICKSON: Nothing in the agreement --

MS. GAERTNER: -- that the legal issue may speak for itself, but I'm trying to figure out what the concern were from the agencies' perspectives who were drafting this letter of intention between them and what they were hoping to achieve, not -- I can appreciate that there's a legal issue there, but they know they have to consult, they've already talked about that, and they know they may -- it may have an impact, and so I'm not sure how -- what they were trying -- what you were trying to do in this. I mean, if you don't know, and this was recommended to you by lawyers, then fine, we'll sit down, but if there's a concern that they were trying to address, I think it would be useful for First Nations to know that.

THE COMMISSIONER: Mr. Timberg, that's how I took the question, was not that they were being asked to give any legal view, but simply whether there was something that they were directly involved in that would have given rise to that clause, or their understanding of that clause in terms of their activities. But I'm not sure whether they were involved or they have any knowledge about that. But I do agree that they ought not to be giving an opinion on that clause. But let's see, first of all, if they have any foundation for giving an answer.

MR. HWANG: From my recollection, Ms. Gaertner, the point that we were trying to reflect here was just to ensure that by way of pursuing this kind of agreement, and it's important to recognize this is a draft, it's never been sort of vetted through the respective, you know, legal reviews and other parts of the organization, but the point was not to fetter or impair or compromise the statutory obligations, the consultative obligations or standards that any of the participating parties would have.

So, you know, if EMBC wanted to go one way and that just didn't meet the Federal Government's scope of how we needed to pursue things, we were free and would not be restricted by way of this agreement to go and do what we thought we had to do.

MS. GAERTNER: Thank you. That's very helpful.

Q Is there anything that you'd like to add from the provincial perspective?

MS. BERARDINUCCI: Yes. I don't recall any concerns that specifically led us to include -- to discuss or include that clause. It's actually terminology that I've seen before in other documentation when you're using, again, probably suggested by legal counsel at some point in drawing up these documents, so that statutory decision-makers have a point of reference, should there be any concerns regarding fettering in any way in their decision-making.

Q Just before I sit down, I -- the most sort of useful thing, in some ways, is this possible way through of looking at a 10-year plan, or looking at something more comprehensive. Is there any other options that are available, other than the ***CEAA***, that could get us there?

MR. HWANG: Yes, certainly. The ***CEAA*** is sort of a component of the regulatory review process, and I think the approach that we've been working on in the background over the last, I don't know, eight to 12 months or so, has been more of a planning-based approach where the proponent, EMBC, would develop this longer-term plan and then we would review it under whatever the appropriate regulatory frameworks and mechanisms existed so it didn't necessarily require a specific tactical approach under ***CEAA***, the plan would just come forward that way.

So it doesn't restrict the opportunity, only within the bounds of what ***CEAA***'s organization is. There's other ways to approach it more comprehensively.

Q And does the province see the value in approaching it more comprehensively in developing the longer-term plan?

MS. BERARDINUCCI: Certainly we've been trying to work towards that for a number of years

Q And what are the limiting factors?

MS. BERARDINUCCI: Time. There's "X" number of staff that have been assigned to the portfolio, and we do the best that we can on a yearly basis, and we've been struggling to find the time to plan the longer-term plan in the context of also working on the annual applications.

MS. GAERTNER: All right. Those are my questions, Mr. Commissioner.

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

MS. BAKER: Thank you. The Province advises they have no re-examination. Does Canada? No. So we're complete on questions, thank you very much.
THE COMMISSIONER: All right. Ms. Berardinucci and Mr. Hwang, thank you very much for making yourselves available this morning and to answer Ms. Gaertner's questions. Thank you very much.
MS. BAKER: Thank you. And Mr. Commissioner, maybe we could just stand down for five minutes --
THE COMMISSIONER: Sure.
MS. BAKER: -- and come right back? Thank you.
THE COMMISSIONER: Thank you.
THE REGISTRAR: The hearing will recess for five minutes.

(PROCEEDINGS ADJOURNED)
(PROCEEDINGS RECONVENED)

THE REGISTRAR: The hearing is now resumed.
THE COMMISSIONER: Thank you.
MS. BAKER: Thank you, Mr. Commissioner. Wendy Baker again and Maia Tsurumi now with me for the marine portion. We have again the witnesses, Dr. Beamish, Dr. McKinnell and Dr. Welch from yesterday. When we left off, I was speaking with Dr. Beamish and we had Exhibit 616A on the screen.

EXAMINATION IN CHIEF BY MS. BAKER, continuing:

Q And Dr. Beamish, you indicated that you don't have a great memory of this time period for reasons you explained yesterday and so if we could turn to page 2 of this document and it may be helpful for you to see it in writing, it may not, so I won't focus too much on the document. But the question I just want to identify here is you'll see at the -- in this document that -- under the first bullet, there's a number 4, "Low food abundance in the Strait of Georgia", is listed under a category described as:

> The following factors are unlikely to have contributed to the poor 2009 returns.

Has there been a change of view then within the Department as to the likely contribution of low food abundance in the Strait of Georgia?

DR. BEAMISH: Well, I guess I can't speak for the Department. Has there been a change? If this was the Department's view, when I read that, I remember that the beginning of this briefing note said that the Department of Fisheries and Oceans did not know what the cause was. I'm doing this from memory. And if I remember that correctly then the rest of this note then speculates on what might have happened. So I would interpret the note to indicate that they didn't have a decision or they didn't know and then they made some speculations. If these speculations then represented the belief of someone, I think that certainly there has been a change and that's indicated by the workshop that was done, I believe, in June of 2010. So my answer is, I can't speak on behalf of the Department but I can say I hope that the Department of Fisheries and Oceans now accepts that there was this catastrophic failure of the prey for all species in the Strait of Georgia. Sorry for the long answer.

Q The workshop you referred to in June of 2010, was that the Pacific Salmon Commission organized workshop?

DR. BEAMISH: Yes.

Q Okay. And then on this same page at the third bullet down, it identifies "factors which could possibly have led to a sockeye mortality". And in there at number 2, it says, "Low food abundance in the Queen Charlotte Sound". I take it that's not been ruled out by the Department; that's still a possible factor?

DR. BEAMISH: Again, I can't speak for the Department but I hope that that is a recognized impact, yes.

Q Okay. I understand that there was another workshop held this year on the issue of declining productivity in April of 2011; is that right?

DR. BEAMISH: Yes, I think so, yeah.

Q All right. Were any research or priority decisions made at that workshop following advice that was discussed then?

DR. BEAMISH: Decisions made by whom?

Q The Department for research on --

DR. BEAMISH: You know, I honestly can't answer that. I attended that workshop, I made a presentation but everyone knew I was retiring so I was left

alone. I don't know what happened.
Q When did you retire?
DR. BEAMISH: May the 27th.
Q Okay.
DR. BEAMISH: Not that I'm counting.
Q All right. Thank you. I'd like to move now to some other --
THE COMMISSIONER: My apologies. The document on the screen --
MS. BAKER: Yes?
THE COMMISSIONER: -- is that already an exhibit?
MS. BAKER: It is already an exhibit. It's Exhibit 616A.
THE COMMISSIONER: Thank you very much.
MS. BAKER:
Q At Tab 18 of the Commission documents is a document prepared under the North Pacific Anadromous Fish Commission. That Fish Commission, you've been involved in that for sometime, is that right, or you were?
DR. BEAMISH: Yes.
Q I don't know if you still are.
DR. BEAMISH: Since 1977.
Q Okay. And you were involved in the creation of this special publication, which describes a long-term research and monitoring plan for Pacific salmon; is that right?
DR. BEAMISH: Yes.
Q I think just in the interests of time I'll ask you if you can turn to page 11 of this document. And the text at the bottom under the photograph describes at the bottom of the first column paragraph:

> However, the intermediate steps linking salmon to climate are rarely measured simultaneously. Thus, it will be necessary to conduct integrated ecosystem research in which physical, chemical and biological components are measured together. While ecosystem modelling may help to identify critical processes regulating salmon production, a strong emphasis should be placed on data collection, as ecosystem models will require large quantities of data to generate realistic scenarios and predictions.

Do you still agree with that proposition?
DR. BEAMISH: I sure do, I wrote it.
Q Okay. Can you elaborate what further research you think needs to be done and how Canada can participate?
DR. BEAMISH: How much time do we have, would you like?
Q If you can give us a summary, an overview, I guess.
DR. BEAMISH: There's a number of things that I think we need to do and recognizing that this all costs money. This was written because there had been an initiative a number of years ago that was called BASIS and I can't quite remember what BASIS stands for, Bering Sea something or other. And what happened as a result of that initiative was that salmon researchers all around the Pacific began to cooperate, I say, almost like a family. And since the development of that program, we all worked together in a cooperative way that I think is remarkable. If I want some data from a Russian colleague out at sea, I can email them and they'll make a measurement for me. So this provides the opportunity, in my opinion, to finally understand the processes that regulate salmon abundance.

To begin with, we proposed something in addition to BASIS. BASIS was an integrated study. Canada didn't really participate because we didn't have ships that would go into the Bering Sea but Russia, Japan and the United States participated. And the attempt was to begin to understand exactly what Pacific salmon are doing on the high seas in terms of what regulates their abundance and specifically where the particular stocks are or where Canadian stocks are.

So one of the initiatives that we would like to see is what I call an International Year of the Salmon. And I know other countries would support this and this is would be an integrated effort, which would allow us to focus on some of the key issues that we need to know about what regulates salmon on the high seas. As part of an integrated effort, each country would also have an integrated science plan that would look at specific issues in the coastal area and it wouldn't rule out freshwater research. But in my opinion, it is now time to do that. We have the technologies that we didn't have just a few years ago. We can apply

DNA stock identification. We have tags such as some of the things that Dr. Welch is doing. And we have the ships and we have the satellite support that we need. I think we have everything in place to finally resolve the issues that we need to know that would regular Pacific salmon abundance. And that all leads to more accurate forecasting.

Q Thank you. Dr. Welch, do you have any comments on the program that's been described by Dr. Beamish, whether you think that's useful and needed?

DR. WELCH: I generally agree with everything Dr. Beamish said. The *caveat* that I'd put is that I don't think we know the areas along the coast or the offshore where the survival problems are primarily occurring. So we need to bound these issues because, as you've seen through the testimony, we can spend an enormous amount of time and money spent collecting data without necessarily knowing that it's in the location where it is affecting the survival of the fish.

So that needs to bound the problem so that while those data collections are occurring, we also need to make sure that we do know where the survival problems are primarily being manifest so that those have to go hand-in-hand if we're going to be able to interpret the results. Otherwise, we get into the long-term problem that we've had for centuries of people picking amongst the various pieces of data and putting together an interpretation of what's happening without knowing that it actually is where the survival problem has occurred.

Q Okay. And Dr. McKinnell?

DR. McKINNELL: I think in spirit, I support what's written in the text in this paragraph although, in some sense, I think that the ecological models that are developed, they actually formalize or quantify the state of knowledge. And so I see them as being a useful adjunct to the data collection system working sort of together. Two comments I would like to make is that in my review of the state of knowledge of Fraser sockeye at sea, I came to the understanding that we need some new approach to estimating salmon abundance at sea. I agree with Dr. Beamish that we have made remarkable steps forward in salmon science on the

genetic front and that has helped us tremendously in trying to understand the composition of stocks.

The reasons that the tagging work was done in the early days is that that was the way to determine where the stock came from. By tagging it on the high seas and then having it recovered later in some fishery, you could at least approximate where it was coming from.

So that would be my first comment is that I believe there is a new area of science that needs to open up about estimating abundance of salmon on the high seas. I don't think boats and nets, as they currently are operating, are going to be adequate to do that. I had a second point and if I think a minute I might recall what it is. Oh, yes, it refers back to something I said yesterday, that under an umbrella like this, there needs to be a way to highlight what the key question is and how you propose to answer it. And I think before monies are invested in what will ultimately be relatively expensive research, I think that you need those two steps, the good question and how it will be answered. Those are my two main comments.

Q Thank you. Dr. Beamish, did you have anything you wanted to add before we move to the next topic?

DR. BEAMISH: No, I don't think so. We have to remember that countries such as Russia and Japan, but Russia, in particular, have been doing high seas salmon research for 20 or 30 years or maybe 30 years. And I think they're very good at it and they publish a lot of material. So the procedures that they use, which include making abundance estimates, which they use for forecasting and which, in recent years, have been very accurate. So I think that our ability to actually make abundance estimates using ships on the high seas obviously can be improved but I think it's still pretty good.

Q At page 35 of this report in the conclusion paragraph, it's identified that:

> The NPAFC Science Sub-Committee should determine what would be required to implement the contents of this report, including planning of simultaneous trawl surveys in the winter. The timing, location, cost and expected outcomes of these surveys need to be

determined.

What has happened now with that recommendation or that conclusion? Has the Science sub-committee begun any of that work?

DR. BEAMISH: Now, I think the short answer is that the Science sub-committee has not done that.

MS. BAKER: Okay. I'd like this document marked as the next exhibit, please.

THE REGISTRAR: Exhibit 1311.

EXHIBIT 1311: North Pacific Anadromous Fish Commission Special Publication No. 1

MS. BAKER: Could I have Exhibit 47 brought up, please? This document that's being brought up is the Ecosystem Science Framework Policy from the Department of Fisheries and Oceans. And if we could just turn to page 9.

Q The second paragraph on the left-hand column says, "Operationalized regime shifts" and it talks about the need to do that:

> Operationalize the concept of ecological shifts to deal with large-scale shifts, such as climate change.

And I wanted to know what has been done in that respect by Canada to operationalize regime shifts? I'm asking you, Dr. Beamish.

DR. BEAMISH: Well, again, I'm not always the best person to be speaking on behalf of Canada or DFO. This is an area of research that I've been involved with myself for a number of years and the difficulty in operationalizing the regime shifts, which are abrupt changes in climate and ocean conditions, and there are other definitions, but the difficulty is that we cannot identify when a regime shift changes until after a period of time. And some people thing maybe two, three years or longer.

So there are two problems, in my opinion. One is that we still have some question about a regime, what a regime shift is, and sciences still debate that issue. And the second is while a large number of scientists do accept that regime shifts are real, the issue of actually being able

to identify when one occurred in time to operationalize the management, I don't think that exists just yet. So the short answer is we have not operationalized regime shifts, as far as I know. And then the longer answer I gave you, thanks.

MS. BAKER: Thank you. Just trying to wrap things up here. This is Exhibit 1294. And pages in this document. I think just if we can have the front page pulled up.

Q And perhaps I can just identify that this is a PowerPoint prepared for the April 2011 workshop that we talked about earlier today. Is that right, Dr. Beamish?

DR. BEAMISH: The April 2011 workshop?

Q That was how it was identified to me, yeah.

DR. BEAMISH: I've seen this before but I assume that's right, yes.

MS. BAKER: Okay. We went to page 34 of this document earlier and I'd like to move further into it another, say, ten pages or so. Why don't we see where that puts us? After the "new data" tabs so further, another couple pages, further, further. The heading we're looking for should be right after this. One more. There, "Next Steps". Thank you. So that's page 50.

Q This document identifies "next steps", I take it, in terms of where the Department wants to focus answering some questions; is that right. Dr. Beamish?

DR. BEAMISH: I think so, yes.

Q Okay. So with that up on the screen, it may be helpful to people, it may not be. I just wanted to ask what the marine research priorities are and I want to ask each of you this question. And here are the two questions I want to ask all of you. What are your own personal speaking marine research priorities? Where would you think we should be focusing research? And then secondly, is there a particular location where you think the research should be prioritized in the marine side? So I'll start with you, Dr. Beamish.

DR. BEAMISH: For sockeye salmon?

Q Yes.

DR. BEAMISH: Looking at these items here, I agree that we do need to have an estimate of the smolts leaving the Fraser River. And yesterday, we

talked about that and I think we agreed that a count at Mission that included DNA would be a very useful way of doing that. There's no question that we need to know how long the average juvenile sockeye remains in the Strait of Georgia. That's useful information. So I think that's a priority. But I would put the third item as a second priority. I mean we have literally hundreds of millions of juvenile salmon of all species enter the Strait of Georgia with large mortalities occurred daily. And I think it's fair to say that after a hundred years of research on Pacific salmon, we still don't know what causes that mortality. And I personally am convinced that we can identify what causes that mortality and when we do that it will make a significant difference to our ability to manage salmon and particularly to forecast.

And I guess that item that I just mentioned is consistent with the fourth item, which is "What's killing salmon?" And the standard interpretation is the predators kill salmon but certainly I think that it goes beyond predators. In other words, there has to be some other mechanism that results in such large mortalities even in very good years. And then following up in the Gulf of Alaska would be a lower priority but still an important one because, as Dr. Welch has already mentioned this morning, it's important to know where the particular stocks are in the Gulf of Alaska. I think that's it. Thank you.

Q Thank you. Dr. Welch?

DR. WELCH: I would prioritize it as a sequence of areas along the coastal shelf because we know the smolts migrate north so the Strait of Georgia for obvious reasons that have been raised here, Discovery Passage, Broughton Archipelago, Queen Charlotte Strait is the second because of all of the issues around potential impacts of aquaculture, Queen Charlotte Sound and Hecate Strait. And this gets into bilateral negotiations with the U.S. but we should really look at southeast Alaska as well because stocks of salmon, for example, hatchery salmon where we know that the survival's gone from 15 percent in the Strait of Georgia for British Columbia coho in the 1970s is now down to 1 percent. So an order of

magnitude change, an enormous change. But up in Alaska, they're still up at 15 percent. So there's been a very large change or reduction in survival in British Columbia.

It's not clear. I would disagree with Dr. Beamish as to how much is in the Strait of Georgia versus outside, but I would phrase it as that's a priority issue because we actually can't discriminate between the opinions of experts as to how much of the mortalities happen in the Strait of Georgia. So being able to look up in southeast Alaska where they have much more abundant salmon stocks but much continuingly high salmon survival is a very important aspect because it gives us an ability to contrast with an area of good survival and try to identify these issues.

So for the coastal phase, I would identify all four of those areas as important. And then the offshore and the subsequent years of life, I would rank that of lower priority because it may be very important but it's going to be very difficult to address that and we'd want to exclude the coastal zone as being of major importance first. So I would put the emphasis there.

And I would agree also with the issue about defining what is killing salmon in the marine environment but you can't do that unless you actually know where they're dying and have a quantitative sense of that.

Q And Dr. McKinnell?

DR. McKINNELL: I think this is a pretty good list. To start with, there's how many smolts leave the Fraser? I would also add how many smolts leave Georgia Strait because that's been one of the key areas of debate. I would also focus not just on the smolt numbers but also on the smolt quality. The idea is to look at the physiological state of the fish either by looking at the energy in individual smolts just to what shape they're in as they emigrate out of the regions.

Of course, we have interests in the amount of time. I think that the focus on the amount of time they're in Georgia Strait has been a highlight right now simply because there are disagreements over Dr. Beamish's sampling about how representative they are and so that's why that one, I think, is highlighted right now. In the

long-term, I'm not sure that it would be that much of a highlight.

Where and when significant mortality occurs in the marine environment I think this is key. And this comes back to the point I was making earlier about having a life table that includes more than just total survival, that includes survival at various life history stages. And that would certainly help to target our research efforts on some particular stage that has the highest mortality.

What's killing salmon in the marine environment? Pathogens, predators, starvation. I think under this point I want to bring up an error that I caused yesterday. I said that there wasn't much appearance of inter-specific density-dependent growth effects on maturing fish. But in fact, my report was right, you see that there is an effect of pink salmon abundance in the Gulf of Alaska on all maturing stages, whether they're jacks, age one dot twos or age one dot threes, four-year-old fish or five-year-old fish on the sockeye. So the pink abundance in the Gulf of Alaska appears to affect the size at return of Fraser River sockeye.

There is also an effect on the post-smolt growth in the first year but I won't get into that here. I've mentioned energy density.

I think I'd like to make a couple of general recommendations. And one is an issue that I think was shared by a number of researchers, who were attempting to create the Commission's technical reports. And that has to do with the data collection management and delivery of information that the Department of Fisheries collects. It was very difficult to get some datasets, particularly those datasets that relate to salmon biological data. The oceanographic data appeared to be well-managed and easy to get at. But there were challenges for all of us, I think, in how the Department delivers the salmon biological data that it collects. And I want to point out that in 1903 when Charles Gilbert was hired to get some understanding about sockeye returns to British Columbia, he was essentially one person contracted by the Province of British Columbia and he was able to write annual reports on the mean size,

mean length, at age, for fisheries in four major rivers in British Columbia. And this was a contract that one person with his technician plus samplers at the canneries of that era. And each year a report describing all of these statistical summaries was provided in printed format by the Province of British Columbia.

If I looked at the stock assessment documents that are currently on the DFO website looking for information about abundance and recent assessments of sockeye salmon stocks along the coast of British Columbia, I think one of them was one I created 12 years ago, is the most current one. I'm not sure. But certainly there isn't an up-to-date assessment of abundance and histories that are served on the DFO website that are available to researchers outside of the Department anyway.

I'd like to make a comment that I think there needs to be some technological developments that will bring salmon biology into the 21st century. There are some aspects of the work of a salmon biologist, such as collecting fish scales and determining the age and measuring its growth from scales that are very, very labour intensive. And I think that science generally would be enhanced by, for example, having a machine that would age and determine the growth of a fish, to have 10,000 of them done in a day. I think it's technically possible. But at least some efforts in technological development need to be made. And the point that Dr. Welch made about the coast-wide view, it's hard.

In 1924 when Dr. Beamish's predecessor, Dr. Clemens took over as the first paid director of the Biological Institute, he attended a meeting of coast-wide researchers on salmon biology, recognizing that to learn some things, it's not possible for Canada to do it in isolation because the fish migrate between the different jurisdictions. So some method of having the coordination of research is certainly essential. And there are some aspects of that that are now being done informally by scientists along the west coast but it would be nice to have some formal mechanism for that to occur.

I think those are all of my comments.

MS. BAKER: Thank you. Because we're pressed for time,

I wanted to ask Dr. Welch about some comments Dr. Beamish made on the length of time that the fish were in the Strait of Georgia. But I understand Canada will be going to a document that deals with that. So I'm going to sit down now and let Canada start its questions. Thank you.

MR. TIMBERG: Yes, and for the record, Tim Timberg and my colleague, Geneva Grande-McNeill, for Canada. Mr. Commissioner, I have 90 minutes allotted to me. If we could have Exhibit 1285 - that's Dr. Beamish's *curriculum vitae*, please.

MR. LUNN: Sorry, Mr Timberg, one more time.

MR. TIMBERG: Exhibit 1285.

MR. LUNN: Thank you.

CROSS-EXAMINATION BY MR. TIMBERG:

Q And Dr. Beamish, this is your c.v. that you identified yesterday?

DR. BEAMISH: Yes.

Q And just for the record, I just wanted to clarify from 1980 to 1993, you were the director of the Pacific Biological Station and in 1983 you were the chief scientist for Canada at the International North Pacific Fisheries Commission; is that correct?

DR. BEAMISH: Yes.

Q And then you were appointed in 1985, president of IRIS, an organization that provides focus for international recruitment studies in the sub-Arctic Pacific?

DR. BEAMISH: Yes, and I'll just add that that was our attempt to establish an organization that's now called PICES. Not many people know that but that's how we got started with PICES.

Q And PICES is where Dr. McKinnell is presently working?

DR. BEAMISH: Absolutely. So we helped him get a job.

Q Thank you. And then in 1983, you were appointed senior scientist, Pacific Biological Station. And can you comment on the statement relationship between climate and Pacific salmon abundance are linked?

DR. BEAMISH: Yes.

Q Okay. And over the page. You were appointed to represent Fisheries and Oceans on the new Pacific Fisheries Resource Conservation Council in 1998?

DR. BEAMISH: Yes.
Q And then you were appointed a Member of the Order of Canada in 1999?
DR. BEAMISH: Yes.
Q And elected to the Royal Society of Canada in 2001. And you became chairman of the North Pacific Anadromous Fish Commission.
DR. BEAMISH: Chairman of the Science Committee, yes.
Q Okay. Thank you for that clarification. And 2007, you were recognized by the international panel on climate change for contributing to the Nobel Peace Prize for 2007?
DR. BEAMISH: Yeah.
Q And then in 2009, you were awarded an honorary doctorate of science degree from Vancouver Island University?
DR. BEAMISH: That's right.
Q Thank you.
DR. BEAMISH: Now, somewhere there I got the order of British Columbia. I can't remember where.
Q 2004.
DR. BEAMISH: Okay.
Q Thank you.
DR. BEAMISH: I like the Order of British Columbia, by the way. I'm sorry.
Q Okay. How long have you been working on studying the ocean in Georgia Strait?
DR. BEAMISH: When I started at the Pacific Biological Station, I think in '74, that's when I first started working on the Strait of Georgia. And in those early days, we actually did study juvenile salmon. I had a colleague, Mike Healy, who still publishes and he and I, although most of the work was his, we did collect juvenile salmon beginning in the early '70s. And then on and off up until the early '90s and then a concentrated effort on juvenile salmon from the early '90s to the present.
Q And can you describe the fish surveys that you've done so we can understand the work you've done on boats?
DR. BEAMISH: This started in the late 1980s when I was the director and we had a scientist who was in charge of the salmon program. I think Dr. McKinnell was in that program at that time, although I'm not sure; I can't remember all this. And one of the concerns that we had was it was

difficult to sample salmon with the equipment that most people were using. And very quickly what that means is that we needed to develop new gear and the new gear we developed were these trawls that everyone uses now. Dr. Welch also helped develop those trawls but the Russians had been using the trawls for years and I can't quite remember where we got the idea from. I usually the credit the Russians and say that we used a scaled-down version of their trawl net. Anyhow, that allowed us, including Dr. Welch and a number of colleagues in the United States, to carry on, I think, a much more rigorous study of juvenile salmon in the ocean.

Q And what's the importance of collecting scientific data from boats?

DR. BEAMISH: Oh, you know, I think one of the famous Canadian oceanographers was John Tully. Not many people remember this anymore. I believe it was Tully that used to say that we go to sea to see. And you can do only so much in your laboratory and he didn't have the computers at the time but it's absolutely essential that we spend time on the ocean looking at the animals that we're going to study. And I can tell you from my experience, and I suspect Dr. Welch's and McKinnell's is the same, is that every day that you spend at sea you actually understand new things and see things that you hadn't thought of or think of things you hadn't thought of. And again, I'll go back to my Russian colleagues who, for 20 or 30 years, have been sending three vessels out for three to six months at a time to study juvenile salmon in the ocean. It's absolutely essential to understand how they survive in that marine habitat.

Q And can you comment on the relative importance of collecting data against the role of computerized modelling in trying to figure out?

DR. BEAMISH: Well, you know, this is an interesting issue. There's a saying that all models are wrong, some are useful. I have colleagues, Rick Thomson who thinks that I shouldn't use the word "wrong" and he's probably correct. So models are extremely useful and eventually the models will be very reliable. But between now and then, we have a lot of work to do. And so it's essential to combine both the modelling and the observations

out at sea. I'll tell you it's rare to find an individual who is good at both of those tasks.

Q And can you comment on what you see the role of DFO and the role of universities and the role of contractors in finding data and modelling? What do think those different institutions should work together?

DR. BEAMISH: I've written about this and I categorize government research as being directed research, which I strongly support. And properly managed research in government has strong leadership that identifies the key issues that need to be solved essentially. And then the researchers focus on those particular issues over a particular timeframe. University research, again, I'm generalizing, but university research is more generalized, sorry, is more curiosity-based. And both types of research end up, in my opinion, can produce good research.

It's just that in government, we have a responsibility to deal with commercial fisheries and a number of environmental issues and I think it's absolutely essential that government maintain a strong research program because you need that directed effort. But again, you work very cooperatively with universities. Remember that universities are producing the students that eventually get the government jobs. So the two should work closely. We do, on individual projects, have improvements, I think, to be made on large-scale integrated research.

MR. TIMBERG: Thank you. Mr. Lunn, if we could have Tab 5 from Canada's binder? It's the document entitled "Bottom-Up Ecosystem Trophic Dynamics Determine Fish Production in the Northeast Pacific", the authors being Daniel Ware and Rick Thomson.

Q Could you identify this document for us, Dr. Beamish?

DR. BEAMISH: Well, this was published sometime ago, if I remember. I can't see the date there but maybe in the '90s somewhere.

DR. McKINNELL: 2005.

DR. BEAMISH: 2005. So sorry about that. And Dan Ware is no longer with us, a really good ecologist. And he and Rick Thomson produced this paper. If I, again, remember it correctly, it's strong

documentation of the importance of essentially the bottom of the food chain, as we say, or the production of food controlling the overall abundance of fish that are higher up in the trophic level. It's a well-cited document and a very nice piece of research.

MR. TIMBERG:

Q So how does that theory relate to Fraser River sockeye salmon of this bottom-up theory?

DR. BEAMISH: Well, my interpretation of how that would relate is that the production of food, and you know, I'll always argue that the critical time is that first four-to-six weeks or four-to-eight weeks. And what happens, of course, is that there's several processes. This could be a very long answer but I'll keep it short. And that is that you have to have the optimal conditions for plankton production and that's what this document is talking about. And so if the optimal conditions for plankton production occur in that early marine period and in other areas, that's reasonable, too, but in that early marine period and if that production matches when the juveniles enter the area where the production is, then you end up with very good survival. And whether it's sockeye salmon or other species, we generally relate this ability of prey or food to be produced at the time and in the quantity that these juveniles need it in the ocean, that is the basis for the overall variability that we see in the overall production or abundance of, in this case, juvenile sockeye.

MR. TIMBERG: Thank you. If that could be marked as the next exhibit.

THE REGISTRAR: Exhibit Number 1312.

EXHIBIT 1312: Sciencexpress Research Article - Bottom-Up Ecosystem Trophic Dynamics Determine Fish Production in the Northeast Pacific

MR. TIMBERG:

Q And Dr. Beamish, yesterday we heard from Dr. McKinnell and Dr. Welch with respect to their reports and we heard about your four expert reports. Could you describe how your four expert reports fit with the reports of Dr. McKinnell and

Dr. Welch?
DR. BEAMISH: Will they get a chance to rebut?
Q Not during my time.
DR. BEAMISH: Okay. Here's what I think. Even though it may sound like we are far apart on some issues, I'm not so sure we are. I'll start with the physical side of things. We heard from Dr. McKinnell that he and his colleagues identified conditions in Queen Charlotte Sound that we would normally associate with poor food production or poor prey production. And we, in the Thomson paper, found the same thing. And I think that we agree that the fish that made it into Queen Charlotte Sound would experience generally unfavourable conditions for growth and survival. Now, I'm going to put words in Dr. Welch's and Dr. McKinnell's mouth there but that's what I think we would agree with that. We, in the Thomson paper, identified, if I remember, five variables and some of which were not in the Dr. McKinnell and colleagues' paper. For example, the freshwater discharge from the smaller rivers.

I think I forgot to mention yesterday that in 2007, those of you that can remember that winter, there was a lot of press about the lack of sunlight and I think it went for months and I don't think it was a record but it wasn't very good. And I'd like to point out that that was the year, the winter, that the trees blew down in Stanley Park. And so we had these anomalous conditions in the Strait of Georgia. We did have low salinity. There was a bit of a break in the winter of 2007, and that's in the Thomson report, that provided conditions that for a very early period might have produced plankton but that was very short-lived.

So Dr. Thomson and Dr. McKinnell, they work only just a hundred yards or so apart, and I suspect after this exercise that the two of them might find a lot of common ground in their interpretations of the physical conditions. I believe Dr. McKinnell used a term that footprint of what he thought happened in Queen Charlotte Sound would have also been in the Strait of Georgia. We think that that footprint might be larger than he thinks; in other words, it might be a snowshoe rather than a foot. But I think that

the two of them might come to common ground on the interpretation that this was just a dismal year for the survival of sockeye and the other species in the Strait of Georgia and those that moved into Queen Charlotte Sound.

The timing is an issue because the issue where the sockeye long enough in the Strait of Georgia to essentially experience the poor conditions in a way that would eventually lead to their mortality. And so Dr. Welch has a shorter time than we do, although I point out to him that he does have a paper in which he, for 2007, has about the same length of time that we have.

Q And I'll take Dr. Welch and yourself to that paper shortly.

DR. BEAMISH: So while we seem to disagree on that and we have reasons for disagreeing on that, I know this year DFO is out making those measurements right now and they have purse seines and a trawl survey and I actually know what the data are right now. And I know that we do now have been much data about residence time in the Strait of Georgia. So I think that those issues will also be resolved but here's the bottom line, is that there's variability in the survival of all species of salmon, of all fish. And what we said in our four papers is that the year 2007, the ocean entry year 2007, was a year which we would categorize as the extreme negative survival or the worst survival in what I like, a hundred-year storm. And it was extremely poor survival and we reported for all species but it was extremely poor survival because of these extreme physical conditions. Now, we did not have plankton measurements but we had the evidence of extremely poor conditions.

At the beginning of their ocean residence in the Strait of Georgia and then as they continued on their migration through Queen Charlotte Sound and then into the Gulf of Alaska in the winter. So I really don't think that the three of us would disagree too much on what I just said. In other words, 2007 was an absolutely dismal year for juvenile salmon trying to earn a living in the ocean.

Q Thank you.

DR. BEAMISH: I think we would agree with that. We have some disagreements on parts of that

explanation.
Q Okay, thank you. I think I should permit Dr. Welch and Dr. McKinnell to comment on that. Dr. Welch, do you agree with that summary, that you're not too far apart?
DR. WELCH: Partly but not fully. The issues that I would have some still disagreement with that I'd highlight here are three-fold. The first is that whether the Fraser sockeye primarily died in the Strait of Georgia or Queen Charlotte Strait/Sound or somewhere else, is critical to the decision about where the research should be focused from this point forward, if there is going to be additional research. I certainly don't disagree with continuing the research in the Strait of Georgia. The strategic concern I would have is that focusing the effort there before we actually know that that's where the problem is, is essentially a recipe for continuing the study for a hundred years if, in fact, the survival problem did not happen in the Strait of Georgia because there's no way to bound that study and say at what point do you give up and say the focus isn't correct.
Q If you could just answer the question. I only have 90 minutes. With respect, if you could just keep on track, if you could, in your answer to Mr. Beamish's --
DR. WELCH: Well, that was the first part of the comment about that.
Q Okay, thank you.
DR. WELCH: The second part Dr. McKinnell should address it in more detail. But in his report, he showed very high freshwater runoff in Queen Charlotte Sound. So the extreme conditions also occurred outside the Strait of Georgia, as well as inside. So it's an interpretational issue about where the survival problem happened.
And then finally, 2007, Dr. Beamish is correct that it was a dismal year for Fraser sockeye but we also had west coast of Vancouver Island sockeye had a reasonable return in 2009. And in 2009, we had a spectacular return of Columbia River sockeye that migrated up the west coast.
Q But you will agree they did not swim through the Georgia Strait, the Columbia River smolts or

juvenile salmon or the west coast Vancouver Island salmon?

DR. WELCH: They likely did not.

Q Right. And Dr. McKinnell?

DR. McKINNELL: I would just like to point out with the reference that you have on the screen right now, Ware and Thomson, that they excluded migratory fish like salmonids from their analysis. You'll see that they talk about resident fish, which are the fish that live in the coast. But in essence, it was a very good piece of work that showed the linkage from plankton production up through zooplankton up to fish production. And so it's a landmark piece of work.

Dr. Beamish mentioned that Queen Charlotte Sound was a region for poor prey production, that conditions there were associated with conditions that would give rise to poor production of prey. The other factor that needs to be mentioned is because, as I pointed out yesterday, it was the most extreme summer temperatures in the record, that has a metabolic cost. A fish swimming through warm surface water uses up more energy just to run its metabolism than a fish swimming through cold water. And so that was a point that I think needed to be added to what Dr. Beamish had said.

As for the Georgia Strait and the potential for my agreement with Dr. Thomson on the nature of the physics in Georgia Strait and Queen Charlotte Sound, I think what I would like to do is just highlight that yesterday Dr. Beamish was saying a snowshoe and I'm saying a footprint. I would like to point out that in some work that I did after preparing the report, the rivers that were discharging into the coast of British Columbia, all of the ones that ranked either first or second in 2007 were from Rivers Inlet north, actually from Queen Charlotte Strait north, the Klinaklini, the Whonnock, the Bella Coola, the Bulkley, Nass and Skeena. All of those rivers had the highest peak five-week discharge in the spring of 2007, whereas in the Georgia Strait the Cowichan River was 11th highest, the Fraser River was 17th highest in the record and the Puntledge River was 51st highest in the record.

And so the point I'm making is that the

extremes, in my view, are not equally distributed between Georgia Strait and Queen Charlotte Sound/Queen Charlotte Strait region. I can use the word extreme for physical conditions in Queen Charlotte Strait and Sound. I cannot use that word for anything that I found looking at Georgia Strait.

Q Okay. Thank you. Do you have anything further to add to that, Dr. Beamish, or I'll move on?

DR. BEAMISH: It's coming. We're making progress.

MR. TIMBERG: All right. If we could then move to Exhibit 1309.

Q This is your paper, Dr. Beamish.

MR. TIMBERG: And if we could move to page 17. And there's a comment here with respect to -- I think I might have the wrong paper here. I think I'm supposed to be in -- I'm going to leave this and I'll come back after the break. I'm a bit off my topic here. Could we turn, Mr. Lunn, to Canada's Tab 7?

Q And Dr. Beamish, could you identify what this document is?

DR. BEAMISH: I think I mentioned this yesterday. In one of our papers, we refer to this in the text without providing this document. This is the diet composition of juvenile chinook salmon in the Strait of Georgia going back to about 1998. I can't actually read the bottom. So it goes back a number of years and through to maybe around 2009 perhaps. But here's the point. This is, I think, a very relevant set of data.

So these are juvenile chinook salmon that we sample for stomach contents. And our sample sizes are extremely large. We sample the fish when we catch them and the person that has been doing the sampling is the same person that's been doing it for the entire survey. And this is in July of 2007 and the grey represents fish in the diet of juvenile chinook salmon. And it's commonly known that juvenile chinook salmon prey heavily on fish in that early marine period. And of the fish that they eat, and you can see that the percentage in some years can be very high, 80 percent perhaps in some years, but on average, 60 percent of the fish that they eat are juvenile herring. Look at 2007.

Q Just for the record, 2009 is the far right column and then 2008, 2007, so it's the third over.

DR. BEAMISH: All right. Thank you. So 2007 is the year that these juveniles went to see and so they were there, that this is the year that we're talking about in the Strait of Georgia. And it's yesterday I reported that there was a synchronous response of all these juvenile fish in the surface waters to these extremely poor conditions, unique conditions. First of all, you see that it's the lowest percentage of fish period in the diet and no herring at all. So herring are completely absent from our samples of chinook salmon. And to me, that indicates that by middle of July most of the juvenile herring in the Strait of Georgia were dead. That's extremely important information, in my opinion.

MR. TIMBERG: Thank you. If we could then turn to Exhibit 1305. Oh, can I have that marked as an exhibit, please, before we move on?

Q And Dr. Beamish, can you clarify that you're the person who created this chart?

DR. BEAMISH: This chart here?

Q Yeah.

DR. BEAMISH: No, I didn't create it.

Q Oh, okay.

DR. BEAMISH: Dr. Sweeting created it.

Q Okay, thank you.

THE REGISTRAR: Exhibit Number 1313.

MR. TIMBERG: Thank you.

EXHIBIT 1313: Diet (% volume) for juvenile chinook salmon captured in July surveys in the Strait of Georgia

MR. TIMBERG: If we could then look at Exhibit 1305? And this is the residence time paper. If we could turn to page 14, there's a recommendation there I'd like to look at.

Q And could you comment on the recommendation here in the middle paragraph? It says:

> Future research could be increased to sample the migrating juveniles as they enter and exit the Strait of Georgia.

Could you just sort of summarize what that recommendation is there?

DR. BEAMISH: Well, this is similar to what we've

already been talking about. We said the north end of the Strait of Georgia. Yesterday, I said Johnstone Strait so that's where I would think would be the easiest. What the recommendation is, is exactly what we've been talking about this morning and yesterday, is that we do need to get a better understanding of essentially the timing and, as Dr. McKinnell said, the abundance of juvenile sockeye salmon that are leaving the Strait of Georgia. And I don't think it's all that difficult to do.

MR. TIMBERG: Okay, thank you. If we could then move to Exhibit 1307? And if we could go to page 18?

Q This is the paper on late entry. And the last sentence there recommends:

> It would seem to be a valuable contribution to future management to determine if there are changing trends in plankton production in the Strait of Georgia ecosystem.

DR. BEAMISH: This is a statement or a recommendation that I've been making for a long time. And just like we routinely will measure salinity and temperature in the Strait of Georgia, I think it's absolutely essential that we combine those routine measurements with a measurement of plankton. And again, we have in place, we have the vessels and we have the people that can do this. There might be an issue with money but even that would not be all that expensive. So one of the things that I think we need to do to improve our understanding of not just sockeye production but all salmon production is to have this ongoing plankton sampling, as a routine component of what we do in DFO. Now, Dr. McKinnell mentioned in his report the value of making horizontal tows, which would be in the top 15 or 30 metres. And I would add to this statement that as well as doing the traditional plankton tows in terms of understanding the prey that's available for juvenile salmon, sockeye in particular, you would add the horizontal tows. This wouldn't cost very much money.

MR. TIMBERG: Okay. Thank you. Before the morning break, if we could just move to Exhibit 73? And this is the document, "Synthesis of Evidence from

a Workshop on the Decline of Fraser River Sockeye June 15th to 17th, 2010", that was prepared by Pacific Salmon Commission and DFO.

Q Did you participate in this Pacific Salmon Commission workshop regarding the causes of decline of Fraser River sockeye salmon?

DR. BEAMISH: Yes, I did. And may I just point out, if you look at the contributors to this report, without going through the names, what's important about that list is that those are recognized scientists or scientists that recognized contributions to salmon and from a variety of locations, including the United States, and that's a good selection of people in this business.

MR. TIMBERG: Okay. And if we could turn to page 9 of this document to Table E-1?

Q Can you describe for the Commissioner, this is, as I understand it, the table of hypotheses of likely causes of the decline of Fraser River sockeye salmon? And if we look at 3a, it seems like the major cause there is:

> Ocean conditions (physical and biological) inside Georgia Strait are important overall Fair indicators of contributors to the Fraser sockeye situation.

Can you describe for the Commissioner your understanding of how that conclusion was reached?

DR. BEAMISH: I mean, obviously I like this conclusion, right? But in addition to my preference, this was the preference of the people that participated in this workshop. And they're very good scientists. And they had two or three days after the papers were presented, and a number of papers were presented, and then this group met for several days and they digested the material and discussed the merits of the various interpretations and they concluded that the reasons for the poor return in 2009 were because of the ocean conditions inside the Strait of Georgia. Now, you know from our papers that this concept of the critical size/critical period hypothesis that conditions outside of the Strait of Georgia also would have contributed. But the principal problem, if you want, originated within the Strait of Georgia and that's what this workshop agreed to.

MR. TIMBERG: All right. And just while we're here, if we could just turn to the next page, Mr. Lunn?
Q And so there were the nine hypotheses that were discussed there?
DR. BEAMISH: Yes, and you can see that they're categorized as "very likely", "likely", "possible", whatever.
MR. TIMBERG: All right. And Mr. Commissioner, this is time for the morning break.
THE COMMISSIONER: Thank you.

(PROCEEDINGS ADJOURNED FOR MORNING RECESS)
(PROCEEDINGS RECONVENED)

THE REGISTRAR: The hearing is now resumed.
MR. TIMBERG: Yes, and it's Tim Timberg and Geneva Grande-McNeill for Canada, continuing. Mr. Lunn, could we have Exhibit 1305, and if we could go to page 13? And if we could look at the second paragraph there?

CROSS-EXAMINATION BY MR. TIMBERG, continuing:

Q And so, Dr. Beamish, yesterday you were talking about the paper by Preikshot on the Residence Time of Juvenile Fraser River Sockeye Salmon in the Strait of Georgia. And you were saying that you referenced a Welch *et al* paper reported that the average residence time of the tagged fish and his study was 26 to 34 days, which is only slightly shorter than our estimate for the average residence time of 35 days, that's what you were referring to yesterday?
DR. BEAMISH: Yes, it was. I mean that's in our paper and we wrote that because I considered that to be very close to what his estimate very close to ours.
MR. TIMBERG: All right. Thank you. And you cited the document and last night we circulated the actual source document, which we've circulated this morning. And Mr. Commissioner, you should have a hard copy somewhere there.
Q And Dr. Beamish, do you have a hard copy there of Dr. Welch's paper?
DR. BEAMISH: I do now.
Q And I just note under the "Abstract", it says:

> Average exit time from the Fraser River was 4.0–5.6 days after release, and average residence time within the Strait of Georgia was 25.6–34.1 days.

DR. BEAMISH: Yes.
Q Okay. And Dr. Welch, you can identify this document?
DR. WELCH: I can.
MR. TIMBERG: And if this could be marked as the next exhibit?
THE REGISTRAR: Exhibit Number 1314.
MR. TIMBERG: Thank you.

> EXHIBIT 1314: Freshwater and marine migration and survival of endangered Cultus Lake sockeye salmon smolts using POST, a large-scale acoustic telemetry array

MR. TIMBERG: If we could then turn to Exhibit 1309? And if we could turn to page 18?
Q And at the very bottom paragraph, again, Dr. Beamish, there's a discussion there with respect to:

> The tagged fish were about 50% larger than the average smolt produced throughout the drainage...

Can you just briefly explain what the significance of the fact that tags are placed on larger fish is to the timing issue?
DR. WELCH: Who are you asking the question of?
Q Dr. Beamish.
DR. BEAMISH: Sorry. Just ask me that again, please.
Q Oh, does tagging large fish make a difference with respect to the time that they spend in Georgia Strait?
DR. BEAMISH: We proposed that that was the case, that the larger fish would probably migrate faster than the average size fish and we pointed out that with Dr. Welch's estimate of residence time and the fact that they were larger fish, that we said that that probably indicated that we were talking about the same residence time.
Q Okay, thank you. I'd like to now switch and move away from the four expert reports and ask you some

general questions about international science organizations, Dr. Beamish.

MR. TIMBERG: And Mr. Lunn, if we could then move to Tab 12 of Canada's binder?

Q And this is a document from the web describing what the NPAFC is. And Dr. Beamish, could you describe what the NPAFC is and what they do?

DR. BEAMISH: NPAFC stands for the North Pacific Anadromous Fish Commission. And this is the most recent organization that initially was INPFC, which was the International North Pacific Fisheries Commission, which I believe started in 1953, but I'm never a hundred percent sure of dates. So NPAFC, if I remember correctly, started in 1992 and it essentially was just the same organization. But the organization now included Russia. And then eventually, in the late '90s, if I remember, then Korea joined. So it's an organization now of five countries and it does two things. When NPAFC was created, by agreement, all of the participants agreed not to fish salmon on the high seas and it's enforced. And we're very good at enforcing the illegal fishing on the high seas. I tell people that who don't believe this, I say that if a ship is fishing illegally on the high seas, they better hope that they get caught by Canada or the United States because if they get caught by Russia, they fire a shell through the bridge first. So it's an organization that hasn't completely eliminated it but is very close to eliminating the high seas fishing of salmon. That's the enforcement side.

The other side is the scientific side. And this is the organization that accumulates the data that Dr. McKinnell was talking about. And in fact, Kate Myers, who is an author on his paper, is a long-time participant in NPAFC. And in addition to accumulating the catch statistics or the fishery statistics for all Pacific salmon on the high seas, we also carry out research. We have research plans and we exchange that information annually every year.

MR. TIMBERG: All right. Thank you. If that could be marked as the next exhibit?

THE REGISTRAR: Exhibit Number 1315.

EXHIBIT 1315: North Pacific Anadromous Fish Commission - About the Convention

MR. TIMBERG: If we could move to Canada's Tab 16?
Q And this is, again, a document from the web about the Pacific Fisheries Resource Conservation Council. And Dr. Beamish, could you identify this document and describe what the PFRCC is?
DR. BEAMISH: Well, the Pacific Fisheries Resource Conservation Council was established, again I can't remember the date, but it's similar to the organization on the east coast. It has a different function than the Pacific coast because it's a focus on Pacific salmon. The first chairman was John Fraser. Now, isn't this interesting? I'm the DFO representative on the Council. Don't tell anyone, all right? And I still go to the meetings. Oh, well, they'll now know. The Council has produced a number of reports and it's an excellent focus for Pacific salmon. It's an independent council and I'm pretty sure that even though the funds come from the Pacific region, that the Council, technically, if I remember, reports to the minister. So we are an advisor to the federal minister. We were initially to advise both the federal and provincial ministers but I don't know if that happens regularly. Anyhow, the Council is diminished now, we don't have as many members and there's decisions to be made about the future of the Council. But they produce some excellent reports and the members over the years are people that are well-known in the community around here, not just in Science but in First Nations and in industry.
MR. TIMBERG: All right. Thank you. And I note for the record this is their terms of reference that set out their mandate and their scope. And if this could be marked as the next exhibit?
THE REGISTRAR: Exhibit Number 1316.

EXHIBIT 1316: Pacific Fisheries Resource Conservation Council Terms of Reference

MR. TIMBERG: And if we could go to Canada's Tab 8? And this is a document titled "Plan for NPFC Bering-Aleutian Salmon International Survey

(BASIS) Phase II 2009 to 2013". And then it's "BASIS Working Group". And I note it's submitted to the North Pacific Anadromous Fish Commission and it's dated April 2009.

Q Earlier, Dr. Beamish, you spoke about the BASIS program. And I'm wondering if this document assists you to describe what the BASIS program is?

DR. BEAMISH: Again, I mentioned previously that BASIS was a more recent work plan.

MR. TIMBERG: Perhaps we could move to the third page, pdf? There's a project summary there.

DR. BEAMISH: What I'm going to say is that this is a collegial commitment amongst investigators that is supported by the country that they belong to. And so I also forgot to tell you that in NPAFC, it's a government organization, and it's run by Commissioners that are actually called representatives. And so everything that's done within the Commission has agreement by the country. So it's a formal process of agreeing to the work of the Commission and to any reports. For example, that report on the long-term research and monitoring plan was a report that was agreed to by all five countries.

So BASIS is a program that's supported by the member countries. But BASIS is also the mechanism, if you want, for scientists to integrate the work that they're doing on the high seas. It's a little bit tenuous in recent years because of some of the financial difficulties among the various member organizations. But we still maintain BASIS in the sense that we have symposia where we talk about the work that's going on within the Bering Sea related to salmon. And as I said, we have a commitment within the participants to try to support each other's research.

Q And this document here talks about research that BASIS is doing on climate change and the impact on salmon-carrying capacity in the Bering Sea was discussed at the November 2008 symposium. And do you have any update on this project?

DR. BEAMISH: Well, all projects like this have a theme, if you want, and the theme for the recent period is looking at the impacts of climate change on Pacific salmon. And of course, that theme is now persistent and, in fact, I think Dr. McKinnell

might have mentioned something about that yesterday. But that's a persistent theme in just about everything that we do with Pacific salmon now simply because the oceans are warming. And these are cold-blooded animals and they're going to be affected by that warming.

In reality, while that's the overall theme of the recent work plan or research plan, the plan itself is a continuation of the work that we have been doing for a number of years.

MR. TIMBERG: All right. Thank you. If this could be marked as the next exhibit?

THE REGISTRAR: That'll be Exhibit 1317.

EXHIBIT 1317: Plan for NPFC Bering-Aleutian Salmon International Survey (BASIS) Phase II 2009 to 2013 - BASIS Working Group

MR. TIMBERG: If we could go to Canada's Tab 8, please?

MR. LUNN: I think that's what we just marked.

MR. TIMBERG: Oh, sorry, I said 8; I meant 10.

Q And this is a document titled "American Institute of Fishery Research Biologists" and it's dated September/October 2010. And I note that the president's message has your name "Dick Beamish, November 2010". Could you identify what this newsletter is, Dr. Beamish?

DR. BEAMISH: Well, this is an organization called the American Institute of Fishery Research Biologists or AIFRB. It's an old organization that I think started in Seattle, Washington Fisheries, School of Washington Fisheries. And about 600 members, mostly in the United States, a few in Canada, and I happen to be the president. The president is elected so I wasn't just appointed. But we have a newsletter that we send out six times a year. And as president, I write about things. And this particular message, one of the things that we want to do is we want to initiate public debates on key issues in fisheries science and, in this case, fishing down the food chain. And unfortunately, money rules but we now have sponsors for this and we are getting close to being able to have our first public debate on key issues in fisheries science, probably in Washington, D.C., either this year or early next year.

MR. TIMBERG: Thank you. If this could be marked as

the next exhibit?
THE REGISTRAR: Exhibit Number 1318.

EXHIBIT 1318: American Institute of Fishery Research Biologists

MR. TIMBERG: If we could go to page 7 of this document?
Q And there's an article here, "Sparks Fly Over Theory that Volcano Caused Salmon Boom". And on page 7 here, there's a statement here. I think, Dr. Welch, you were involved in this interview here. Are you familiar with this article here, Dr. Welch?
DR. WELCH: Actually, it's the first time I've seen it so I'll have to take a moment to read it.
Q Okay. This is one, two, three, four paragraphs down. It says:

> One way to check the idea, says David Welch of Kintama Research Corporation, a marine science consultancy in Nanaimo, British Columbia, would be to check the scales of salmon that returned in 2010 to see if they experienced an unusual growth burst in the autumn of 2008.

Do you recollect --
DR. WELCH: I wasn't aware of it being in here but, yes, these are my comments.
Q All right. And then at the bottom of this article, the second-to-last paragraph, it says:

> Salmon don’t eat phytoplankton: they eat zooplankton and small fish, which in turn feed on phytoplankton. Zooplankton take months to a year to reproduce, so a single big burst of food for them over 3-4 weeks doesn’t necessarily boost their numbers much, says Welch.

Do you agree with that summary?
DR. WELCH: As a general statement, yes.
Q Okay. And over the page at the end there, this article discusses that:

> Some companies formed with the controversial

intent --

I'm on the "all this could spur", if we could have that perhaps enlarged? It says:

> All this could spur some to think of intentionally seeding the ocean with iron to boost fish numbers.

Dr. Walters is asked, "Is this a good idea?" He says, "Good God, no." I'm wondering what your opinion is of that idea.

DR. WELCH: Sorry. Give me a moment to organize my thoughts simply because I've been contacted by people on both sides of the debate and I need to see how to think a bit about how to frame this for the court. Sorry. So let's repeat your question first. What are you asking me?

Q Well, I'm just wondering if you agree with Dr. Walters' comments when asked about sea fertilization. He says:

> Good God no. Our experience with fertilizing things is it's way too easy to fertilize the wrong thing. In general, it's a pretty dangerous thing to do.

DR. WELCH: All right. So no, I wouldn't agree with that. First, on the freshwater side, it's been common efforts for 50 years to try fertilizing in freshwater to boost salmon production. So if it can be done with fertilization in freshwater, then there's no reason to think that we can't also at least consider it on the marine side. It's a much more controversial idea to fertilize using iron in the Gulf of Alaska than it is to fertilize with nitrate or phosphate fertilizer in the lakes, however.

Q But this article is about fertilizing the ocean, not lakes. I'm asking you about your opinion about fertilizing the ocean.

DR. WELCH: And my opinion is that it should certainly be looked at or debated but not necessarily actioned without a full discussion. And as I've stated, it's a much more controversial idea to do in the ocean what's being routinely done in freshwater.

MR. TIMBERG: All right. Thank you. We'll have a debate on this tomorrow so I'm going to move on in the interests of time. If we could move to Canada's Tab 17?

Q Dr. Beamish, can you identify this newsletter of the AIFRB dated March 11, 2011?

DR. BEAMISH: Well, this is another newsletter, a more recent one.

Q And on page 1, there's a comment that you make about -- I don't have the reference here but in here you state that:

> In the North Pacific, we are getting historic high catches of Pacific salmon.

And I'm wondering if you can comment on that.

DR. BEAMISH: Well, you know, particularly maybe in British Columbia, Washington and Oregon, the popular press repeats the concern that we have for salmon. There's no question that we have issues with salmon in terms of their abundance and survival. But in terms of the commercial catch, the catches in Canada, Washington, Oregon and B.C., are roughly 1 or 2 percent of the total commercial catch in the Pacific. In the Pacific, the total commercial catch by all countries set a record high in 1995 and then it was broken again in 2007 and then broken again in 2009. Pacific salmon catches in the North Pacific are at historic high levels and increasing. So Pacific salmon, as an aggregate, mostly pink and chum, are doing extremely well in the North Pacific, not nearly as well, of course, in British Columbia, Washington and Oregon.

Q And then can you perhaps relate those high catches back then to Fraser River sockeye salmon to help us understand what's going on?

DR. BEAMISH: You'll have to ask it a little bit differently. I'm not sure I can answer that.

Q Well, if we've got historic high catches of salmon in the Pacific, I'm asking you to sort of make that statement and tie it back to our Fraser River sockeye salmon.

DR. BEAMISH: So if we're getting historic high catches in the Pacific, why are Fraser River sockeye salmon not at historic abundances perhaps? Excluding what happened in 2010 but I think the

issue is that pink and chum are the species that make up 80 to 85 percent of the total commercial catch in the North Pacific. And they are doing very well. And I think most of us feel that pink and chum are doing well because they are the first salmon to really enter the ocean and we think that the timing is more appropriate for their survival. And then we have chinook and coho at the other end that enter later and we are seeing trends over the years that chinook and coho, in general, in, say, British Columbia, are not doing as well as they used to. And sockeye from the Fraser are somewhere in between.

If you ask me my interpretation, I always say that it's just very difficult to explain why sockeye are performing the way they are in terms of their production. But I could also suggest that we're looking at sockeye from the Fraser River being at the southern end of their distribution and perhaps being more sensitive to the variability that's associated with a changing climate or changing ecosystems. But you know, what I just said is speculation.

MR. TIMBERG: All right. Thank you. If we could then move to Exhibit 553? And we'll move to page 54 of that. This is Technical Report number 9.

MR. LUNN: Page, sorry?

MR. TIMBERG: Fifty-four.

MR. LUNN: Thank you.

MR. TIMBERG: Okay. And here we have the recommendations from Technical Report number 9. And perhaps we could just scroll through these briefly so that Dr. Beamish can have a review of them. And if we could just keep going down to the bottom till we're finished? There's just a few recommendations. And so going back --

DR. BEAMISH: If you could just do that one more time. You can go backwards. That would be fine.

MR. LUNN: Thank you.

DR. BEAMISH: Yeah, okay.

MR. TIMBERG:

Q And have you reviewed these recommendations?

DR. BEAMISH: I've read them, yeah. I just wanted to make sure.

Q And do you have any comments for the Commissioner with respect to the benefit of these recommendations?

DR. BEAMISH: Well, these are interesting recommendations. They obviously will produce some interesting science. They wouldn't be my top priorities. We have discussed already on this panel here, we've already discussed some of the priorities and I think I've identified my priorities already. These are interesting but they're not the highest priorities, in my opinion.

MR. TIMBERG: All right. If we could then perhaps move to Exhibit 748, which is Technical Report number 10? Technical Report number 10 is Fraser River Sockeye Production Dynamics. And this is Randall Peterman and Brigitte Dorner. If we could go to page 4? And here, Peterman suggests five recommendations. If we could just go through those slowly.

Q You've reviewed this report before?

DR. BEAMISH: I remember these, yes.

Q Yeah. And what are your comments on these recommendations?

DR. BEAMISH: Well, my comments are that, well, first of all, they're nicely written. It's nice to see a recommendation followed by an explanation. It's nice to see a short number of recommendations. Having said that, recommendation number 1 made my brain hurt. I can't understand that. So I just gave up on that and then I went to the other ones, which I think are good. I support them all.

MR. TIMBERG: All right. If we could turn to page 2 of this document? And if we could just scroll down? Here in the bold here, we've got Peterman's sort of conclusion that there's been a decrease in productivity for most Fraser and many non-Fraser sockeye stocks starting in the late 1980s or early 1990s.

Q Do you care to comment on how Peterman's conclusion fits or connects to your four expert reports?

DR. BEAMISH: This is a big issue. Our reports, our four reports, are focused on really two years and they're focused on the return years of 2009 and 2010. The conditions that we identified that caused the extremely poor return and extremely good return, we think certainly the extremely poor return are virtually unique. So our papers probably don't relate directly to this. Having said that, I have published a paper along with

colleagues that identified regimes or trends in sockeye stocks.

Now, I'll point out for everyone's benefit that Dr. McKinnell has also published a paper that doesn't agree with our paper. But you know, that's life in the scientific community. But of course, I do believe in the paper that we published. And I'm mentioning this because in that paper we identified that the regime or the period beginning in the '90s was a period of decreasing productivity of Fraser River sockeye. And those decreases in productivity are incremental so they occur over a period of time, let's say, ten years or more. So each year, you get a little bit less.

And my interpretation of something that's incremental like that means that you're looking at a climate ocean impact where you're gradually seeing something change the population. So that paper in a sense relates a little bit to this but this is Dr. Peterman pointing out that there are these trends, these natural declining trends. And that's how I'd answer that.

MR. TIMBERG: All right. Thank you. If we could then move to Canada's Tab 37? And this is a book titled, "The Future of Fisheries Science in North America". We have some excerpts from it. And actually I want to go to Tab 38, which is the next Tab 38 and for the assistance of the Commissioner, Chapter 1 is a chapter by Dr. Beamish and Chapter 29 is an article that Dr. Beamish co-authored with Dr. Brian Riddell.

Q And so Dr. Beamish, could you perhaps identify this chapter and perhaps just provide the Commissioner with a brief overview of this book?

DR. BEAMISH: Okay. Well, this actually was an effort of the American Institute of Fisheries Research Biologists with a large number of sponsors so that we could have it. We invited Fisheries scientists from across North America to a conference in Seattle and then we had a publisher inviting us to publish our presentations. And I think there was 34 scientists that contributed to the book.

The concept was to speculate on where fisheries science on a diversity of topics in fisheries science, where fisheries science might be, say, 30 years from now. I was the editor of

the book, along with a person named Brian Rothschild, who is a stock assessment type. I think he's in Massachusetts right now. And then one of the chapters was this chapter written by myself and Dr. Riddell. Now, this is speculation. Now, you're going to ask me questions about this so I brought a copy of my book.

MR. TIMBERG: All right. Mr. Commissioner, this chapter identifies ten issues that the authors think will drive fisheries science on Canada's Pacific coast over the next few years.

Q Before we get into those ten issues, if you could just comment on the abstract with respect to this chapter, as to the goal. You talk in the abstract about the connection between human population growth and marine aquaculture. You say:

> We also know that human populations will continue to grow and increase the demand for seafood. Expansion of marine aquaculture and ocean ranching is the only way to meet this demand.

Could you comment on that statement?

DR. BEAMISH: Well, I think that this is generally accepted. In fact, we finished the chapter with ten issues that we think represent the key topics, if you want, or the key issues in fisheries science in British Columbia. And one of them is aquaculture. And we all know that, again, I'm doing this from memory, I should probably check and see. Let me just check and see and so I won't guess.

MR. TIMBERG: I'm just trying to be efficient here. Why don't we just jump right through then to the ten issues? It starts at page 579.

DR. BEAMISH: Why don't I just do aquaculture since I've flipped through it?

Q Okay, sure. And what are you looking at?

DR. BEAMISH: I can just read a few sentences and I just highlighted a few sentences that represent these issues.

Q And just for the record, are you then at issues 6, "Aquaculture and Ocean Ranching"?

DR. BEAMISH: Issue 6, page 584.

Q Thank you.

DR. BEAMISH: And I know that some people know this but

I'll just read a few sentences.

> Approximately half of all fish consumed by humans is now raised on farms. Within 25 years, the world population is expected to consume about 83 million tons of farmed fish, up from 46 million tons in 2004. A limitation to the growth of aquaculture and the aquafeeds industry is the virtually fixed supply of fish oil and fish meal.

Now, I mentioned that this is speculation, okay? And so we speculated that that production of fish meal and fish oil that would be developed to genetically engineer plants so that the proteins that currently make up diets could be produced cheaply just simply by genetically engineering plants.

> This technological advance will reduce the cost of aquaculture resulting in a supply of inexpensive seafood that is certified as safe to eat and safe for the environment. With an affordable and plentiful food supply of safe seafood, management agencies will be able to reduce fishing rates and thus rebuild overfished stocks in British Columbia.

Now, again, that's speculation. But we also add that British Columbia is perfectly positioned to be involved in aquaculture. We have a reputation for pristine waters and we have the technologies and the abilities to improve our aquaculture capabilities. So we think that not only will aquaculture continue to increase and be a major source of food on the planet, we think British Columbia will be perfectly positioned to develop that industry here.

MR. TIMBERG: All right. I'll just ask if we could move to page 579.

Q The document speaks for itself but perhaps we could go through each of the ten issues and you could simply provide your highlighted comments for the assistance of the Commissioner. So page 579, just for the record, it says:

> We selected ten issues that we think will

> drive fisheries science on Canada's Pacific coast over the next few decades.

And if you could perhaps just talk about the first issue, "climate change", if there's anything specific you wanted to highlight.

DR. BEAMISH: Well, again, we consider that climate change is the major issue in fisheries science. It's the underlying issue. And again, it's because we are experiencing a warming of our aquatic environments. It's cool for the last few years but most of us think that that trend that we've seen, say, for the last 40 years is going to continue. Strait of Georgia, for example, has warmed by about a degree in the last 30 or 40 years. So everything that we speculated would happen in fisheries science in the future was associated with the expected impacts of climate change.

Q Okay. Thank you. I'm just cognizant of the time, Dr. Beamish.

DR. BEAMISH: I understand.

Q The second issue, you talk about the Wild Salmon Policy and its importance. What do you see is the long-term impact on the implementation of the Wild Salmon Policy, or the future impact?

DR. BEAMISH: I'll just read a sentence here:

> While the WSP required nearly a decade of drafts and public consultations, its completion is timely and its effective implementation is likely --

Now, we published this book before it was implemented.

> -- to dominate the management of Pacific salmon for the next decade.

Again, there's no question that the implementation of the policy is going to change how we manage Pacific salmon. But we noted in the last sentence of this issue that implementation of the policy requires a significant commitment to better monitoring and support for science. Under the conditions of reducing budgets, this is a major issue.

Q Okay. And then you comment on Issue 3, Pacific Salmon Hatcheries.

DR. BEAMISH: Well, this is an interesting issue because, as again some people know that we started our hatchery program officially in 1977. And overall, the hatcheries have not produced the doubling of salmon catch, which was proposed. But hatcheries are extremely important. First of all, they have strong public support. I'm just going to read a little bit again. No, I won't; I'll just summarize it. Our view is that we need to rethink how we use hatcheries in the overall management of salmon. I personally think that hatcheries can be used to enhance the production of, say, chinook or coho, or species for the recreational fishery, and one of the ways of doing that would be to release fish later in the year like we see for South Thompson chinook. So we think that if hatcheries are more experimental, that we probably would find overall that we would see a benefit that everyone could appreciate.

Q And can you comment about Issue number 4, the issue of certification?

DR. BEAMISH: Well, certification developed a few years ago and this is this Marine Steward Council where fisheries have to be certified as being safe essentially. And we're well into that process right now. But we speculated that we'll see a peak in the requirement to have fisheries certified. And we think that the requirement to have fisheries certified served a very useful purpose, or is serving, I should say, a very useful purpose and it's requiring that governments deal with the problem of overfishing, which, by the way, is a very hard term to define. But we see that governments are beginning to take this issue of overfishing seriously and I think that the Marine Stewardship Council deserves a lot of recognition for that. But we think that with time, as it becomes clear, that fisheries are being better managed, that this requirement will diminish or it will change into some other form.

Q Okay. And can you comment on Issue number 5, ***Species At Risk Act***?

DR. BEAMISH: Well, again, the ***Species At Risk Act*** is a very important way of protecting species that can't protect themselves. I have two species that

I've been dealing with that have been listed in the Act, maybe not in the Act but have been listed as needing protection. They're lamprey. No one cares about them but I do. But I'll just read the end of the ***SARA*** paragraph:

> In the medium term, however, we expect that SARA will be rethought and revised. An ecosystem approach that establishes marine-protected areas could be integrated into SARA. For example, instead of establishing small areas for protection, larger areas, such as the entire Strait of Georgia, could be a marine-protected area but with fishing allowed in specific areas. A species needing protection would simply not be made available and would then respond naturally to the changing ecosystem.

And why we wrote that is that we recognize that, as the climate changes, some species are going to do better and some are not and some are simply going to disappear because of the changing environment. And so it's not possible to protect species that are essentially evolving out of the system. So some of these things, well, it's an excellent way of protecting animals; we think that there will be some rethinking of the ***Species At Risk Act***.

Q And we've discussed Issue 6. Issue 7, "Ecosystem-Based Management Will Lead to Regional Management".

DR. BEAMISH: This is an issue that Dr. Riddell really -- he wrote this section. And I'll just again read the end of this.

> A movement towards more regional management structures and processes (e.g. Strategy 4 of the Wild Salmon Policy) will need to ensure that there are broader overall policies to resolve the trade-offs between resources and between users. The improved awareness of what we actually know and do not know probably would have the consequences of reducing the amount of fishing to account for uncertainty. However, as previously mentioned, we anticipate a substantial added

value to the price of wild fish that are properly handled and processed with the net result of less spent on fuel and more on sustainable exploitation rates.

And really what this means is that most likely, if we move to a regional management, that there would probably be reduced fishing effort but we're expecting that the added value of providing good quality wild fish would make up for that reduced fishing.

Q All right. I think we've discussion international cooperation already so I'll leave that.

DR. BEAMISH: Yeah.

Q Can you briefly just describe what the "Watson Effect" is under Issue 9?

DR. BEAMISH: Very briefly, I'll deal with that. The "Watson Effect", the name comes from Dr. Bill Ricker, or the term comes from that. And Bill was an avid Sherlock Holmes fan; in fact, wrote Sherlock Holmes fictions. And he, if you remember Sherlock Holmes' assistant, Watson, he said, "Everything is simple once it's discovered." And what we expect is that we will see some major discoveries in the next ten to 20 years and those discoveries will make some of the things that we're talking about today appear to be very simple.

Q Okay. And then Issue 10, "A New Approach to Fisheries Science", and then you've got a proposal for an independent board. Perhaps you could briefly --

DR. BEAMISH: Well, this is my favourite. Now, remember that this is speculation.

We suggest it's time to rethink how we do fisheries science. Today, and in the past, fisheries science was carried out mainly in universities and governments.

We've already talked about that so I'm going to skip a bit. And we talk about a new science organization.

We think that the science organizations that move faster and smarter in the future will provide the best advice.

And we say that because we think that there's greater variation in the issues and there's no better example than the poor return in 2009 and 2010. And again, this is a reference of something that Bill Ricker used to say about salmon, and that was, that he expected to be surprised by what happens to salmon. And we think those surprises are going to increase in frequency. And so we said that we think that the science organizations that provide the best advice in the future will be the ones that can respond fastest to these surprises. And to do that we're suggesting don't change anything. We're not suggesting we change universities or government but we suggest that we establish a small multidisciplinary board that would be a fisheries science advisory board. And it's a small board. I have a little figure here. Do you have that, by any chance?

Q Yes, we do.

DR. BEAMISH: There it is, look at that. And Mr. Commissioner, I don't know if you're going to retire but there's a job for you on this board right here. I think you would be a perfect person for this board. So these are senior people in business and in science, these are people that have a recognized history of being able to make a decision, they have no vested interest, they would look and listen to the issues in fisheries science that have priority and they would provide advice to universities, to governments with the intent of creating multidisciplinary teams that would work together over a predefined period of time and they would also be involved in evaluating the quality of what came out of it.

MR. TIMBERG: Okay. Thank you. I'm over my time. I have two final questions, Mr. Commissioner, and my friend, Ms. Baker.

MS. BAKER: I'm looking strongly at him because we are on a very tight schedule and Mr. Prowse is scheduled to begin his questions now.

MR. TIMBERG: If I could be permitted to ask two questions that would be appreciated.

DR. BEAMISH: I promise to be brief.

Q We've heard about salmon schooling in rivers on their return. Do salmon school in the open ocean?

DR. BEAMISH: No, the belief is that they don't. A lot of that comes from Russian science.

MR. TIMBERG: All right. And Mr. Lunn, if we could go to Exhibit 1291, which is Technical Report number 4, page 177?
Q And Dr. McKinnell, this question is for you. You state in your report that there were some peer comments made but you state, at page 177:

> No changes to the PICES Final Report were made in response to comments by the Commission's reviewers.

That's correct. You received feedback but you didn't make any changes to your final report?
DR. McKINNELL: That's true.
MR. TIMBERG: Okay. And those are my two questions. Thank you.
MR. LUNN: Mr. Timberg, shall we mark Tab 38?
MR. TIMBERG: Yes, please.
THE REGISTRAR: Exhibit Number 1319.

EXHIBIT 1319: Chapter 29 - The Future of Fisheries Science on Canada's West Coast Is Keeping up with the Changes

MR. PROWSE: Yes, Mr. Commissioner, Cliff Prowse from the Province of British Columbia. If we could have the last exhibit?

CROSS-EXAMINATION BY MR. PROWSE:

Q There's a statement in the headnote or the abstract here suggesting that climate change is important but we don't understand the mechanisms, is my summary. First of all, Dr. Beamish, if I've paraphrased that correctly, is that your belief?
DR. BEAMISH: We understand portions of some mechanisms. We're beginning to do that. But as a general statement, I would suggest that we basically don't understand the linkages between a changing climate and the overall population dynamics of the species that we have to manage.
Q And Dr. Welch?
DR. WELCH: Sorry, what's the question for me?
Q The question is whether you agree with the statement that we don't understand linkages from climate change to what's happening operationally on the ground?

DR. WELCH: Yes, I agree with that.
Q And Dr. McKinnell?
DR. McKINNELL: I think that the details are certainly unclear.
MR. PROWSE: All right. And Mr. Lunn, if we could have a document that the Province circulated by Michael Healey, "The Cumulative Impacts of Climate Change on Fraser River Sockeye Salmon and Implications for Management"? I think it's the link that we need.
MR. LUNN: Thank you.
MR. PROWSE: So will that come up?
MR. LUNN: I don't think I have that document available. I can see how quickly I can get it.
MR. PROWSE:
Q Perhaps I'll ask the panel, are any of you familiar with Dr. Healey's 2011 paper?
DR. BEAMISH: I read portions of it.
Q And neither of the other two of you are familiar with it?
DR. McKINNELL: I began reading it but when I found an error in it on one of the climate aspects, I stopped.
Q Dr. Welch?
DR. WELCH: And I've only skimmed it, not in detail.
Q First of all, Dr. Healey is a professor emeritus at UBC. He's well-recognized, is he, as a scientist who's interested in the ecology of Pacific salmon?
DR. WELCH: Yes, he is.
Q And I think I'll come back to his article this afternoon but he reaches some pretty dramatic conclusions, and negative, with respect to the Fraser River sockeye salmon. Perhaps, Dr. McKinnell, you said you found an error in it. Do you recall what that was and why you stopped reading?
DR. McKINNELL: Dr. Healey described that the thermocline in the Gulf of Alaska was shoaling over time and cited Dr. Freeland. I visited Dr. Freeland and asked him whether that was what he said because it was not my recollection. And he agreed that what he had said was that the mixed layer depth was shoaling in the Gulf of Alaska.
MR. PROWSE: Here we have the article. Mr. Commissioner, I would ask that this be marked as the next exhibit.

THE COMMISSIONER: I'm going to do that, Mr. Prowse, and then adjourn for the lunch break. But I'm sorry, which article are you now referring to?
MR. PROWSE: It's "The Cumulative Impacts of Climate Change on Fraser River Sockeye Salmon" by Michael Healey, 2011.
THE COMMISSIONER: So this is the link that you had mentioned earlier?
MR. PROWSE: Yes.
THE COMMISSIONER: Thank you.
THE REGISTRAR: 1320.
MR. PROWSE: Thank you.

EXHIBIT 1320: The cumulative impacts of climate change on Fraser River sockeye salmon and implications for management by Michael Healey

THE COMMISSIONER: We'll take the break. Thank you.
THE REGISTRAR: The hearing is adjourned until two o'clock.

(PROCEEDINGS ADJOURNED FOR NOON RECESS)
(PROCEEDINGS RECONVENED)

THE REGISTRAR: The hearing is now resumed.
THE COMMISSIONER: Mr. Prowse.
MR. PROWSE: Thank you, Mr. Commissioner. So could we have Exhibit 1320, please, Mr. Lunn?

CROSS-EXAMINATION BY MR. PROWSE, continuing:

Q So, Dr. Beamish, I think I'll take you through some of this article and see whether you agree or disagree with some of the steps that are in it. So the first sentence says that:

The species of Pacific salmon are economically, culturally and ecologically important throughout their North Pacific range.

Do you agree with that?
DR. BEAMISH: Yes.
Q

Because of this, the effects of climate change in [North] Pacific salmon are of major

concern to resource managers.

Do you agree with that?
DR. BEAMISH: Yes.
Q
The freshwater and marine habitats of salmon are expected to warm by 2-5 degrees...or more over the next century, perhaps earlier.

What about that?
DR. BEAMISH: Oh, that's a model. I simply don't know necessarily. I think it's probably possible.
Q All right.
DR. BEAMISH: Five may be a little bit high.
Q
This degree of warming will have uncertain but potentially devastating effects on salmon and their ecosystems.

Citing Beamish 2008. But perhaps mis-citing Beamish in 2008. Anyway, what do you say about that sentence?
DR. BEAMISH: The concern about that sentence is that it lumps all species of salmon in one sentence, and I don't think that's the best way of doing it.
Q And Fraser River sockeye salmon, as I understand it, are particularly --
DR. BEAMISH: Yeah.
Q -- heat sensitive.
DR. BEAMISH: Yeah, I would agree with Fraser River sockeye salmon.
Q Then turning to the next page, Mr. Lunn, which is 719 in the paragraph that starts, "The Fraser River in British Columbia...". So the last couple of sentences start:

Because of their commercial and cultural importance, sockeye salmon in the Fraser River are among the best studied of Pacific salmon.

Is that correct?
DR. BEAMISH: Yes, probably.
Q The author then says that:

The wealth of information on this species allows me to make relatively informed

judgments about the likely effects of climate change.

And he says:

> [The] Fraser River sockeye are thus a useful model species for understanding the effects of climate change.

What's your comment on those two propositions?

DR. BEAMISH: You could make informed -- I'm not so sure the word is "judgments". It's more informed speculations about the likely causes or the possible causes. It's close. Dr. Healey is a good scientist and he's studied salmon for a long time. I think many of us are careful about being categoric about the defining the responses. So, in a general way, that's close to what I would think, but I would be cautious about being categoric.

Q And he, in the next paragraph, says he's developing a qualitative model. So what's the methodology around qualitative model? How does that fit within a spectrum of scientific debate?

DR. BEAMISH: Well, it means he's not doing a mathematical analysis or statistical analysis. He's doing what most of us do. He's just thinking this through.

Q All right. Sorry, so this is -- these are the questions I didn't know whether I was going to get anywhere with, so it's a natural segue.

MR. PROWSE: Mr. Lunn, can you pull up the second article which I produced which is called, "Why Most Published Research Findings are False" by John Ioannidis.

Q So are you familiar with Dr. Ioannidis?

DR. BEAMISH: Well, I don't know the author.

Q Are you familiar with the article at all?

DR. BEAMISH: I did read the article. Not really closely, but I did read it.

Q As I understand it, Dr. Ioannidis is in fact the chair of Disease Prevention at Stanford University and he does work in clinical research methodology and evidence-based medicine with the challenges of the current molecular medicine, genomics, and he also is previously chair of the Department of Epidemiology at medical school in Greece. So he

has a background in medicine and epidemiology and, as I understand it, he has done 450 peer-reviewed papers.

So part of the science of fish as we've experienced in this inquiry includes the use of statistics, and part of the science involves epidemiology. How does that part of the science fit together with the topics of climate change, for example?

DR. BEAMISH: I'm sorry, I'm not quite clear on your question.

Q It wasn't a very good one.

DR. BEAMISH: Well, I'm just not sure. You threw in the word "statistics" and --

Q Yes.

DR. BEAMISH: -- when you use that word, I would pass the microphone to my colleagues. I'm not a statistician. I'm an old-fashioned biologist.

Q But you've done a chapter on the future of fishery science research so --

DR. BEAMISH: Yes.

Q -- part of the future of fishery science research does involve statistics and modelling, does it not?

DR. BEAMISH: It involves modelling. Statistics is commonly used in everything we do, but I'm not quite sure where we're going here.

Q I've digressed and I think I'll retreat.

DR. BEAMISH: That's good.

MR. PROWSE: So in his article, if we can pull up page 729, Mr. Lunn. This is the article 1320.

MR. LUNN: Which article?

MR. PROWSE: This is the article 1320.

Q So he goes through what he calls cumulative effects, and he's gone through the different life stages and he's trying to think to build on each life stage.

So, at number 5, we get to smolts. So I'd like to take you through the points starting at number 5. So he says:

> Smolts will enter a warmer, less productive coastal ocean where trophic relationships have been disrupted by phonological changes that will likely not match the phonological change in smolt migration timing.

Can you comment on that sentence?
DR. BEAMISH: Well, yes, I think we actually mentioned something about that earlier. That's simply arguing that the food that's necessary for these smolts to grow quickly will not be as well matched with their ocean entry times. Consequently, they will grow slower.
Again, I would agree with that, but we're talking about sockeye now. I would think so.
Q All right. And again, he talks about zooplankton and saying they'll be less suitable, and again, he comes back to post-smolt growth being slower. Then he builds, I think, by saying:

> ...further compromising an already low survival rate because of their small size at ocean entry.

So his assumption is that, in the fresh water, they've already got a small size at ocean entry. On that assumption, do you agree with the concerns about the dominant zooplankton in the warmer waters causing growth problems for sockeye?
DR. BEAMISH: Yes, could be.
Q He then throws in a statement that:

> Ocean acidification may also compromise the abundance of important prey such as pteropod mollusks.

I don't know if we talked about ocean acidification.
DR. BEAMISH: I don't think it's been mentioned yet.
Q What can you tell us about ocean acidification?
DR. BEAMISH: I'm not an expert on ocean acidification; maybe my colleagues are. But ocean acidification, of course, is a consequence of global warming in which we are already seeing -- and remember that the ocean has a basic pH so it's not in the acid range. But the pH, or hydrogen ion content is increasing which is reducing the pH and we are observing some acidification in the world oceans and scientists are concerned about that.
Q Point 6 then, he moves on to say that:

> Poor growth in coastal waters will carry forward into the oceanic phase. Suitable

thermal habitats in the North Pacific will be pushed north by global warming so that fish will be concentrated into a smaller area of ocean and feeding competition will be greater.

I think we heard something about that in the last couple of days.

DR. BEAMISH: Well, actually Dr. Welch is the expert on it. He's been writing about that. Dr. McKinnell also wrote about it. I don't think the two of them necessarily agree, but they're beside me here.

Q Dr. Welch, do you care to comment?

DR. WELCH: Could you rephrase the question again?

Q Well, the concern is that:

> ...suitable thermal habitats in the North Pacific will be pushed north by global warming...

DR. WELCH: Yeah, I've reviewed a recent paper for one of the journals where the authors looked at the most recent group of global warming models and they all indicate that projections from the original models are still consistent. There might be a 10- or 20-year difference in the time that a temperature reaches into the Bering Sea instead of the North Pacific, but they're not showing anything qualitatively different from the early models.

MR. PROWSE: Now at page 730, Mr. Lunn.

Q After going through another several steps in the analysis, he says:

> If global warming can be stopped before a critical stage is reached, the Fraser River system will eventually settle into a new regime of production. However, on the basis of present evidence, it seems doubtful that the new regime would involve substantial commercial production of salmon. Indeed, it seems more likely that many Fraser River sockeye populations will be extirpated, and those that remain will be in a tenuous position.

So, Dr. Welch, can you shed hopeful perspectives on that statement?
DR. WELCH: Unfortunately no. I agree with him completely.
Q Dr. Beamish?
DR. BEAMISH: The only issue here is the time frame and that's relevant, but taken at face value, that statement is fine. But the time frame is extremely important and that's missing here.
Q Dr. McKinnell, as I understand it, weather effects have contributed to the 2009 problems with Fraser River sockeye salmon, that it's the subject of Technical Report 4; is that correct?
DR. McKINNELL: No, I would use the word "climate", not weather, because climate is the average of weather and this was an average over a period of time.
Q So it follows, then, that unusual climate conditions affected 2009 sockeye salmon, the abundance of it; is that correct?
DR. McKINNELL: It created the conditions that could potentially affect their mortality.
Q But don't we know that something did affect their mortality?
DR. McKINNELL: Yes.
Q And your evidence is that the warm surface layer, the low salinity, the heated-up water, the fact that the fish used up more energy when the water is warm and that the mixed lawyer wasn't as deep as with the low salinity all contributed to the 2009 failure; isn't that correct?
DR. McKINNELL: They were conditions that could have caused the 2009 failure, yes. But nobody saw the fish die.
MR. PROWSE: All right. Apparently I was going to ask about the volcano, but I'll have to leave that for somebody else, Mr. Commissioner. Thank you.
MS. BAKER: The next counsel is Alan Blair.
MR. BLAIR: Mr. Commissioner, for the record, Alan Blair, counsel for the B.C. Salmon Farmers Association, and assisting me is Shane Hopkins-Utter.

CROSS-EXAMINATION BY MR. BLAIR:

Q Gentlemen, I'm going to try to, to start with, pick up where counsel for Canada, Mr. Timberg, started this morning when he put a proposition to

the three of you really asking you to comment on the evidence that some of you had given yesterday. If I was a scorekeeper at a baseball game, I'd say he got two out of three. Dr. Welch managed to slip away and didn't maybe answer the question as directly as I'd like to come back to (sic), so I'll come back to you, Dr. Welch, and there's a warning.

But just to set the scene for what I'm getting at is yesterday we heard evidence from Dr. Beamish, and I'm going to summarize it and I'll invite Dr. Beamish to correct me if I'm wrong. Then I'm going to summarize some evidence that I think I heard from Dr. McKinnell and I'll invite him to correct me if my summary is wrong.

My point of this exercise - and I wish to draw Dr. Welch in as well if we can - is to find the consensus or agreement around some basic facts, because, of course, Mr. Commissioner's job is to find some consensus around some basic facts and ultimately make some recommendations to deal with this issue that we're all examining.

Much of the tenor of the discussion that I've been listening to for the last day and a half now is three very highly qualified men who, in aggregate, must have 400 years of experience, given the number of scientific publications you've all authored and co-authored, but to try to help those of us who are not scientists understand where you agree. So here's my basic premise:

Yesterday I heard Dr. Beamish indicate that, in his work -- in particular I'm referring to the summer of 2007. In his work in the summer of 2007, but also drawing upon his experience from doing field work, trawls through the Strait of Georgia. He sampled fish and across a wide spectrum of species, herring as well as a number of different species of salmon. He found fish with empty bellies. He found fish that were stressed from lack of food, and not only from the empty bellies, but he gave some evidence yesterday about some other indicia he saw when he examined the fish closely.

Now, that summary - I'll invite Dr. Beamish in a moment to correct me if I have that general proposition wrong - wasn't, as I heard it, contradicted by either of the other two members of

the panel.

I'm going to jump now to the other part of my premise. Dr. McKinnell, both yesterday and then I thought very well again this morning, when Mr. Timberg asked the question, gave his evidence again about the effect in the Queen Charlotte Strait and Queen Charlotte Sound, and yesterday, Dr. McKinnell, you used two words, "chemical" and "physical", observations that you made in that area sort of northeast, I guess, east of the north end of Vancouver Island in the areas that I referred to.

Of course, you notably didn't say "biological" in part of that answer. You may recall, but you were giving evidence with respect to the chemical and physical properties that you observed.

My premise to the three of you is that I don't think anything that I heard Dr. McKinnell say yesterday was contradicted by Dr. Beamish, and I didn't think I heard anything that Dr. Beamish said yesterday with respect to his trawls in the Strait of Georgia was contradicted by Dr. McKinnell. I just want to know whether the three of you all agree with those basic premises; that is, that Dr. Beamish's evidence around fish with empty bellies in the Strait of Georgia was a sign of some issues with respect to food and that they were stressed. Dr. Beamish, have I caught the nub of your 2007 trawls? They were hungry fish, stressed by that event?

DR. BEAMISH: I like the term "hungry fish" better than "empty bellies", but more or less, yes.

Q All right. And, Dr. McKinnell, did I capture the essence of your summary when you said, showing that exhibit with the three red dots showing those three points of latitude and longitude, and the summary we had you explain again this morning, warm water not really conducive to young migrating salmon, that you were discussing the chemical and physical properties of that water? Did I summarize that? Today, you used the example that it was an extreme event.

DR. McKINNELL: The only nature in which chemistry came to play was if we consider salt, which is the salinity issue, so, yeah.

Q It was mostly physical properties you were

speaking of?
DR. McKINNELL: Yes.
Q You did use the word "chemical" and "physical" yesterday. You might recall that?
DR. McKINNELL: That's probably true, but the chemical is salt.
Q All right. So my question for all of you is do you all agree -- is there any reason to disagree with your learned colleagues to your left and right on those premises? In other words, I see them as not competing theories. I'm not asking you which most likely caused a reduction of fish, just that do you accept the expertise of your colleagues on the panel and find no conflict in those basic conclusions?

I think -- I'm going to get back to you, Dr. Welch, because I think Mr. Timberg got you most of the way there. I think I heard Dr. Beamish say, yes, I accept that summary of Dr. McKinnell, and I think I heard Dr. McKinnell this morning saying, yes, I understand what Dr. Beamish said and I don't quarrel with that assessment. So firstly, the doctors on the two bookends, is that fair? Dr. McKinnell, you don't quarrel with the conclusion reached by Dr. Beamish about his Strait of Georgia trawl?

DR. McKINNELL: That's a rather broad question, and I would like a specific point raised where I could give a yes or no answer.
Q Okay. Dr. Beamish's evidence is that the fish that he tested didn't have enough food in them, that they were strained and stressed as a result of that. That was his evidence as I understand it. You've no reason to question that?
DR. McKINNELL: I think that's an inference.
Q Well, he --
DR. McKINNELL: No measures of the energy density in the fish, the actual amount of energy that these fish had, were ever made.
Q Well, let me come back to Dr. Beamish, because this is a panel, and I intend to, at least at the beginning, to treat you as a panel and we're going to have some -- I think on CBC radio, they call it the bare-knuckle round, but we'll try to do it with gloves on.

Dr. Beamish, maybe we're splitting hairs, but the fish that you looked at that you were

concerned about the state of the -- the physical state of those fish and the amount of food that they appeared to you not to have been able to consume, correct?

DR. BEAMISH: The fish were small. Where we measured condition, it was abnormally low, and yeah, so that is -- and chinook and coho had the highest percentage of empty stomachs in there, for coho, chinook, except for one year. So you combine those three things and the interpretation is exactly what you said, is that they were stressed in terms of their ability to grow normally. So I agree with you.

Q Dr. McKinnell?

DR. McKINNELL: In the Thomson et al paper, the authors report the average weights of juvenile sockeye salmon in the Strait of Georgia. The average weight in 2007 was no different than the average weight in 2008. The 2008 return was a record return and the 2007 return was very poor survival.

Q Okay. Dr. McKinnell, I'll put the question harder. Maybe we are getting close to a bare-knuckle round. Are you suggesting that the premise that Dr. Beamish entered yesterday, and just again summarized very succinctly now is wrong?

DR. McKINNELL: No, he suggested that the average lengths were smallest in 2007, and larger in 2008. I'm just pointing out that if you use a different measure of size, there was no difference between 2007 and 2008, and I don't know the reason for this discrepancy.

Q You've read his reports?

DR. McKINNELL: I'm sorry, this was Dr. Thomson's report.

Q I'm sorry, you're aware of the conclusions that Dr. Beamish reached as a result of his trawl work in 2007?

DR. McKINNELL: Yes.

Q And you're aware that he predicted, I think in February of 2008, that 2009 would likely be an extremely low return for sockeye?

DR. McKINNELL: Yes, we've already discussed his prediction skill.

Q Well, he was absolutely right in that regard, wasn't he?

DR. McKINNELL: And absolutely wrong in two other

years.
Q Okay, but he was absolutely right in terms of what observations he made in 2007, predicting in 2008 the poor results in 2009 for Fraser River sockeye, correct?
DR. McKINNELL: Yes. Yes.
Q And the premise for that prediction in February of 2008 was the work he's told the Commission about yesterday and today, and we all heard it and you were here. So do you agree that -- you're not disagreeing with his conclusion that was based on his work. You're not in a better position to form any better conclusions about what observations he made in the Strait of Georgia, are you, sir?
DR. McKINNELL: Perhaps we should take a little bit of time to discuss how much opportunity the people working on Chapter 4 had to examine these data.
Q There's a reason I think why we have three people on a panel, and we have three of you here for all of yesterday and all of today and part of tomorrow.
DR. McKINNELL: Yes.
Q Together you're all recognized experts, and I'm not trying to find conflict. I'm trying to find out whether three intelligent people can show the wisdom of acknowledging the wisdom of the people on the panel.

Are you all just diametrically opposed to solving this? Because from the lay person's perspective, it looks to me this way: That the fish that Dr. Beamish saw in the summer of '07 in the Strait of Georgia were hungry and stressed, and they went into, unacceptably for fish migration purposes, hot water, when you gave your chemical description of the observations that you analyzed, and that's a one-two punch that maybe many species of salmon, but in particular Fraser River sockeye salmon outbound in 2007, had a tough time in the Strait of Georgia and a tough time up in Johnstone -- sorry, up in Queen Charlotte Sound and Queen Charlotte Strait. Is that a premise that's difficult for the three of you to agree to?
DR. McKINNELL: I think it's an inference that Dr. Beamish chose to make from the observations he had made.
Q And I'm asking you is that a fair and reasonable inference?

DR. McKINNELL: It's a possible -- I mean, I'm not going to say yes. I'm saying that it is a possibility.

Q You have no evidence to confound that premise or thesis, that opinion.

DR. McKINNELL: Well, other than what I've mentioned is that the fish that came out in 2008 were the same size as the ones that were there in 2007 at the same time of year, so --

Q But you didn't do any competing studies similar to Dr. Beamish's in the Strait of Georgia 2007.

DR. McKINNELL: No, I took these data from his report.

Q Dr. Welch, this morning when Mr. Timberg asked you a similar kind of question to what I've just put to your two colleagues, your answer -- I think it was perhaps just a lack of communication -- but you immediately went to research that should be done as opposed to what I took to be a desire to have a question answered about what do you think about the conclusions of the gentlemen to your left and right. And so I don't want you to talk about research that should be done. I want you to look at Dr. Beamish and say, "Yeah, I mean, he's been around for 100 years and he's done this work in Strait of Georgia for a long time and I respect that he's in a position to draw the conclusions that he's given, and I don't have any reason to disagree with him."

Then you can turn to your left and look at Dr. McKinnell, and I want to know whether you can say the same thing.

DR. WELCH: Well, I'll disagree with two things. I don't think Dr. Beamish has been around for 100 years, and we can take the data that's been selected and each of us, as human beings, take pieces of the data and make different inferences from the same ingredients.

The Strait of Georgia survey is done in July. It was primarily focused on coho, and most of the sockeye had disappeared by the time the survey occurs. So there's a question about the residual less than one percent of the sockeye that's there as to how relevant they are for inferring survival for the group as a whole.

The broader issue that I take issue with is not Dr. Beamish's excellent data, but the inference that we know that the survival problem,

with very high likelihood, happened in the Strait of Georgia. The reason for that's a policy issue, that if you make that decision and conclude that it happened, then you would focus all of your work in the Strait of Georgia to better understand those issues in the future. That's not reasonable given the data.

In fact, over the last year or so, you've seen a backing off from that position that was summarized in the PSC report from June of 2010 which characterized the Strait of Georgia as being the primary location.

We now see Dr. McKinnell's report showing the same types of anomalous conditions, or highly anomalous conditions happening to the area to the north. So we now have a situation where I don't think it's appropriate to conclude that we can say where the survival problem happens. We know a lot of things went -- "wrong" is the wrong -- isn't quite the right terminology, but a lot of things were in extreme conditions in 2007. But to infer where the fish died and caused the crisis that we see in 2009 and brought us all here, is not appropriate, in my opinion, to draw from these pieces of data.

Dr. McKinnell's point that -- Dr. Beamish and Dr. McKinnell can both be correct. Dr. Beamish has said that the length of these fish was very small in 2007 from his survey, and Dr. McKinnell can point to Dr. Beamish's own survey and say that his weight data shows that the average weight hadn't changed, apparently.

So these are highly qualified people, as you say, that can still come with different syntheses out of the same sets of data.

Q I'll put the question differently to you, then, Dr. Welch. Dr. Beamish has given evidence which suggests that the outgoing 2007 Fraser River sockeye salmon were stressed, by his observations and field work. You acknowledge that's what he says?

DR. WELCH: Yes.

Q And you acknowledge that if his conclusion is correct, that could be a significant cause of the decline of the returns for 2009; could be.

DR. WELCH: With the greatest respect to my friend and colleague to my right, Dr. Beamish, I don't agree

with the conclusion that you can draw that conclusion from data collected in July, when the vast majority of the fish had already left.

It's a valiant effort to take the data and make it applicable to the sockeye issue. But just as people appropriately raise questions about the applicability of the fish that we've tagged with acoustic tags which didn't show a survival problem, the same thing is true of a survey that happened after more than 99 percent of the smolts had left. The same types of questions arise as a result.

Q So what about Dr. McKinnell's suggestion that the observations he was referred to yesterday and again this morning, where he described the physical conditions and the chemical condition of the water being an extreme event. Is that a likely cause, a possible cause, to use the same language?

DR. WELCH: It's a likely cause.

Q Is it a likely cause, and Dr. Beamish is not a likely cause?

DR. WELCH: Both are likely causes.

Q Both are likely causes?

DR. WELCH: Yeah. Likely contributors. And then the question is how much weight would be assign to each of those in contributing to the overall decline and survival that was observed in 2009 when the adults returned?

Q Dr. Welch, I'll stick with you just for a second because you said something just a few moments ago which was interesting to me. You said that it's difficult, from the information that we have, to know what caused the fish to die or even when the fish died, correct?

DR. WELCH: Correct.

Q You did, however, and perhaps in subsequent drafting you corrected yourself, but you did draw the inference from your own post studies that your submission -- and submissions to the Commission, Project 10 -- or, rather, I should say in -- you were the first witness or the second witness early on, so I can't recall what exhibit it was that you entered. But your conclusion was that your post studies showed that there was a mortality of fish, but the mortality didn't show immediately after passing through fish farms, but probably developed

several weeks later; paraphrasing generally what you said. Do you recall generally saying that?
DR. WELCH: Yes. After passing out of Queen Charlotte Strait, we were quite careful not to raise anything about fish farms explicitly.
Q Well, you did say "did not die immediately after passing through fish farms", but in fact the reality is you have no idea whether the fish died after they passed the array at the north end of Vancouver Island, correct?
DR. WELCH: That's correct.
Q So the last time you had a signal on the fish that passed was when they went over the array, and then when they came back two years later.
DR. WELCH: Correct.
Q How many came back?
DR. WELCH: One percent. Two of the 200 fish.
Q Right. Right. So you can't conclude that they died immediately or that they died at any time in close proximity to their migration path up the coast.
DR. WELCH: Correct.
Q And so also to say that a survival problem probably developed several weeks later is also complete conjecture?
DR. WELCH: Well, I suspect that my written reports probably said "at least", but I'd have to review my documents.
Q But the reality is you really can't put any time parameter at all on their demise.
DR. WELCH: No, we report the results for the times in the life history that we have.
Q So, then, to summarize, there's absolutely no evidence from your post studies which suggest any disease transfer from a fish farm. You have no data or reference on that in your study?
DR. WELCH: The key points that we made is that seven-eighths of the total mortality happened after - for the fish that we had tagged - happened after they passed Queen Charlotte Strait and the detection sub-array that we had up there.
Q In other words, at some point after they left the north end of Vancouver Island, 70 of the fish died, but whether they died in a month or 16 months, you have no idea.
DR. WELCH: Correct.
Q Whether they were eaten by another fish or

succumbed to ocean pressure of some kind, you have no idea.

DR. WELCH: All of those probably apply to some degree.

Q Do your transponders still work when they're on an outbound salmon that's been eaten by another fish?

DR. WELCH: Yes.

Q So some of the successful outbound migrations could in fact be quite dead fish inside the stomach of a larger fish or other predator.

DR. WELCH: Well, to quote Leviticus, all things must come to pass, counsellor, so you'd expect the tags to stay in the predator for a few days and then be evacuated.

Q Well, I certainly won't try to disturb those findings.

You examined the issue of straying, I believe, or at least you're familiar with the term?

DR. WELCH: Yes.

Q And for those of us who are learning so many terms, including those things which shall pass, "stray" means that not all fish return to their natal streams?

DR. WELCH: Correct.

Q And so, indeed, some of the fish that you tagged, it is entirely possible that they may have strayed and not come back to their natal streams?

DR. WELCH: That would be extremely unlikely because DNA analyses don't indicate significant amounts of straying between streams of any of the species of salmon.

Q Straying was discussed as far back as at least the 1970s as a concern in trying to monitor what escapement should be permitted?

DR. WELCH: Yes, but they're talking about levels on the order of one percent or less of what would come back, and in practice, it must be much less than that.

Q Dr. Beamish, I'm going to provide a summary of some points that I think I have understood in this technical evidence, and maybe it's only of assistance to me, but I hope it's of some assistance to the Commissioner. If I get any of these summary points wrong, please correct me. None of you seem shy about that, and that's good.

Dr. Beamish, you concluded that the marine environment inside and outside of the Strait of

Georgia has been changing with warmer surface waters, lower discharges, change in timing of peak flows, changing wind patterns, plankton bloom timing, salinity and perhaps other changes as well. You've made those observations over the years?

DR. BEAMISH: In a general way, but not specific for -- did you mention plankton?

Q I did.

DR. BEAMISH: Yeah, we don't really have measurements on that. So without dealing with exactly the specific items, in general the concept that we have seen changes in the Strait of Georgia is correct.

Q And it's been your conclusion that changes to the marine environment can result in less favourable conditions for Fraser River sockeye, but perhaps in some cases, more favourable conditions for other species of salmon?

DR. BEAMISH: Yeah, that's a very interesting point. Let's just take a minute there, okay, because when you're dealing with 2007 ocean entry, our point was that everything responded to the events that caused extremely poor growth and survival. So, to some extent, my colleagues can argue that we may not have all the measurements we need for sockeye, that's true. That may -- is true. But what we're looking at is everything, every single thing, almost every thing, 98 percent of the fish are responding to this extreme anomaly.

We have the physical evidence for it and we have the biological evidence in terms of the growth and survival. We don't have the food measurements of the prey, but that's why the sockeye issue is -- that's why we use it, is because, yes, we don't have as many measurements for sockeye as we do for the other species - herring in particular maybe - but everything is responding that way.

So if you look at it in another way, let's say that they're not stressed, okay? Then that meant that these little salmon had absolutely no stress, they were just behaving normally, and I argue that they spend less time in Queen Charlotte Sound, so these fish that are not stressed then enter Queen Charlotte Sound and all of a sudden they become stressed and die. To me, that makes

no sense.
I'm not sure I answered your question.
MR. BLAIR: Mr. Lunn, I'm going to direct the witnesses to B.C. Salmon Farmers Tab number 3.
Q Dr. Beamish, this question is for you. This is a document prepared by yourself as one of the authors together with others.
DR. BEAMISH: Yes, it is.
Q And, in part, it concludes that you believe that the long-term declining trends and the abundance of several salmon species, including sockeye, since the early 1990s, and the increased production of pink and chum salmon, indicates that the decline of the sockeye salmon production is a consequence of general changes to the dynamics of the Strait of Georgia ecosystem. Is that a fair summary?
DR. BEAMISH: Yes.
Q Or part of that.
DR. BEAMISH: Could you just go down a little bit and we'll see what -- a bit more. Yes, that's it. You might have noticed that's draft number 20.
Q All right. There's a final, is there, after draft 20?
DR. BEAMISH: Yeah, the final is the four papers that we submitted to the Commission.
Q All right. In any event, my conclusion -- or, rather, the summary of the conclusion is stated in your four papers?
DR. BEAMISH: Yeah.
MR. BLAIR: Mr. Lunn, could we see B.C. Farmers Tab 4?
Q Dr. Beamish, this article refers, in part, to a conclusion that you and others have reached, that you believe the poor returns of 2009 were determined before the juveniles left the Strait. Is that a fair summary of this?
DR. BEAMISH: Just can you help me and tell me where this document came from?
Q I cannot, other than --
DR. BEAMISH: It has my name on it, but maybe -- do you know where it came from?
Q No, I'm sorry, Dr. Beamish, I just see your name is together with others. Obviously penned over Pacific Biological Station.
MR. TIMBERG: Mr. Commissioner, the only information I have is at the bottom of the document there's a stamp which indicates where -- whose computer it

came from. So it looks like it's from Terry Davis who's in Communications at DFO, and then it says [as read]:

> Fraser River sockeye judicial inquiry documents for consideration for Commission.

I'm not sure what that means, to tell you the truth.

DR. BEAMISH: Well, it's a little bit academic to know where it came from. I guess I don't need to know that. But it more or less summarizes what I think. Not "more or less"; it summarizes what I think. I just don't remember writing that, that's all, in that format.

MR. BLAIR: I wonder if we could mark it as the next exhibit, Mr. Registrar.

THE REGISTRAR: Exhibit 1321.

> EXHIBIT 1321: Document entitled, "A possible reason for the poor returns of sockeye salmon to the Fraser River in 2009

MR. BLAIR: Could we go to Salmon Farm Tab 8, please.

Q Dr. Beamish, this is a question for you. Firstly, are you familiar with this document?

DR. BEAMISH: That one I am.

Q Can you take a stab at summarizing what it stands for, please?

DR. BEAMISH: Well --

Q If it assists you, I could direct you to --

DR. BEAMISH: This is a paper that Dr. Noakes published and this was probably given at a North Pacific Anadromous Fish Commission symposium, and then it was published in what we call "Bulletin 2". So it's a peer-reviewed document. The peer review is a little easier than it is for major journals, but it is still peer-reviewed. The abstract identifies what the content is.

Q Dr. Beamish, if it assists you, perhaps we can direct you to page number 7.

MR. BLAIR: Mr. Lunn?

Q And in particular there's a passage at page 7 dealing with the ecological consequences of enhancement.

DR. BEAMISH: Well, the issue here, and some other papers that we were writing about, was dealing

with the hatchery/wild interactions. This topic is an issue that is a substantial issue in fishery science, the hatchery and wild interactions. It applies to a variety of species, pink salmon, chum salmon, chinook and coho. There's an extensive literature on the potential interactions.

I've participated in the debate, if you want, and my interpretation is that there is evidence of hatchery and wild interactions amongst the various species, but in terms of the long-term harm that might be caused, and "harm" being defined as maybe a substantial reduction in production or something, in terms of the long-term harm, that is less clear amongst the scientific community.

So in this paper - and I'm doing this from memory - is this is one of our contributions to that overall debate, if you want, on hatchery and wild interactions.

MR. BLAIR: And if we could mark this as the next exhibit, please?

THE REGISTRAR: Exhibit 1322.

EXHIBIT 1322: Document titled, "Changing the Balance: Interactions Between Hatchery and Wild Pacific Coho Salmon in the Presence of Regime Shifts"

MR. BLAIR:

Q And I just want to follow along, Dr. Beamish, on the theme of the impact of hatcheries.

MR. BLAIR: Mr. Lunn, if we could go to our Tab 2.

Q Do you recognize this document, Dr. Beamish?

DR. BEAMISH: Yes, I do. Now I do, yeah. It took me a minute.

MR. BLAIR: Could we, Mr. Lunn, please go to page 15, the bottom left-hand column, page 15.

Q You see the paragraph that starts, "Disease in hatchery fish is not uncommon...".

DR. BEAMISH: Yes.

Q Down about four lines, the document says:

We also suspect that a great many cases of disease are not reported or investigated because the hatchery fish do not [exist] exhibit clinical signs of disease (or hatchery staff may not recognize the clinical signs of disease) despite one or more disease

pathogens being present.

You see that?
DR. BEAMISH: Yes.
Q Can you expand on what you mean by that?
DR. BEAMISH: No, not much beyond that. The issue is that there is evidence that disease an occur in hatcheries and that's that statement there.
MR. BLAIR: Could it be marked as the next exhibit, please?
THE REGISTRAR: Exhibit 1323.

EXHIBIT 1323: Early Marine Survival of Coho Salmon in the Strait of Georgia Declines to Very Low Levels

MR. BLAIR: Salmon Farmers Tab 9, please.
Q Dr. Beamish, take a moment, if you need to, to acquaint yourself with this document. Do you recall being the co-author of this?
MR. BEAMISH: I think this is a book chapter that just came out; isn't that correct?
Q Yes, 2011.
DR. BEAMISH: Yeah.
Q The questions that I have here really are with respect to the carrying capacity of the North Pacific. You've alluded to it - in fact other members of the panel as well - the issue is that in this work with Dr. Noakes, you helped to explain the effect of the carrying capacity of the North Pacific and the rapid expansion of salmon production facilities around the North Pacific and that they are related to the carrying capacity of the North Pacific?
MR. BEAMISH: It's a little more complicated than that, but more or less what you said is correct, yes.
Q Yes. So if we have Fraser River sockeye going out into the North Pacific and they are competing actively with the enhanced salmon production in Russia or Alaska or other parts of the North Pacific, it can have an impact on all of the species. They're inter-related, the food and the ocean and those types of issues.
DR. BEAMISH: There is a potential that - and particularly for chum salmon that are enhanced in Asia - there is that potential that our pink salmon, say, in Alaska, could have an impact on

Fraser River sockeye, say in the Gulf of Alaska, yes.

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

THE REGISTRAR: Exhibit 1324.

EXHIBIT 1324: Document titled, "Shifting the Balance: Towards Sustainable Salmon Populations and Fisheries of the Future"

MR. BLAIR: B.C. Tab 7, please.

Q This question is for you, Dr. Welch. You're listed there as a co-author with a number of others?

DR. WELCH: Yes, I am.

Q You recognize the document?

DR. WELCH: I do.

Q The title is pretty descriptive, "Recent Salmon Declines: A Result of Lost Feeding Opportunities Due to Bad Timing?" Is that all we need to know?

DR. WELCH: Well, the question mark speaks about how well we, as scientists, can actually answer the question for you.

Q So can you explain this document in simple language to us folks?

DR. WELCH: The key issue is that there may be a change in the timing of the plankton relative to the time that the salmon smolts come out and so survival of those smolts may change depending on the feeding opportunities because of those shifts.

Q And as it relates to -- perhaps you can explain how it relates to post-release survival of hatchery fish, the question of timing and food.

DR. WELCH: Well, the premise is that if they go out in periods of higher productivity, more food, that survival is better.

Q And the summary of that premise, that because of the warming water, plankton bloom food production can occur earlier and therefore perhaps there ought to be adjustments to the timing of the release of hatchery fish?

DR. WELCH: I think I'll quote from the second sentence of the abstract.

> Species and stocks [of salmon] that leave natal streams earlier may be favoured over late migrating fish.

Because there's evidence that associated with the warming that we're seeing in the North Pacific and the adjacent rivers that the plankton blooms are coming earlier.

Q And is it your experience, then, sir, that if the plankton blooms are coming earlier, those species of fish that migrate out of the river systems and up the coast demonstrate better survival rates because of that, or is that still unknown?

DR. WELCH: That's still unknown. We'd have to specifically measure the survival of early emigrants versus later emigrants, and that really hasn't been done.

Q Is that, the way I've described it, an active theory of some people that perhaps --

DR. WELCH: Very active.

Q And as it relates to hatchery, then it suggests to me that you might also then time the release of your hatchery fish to release them earlier as well since you can control that?

DR. WELCH: Yes.

MR. BLAIR: A moment, please. I wonder if the one we have on the screen could be marked as the next exhibit, please.

THE REGISTRAR: Exhibit 1325.

EXHIBIT 1325: Document titled "Recent Salmon Declines: A Result of Lost Feeding Opportunities Due to Bad Timing?"

MR. BLAIR: And if we could go to Commission Tab number 22, please, Mr. Lunn, and to the next page.

Q Dr. Welch, are you familiar with this document?

DR. WELCH: Yes, I am.

Q Thank you. In part, this document describes in detail some of the points that have been made by the panel earlier, in the last day or so, about zooplankton and the effect of cooler water and warmer water; is that correct? It covers that issue?

DR. WELCH: It reports it, yes.

Q Yes. And again, for the lay people in the room, cool water can produce zooplankton which have higher energy values than warm water?

DR. WELCH: Correct. For salmon, yes.

Q I simplified it and I got it right. Dr. McKinnell, any correction on it?

DR. McKINNELL: No, no.
MR. BLAIR: Excellent. Making progress. If we stay here till the end of the year, Mr. Commissioner -- I'm thinking back to my preparation for this panel and I saw an article written in the *Nanaimo News*, September of last year, where they predicted the Commission would end its work December 31st, and indeed it might. Just a year late.
Q The point of taking you, Dr. Welch, to this, and to the Commissioner, is that the issue of food and food values, cooler water can produce a benefit to the fish that we heard from Dr. McKinnell, that they will use less energy themselves than when they're in warm water migrating. Dr. Welch, you agree?
DR. WELCH: Correct.
Q And also the quality of the food of the zooplankton is higher from a caloritic (sic) perspective?
DR. WELCH: Correct.
Q So a double whammy if you have warm water.
DR. WELCH: Yes.
Q Fish need more energy and the food they're eating doesn't have as much energy.
DR. WELCH: That's the general principle that we go under as a scientific group. We're still working on the linkages to understand it better, but that's certainly the general premise.
MR. BLAIR: Thank you. Could that be marked as the next exhibit?
THE REGISTRAR: Exhibit 1326.

EXHIBIT 1326: Document titled, "State of the Pacific Ocean 2009"

MR. BLAIR: Just a moment, please. Mr. Lunn, could we go to Commission Tab 23, please?
Q This question really is for all three of you. Firstly, are you familiar with the document generally, all of you? No one's saying no?
DR. WELCH: Yes, I am.
Q Thank you. I'll start with you, Dr. Welch. You recall yesterday - and I'm not going to ask the registrar to put it up on the screen just now - but recall yesterday the temperature gradient charts that Dr. McKinnell spoke to, and in particular, the difference between the summer of

'07 and the summer of '08, and that the summer of '07 was hotter, warmer water against the coast Dr. McKinnell recalls. I'm sure that -- nodding.

So the question here is that in this article, it does seem to identify that there is cooler water on the west coast of Vancouver Island - in other words, not the anomaly that Dr. McKinnell spoke of at the northeast part of Vancouver Island where we had the extreme high temperatures as was evidenced in the other figure, but this document supports the premise that there were records of cooler water along the west coast of Vancouver Island.

Now, are you gentlemen familiar both with that as a fact and that this paper covers that fact?

MS. BAKER: This is a very long document with a number of research papers attached. I wonder if you could take them to the paper.

MR. BLAIR: Yes, I'll try.

DR. WELCH: To be clear, which year are we referring to?

MR. BLAIR: If I could just have a second, please? I'm sorry, the question, Dr. Welch?

DR. WELCH: The question which calendar year are we referring to when you're talking about colder water?

MR. BLAIR: 2007.

DR. WELCH: The document in front of us here, CSAS 2010-053 refers to 2009. It will not be referring to the prior years of data in a specific sense.

MR. BLAIR: I do have a quote. I'm must trying to find the quote. Page 139, please.

We can't find it, I'm sorry. I wonder if we could mark the document as an exhibit and we'll try to find another time to direct the panel or subsequent panel to the right page.

THE REGISTRAR: Exhibit 1327.

EXHIBIT 1327: CSAS Document, " State of physical, biological, and selected fishery resources of Pacific Canadian marine ecosystems in 2009"

MR. BLAIR: Thank you. I have no further questions. It's like a race. We're done. Thank you.

MS. BAKER: Mr. Commissioner, the next questioner is

Mr. McDade. I don't know if you want him to start after the afternoon break or start now.

THE COMMISSIONER: Yes, maybe it might be more convenient just to take the break now.

(PROCEEDINGS ADJOURNED FOR AFTERNOON RECESS)
(PROCEEDINGS RECONVENED)

THE REGISTRAR: The hearing is now resumed.

MR. McDADE: My name is Gregory McDade, and I am counsel for Dr. Morton and the Aquaculture Coalition, and I'll have a few questions for you.

CROSS-EXAMINATION BY MR. McDADE:

Q Let me start first with you, Dr. Beamish, and with the papers that you've submitted. Could I first have Exhibit 1303 on the screen, the "Anomalous ocean conditions" paper that you wrote along with Dr. Thomson and others. And as I understood from your evidence yesterday, you formed the conclusion, either before 2009 returns were in or very shortly thereafter, that there was a problem with prey abundance in the Strait of Georgia. And you then went and recruited Dr. Thomson to try and answer the question of why. Is that fair enough?

DR. BEAMISH: Yes.

Q You said you called him up and said "If you can't figure out what's going on in the Strait of Georgia, that you don't think the taxpayers are getting their money," and you said he accepted the challenge that you put to him. That was your evidence yesterday.

DR. BEAMISH: I was kidding Dr. Thomson, but that's what -- essentially what I said, yes.

Q So in fairness to Dr. Thomson, his focus on the Strait of Georgia and on finding anomalous conditions, and then focusing primarily on the 2007, 2008 and 2009 year were because of your request.

DR. BEAMISH: Yes, that's true.

Q But you had, before getting any of this wind and salinity and his MLD modelling done, you had already formed the conclusion that the prey abundance was the issue.

DR. BEAMISH: The issue was that we were observing this synchrony in response, okay, and it was developing

at that time. Had I already concluded that it was prey abundance? It was -- it was a possibility. I don't think I would say that I had finalized the conclusion, no.

Q But that's what you asked Dr. Thomson to go and find the reasons for, isn't it?

DR. BEAMISH: No. I asked Dr. Thomson to take a look at what was happening in terms of the physical conditions in the Strait of Georgia. And in other words, in particular, I asked him if he would take a look at winds. That's how we started out, because he has better wind data than we could get through the looking at wind information that would come, say, from -- either from Vancouver or from Victoria Airport.

Q Well, maybe it would just help if I put up an email on the screen, an email chain that you were involved in. It's Conservation Coalition document number 8. It's an email dated May 3rd. That's an email chain between you and Dr. Thomson. Do you recognize that?

DR. BEAMISH: That was probably it.

Q Yes. And if we could go to the second page of that document. Yes, that large paragraph here is an answer from Dr. Thomson to you saying [as read]:

> I like your attempt to bring in the winds, but I think your interpretation is not correct. It didn't make sense to me that 2007 would have such a thin MLD and strong winds. That's impossible --

- he says -

> -- irrespective of river runoff.

So what's he saying there?

DR. BEAMISH: Well, I have a rule, I'm not sure whether I mentioned, I thought I might have yesterday, and that is when Dr. Thomson and I disagree on something, my rule is that he's right. This was at the beginning of looking at what the physical conditions were within the Strait of Georgia. So we had looked at winds as we would be able to get them, as I said, from Vancouver Airport or Victoria Airport, but we knew that he had winds

that were measured within the Strait of Georgia, and that's what this email most likely reports. In other words, he's saying that he doesn't agree that what I was exploring, and in terms of winds, is right, that it had to be something else. That's how I interpret that.

Q Well, if you see the interchange just below this, if we could just go down the page a bit. So what provoked this is you had actually written this report, or a draft of it, and you'd sent it on to him for comment; is that right?

DR. BEAMISH: Now, I'm not 100 percent sure what that refers to. It says "Sockeye report". What's the date on that, can you see?

Q It's April 30th of 2010.

DR. BEAMISH: April the 30th, 2010. January, February, March, April, that's -- it's obviously I sent him a report. That was -- the reason I'm hesitating a little bit is that I wasn't necessarily back at work at this time. All right? January, February, March, April. That's -- I can't exactly remember when I returned to work. Obviously I sent it from somewhere, but -- yeah, I'd sent him something, and but whether I was back at work fulltime or not, I'm not sure.

Q All I'm suggesting here, there's nothing special I'm suggesting, it's that he was commenting on a report you sent him that had something in it about strong winds, and he corrected you and said that couldn't happen.

DR. BEAMISH: That's -- either it was in the report or it was in a discussion, yes, that's more or less correct. Yes.

Q And if we can go back to the top of the first page, it says [as read]:

> Dick, I'm working up the Strait of Georgia winds for you. I think they were very weak in 2007 in spring. But we need to look at wind components, not just strength. Strong winds normally deepen the mixed layer depth.

And he signs it:

> Your fan, Rick.

So what was taking place in this time period is

that the facts were that absolutely 180 degrees to what you thought they were, you thought there were strong winds that caused this, and in fact he comes back to you and says, no, actually, the winds were weak. That's a fair interpretation, isn't it?

DR. BEAMISH: Let me just think about what we're talking about here. The -- what we were looking at was a -- we suspected that there had to be an issue with the prey production, and this could be -- it could be freshwater, and it could be -- it could be winds. One of the reasons that I was exploring the possibility of winds was because of the strong winds in the -- in Stanley Park essentially, and but it didn't necessarily have to be winds. I just wanted to make sure that we had an appreciation of what the winds were. I don't think it's correct to say that we had come to a conclusion at this time about what caused -- what was the physical change or changes that caused the poor growth and survival of the fish.

Q Well, obviously prior to April 30th you had a proposed model that depended on strong winds that you felt explained that lack of prey production; isn't that right?

DR. BEAMISH: No, I don't -- I don't think that we -- I mean, it sounds like you're suggesting that we looked at one parameter and said that's the reason for all this to happen. I think the answer is that we were looking at winds and looking to see whether what the winds were. And I agree that if you read this, if they were strong winds, there's an issue there. All right? But we had to make -- I had to be sure that we had a reasonable appreciation of what the physical conditions were in the winter and spring of 2007, and that's what we were exploring with this -- with this email.

And I was also getting caught up on some scientific issues that I had been away from for some months. And I think, it's hard to go back exactly to May, but that's what was happening. I basically stopped doing everything for over two months, and it's about this time that I was beginning to -- well, I'll be honest with you, I was beginning to see whether I was going to be able to come back to work.

Q Well, all I'm trying to establish is the process,

the scientific process. What I think I understand here is that you had come up with the idea of poor prey abundance first, and then you were trying to establish a model that would be consistent with your data that would confirm that.

DR. BEAMISH: I can only keep answering the question the same way. I mean, this could have been a disease, right? This could have been some catastrophic event that was unprecedented. And I used to say to people, "You know, maybe it's aliens." Now, obviously, I don't believe it's aliens, but the point is that something very anomalous was happening and we were trying to understand what it was. Winds was one of the components that we were looking at, and Dr. Thomson was a colleague who had very good wind data.

Q All right. So can I come back to the report, Exhibit 1303. So as I understand it, Dr. Thomson is responsible for this portion of the report dealing with the wind and the physical components, but the biological parts are yours; is that fair? Table 1 and Table 2 of this document come from your trawl data?

DR. BEAMISH: Sorry, what's the -- where am I here?

Q So let me just take you to Table 1 and Table 2. Table --

DR. BEAMISH: Yeah, I know what Table 1 and Table 2 are, and Table 1 and Table 2 are a combination of data that Dr. Trudel and myself collected.

Q All right. And so Dr. Thomson depended on that.

DR. BEAMISH: Dr. Thomson incorporated our information into the report, yes.

Q So could we go back to page 11. This section of the report, you'll see the heading there, "Average catches of juveniles...in the trawl surveys", that section of the report would have been yours, not Dr. Thomson's?

DR. BEAMISH: That's right, yes.

Q And over on page 13, the next section, "Size of juvenile sockeye...in the trawl catches", that was your section, not Dr. --

DR. BEAMISH: That's right, yes. Well, that's our section, meaning Dr. Trudel and myself.

Q Yes.

DR. BEAMISH: He's an author and he participated in producing this document.

Q If we go forward to page 21, the "Discussion" portion that starts there relating to the comparisons between years of the trawl surveys and the conclusion that appears at the bottom of that paragraph:

> ...it does appear that the early marine survival in the Strait of Georgia was substantially greater in 2008 than in 2007, resulting in larger catches in the Strait of Georgia and in Queen Charlotte Sound...

That's your data that produced that?

DR. BEAMISH: Yes.

Q And the next section on the next page, "What was unusual about juvenile fish...", that's your data?

DR. BEAMISH: Yes. Yes, it is.

Q And if we go -- that discussion goes forward to -- right to page 29, that's all basically you're responsible for that portion of the report.

DR. BEAMISH: If you'll just scroll down and we'll see -- hang on. Most likely, yes. I'm reading it quickly, but most likely that's true.

Q Now, the model that Dr. Thomson was responsible, which is the wind and salinity and the MLD, the mixed layer depth, is simply a theory to support the idea that it might have affected prey abundance, right?

DR. BEAMISH: I'm sorry, say that again? I'm just unclear what you're saying.

Q I'm suggesting to you that the data combined by Dr. Thomson around wind, salinity, and mixed layer depth produces a theory that could affect prey abundance.

DR. BEAMISH: Yes, that's correct. Yes.

Q It's really just a model.

DR. BEAMISH: Yes, it's a type of model. Yes.

Q It's a type of qualitative model --

DR. BEAMISH: Yes. Yes.

Q -- as opposed to a statistical one.

DR. BEAMISH: Yes.

Q And it's an untested model.

DR. BEAMISH: Untested in what way?

Q Well, there's never been any experimental testing of it?

DR. BEAMISH: I'm not sure how to answer that. I can't think of how we would experimentally test that

kind of a model, to be honest with you.
Q All right. There's no peer review of that particular model?
DR. BEAMISH: Oh, that's -- okay, I understand that. Certainly this material has not gone through a peer review.
Q And it's only been used for this particular circumstance. It's not been applied to a number of other years to see if it holds true.
DR. BEAMISH: Are we talking about the mixed layer depth calculation?
Q Yes.
DR. BEAMISH: You know, it's too bad that -- it's better that Dr. Thomson answer that, but I'm going to tell you that I understand that he's published, I think, several papers on it, so the concept has passed peer review. And so his approach to making that determination has been peer reviewed and published.
Q The connection to prey abundance and in particular any connection to the prey abundance for -- and survival of sockeye salmon, that is merely speculative, isn't it?
DR. BEAMISH: Yes, that's true.
Q There is --
DR. BEAMISH: The connection, it's speculation and I think we - I hope we did - we made that clear, that what we have is the physical conditions that normally would lead to this -- to poor prey production, and then we at the other end of that scenario, if you want, we then look at the biological conditions which we talked about yesterday, and of course the -- you've heard this several times now, that overall synchrony in that response, all right, indicated to us that there was something biological happening that was unprecedented.
Q Yeah. No, but my connection is specifically with sockeye salmon. Other than your trawl data that you put in the paper there's no evidence that this model has any impact on sockeye salmon at all, is there?
DR. BEAMISH: No, no. The information on the mixing layer depth is information that -- and the other calculations, or the contributions of Dr. Thomson's is material just like you heard about in Queen Charlotte Sound from Dr. McKinnell, where

they looked at the physical conditions, and by comparing those with normal conditions, they would identify that -- they would come to the conclusions that these were extremely anomalous. That's what Dr. Thomson and his colleagues did for this paper. They identified extremely anomalous conditions that normally would lead to poor production. That's what their contribution was.

Q But you've gone one step further in this paper. You added the trawl data and the catch for 2007 as if it had some relevance to establishing the credibility of that model. Was that a fair statement?

DR. BEAMISH: Well, not that it establishes the credibility of the model. That would be established through a different process. That would be what I just reported, that the credibility of the model is determined when he publishes it. What we did was to show in this paper, and in the other paper, that these physical changes were associated with what I keep saying is unprecedented synchrony in the response of juvenile salmon and herring in the Strait of Georgia, and the connection between the two, had we had some ability to measure the productivity of the prey that would have produced, of course, that would have been other evidence that would have been useful. We don't have that. So we have either side of the explanation.

Q Well, you had available to you Dr. Peña's evidence that the plankton was relatively similar in this year than in other years. You chose not to use that.

DR. BEAMISH: No, she didn't say that. All right? That's -- as a matter of fact, if you look at this report, I can't quite remember what page it's on, maybe page 17, there is -- there is some issue on plankton. And what we identified was that there was the possibility that there could have been some production, plankton production very early in the year, but that plankton production was not sustained through the period that the juvenile salmon would be entering the Strait of Georgia. And I can't remember exactly where that is. It's too bad that Dr. Thomson isn't here to talk about that, but that's in this paper.

Q But there's no plankton trawl that year.

DR. BEAMISH: That's true. There's no plankton information available.
Q No direct evidence of prey abundance.
DR. BEAMISH: That's true. Yes.
Q And if I could go to Exhibit 1309, if we could go to page 46. Now, that was the -- you were referred to that yesterday, this is the chart from your paper that refers to percentage of empty stomachs. For sockeye you'd agree with me that the percentage was relatively consistent with other years.
DR. BEAMISH: Yeah, and we also reported that in general those sample sizes are pretty small.
Q So that's what I understood you to do yesterday. You took this fact that sockeye apparently has absolutely normal stomach contents and you dismissed your own finding by saying the sample size was too small. Is that fair?
DR. BEAMISH: You'll have to explain to me what my own finding was.
Q Well, wouldn't you say the finding is that the stomach contents are normal?
DR. BEAMISH: But remember that what we were again --
Q Well, just answer that question, yes or no.
DR. BEAMISH: I can't answer it yes or no. You'll have to --
Q Try.
DR. BEAMISH: You'll have to ask it in a different way, then.
Q Okay, well --
DR. BEAMISH: You're asking me to say yes or no to something that says "my finding", when I'm trying to tell you that my finding was different than what you're suggesting, and you're not allowing me to explain what my finding is.
Q Well, let me ask you this. What do you mean by the sample size is too small to draw conclusions from?
DR. BEAMISH: Well, it's very small, all right? And if you look at the sample sizes of chinook and coho, all right, you'll see that they are larger.
Q So is it fair to say that --
DR. BEAMISH: And -- hang on, hang on, hang on, you have to let me answer.
Q I have a limited time here.
DR. BEAMISH: Well then, then go to someone else then, if you won't let me answer.

Q Go ahead, answer the question.
DR. BEAMISH: To allow me --
Q Can you explain why the sample size is smaller?
DR. BEAMISH: Yes, you see, the issue is this, that when we looked at the message in these papers is that the response to -- of the fish in the surface waters in the Strait of Georgia is unprecedented. We don't have all of the data that we want for all of the species throughout the timeframe that we're looking at these fish. So the key information that indicates that prey production was restricted, okay, or reduced, and I think anomalously low, unique, if you want, comes from these data that you're looking at now. And the sample sizes there are good.

And you're looking at an indication that coho and chinook, over this time series, synchronously showed a very high percentage of empty stomachs, along with all of the other information that we provided, we interpreted this to indicate that there was an issue with prey production. Also you saw this morning the diet of chinook salmon and you saw that herring were virtually absent from the diet. That all indicates that the normal prey of juvenile salmon in the Strait of Georgia in 2007 was basically minimal, or there was clearly a problem with these fish, these juvenile salmon finding prey. That's what the data show.

Q Sorry, maybe I've been mistaken, but I understood that sockeye didn't eat herring. Their diet's quite different than chinook, isn't it?
DR. BEAMISH: That's true. Sockeye don't eat herring, but chinook do, neither -- and coho don't eat a lot of herring, either. But in aggregate, when you're looking at the four species of salmon plus herring, and of course herring don't -- well, they might eat a little bit, but all right. When you look at that, and look at the synchrony of that response, that was our interpretation that this was an issue with them trying to find food.
Q But the fact that sockeye eat different food and their stomach contents are not remarkable, you say can be dismissed because the sample size is so small for sockeye, isn't that right?
DR. BEAMISH: No. I'm saying that the sample size that we had was small, and we have diet, by the way, of what they were eating, but when you have sample

size of 50 or 60 fish, I'm reluctant to draw too many conclusions about that. We --
Q It wouldn't be responsible --
DR. BEAMISH: Excuse me. We produced it because, you know, people looking at this, like yourself, you need to be able to see what these other species were doing. And we identify that a small number of salmon, of sockeye salmon were looked at, and that's what we found. But I'm not drawing many conclusions from that. I am saying that the small sample of them, they were small in size, and we also reported that they were small in size in the Queen Charlotte Sound.
Q Well, why is the sample size of 65 fish too small to rely upon for stomach contents, but big enough to rely upon for the length?
DR. BEAMISH: Well, it's the same issue. The lengths that we're using in 2007, we accept that that's small. I'm reporting to you or reporting in this paper, that those small samples that we had, had a small size. The sample size that is in Queen Charlotte Sound is a little bit bigger. It's not much bigger actually, but a little bit bigger. But still it's useful to know that they were -- they were small.
Q It would be irresponsible to draw conclusions from a sample size that small, wouldn't it?
DR. BEAMISH: Would it be irresponsible? It would not be something that I would do as a scientist to be a -- to draw major conclusions from that, that's true. I'm not so sure "responsible" is the right word.
Q Well, if you did that in the paper, that would be bad science, wouldn't it?
DR. BEAMISH: Pardon?
Q To the extent you --
DR. BEAMISH: No, I think if you, for example, if you look at some of Dr. Welch's and others, even Dr. McKinnell's, some of his drafts, the sample sizes are extremely small. We have these small sample sizes sometimes and we can't do much about it. So we report them, and, you know, they are what they are. People look at them and they know that it's a small sample size and the fish are small, and that's information to my colleagues, other scientists can get some information from that, and that's why those are reported.

Q Well, let's go to Table 2 of the first paper, Exhibit 1303, if we could. Now, in that table, you report the length of juvenile salmon as 107.9 millimetres in 2007 and 110.9 in 2008, right?
DR. BEAMISH: Yes, it looks like that.
Q And on that 3-millimetre difference you draw -- you say that's a significant difference?
DR. BEAMISH: I don't know. Is that what it said?
Q Well, the word "significant" appears in the last line of the description of the table, just above the table, "significantly smaller".
DR. BEAMISH: If it says that, I can't really see it there, but we would have done a test on them. But if -- I can't see where it says that, but if you've looked at it, then it must --
Q There were --
DR. BEAMISH:

> Lengths for fish caught in the Strait of Georgia, Queen Charlotte Sound, and Hecate Strait...were significant smaller than those caught in 2008 and 2009.

What I'm puzzling over is whether that's the aggregate of those lengths. In other words, it's not -- I just can't remember that exactly, in other words, when we took all of the lengths to compare to the lengths in the other years.
Q Well, so would you agree with me, regardless of what it says in the table, that the 65 fish caught in 2007 were too small a sample to draw that conclusion in comparison to 2008?
DR. BEAMISH: Well, I just told that I'm not quite clear what that conclusion refers to, and that --
Q That they were smaller in 2007 in the Strait of Georgia than in 2008. You had too small a sample size to say that, didn't you.
DR. BEAMISH: To say that they were smaller in -- I'm not sure that we actually said that. I don't remember saying that they were smaller in 2007 than 2008, because I recall that they weren't.
Q All right. So --
DR. BEAMISH: All right? So I would have to take some time to check the paper. But just from memory, I don't think that they were significantly smaller.
Q So as far as you're concerned now, it's reasonable to say the fish in 2007 and 2008 were the same

size?
DR. BEAMISH: In terms of length and weight?
Q Yes.
DR. BEAMISH: Yeah, they were similar in size. I wouldn't say the same, but I think it's fair to say they were similar, yes.
Q Can I take you to -- can we go to Table 5 of the other report?
DR. BEAMISH: While you're saying that, I know you have restricted time. Well, okay, never mind, I'll -- all right.
Q So I'd like to take you back to your synchronous report, to Table 5, which is at page 34. Now, Dr. Beamish, I understand this table is produced from exactly the same trawl data as the Table 1 in the first report.
DR. BEAMISH: You'll have to tell me what -- remind me what Table 1 was.
Q Well, Table 1 and 2, which we've just looked at, were the --
DR. BEAMISH: Well, this is trawl data for the Strait of Georgia.
Q Right.
DR. BEAMISH: Okay? That's true.
Q But if we take the sockeye portion and we go under 2007, so that's four chunks of data down.
DR. BEAMISH: Yes.
Q And third-last row.
DR. BEAMISH: I've got it. Yes.
Q We see 107.9.
DR. BEAMISH: Yes.
Q And 65 fish.
DR. BEAMISH: Yes.
Q If we go to 2008 we see 106 as length and 11.9 as weight, right?
DR. BEAMISH: Yes.
Q So it's clear that whether or not the difference is significant, 2008 fish were smaller than 2007.
DR. BEAMISH: Well, there's -- I thought we just agreed that they were similar in size. Isn't that what we just agreed a minute ago, you and I?
Q They're similar in size.
DR. BEAMISH: Well, that's what we agreed, you and I agreed to that, just a minute ago.
Q So you couldn't draw the conclusion that the fish in 2007 were smaller than the fish in 2008.
DR. BEAMISH: We just agreed to that. Yes.

Q Right. So --
DR. BEAMISH: But I will point out one thing, all right? I know this is taking time away from you, but the difference in 2008 and 2007 is also the abundance, all right? Is that the number of juvenile sockeye in the Strait of Georgia in 2008 was extremely large. And you get into this issue of -- and there was huge numbers of pink salmon, all right? So you're dealing with this - I know, I realize for these proceedings it's hard to get into all the details - but you're dealing with a very different situation in the Strait of Georgia ecosystems. You're dealing with large abundances of these juvenile salmon, including pink and sockeye. And so those large abundances themselves can influence growth, as well as restricted prey production.

Sorry for taking a little bit of time, but that's important.
Q Well, I thought -- when I started here, I thought your thesis was based on the fact that in -- based on the trawl data the fish you caught in 2007 were fewer in number and smaller in size. Now I seem to be incorrect about that. You agree they weren't smaller in size?
DR. BEAMISH: Than what?
Q Than 2008.
DR. BEAMISH: That's agreed. I agree that they're similar in size.
Q So now you want to say you drew some conclusions about 2007 and 2008 because they were fewer in number.
DR. BEAMISH: No, I said that -- well, that's partly true. But what I'm saying is that I'm trying to make the point that when you -- that the size in 2008 that they were smaller, the sockeye were smaller, is in part, I think, a result of the large abundances of lots more juvenile fish in the Strait of Georgia, and that hasn't come out yet. And now I'm telling everyone that in 2008 there were large abundances of pink salmon. Remember that in 2009 we got almost a record return of pink. These juveniles are all in the Strait of Georgia and they're all feeding at the same time.
Q Well, let me ask --
DR. BEAMISH: So that small size could -- could also be related to this density effect that you've heard

about.
Q So the reason the fish were smaller in 2008 is because there were more other fish; is that right?
DR. BEAMISH: No, we don't know that for sure. I suspect that that's -- I don't know that for sure. I suspect that that is related to it, yes.
Q Okay. Well, let's go to the abundance. The only evidence you have about abundance is the fact that 65 fish were caught in the trawl in 2007 and something over 1,000 were caught in 2008. That's the only data point you have from which you're drawing that conclusion, right?
DR. BEAMISH: Well, we don't actually use abundance in this paper. I'm pretty sure it's not in there. I do have abundance estimates. But they haven't -- I haven't talked about those yet.
Q Well, it would be completely inappropriate, would it not, to draw any kind of conclusions about abundance based on the trawl in July of 2007.
DR. BEAMISH: Absolutely not. It would be -- you could draw -- I can make abundance estimates. I'll tell you what they are. They're around 200,000 fish for 2007. I'm just doing it from memory. We've made those abundance estimates.
Q You're saying that it's appropriate to do an abundance estimate on sockeye based on a trawl that takes place from July 8th to July 15th.
DR. BEAMISH: I'm telling you that when -- even with that small sample size we can make an abundance estimate, yes, we can. The confidence limits are extremely large but scientifically we can make an abundance estimate. I have an abundance estimate. I don't want to use it for the reasons that you're suggesting, but I can make it. I can put confidence limits on it.

And someone here estimated that was about one percent of the surviving fish in 2007 in that early July period, and that's probably true. But that also means that of the 500 million or 450 million that were produced in the Fraser system, only 20, 25 million were -- approximately, were alive at that time. And these are very rough estimates that we didn't put into these documents because it's sort of information that you want to be careful about, if you're going to, you know, if you're going to draw important conclusions from.

But, no, I can produce abundance estimates

from this.
Q Wasn't the whole trawl survey designed for coho, designed for species that you thought were resident.
DR. BEAMISH: You'll have to explain that.
Q Well, I'll come back to that. Let me bring up a document on the screen.
DR. BEAMISH: Yes.
Q A document that I believe you wrote, Dr. Beamish. Aquaculture number 7.
MR. LUNN: (Indiscernible - away from microphone).
MR. McDADE: Aquaculture 7, Beamish, 2001, Persistence. Yes.
Q This is your document, Dr. Beamish?
DR. BEAMISH: Yes.
Q Can we go to page 5?
DR. BEAMISH: Well, just first of all, this is -- remember what kind of document this is, right? These are documents that we submit when we meet at the North Pacific Anadromous Fish Commission, all right? These are documents that report to our colleagues what work we have done that year. So, yes, these are documents that are available to the public, but these aren't peer reviewed documents. These are the equivalent of progress reports, just so that everybody knows what this is.
Q Page 5, please. I want to take you to the last sentence in the first paragraph:

> Larger numbers of juvenile sockeye were caught in 2001...than in 2000..., however, we do not believe that the June/July survey is a measure of relative abundance among years as most juvenile sockeye leave the Strait...before July.

That's your own words, isn't it?
DR. BEAMISH: Well, that's what we wrote at that time, when I, whatever the date was for that, okay? But here's the issue, all right? I just want to make sure I read it correctly here. I'm trying to -- that's for June and July, right?
MR. McDADE: Can I just have that document marked as an exhibit while the witness is reading.
THE REGISTRAR: Exhibit 1328.

EXHIBIT 1328: Beamish et al, Persistence of the improved productivity of 2000 in the Strait of Georgia, British Columbia, Canada, through to 2001, October 2001

DR. BEAMISH: Okay. So remember that I just told you that we can make abundance estimates. Now, this was a while ago that we wrote this, and these are progress reports. But what this is saying is that these are abundance estimates. Now, are they available -- I'm sorry, are they usable among years? As we accumulated more information on this, I began to change my interpretation of this, all right? And you have evidence of that when Dr. McKinnell and other people comment on our report where we say that, look, we think the returns in 2009 are going to be very poor. And people, I think, fairly say, "Well, you are fishing the tail end of the survey and how do you know that that's representative of the population?" The answer to that is, well, we don't really know. We will only know after we accumulate enough information and see whether those predictions are usable. And they require, you know, a continuous data series.

So at the time that we wrote that, yes, that's probably the way I was thinking. However, by the time I get to 2007 and '08 and '09 I'm beginning to think that there's at least a possibility that those abundance estimates are usable. All right? And we did present that graph that indicates that they might be usable in our document that we submitted.

MR. McDADE:

Q You agree that the --

MR. TIMBERG: Mr. Commissioner, I note the time.

THE COMMISSIONER: The time, yes. We're going to have to take our adjournment now. Thank you.

THE REGISTRAR: The hearing is now adjourned and will resume again tomorrow morning at 9:00 a.m.

(PROCEEDINGS ADJOURNED TO JULY 8, 2011 AT 9:00 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.

_____

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

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