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:

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Federal Courthouse
701 West Georgia Street
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Friday, July 8, 2011

Tenue à :

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

le vendredi 8 juillet 2011

Errata for the Transcript of Hearings on July 8, 2011

Page	Line	Error	Correction
vii 9	Exhibit 1332 46	dated September 4, 2010	September 10, 2004
vii and 95	line 28	Exhibit 1351 is marked incorrectly as “Submission 0179 by Dr. Parsons”	Irvine and Arkenhead, Unpublished Results re Chilko Sockeye, June 2011 [DFO & Ladysmith Institue]
6	7	must marked	just marked
9	32	Grade McNeill	Grande McNeill
23	44	bellow	below
30	17	DR. BEAMISH	DR. WELCH
33	42	DR. MCKINNELL	DR. WELCH
34	9	DR. WELCH	DR. MCKINNELL
44	31	DR. BEAMISH	MR. LEADEM
106	47	NPSC	NPAFC
107	4	NPSC	NPAFC
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Suite 2800, PO Box 11530, 650 West Georgia Street, Vancouver, BC V6B 4N7
Tel: 604 658 3600 Toll-free Tel: 1 877 658 2808
Fax: 604 658 3644 Toll-free Fax: 1 877 658 2809
www.cohencommission.ca

APPEARANCES / COMPARUTIONS

Brian Wallace, Q.C. Wendy Baker, Q.C. Lara Tessaro Maia Tsurumi	Senior Commission Counsel Associate Commission Counsel Junior Commission Counsel Junior Commission Counsel
Tim Timberg Geneva Grande-McNeill	Government of Canada ("CAN")
Clifton Prowse, Q.C. Heidi Hughes	Province of British Columbia ("BCPROV")
No appearance	Pacific Salmon Commission ("PSC")
No appearance	B.C. Public Service Alliance of Canada Union of Environment Workers B.C. ("BCPSAC")
No appearance	Rio Tinto Alcan Inc. ("RTAI")
Alan Blair Shane Hopkins-Utter	B.C. Salmon Farmers Association ("BCSFA")
No appearance	Seafood Producers Association of B.C. ("SPABC")
Gregory McDade, Q.C.	Aquaculture Coalition: Alexandra Morton; Raincoast Research Society; Pacific Coast Wild Salmon Society ("AQUA")
Tim Leadem, Q.C.	Conservation Coalition: Coastal Alliance for Aquaculture Reform Fraser Riverkeeper Society; Georgia Strait Alliance; Raincoast Conservation Foundation; Watershed Watch Salmon Society; Mr. Otto Langer; David Suzuki Foundation ("CONSERV")
Don Rosenbloom	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 Leah Pence 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")

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Vancouver, B.C./Vancouver
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July 8, 2011/le 8 juillet 2011

THE REGISTRAR: The hearing is now resumed.

JOHN DAVIS, recalled.

MR. WALLACE: Good morning, Commissioner Cohen. For the record, Brian Wallace, Commission Counsel, and Lara Tessaro is with me. This morning first thing we want to just clean up some unfinished business arising from documents that were produced with respect to the Cultus Lake ***SARA*** list issue late in the day, and we felt it would be unfair to require people to deal with them in the short notice. So we've asked Dr. Davis to return to allow us to introduce five documents and put a very limited number of questions to him.

We have an hour for this purpose. I will take, I think, about half that, but perhaps a bit less, I hope, to put the documents to Dr. Davis. And I have had indications from counsel for three participants that they have some questions they wish to ask, as well, and that would be from Canada, the Conservation Coalition and from the First Nations Coalition. I see Mr. McDade is here, as well, and Mr. Blair. I'm not sure if they have -- I see heads shaking. So I think that we're onside for time.

EXAMINATION IN CHIEF BY MR. WALLACE:

Q If I may, Dr. Davis, you have been affirmed to tell the truth in this proceeding and that affirmation is still in play, correct?

A Thank you, that's correct.

Q I would just note for the record that of the five documents that we received and circulated earlier, three have redactions for solicitor-client privilege on them, four have redactions for solicitor-client privilege, and so we circulated yesterday versions of those which note expressly on them that that is the basis for the redactions in them.

First, Dr. Davis, if I could ask you to go to Tab 1 of the documents in front of you. This is a

document entitled "March 26, 2005 Deck for Briefing the Minister of the Environment". Can you briefly describe for the Commissioner, please, what this document is?

A This document is a compendium of information that came from Pacific Region associated with the emergency listing request for Sakinaw and Cultus Lake sockeye. It would have been compiled in the Region, and then further compiled in Ottawa, and it was a deck that was used by Assistant Deputy Minister David Bevan and myself to brief the Minister of Environment.

Q And the two of you had a personal briefing with Minister Anderson on it?

A That's correct.

MR. WALLACE: Thank you. May I ask, Mr. Registrar, please to have the deck marked as the next exhibit.

THE REGISTRAR: That will be Exhibit number 1329.

EXHIBIT 1329: March 26, 2005 Deck for Briefing the Minister of the Environment, ***SARA*** Emergency Listing Request: An Approach for the Recovery and Rebuilding of Sakinaw Lake and Cultus Lake Sockeye Salmon, Minister of the Environment, March 25, 2004

MR. WALLACE: Thank you.

Q Just for the record, I think we have the provenance of that document, Mr. Commissioner, so I won't take the witness to the documents that were electronically associated with it. We now know what it was prepared for and how it was introduced and that it was used in the briefing of the Minister.

So moving on, if I could take you to page 23, I just have a couple of questions on this document. Page 23 of the exhibit, on the left-hand column under "Options", the base case was compared with three options for achieving harvesting options, I would describe them, with particular results being sought in terms of returning spawners. And Option 2 is to manage the fishery to achieve 250 spawners, that was described as "more restrictive", and with an escapement rate of 10 to 12 percent. And the third option is to manage to achieve a smaller

number:

> ...100 spawners --

- which is then in parentheses referred to as -

> -- (quasi-extinction) or more, with a high probability.

And that was described as "restrictive" with an escapement rate of 15 to 20 percent.

Can you advise the Commissioner, please, what the expression "quasi-extinction" means and whose advice was that based on?

A Just one correction first, Mr. Wallace. It's not escapement rate, it's "exploitation rate".

Q I'm sorry.

A It's easy to mix those --

Q That's a very significant difference.

A -- easy to mix those up. Yes.

Q Thank you very much.

A Yeah, exactly. Right.

Q It's the exploitation rate of 10 to 12 percent.

A Yeah, in terms of...

Q Thank you.

A And the quasi-extinction was associated with coming down to a very low number of spawners that the 100 spawners repeated over four years would be close to the level of extinction. You wouldn't want to go below that number of spawners. I've seen sufficient to maintain the population.

Q Yeah. And whose advice was that determination?

A I couldn't name names specifically, but that, I believe, is coming from the scientists and from the fisheries managers in Pacific Region as part of their assessment work that led to this documentation.

Q Thank you. And at page 25 of the document there seems to be a page dealing that's entitled "Timing of Cod". Everything else in the memorandum relates to Pacific salmon. Can you -- and sockeye, in particular. Can you advise why the juxtaposition of a page about cod?

A We always dealt with batches of species advice that came forward from COSEWIC. So COSEWIC being the group that provided the assessments that went to government recommending classifications of

listing decisions associated with ***SARA*** species. So cod was one of the species coming forward through the process. So that's in there just to remind the Minister what's going on with respect to the cod issue, too.

Q So this was simply a matter of process, these are other things that you will also be considering?

A Correct. And throughout all the different briefings on ***SARA***, it was usually batches of species coming forward.

Q Thank you. If I may take you now, Dr. Davis, please, to Tab 2 in the book. This is a Memorandum for the Minister dated August the 27th, 2004. Have you had an opportunity to review this memorandum?

A Yes, I have.

Q And you do not appear to be included as having been copied in it. Did you have any involvement in this?

A It's curious I'm not on the signoff documentation in this, but I either saw it or would have seen it after the fact, and I'm not unfamiliar with the content. This, it could have been I was away on the day or two when that was prepared, or something like that.

Q Yes. Looking at the people at the end of the document indicated as having received copies, we have Dr. Watson-Wright, she was the ADM of Science?

A That's correct.

Q And Ms. --

A Huard.

Q -- Huard, who was the ADM of Policy?

A Policy, right.

Q And Ms. Kirby, ADM of Habitat?

A That's correct, and Oceans, Habitat and Oceans.

Q Habitat and Oceans.

A yes.

Q And you at that time were Special Advisor on ***SARA***?

A I was, and so I was heading up the group that coordinated the process.

MR. WALLACE: I wonder, Mr. Registrar, if this could be marked, please, as the next exhibit.

THE REGISTRAR: Exhibit 1330.

EXHIBIT 1330: Memorandum for the Minister re ***SARA*** Legal Listing Decision - Cultus and Sakinaw Lake Sockeye (Information Only) dated August 27, 2004

MR. WALLACE:
Q Now, do you agree with the substance of this Memorandum for the Minister on providing information on the ***SARA*** listing decision?
A It's certainly consistent with the information and the advice that was going forward to the Minister, yes.
Q Page 1 of the memo says in the "Summary" box:

> A decision on whether to recommend that Cultus and Sakinaw sockeye should be listed or not listed under the ***Species at Risk Act*** (***SARA***) must be made over the next two weeks.

And it goes on to say at the bottom of the box, just below the redaction that:

> A briefing note with the department's recommendations will be provided within the next week.

Do you know whether such a document was produced?
A I think it's the other document that you have in this set that we're looking at.
Q Okay. And that will be Tab 4?
A Sorry, was that a question?
Q Yes.
A Oh, yes.
MR. WALLACE: Thank you. Perhaps then it would be convenient then to mark Tab 4 as the next exhibit.
THE REGISTRAR: Exhibit 1331.

EXHIBIT 1331: Memorandum for the Minister, ***SARA*** Legal Listing Decision - Recommendation for Cultus and Sakinaw Lake Sockeye (Decision Sought) dated September 13, 2004

MR. WALLACE:
Q Just for the record, this is described as "Memorandum for the Minister, ***SARA*** Legal Listing Decision - Recommendation for Cultus and Sakinaw Lake Sockeye" dated September 13, 2004.

A My tabs are different from yours, Mr. Wallace, so that's why I hesitated there, so...
Q Oh, I see. Okay. But that is the document to which you were referring?
A That's correct.
Q Thank you. Going back to the previous exhibit we must marked, Exhibit 1330, I wonder if I could just ask you to address a question on page 4, Dr. Davis. It says just below in the bullet, just below the redacted portion:

> The department is of the view that protection of these small populations under ***SARA*** is unacceptable both in terms of socio-economic dislocation and the limited genetic impact. This position may raise opposition from Environment Canada and other agencies.

When you testified in May, on May 30th, you agreed or you testified that DFO agreed with the COSEWIC assessment, which was itself based on advice provided by DFO scientists. Do you recall that?
A Yes, I do.
Q And yet here DFO officials in Ottawa appear to be giving advice which suggest the opposite, I would say, of the COSEWIC advice, about the limited genetic impact. Can you explain that difference?
A I think the portion of the sentence that had the greatest weight in terms of all of the discussion was the socioeconomic side of it. The genetic impact deals with the relatively small populations, relative to all the other salmon biodiversity associated with the Fraser runs.
Q And on the socioeconomic part, I'm curious that on page 3 of the Exhibit 1330, just on the first bullet of "Next Steps" it says:

> Further analysis is being finalized on the socioeconomic impacts of listing for both populations.

Yet in the third bullet of the same set it has the conclusion that protection of the small population is unacceptable. is there -- do you see a contradiction between those two bullets?
A I don't see a contradiction, *per se*, but I believe this bullet that you're referring to does inform

the Minister that in fact more work was going on to further develop the socioeconomic impacts, and in fact there are other documents that have been part of the evidence we've looked at that pertain to further work that went on in the fall of 2004 on socioeconomic impacts.

Q With respect to your comment that the more important piece of this was the socioeconomics, and essentially there was less emphasis put on the biodiversity because of the size of the population, would you agree that that analysis is inconsistent with the way Strategy 4 of the WSP would require such an analysis to be done?

A That's a very interesting point, and in fact here we're dealing with advice to a Minister in terms of impacts on a large number of Canadians, and also the other aspect of an important responsibility, a vital responsibility of the Department, which is protection of the resource and biodiversity. And I think that's what the Wild Salmon Policy is all about, and I really do think those are the kinds of decisions that this Commission will have to grapple with, with respect to how you set the bar on implementing WSP. And I would like to address that a bit more later this morning if we have an opportunity.

Q We'll come back to that if we may. Let me just get the housekeeping done first.

A Right.

Q Going then to -- I think I made a mistake a moment to ago. I referred to the exhibit we were looking at as Exhibit 1330, and in fact we were at that point looking at --

MR. LUNN: I think that's right.

MR. WALLACE: It was correct?

MR. LUNN: Yes.

MR. WALLACE: Thanks.

Q In comparing Exhibit 1330 with Exhibit 1331, these are two successive memoranda for the Minister, and the first we were looking at, 1330, the one we've just been discussing, was stated to be for "Information Only". The second one, 1331 is described as "Decision Sought". So these two memoranda are of different character. Can you just describe how this -- is this a typical way that decisions are sought from the Minister through a two-step process?

A This was often the way. In fact, it was a multiple step process on Sakinaw and Cultus sockeye. There were a number of different briefings and discussions with the Minister, and between Ministers, as well, this subject would come up in federal-provincial and inter-ministerial meetings. And you'll see in some of this documentation reference to a meeting in Whitehorse in September that where again this would have been discussed. And the Deputy at the time, did like to give the Minister a heads-up on issues, so for information, the first memo, and then come to the decision later. And I think that allowed the Deputy and the Minister to have their own discussions as well, and for the Minister to take into account and think about and explore various issues. So quite a common practice.

Q All right. And it's Exhibit 1331 which was the final document put to the Minister, and which he then signed off on as accepting the advice, right?

A Yes, he did. And you'll notice he signed off quite a bit later, so somehow that was in his in-basket for a while.

Q Thank you. And at page 5 of Exhibit 1331 there's a reference to the meeting I think you just referred, the meeting in Whitehorse on September 16th and 17th. Are you aware of whether this was raised with Minister Dion, the Minister of the Environment at that meeting?

A I believe so. I have difficulty separating multiple ministerial meetings where we went and we discussed ***SARA***, but I suspect it was.

Q So it wouldn't -- if that was the case, then, it wouldn't have been -- it wasn't signed off by the Minister of Fisheries until after that meeting.

A Right. Yeah.

Q Now, consistent with what you said earlier about the relative importance of socioeconomics and the biodiversity issue, in connection with these two subspecies, I notice that the document seeking the advice under the headings, the headings are under "Analysis" and "Comment", "Socioeconomic and Fisheries Impacts of Listing", "Socioeconomic and Fisheries Impacts of Not Listing", "Legal and other Considerations" and "Public Reactions". There is no reference there to biological diversity or the conservation issues, correct?

A I don't believe so, but that doesn't mean that it was not discussed with the Minister through this process.
Q Do you know whether conservation issues were discussed with the Minister?
A We would always discuss that in the briefings with the Minister with respect to here's the biological situation, here's the socioeconomic situation, here's the stakeholder and First Nations perspective, that was key.
Q Yes. If I could take you now to the document which is a deck with the -- headed "***SARA*** and Potential Listing of 16 Aquatic Species including Sakinaw and Cultus Lake Sockeye Stocks, Confidential Draft, 10/09/04". Are you familiar with this document?
A Yes, I am.
Q Can you tell us the genesis of this document and what your involvement in it was?
A This is a draft document that summarizes the information again associated with the listing of Sakinaw and Cultus. It's a fairly detailed document. I'm certainly familiar with the content. I do not know if this exact document that we have before us was the one given to or used in the briefing, but certainly the content of it is familiar and it's likely to be part of the document train that went forward.
Q So this is likely to have been, or something similar provided to Minister Regan --
A Yes.
Q -- in the course of the decision-making?
A And it's quite a big document, and typically we wouldn't go through a deck in that detail in a briefing. It would be a combination of oral and portions of a deck. But packages of information went to the Minister, the Minister's staff and the Minister of Environment.
MR. WALLACE: Thank you. Mr. Registrar, could this be marked, please, as the next exhibit.
THE REGISTRAR: Exhibit number 1332.

EXHIBIT 1332: ***SARA*** and Potential Listing of 16 Aquatic Species including Sakinaw and Cultus Lake Sockeye Stocks, Confidential Draft, dated September 4, 2010

MR. WALLACE: Thank you.
Q Finally, if I could ask you, Dr. Davis, to go to the Memorandum addressed to Paul Macgillivray from the Assistant Deputy Minister, Fisheries Management of September 17, 2004. I note that you are copied on this document. You're familiar with it?
A Yes, I am.
MR. WALLACE: Mr. Registrar, could this be marked as the next exhibit, please.
THE REGISTRAR: Exhibit 1333.

EXHIBIT 1333: Memorandum from D. Bevan, ADM Fisheries Management to P. Macgillivray, RDG Pacific, re Cultus and Sakinaw Sockeye, dated September 17, 2004

MR. WALLACE: Thank you.
Q On this page 1 of the document it starts:

> The departmental recommendation not to list Cultus and Sakinaw sockeye as endangered means that we are charting new waters under ***SARA*** legislation. These could well be the first endangered species not accepted under ***SARA*** due to the socio-economic impacts.

So as at the date of this, September 17th, 2004, I take it the recommendation -- the determination of the recommendation would be made not to list, correct?
A Yes, and that timing is consistent with the notes we've just discussed.
Q But as we've been discussing, some of the events that went into that final decision occurred after this memorandum, correct?
A Right. And this was a recommendation.
Q Yes. And further at page -- page 1 in the first paragraph, it goes on to say:

> While the Act allows for only socio-economic impacts to be considered in the listing decision, DFO needs to go well beyond those economic arguments to carry this forward.

And that's consistent with what you just advised.
A Yes. And it also reflects the concern you were

asking about, about effective management, biodiversity and those sorts of things, and the gist of this memo is really the ADM of Fisheries Management encouraging the region to take further steps.

Q Looking at those suggested further steps, the memo goes on to make reference to the "Wild Salmon Policy" and to "Mitigation" measures, and a fourth issue, "Legal Risks", which has been redacted. Under the "Fisheries Management" head it says in the second or third sentence:

> When an announcement is made regarding the final ***SARA*** decision for these two populations (expected by year-end), we will need to set out a plan for the management of Cultus and Sakinaw sockeye that would be in line with an exploitation rate of 10-12%.

If subsequent years' exploitation rates were higher than that, say, as 20 or 30 percent, what would your reaction be?

A I'd be concerned, because this was based on 10 to 12 percent, which was being put forward in terms of protecting those stocks.

Q And under "Mitigation" on page 2, the memo says:

> With weak stock management, as required by ***SARA***, the WSP, and the precautionary approach, it appears there will be ongoing returns of sockeye stocks to the Fraser River that could be harvested in terminal in-river areas. Economic losses in marine fisheries could be offset or mitigated to some extent by the development of in-river fisheries. While this would be highly controversial, there is no biological reason for denying these opportunities. Both the *Review of the 2002 Fraser River Sockeye Fishery*...and *Socio-Economic Implications of the Species at Risk Act*...note that DFO has not evaluated the potential for more in-river fishing. The 2002 Review also recommended that there should be consultations leading to a policy decision by 2004 on harvesting in more terminal areas.

Did you ever discuss that mitigation measure with Mr. Bevan?
A We did discuss these issues and the fact that the Wild Salmon Policy and dealing with weak stocks was a really important consideration for the region. We were certainly aware that the Wild Salmon Policy document was in preparation, and what we have here is the ADM emphasizing that to the region and saying you need to get on with it, and you need to look into these kinds of more terminal opportunities as part of the approach, recognizing that that is a hugely complex policy shift that affects many people in the industry, First Nations and others all along the B.C. coast.
Q Are you aware whether DFO ever did get on with it and conduct the evaluation consultation that would be required to...
A I'm not aware of the details, but that is a very good thing to explore.
Q So you're not aware of -- are you aware of whether or not any -- any evaluation was done by DFO in more terminal or in-river fisheries?
A I had understood that they were doing some of that work, but I don't know the outcome of that.
Q And you're not aware of any policy decision made based on that evaluation.
A No.
MR. WALLACE: Thank you, Dr. Davis. Mr. Commissioner, those are my questions for Dr. Davis. Mr. Timberg.
MR. TIMBERG: For the record, Tim Timberg and Geneva Grade McNeill for Canada.

CROSS-EXAMINATION BY MR. TIMBERG:

Q Dr. Davis, you just commented that at this time the WSP was being developed. Is it correct that the WSP was finalized in June of 2005?
A I believe so.
Q And you were just asked a question about follow-up to this memo. When did you retire from the Department of Fisheries and Oceans?
A 2007.
Q Thank you. And you said earlier to Mr. Wallace that you would like the opportunity to speak about the implementation of Wild Salmon Policy and this Commission's need to grapple with the decision of

how high to set the bar. I wonder if you'd like to comment on that.

A Thank you. In my earlier testimony I talked at some length about the situation we find ourselves in now. We are dealing with a changing ocean, a changing world, and considerable variability as evidenced by the purpose that this Commission is addressing, with runs that will fluctuate quite wildly. It suggests to me that you have to have a management process that is flexible and capable of being responsive to changing environmental conditions with really good in-season management information that is used to make these type of decisions. Furthermore, with the implementation of the Wild Salmon Policy, that raises many implications that I'm hoping the Commission will explore.

For example, if we set out a whole number of conservation units for small sockeye stocks or other stocks in the fishery, it's going to be quite like the ***SARA*** situation, where in order to protect, to rebuild and to manage these stocks, the same kinds of decisions will come before the Department and before fisheries managers. And that then has all kinds of implications. And what does that mean from the standpoint of how big a commercial, recreational or First Nations fisheries can be. What are the kinds of in-season decisions that have to be made with respect to protecting weak stocks while allowing economic activity to proceed, and while allowing food, social, ceremonial and other benefits to flow from the resource that people are very much concerned with.

So it means to me that one needs to explore this very, very carefully and just where do you set the bar, Mr. Wallace, with respect to protecting weak stocks, and in doing so, what are the implications of that. It could be a very, very different fishery on the West Coast, but one that also has benefits from robust stocks and protecting stocks that are there to provide benefits for the future. And I think it's very much going to boil down to questions about can we get consensus about the tradeoffs that need to be made, can we get the kind of buy-in from the different groups that are involved in the fishery,

so that a longer-term approach can be taken to planning the strengthening the rebuilding and the augmentation of the stocks in the face of uncertainty, and can we have decision rules that in fact allow for flexibility to deal with the coming impacts of climate change, the ups and downs of the stocks, and have them put in place in such a way that in-season everyone knows what is happening and what needs to be done in order to respond to the conditions that are present in that particular cycle.

So I really feel that there's a whole policy context here, and a structural context, and the way the Wild Salmon Policy is going to be implemented, it needs a very thorough look.

MR. TIMBERG: Thank you, Dr. Davis. Those are all my questions.

MR. WALLACE: Thank you. Mr. Leadem.

MR. LEADEM: Leadem, initial T., for the record, Mr. Commissioner.

CROSS-EXAMINATION BY MR. LEADEM:

Q Good morning again, Dr. Davis. It's good to see you back again, and thank you for coming back to answer these questions on these documents that were unearthed.

A Thank you, sir.

Q I'd like to begin by looking at -- I only have five minutes, so I'm going to be very quick, Mr. Commissioner. Document Exhibit 1331, Mr. Lunn, if I could have that pulled up, please, and if we can go to page 4 of that document. I think it's the next page. It's right before the signature block. No, I may have the wrong number, I'm sorry, 1330.

This is the passage that Mr. Wallace referred you to. It actually intrigued me, as well, when I read these words in this Memorandum to the Minister that was signed off by the Deputy. And the words that caught me were "limited genetic impact". And obviously there's going to be tradeoffs, as you alluded to in your evidence, between socioeconomics and the value of preserving the species. Do I have that right?

A Yes.

Q And this is a difficult concept, because in effect what you're doing is effectively putting a price

tag on extinction of a species, are you not?
A You could look at it that way, and I would explain it by saying, and I've talked about setting the bar in a number of ways, one can devise a management approach that protects the weakest stock, in which case you wouldn't have much or any of the fishery. So those are the kinds of difficult tradeoffs and they're very much the kinds of tradeoffs I just alluded to with respect to how you implement the Wild Salmon Policy.
Q And the reason why I focused on the words "limited genetic impact" was precisely because of the reasons that Mr. Wallace pointed out to you, that it seems to run counter to the scientific advice that was being provided to the Department; is that not fair?
A It would appear to run counter to it, and it very much relates to the kinds of discussions that were going on about, well, what is the percentage of the overall Pacific sockeye runs associated with Sakinaw and Cultus, they constitute a small percentage, but it very much does point out that here is an issue with respect to biodiversity protection.
Q And what it also points out to me, if I can go one step further with you, is that there seems to be a disconnect between the scientific advice that is being provided to the Department and the advice that's being provided to the Minister. Because I can't conceive of a scientist who is well grounded in conservation biology and knows of the concepts of biological diversity who is going to say words such as "limited genetic impact". So to me, the message is not getting through. The scientists, the message from the scientists in DFO is not getting through to the Minister. Would you agree with that concept? Am I reading too much into this?
A I think you are in the sense that the Minister was aware that the scientific advice that led to the COSEWIC designation came in fact from departmental scientists in the beginning. They did some of the assessment work that led to the COSEWIC activities. So the Minister is certainly not unaware that there is this advice coming from the Department.
Q So somehow or other the people that put together

the briefing note to the Minister, then, are not making that connection; is that fair?

A I'm not sure what was in their heads when they wrote that, but they're certainly pointing out, and they're not hiding the fact that this is part of the overall complexity of this issue.

Q All right. And one final question on that same paragraph. It goes on to say:

> This position may raise opposition from Environment Canada and other agencies.

And so that points out to me that there's some conflict, then, between Departments within Canada. So that Environment Canada might be the promoter, for example, of ***SARA*** listing, whereas DFO might be saying, well, no, we can't list it. Is that the sort of tradeoffs, or is that the tension that exists between departments in Canada?

A Sometimes there's tension between departments. I think what this is alluding to is that the Minister of Environment in fact is the lead minister for ***SARA*** and consequently would have a position on these sorts of issues.

Q Yes.

A And he's receiving advice from what is called a "competent minister" under the legislation for aquatic species.

Q Who would be DFO Minister.

A DFO Minister.

Q Right. And the other agencies, do you have any knowledge about the other agencies that are alluded to in that paragraph?

A Well, there are other agencies. There was the Parks Canada agency, too, which has an interest in things.

MR. LEADEM: All right, thank you.

MR. WALLACE: Thank you. Ms. Pence.

MS. PENCE: Thank you. Leah Pence for the First Nations Coalition, and with me is Brenda Gaertner.

CROSS-EXAMINATION BY MS. PENCE:

Q Good morning, Dr. Davis. Thanks for being here. Mr. Lunn, if you could please pull up Exhibit 1332, that's the deck that I understand, the draft deck, the contents of which formed the

presentation that was given to the Minister in September of '04. And if you could please go to slide 9, I think it's on page 5 of the document.

Because I understand that a risk analysis was carried out on the decision to list these -- or not to list ultimately these two populations under ***SARA***; is that right?

A Yes.

Q And, Mr. Lunn, if you could forward again, because I think that risk analysis is part of this document. So if you could forward on to page 17. Yes, page 17, and scroll down a little bit. So there we go. We have the "Risk Analysis", and if you could scroll onto the next page then, and I'd like to go to the bottom where there's the table. Great. Just hold it there for a moment.

So Dr. Davis, you'd agree that fisheries managers were wanting to establish some consistency in the decision-making process, given that this was the first important decision under ***SARA*** for the Department; is that right?

A Yes.

Q And part of that internal decision-making process would be establishing the process that DFO would use to assess and weigh risks; is that right?

A Yes. What was going on in one of the Ottawa groups, there was a risk analysis documentation being prepared, and I believe this is an excerpt from a longer document that deals with it, and one in fact that I had in my package of materials for my last testimony.

Q Okay. And I'd also like if we could pull Exhibit 27, because I'm wondering if that risk analysis documentation is also Exhibit 27, which is the Integrated Risk Management Policy. Is that what you referring to, as well?

A No, I don't believe it is. The one I was referring to was one that was prepared by Dr. Bill Doubleday's group in Policy Sector. And this, I'm not sure I've ever seen this document, or if I have, I haven't focused much on it. So this one's new and much broader.

Q Okay, fair enough.

A Yes.

Q If I could go to the last page of that Exhibit 27, though, because I think there's some similarities there. Mr. Davis, you'd agree that the table we

see here that's marked "Risk Tolerance Model" is very similar to the that we see back over on that deck Exhibit 1332 that was used for the Cultus decision.

A Yes, it's arraying impact on a rising scale, going vertically against likelihood on a rising scale going horizontally.

Q Thank you. And it uses kind of a stoplight approach of risk, red, yellow, green.

A Correct.

Q Thank you. So you'd mentioned Bill Doubleday, but who was involved specifically in completing the risk analysis for the Cultus and Sakinaw decisions?

A That one I believe was led by a gentleman called John Lark, and if I recall correctly, which I might be fuzzy on, he was working with the Evaluation and Audit Group.

Q And is that out of the Headquarters Office in Ottawa?

A Yes.

Q Okay. And was anyone else involved in that risk analysis? Was Department of Justice involved in that, as well?

A I don't know. There were probably others, yes.

Q And what about people from Pacific Region?

A My assumption is that in compiling it, you have to have data, and you have to have information. So what they would have done is work with regional staff to look at the different aspects of the risk analysis.

Q Thank you. So we're done with Exhibit 27 now, thank you, Mr. Lunn. If we can go back, then, to the results of the risk assessment, and if you could just scroll up to the previous table, because I just want to make sure I understand what goes into this "Risk analysis process". I'm looking for slide 35. Yes.

So it's really based on two factors, if I'm understanding it right, the likelihood that the harm will occur and then the impact of the harm; is that right?

A Correct, of the two axes of the blocks.

Q Great. And then if we scroll back down - sorry, Mr. Lunn - to slide 36. You were talking about the stoplight approach, and then we've got the numbers, scrolling down, then, the 9, 8, 6 --

sorry, Mr. Lunn, if we could stop at slide 36.
A He's very good at this. I'm impressed.
Q So 9 would be high impact of harm, high likelihood that the harm will occur; is that correct?
A That's correct.
Q And 5 would be medium impact of harm, medium likelihood, and going down.
A Correct.
Q And then if we scroll over, and I'll be patient here, to get to slide 37, please. And slide 37 is where we see the summary of the risk assessment, the results, really; is that right?
A That's correct.
Q And how -- how do you determine these ratings? For example, what gets a 6 versus what gets an 8, what gets a 5, what gets a 9. How is that decision made?
A That's a very good question. It's a qualitative assessment, as I understand it, and it would be -- I mean, how do you -- how do you judge federal-provincial relationships, whether the province is mad at us or not, and it rates a 9 or an 8 or a 7, or something like that, that's I would say, looking at these, this is useful because it arrays all the different considerations. But numerically, I'm not sure from a scientific perspective how you evaluate those numbers.
Q Thank you. And who is it that does that numerical rating, then, is that, like you said, John Lark with the Evaluation Audit Department in Ottawa?
A I believe that's what was going on.
Q Okay.
A But probably in discussion with people to get a general sense of the weighting of it.
Q Thank you. So I'm curious about some of these results, and in particular "A", which is "Minister's Freedom to Act", "B No Recovery", "C Extinction", "D Commercial Fishing", "E" is "Aboriginal Food and Social Fishing", "K", like you said, we've got "Federal-Provincial" relations, "L Relations with Fishing Industry", "N" is "Legal" and "P" is "Compensation". And I'm wondering, can you tell me why there's a line item there for "Compensation", what does that refer to? Is it usual for a federal government to offer compensation in these situations?
A No, but there's a very interesting legal issue

associated with ***SARA*** as to whether if you infringe, for example, First Nations, there might be some requirement for compensation.

Q Thank you. And why is there a line item at "D" for "Commercial Fishing" and then another line item at "L" for "Relations with Fishing Industry"?

A Mm-hmm.

Q Is that counting fishing interests, commercial fishing interests twice?

A If you look at how DFO does its work, there's a huge amount of consultation and relationships with different boards, groups, that sorts of thing. So having effective working relationship is an important aspect, and we often think about things in terms of manageability, and fisheries managers had found in some cases when they made a huge and substantive policy shift, people were so upset that they would be almost defiant and not in fact go along with it. So there's manageability aspects to these relationships, too.

Q Right. Thank you. And why isn't there, then, a line item for relations with First Nations, especially given the constitutional obligations that the Crown has to First Nations. I don't see that there.

A I'm not sure why they wouldn't put it in. I would think they would see it subsumed under "Aboriginal Food and Social Fishing", but you have a point.

Q So from the risk assessment summaries, we see that there's high impact, so I'm meaning a "9" under the "List" column for "Minister's Freedom to Act", for "Commercial Fishing", that's at "D", for "Federal-Provincial", that's at "K", for "Relations with Fishing Industry" which we've just discussed, that's "9", and then for the "Compensation" question a "9". And I've actually done a little total, so you'll just have to indulge me here. I've totalled the numbers for the "List" and the "Do Not List" column, and what we get is 110 in the "List" column, for the total risk number, and then 94 in the "Do Not List" column. So the "List" column has a lot more numerical risk, if you were. So from this do we understand that decisions about protecting species is really a numbers game, qualitative numbers game? I don't know how to frame that.

A I don't think so. I think you're looking at the

whole issue, and this is one part of the advice that is provided to Ministers. So I wouldn't in any way say "Minister, this was the score, so you've got to do this."

Q Okay. I'm also curious about how DFO's number one priority, conservation, plays into this. Because I find it puzzling that "No Recovery" and Extinction" have the same ratings, whether you're listing or not, and yet ***SARA***, as I understand it, is intended to protect species at risk. So how is it that you have the same ratings in both of those columns?

A I don't know how they derived those particular ratings, but...

Q Would you agree with that rating?

A Well, "No Recovery" is important from the standpoint if you do everything possible to protect the stocks under ***SARA***, close down the fisheries, do all these Draconian things and no recovery is possible, there's no way to escape. There's an issue with respect to ***SARA*** is a very blunt instrument in some ways. It's very unclear about how to delist something.

Q Mm-hmm.

A And if stocks continue to decline, you could have all kinds of impacts on people, including First Nations with no ability to turn things around and a very long period of time before something might get off the list. So that's why that's one high. And "Extinction", of course, is important. Here there was a situation at that time where plans were being put in place for Sakinaw and Cultus, quite comprehensive plans costing nearly a million dollars a year in order to try to effect the recovery. So I think that would mitigate the score on the extinction side.

Q Okay, thank you. I just want to focus finally on "N", which is the "Legal Considerations". And we see that the legal risk is higher if you do not list. It's an "8" there, whereas it's a "6" if you list. Is that because DFO had concluded that there was risk of legal action by environmental groups, First Nations, potentially others, for DFO's failure to meet its conservation mandate, or to fulfill the implementation of ***SARA*** or its failure to honour obligations to First Nations. Is that what that legal risk refers to?

A Perhaps, and perhaps in this case there were discussions with legal counsel. I'm not sure.
Q And yet despite that higher risk on the "Do Not List" side, the Minister decided that it wouldn't list. So does that suggest that the Minister was willing to risk lawsuits from First Nations and from others in order to have the freedom to act, and in order to meet some of the interests of the commercial industry?
A I'm not sure what the Minister's views were with respect to the legal aspects, but nevertheless we have a piece of legislation that, you know, is designed to do things for conservation purposes and the Minister had to look at that very carefully.
MS. PENCE: Thank you. Those are my questions.
THE COMMISSIONER: Thank you, Ms. Pence.
MR. WALLACE: Thank you, Mr. Commissioner. I have no re-examination, Mr. Timberg has none. I'd like to thank Dr. Davis and all participants for cooperating and allowing us to do this so efficiently.
THE COMMISSIONER: Yes. Dr. Davis, I'd like to add my appreciation to you for returning here this morning, and for making yourself available to address questions with respect to these documents. I'm very grateful, sir. Thank you very much.
A Thank you, sir, and it's certainly a privilege to be here. And from what I hear, there's all kinds of chinook coming back this year. It's fabulous on the West Coast and up in the Charlottes, so it's not all doom and gloom.
THE COMMISSIONER: Did you want to take a short break then, Mr. Wallace, and...
MR. WALLACE: Ms. Baker is on her way.
THE COMMISSIONER: All right. We'll just stand down briefly.
THE REGISTRAR: The hearing is recessed for five minutes.

(PROCEEDINGS ADJOURNED FOR SHORT RECESS)
(PROCEEDINGS RECONVENED)

THE REGISTRAR: Order. The hearing is now resumed.
THE COMMISSIONER: Mr. McDade.
MR. McDADE: Thank you, Mr. Commissioner. Continuing on, before we commence, I'd like to be sure to

mark the e-mail that we discussed yesterday, the May 3rd e-mail string with Dr. Thomson. Could I have that marked as an exhibit?

THE COMMISSIONER: Yes.

THE REGISTRAR: 1334.

EXHIBIT 1334: E-mail dated May 10, 2010, from Richard Thomson to Richard Beamish, Subject: Sockeye report

MR. McDADE: And Mr. Commissioner, I have a bit more on cross. I had scheduled 15 minutes for the next panel this afternoon, and I've given that time up to allow myself a little bit extra time this morning.

RICHARD BEAMISH, Recalled.

STEWART McKINNELL, Recalled.

DAVID WELCH, Recalled.

CROSS-EXAMINATION BY MR. McDADE, continuing:

Q Dr. Beamish, continuing on where we left off yesterday -- could I have the report that's Aquaculture 6, up on the screen, estimating the abundance of juvenile Coho salmon in the Strait of Georgia by means of surface trawls.

Dr. Beamish, that's the document you cite in your papers that you've submitted here, today, as the methodology for your trawls?

DR. BEAMISH: Yes, most likely.

MR. McDADE: Yes. Could I have that marked as the next exhibit.

THE REGISTRAR: 1335.

EXHIBIT 1335: Estimating the Abundance of Juvenile Coho Salmon in the Strait of Georgia by Means of Surface Trawls, by Richard Beamish, et al

MR. McDADE: And Mr. Lunn, could we scroll down, just bellow the abstract, in the second column. Three lines down from the top, Dr. Beamish, there's a sentence that says:

> We propose that for some salmon species, such as Coho salmon...routine standardized surveys of total juvenile abundance can improve management...

Let me suggest to you that what you're saying in this document is that the trawl is designed primarily for Coho salmon, not for all -- and it's not appropriate for all species?

DR. BEAMISH: Yes, I think that's true.

Q So can I suggest to you that the species it's not appropriate for are sockeye and pink?

DR. BEAMISH: Well, you know, you'll just have to -- what do you mean by "it's not appropriate for"? If you can just give me a little more information, I can answer the question.

Q Well, that it's not appropriate to use this trawl and the way it's designed to estimate or compare abundance year over year?

DR. BEAMISH: I'm sorry, I know you're in a bit of a hurry and I'll try to answer them quickly, but the -- you can't compare among years. You can't compare the catch per unit of effort. When you're trying to change those catches into an estimate of total abundance where you're putting a number on it, I think you're correct that this is -- that I would agree with you, is a better way of saying it, that making abundance estimates for pink and sockeye are more difficult than making abundance estimates for Coho.

MR. McDADE: Can I have the document that's Aquaculture 5 up on the screen.

Q And this is another paper that you wrote, I believe, Dr. Beamish, An Abrupt Increase in the Abundance of Juvenile Salmon in the Strait of Georgia. You recognize that paper?

DR. BEAMISH: Yeah. Again, these are papers that we produce usually each year to inform our colleagues that, in this case, the North Pacific Anadromous Fish Commission, about the work that we have done during that year.

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

THE REGISTRAR: 1336.

EXHIBIT 1336: An Abrupt Increase in the Abundance of Juvenile Salmon in the Strait of Georgia, by R.J. Beamish, et al, September 2000

MR. McDADE: And could I go to page 4, and scroll to the bottom.

Q There's a sentence there that starts four lines from the bottom, Dr. Beamish. It says this -- or let me go to the sentence above it:

> A comparison of pink and sockeye estimates among years was not made because these species tend to be highly migratory with residence times considerably shorter than the other species...

So there I think it specifically says that you can't -- comparison between years is not appropriate; is that right?

DR. BEAMISH: Well, that sentence is a statement made by Dr. Healey, all right? And I realize that we are citing his work, right? It's a statement that he made. And the complication is that at the time when we were writing these reports, I think that the statement that the residence time are considerably shorter than other species is probably okay. I would not use the word "considerably" anymore. So at the time that we wrote the report, going back the way I was thinking when I wrote this, that wouldn't be true at the time. I wouldn't quite -- I wouldn't say that today, no. It would be different today.

MR. McDADE: Can I ask that we put up on the screen, again, Exhibit 1303, which is the Anomalous Ocean Conditions by you and Dr. Thomson. And can we go to Table 1 at page 53 again.

Q Now, Dr. Beamish, as I understand the paper, in the Strait of Georgia in 2007, you did -- or there was some 74 trawl sets done, and in 2008 some 90 trawl sets. As this paper indicates, in Queen Charlotte Sound there were only five sets done, both in 2007 and 2008. Certainly, the -- and what I'm asking you to agree with is the number of sets makes that data far less reliable in terms of comparing abundance and size?

DR. BEAMISH: In terms -- I wouldn't use the word

"abundance", but in terms of comparing the catches, yes, I agree with you.
Q And the Hecate Strait data in your paper, I think, as you note in your paper, the Hecate Strait numbers are actually not supportive of the theory or the conclusions at all; they're an anomaly?
DR. BEAMISH: Can you just tell me what you interpret to be the theory?
Q Well, the Hecate Strait numbers don't support any difference in catch between 2008 --
DR. BEAMISH: Oh yes.
Q - and 2007?
DR. BEAMISH: Yes, that's true, yeah.
Q So can I suggest this, that the trawl survey, as a technique, is at best a snapshot of what you see at the time you do the survey?
DR. BEAMISH: Again, if you can just give me a little bit more explanation on what you mean by "what you see"?
Q Well, it's not necessarily indicative, for instance, of the conditions of sockeye -- if you take a trawl from July 8th to 15th, it doesn't give you much in the way of indications of what the status of the sockeye were a month or two earlier, when the bulk of the sockeye went through the Strait?
DR. BEAMISH: I think that's fair. Scientifically, that's correct, yes.
Q And that trawl survey also doesn't tell you -- well, you didn't test these fish for disease?
DR. BEAMISH: No.
Q And if there are any changes in abundance due to disease, you wouldn't -- that would be as consistent with any changes in abundance as it would be problems with prey?
DR. BEAMISH: Yes.
Q And I think you accept in your paper that if the virus that's been posited by Dr. Miller was a factor in 2007, the ocean conditions in the Georgia Strait would have exacerbated that disease?
DR. BEAMISH: Okay, I just want to be careful, but I don't think that -- we didn't refer to the virus, did we, in that paper? I doubt it. Okay, I'm going to assume that we didn't, but I'm going to answer your question by saying that -- just ignoring the reference to the virus, what you said

I would agree with.
Q And if any smolts were in poor condition in 2007, before they went through the gauntlet of the fish farms up in the Discovery Islands and the Johnstone Strait, that would make them more susceptible to any pathogens they might pick up along the way?
DR. BEAMISH: Well, I can't answer that, but I would think that that's possible, yes. I mean, I'm not qualified to answer that, but it does seem to be reasonable.
MR. McDADE: Mr. Lunn, could we just call up the data that I refer -- the spreadsheets that Canada's provided in relation to this paper? There are two of them. The smaller one is the one I put up.
Q Dr. Beamish, I asked that you provide the raw data that was part of these trawl surveys, and I'm just going to put one up on the screen. As I understand it, you've supplied the data for Hecate Strait and the Queen Charlotte Sound trawls. The Georgia Strait data has not yet been provided?
DR. BEAMISH: That's true, yes.
MR. McDADE: And apparently will be provided later. And so this is just referring to the Queen Charlotte Sound. If we can just call up -- well, first of all, can I mark this as an exhibit.
THE REGISTRAR: 1337.

EXHIBIT 1337: Juvenile Pink, Chum and Sockeye raw data Excel spreadsheet for the period June 2007 to July 2009

MR. McDADE:
Q If we look at column D and the first 10 rows of column D
MR. LUNN: I'm sorry, I can't blow it up the way we can with PDFs.
MR. McDADE: Okay.
Q Well, in the interest of time, let me suggest to you, Dr. Beamish, that the numbers found in these five sets in the Queen Charlotte Sound in 2007 and 2008, were quite diverse. In a couple of sets they found one or no salmon, and in a couple they found a great number.
DR. BEAMISH: We're talking about 2007 in Queen Charlotte Sound?
Q And 2008.

DR. BEAMISH: I recall that being correct, yes.
Q So there's a great variability in these sets?
DR. BEAMISH: I think so, yes.
Q Which is another factor of randomness or --
DR. BEAMISH: Yes.
Q -- lack of reliability --
DR. BEAMISH: Yeah.
Q -- in the data?
DR. BEAMISH: And it's an indication of a variability, yes.
Q So let me just -- my last questions to you, Dr. Beamish, then, if we could go to the Synchronous paper, which is Exhibit 1309, I just have a couple of other anomalies I'd like to ask you about. The table at page 34, Exhibit 1309.
Now, if we could just -- the first set of data is in relation to Coho, and Mr. Lunn, if you could just highlight the 2007 and 2008 section. Yes. So as I see the Coho data, Dr. Beamish, it appears to me that under 2007, 1,233 Coho were caught; in 2008, 723.
DR. BEAMISH: I think that's what that says, yes.
Q So that actually in your 2007 trawls you got more Coho than 2008?
DR. BEAMISH: According -- well, that -- you'll have to look at that in terms of catch per unit of effort, and I can't see that from the table, but that probably -- it might be true. I don't know for sure.
Q Can we then move down to the Chinook?
DR. BEAMISH: We're just not comparing catches. You have to compare catch per unit effort. Is that catch? I can't tell from that table what it is, quickly.
Q Well, it seems to be the number of Coho caught --
DR. BEAMISH: I know.
Q -- in the same set of trawls --
DR. BEAMISH: Yeah, except that it depends on the number of sets, all right, and I can't get that quickly from the table.
Q Well, as I understood, there were 74 trawls in 2007, and 90 in 2008.
DR. BEAMISH: But that was for sockeye.
Q Isn't it the same trawls we're dealing with?
DR. BEAMISH: No, because the sockeye are only the top 15 metres and Coho are the top 30 metres.
Q All right. Well, let me move down to Chinook and

ask you --
DR. BEAMISH: Okay.
Q -- about the numbers there. It seems to be a similar indication of Chinook, that there are actually more Chinook caught in 2007 than 2008.
DR. BEAMISH: Again, it's the same issue of how many sets we made and what the catch per unit effort is. You can't really, unfortunately, just compare the catches without comparing them to standardize them by the actual number of trawls. And I'm sorry, I can't remember what the catches were, relative to the two years.
Q Well, your counsel is going to be providing those data to us in due course.
DR. BEAMISH: Yeah.
Q All right. And under chum, just one more line down, as I see it, under chum you see the number 140.6 compared to 101.8? That's length.
DR. BEAMISH: That's true.
Q So the chum in 2007 were actually longer than in 2008?
DR. BEAMISH: That's correct.
Q Now, I'll just thank you, Dr. Beamish, for your help. I'll just ask Dr. McKinnell --
DR. BEAMISH: Okay.
Q -- and Dr. Welch, as I understood your answers to Mr. Blair, there was some reluctance to agree with Dr. Beamish's conclusions. Am I correct that that reluctance has to do with the sufficiency of the samples and the issue with the data that I was cross-examining Dr. Beamish about?
DR. WELCH: Who are you asking?
Q Each of you.
DR. McKINNELL: I think the issues that I had with these data were that information about growth and information about survival were inferred but not measured. So that would be my main comment.
Q And Dr. Welch?
DR. WELCH: I would have two general comments. The first, is in July it's the tail end of the sockeye that are mostly migrating through, so any slight variations in either the timing of the fish or the timing of the survey can have large implications for the numbers caught.
The second, is a general scientific issue between different investigators. Dr. Beamish has pointed out, in Table 2, that the size of the

sockeye in 2007 was smaller than 2008. I did look at that last night. It is statistically significant, but it's almost biologically irrelevant, because it's only a three millimetre difference. And in the same table the weight shows that in 2007 those slightly smaller fish in fact weighed more than the fish in 2008. So it's an interpretational difficulty between scientists as to which of the data you put more weight on.

Q And Dr. Welch, are you aware of any other studies that actually show that some species of sockeye were doing well in the Georgia Strait in 2007?

DR. WELCH: Well, yes, I think you're referring to the paper I -- that's in press with Dr. Wood as lead author, and myself.

Q And what does that say?

DR. BEAMISH: In that paper we tagged Sakinaw sockeye and -- actually, I'm not -- I'm not positive it's referring to the 2007 release year. I'd have to go back and check that document. But what we found was that the Sakinaw sockeye that migrated out of the Strait of Georgia never returned. They had tags similar to the Cultus Lake tags. But the Sakinaw salmon that we did not -- that did not -- that we did not register leaving the Strait of Georgia actually had three and a half percent, 3.4 percent survival, much higher than the marine survival of the wild run as a whole. So it was a very surprising result.

Q So it would tend to indicate that sockeye that migrated through Johnston Strait were the ones that had the problem?

DR. WELCH: Well, I would actually phrase it as there's a couple of lines of evidence suggesting that animals that stay in the Strait of Georgia have higher survival than animals that migrate out.

MR. McDADE: All right. I thank you, gentlemen, for answering these questions.

MR. LEADEM: For the record, Leadem, initial T., appearing as counsel for the Conservation Coalition.

CROSS-EXAMINATION BY MR. LEADEM:

Q I want to begin my examination of you gentlemen by focusing upon the technical report, which I believe we've marked as Exhibit 1291. That's your

PICES report, Dr. McKinnell, so many of my questions will be to you, initially.

Firstly, let me thank you for a well-written report, and I certainly found it enjoyable reading, so much so that I even read the appendices, and that's where I'm going to take you, actually, because the appendices were quite informative. And I want to start by asking you a general question about the report, and perhaps the easiest way to do that is if we can look at page 176 together.

DR. McKINNELL: Okay.

Q Right at the bottom of the page - 194 of your copy, Mr. Lunn, if you're on the PDF - the last paragraph there says:

> Prior to its release, the report was peer-reviewed within PICES by 5 scientists

And that's the point I want to hit with you, first --

DR. McKINNELL: Okay.

Q -- that in a question from Canada yesterday, you were asked whether or not you incorporated the views of the reviewers from the Commission, and you said, "No," you did not. Nonetheless, this was peer-reviewed by five scientists; is that correct?

DR. McKINNELL: Well, five plus the Commission's reviewers.

Q Yes. And this is normal procedure with respect to documents that are coming out from PICES under the authority of PICES; is that fair to say?

DR. McKINNELL: It is relatively rare for PICES to be asked to prepare an advisory report, and so common practice, I would suggest, is still being established, but it was set up that there would be a review process.

Q And this was the review process that was picked for this particular paper?

DR. McKINNELL: The review process was established by the chairman of one of the committees in PICES.

Q And there were two external scientists who reviewed it, and they're mentioned there, Dr. Ruggerone, from Seattle, and then Dr. Fukuwaka, from Japan; is that right?

DR. McKINNELL: That's correct.

Q And then when you responded to my learned colleague from Canada, when you said that you did not take into consideration the comments of the reviewers from the Commission, my understanding from reading through, that's a question of timing; you simply did not have enough time to incorporate that and then go back to the board and get approval; is that fair to say?
DR. McKINNELL: That's correct.
Q The next area I want to take you to is Appendix 4, and these are comments that I found to be quite informative. They're comments on the Pacific Salmon Commission Workshop, beginning at page 168, Mr. Lunn.
DR. McKINNELL: Right.
Q My understanding is that you were requested, subsequent to the publication of this report, to have an examination of the workshop that was conducted in June of 2010; is that right?
DR. McKINNELL: I believe it was part of our statement of work.
Q Okay. And your comments with respect to the conclusion, you took some issues with that, and those are summarized in Appendix 4; is that correct?
DR. McKINNELL: Correct.
Q And if I can summarize, most of your comments dealt with the focus upon the Strait of Georgia; is that right?
DR. McKINNELL: That would be because the Salmon Commission's report was focusing on the Strait of Georgia, as I understand -- as I recall.
Q Right. And you may recall yesterday that my learned colleague from Canada was asking questions of Dr. Beamish about this same workshop and the conclusions in the workshop?
DR. McKINNELL: Yes.
Q And so what you have to say about that workshop is found, if we can go to page 169, under the bullet with an underlining, you say:

> There is a positive correlation between the abundance of juvenile sockeye (catch per unit effort) in the Strait of Georgia and log (total Fraser SK production) two years later over 1998-2007...

I'm not going to pretend I understand R-square values. And then you make a number of comments about that; is that right?
DR. McKINNELL: Yes.
Q And I take it that the tenure of those comments is that you take issue with the finding from the Pacific Salmon Workshop; is that fair to say?
DR. McKINNELL: Yeah, that's fair.
Q You disagree with them?
DR. McKINNELL: On this point.
Q And the reasons why you disagree with them are given in the four bullets that follow; is that right?
DR. McKINNELL: Yes.
Q And I won't ask you to repeat them, they're there for our reading pleasure and edification, but I just want to make the point that when the Pacific Salmon Workshop in June 2010 concluded, that a good place to start in terms of looking at contributory factors that led to the 2009 decline, was the Strait of Georgia, you would tend to take issue with that?
DR. McKINNELL: Only after having written our report.
Q Yes. And I'm going to turn to you, Dr. Welch. The community around the sockeye and investigation into sockeye, is a relatively small one and tight-knit one. Did you participate in that workshop in June 2010?
DR. WELCH: No, I didn't.
Q All right. Have you followed any of the thinking from Dr. Randall Peterman since that workshop and what his current views may or may not be with respect to the focus upon the Strait of Georgia?
DR. WELCH: We've had a couple of -- we've had professional conversations on things, but I don't think I'd like to characterize what I think I know about Dr. Peterman's --
Q Okay. I'll leave it at that. Do you have any views about the conclusions reached from that workshop, that the focus should be on the Strait of Georgia?
DR. McKINNELL: Yes, I do. I think it's too narrowly focused and the problem is that if we focus in on the Strait of Georgia before really establishing that that's the problem, you can spend almost an eternity studying the problem within the Strait of Georgia if it's not there, without recognizing

that it's not where the primary determinants are.
Q Now, Dr. Welch, you, yourself, are one of the reviewers that the Commission hired to actually examine Dr. -- or the PICES report. I'm going to call it the PICES report, with all due respect to you. I realize that you were the senior author, but it was generally the work of several scientists.
DR. WELCH: I would prefer that you call it the PICES report.
Q All right. So Dr. Welch, you examined the PICES report --
DR. WELCH: Yes, I did.
Q -- and made some comments based on your review of that; is that correct?
DR. WELCH: Yes, I did.
Q Okay. And if we can turn to page - I believe if we look at 185 of the report - this is in Appendix 6, The Reviewer's Comments - and I believe Dr. Welch's comments can be found right after Dr. Cooke's. You're faster than I am.
Now, there are a couple of things that I found to be intriguing about your comments of the PICES report, Dr. Welch, and under number 2, the bold number 2, you were asked to evaluate the interpretation of the available data. And you pointed out some discrepancies or differences between the McKinnell, et al report, which I take it to be the PICES report, and the Peterman and Dorner reports, which we have already heard from Dr. Peterman, who's presented evidence on his report, and you have a bit of a table there.
DR. WELCH: Yes, that's the table in blue.
Q And this is something I'm going to come back to you as well, Dr. McKinnell, because the major discrepancy that you point out is that the decline in the PICES report is, according to you, Dr. Welch, a sudden shift occurs in 1992, and then there's a decline as a step-function, whereas Peterman and Dorner seem to describe it more of a gradual or trend to lower productivity is that fair --
DR. WELCH: Yes.
Q -- is that what you're pointing out there?
DR. WELCH: Correct.
Q All right. And so back to you, Dr. McKinnell, with respect to the PICES report, you found that

there was this sudden decline in 1992, that it was a dramatic shift; is that right?

DR. McKINNELL: I think in the report -- well, first, we noticed that a shift in productivity had not been considered --

Q Yes.

DR. McKINNELL: -- by the PSC report, Dr. Peterman's report. We evaluated the recruits per -- log recruits per spawner time series for about 16 stocks, and seeking to see whether it was -- whether one model, a gradual decline, or a step-shift, fit the data better. And in our, I will say, preliminary evaluation, we found that the simple model fit the step-shift slightly better than the trend model in a number of -- actually, I think, the majority of the stocks. Twelve of 16, thanks, Dave.

And so, as I say, this is a preliminary analysis, and I think a useful to do would be to actually do the rigorous statistical analysis on the stocks to determine whether you can distinguish between a step-shift and a trend, given the available data.

Q Does it matter much whether we call it a step-shift or a trend?

DR. McKINNELL: Absolutely. Because if you're looking for a cause, if a case was a one-time -- if the response was one-time change in mean productivity, you might look for some very different cause of that change than if you understood it as a general declining trend.

Q Right. So in your way of thinking, then, going back to 1992, you would look to see if there was anything dramatic or anything new that was happening at that time to determine why there was this sudden shift?

DR. McKINNELL: Well, that would be my initial exploration.

Q Now, the other difference, Dr. Welch, I'm going to flip back to you again, because you were the reviewer, if we can now go to the next page, you say, "Does not identify" -- the one on the left is the PICES report:

> Does not identify Strait of Georgia as the likely geographic site of the productivity problem, and identifies strong correlations

with anomalous events in Queen Charlotte Strait (at least for the 2007 out-migration year).

And then, based upon your -- I believe you were also a reviewer of the Peterman report, were you not, Dr. Welch?

DR. WELCH: Yes, I was.

Q All right. So then you say, "Ditto," so I take it, by "Ditto," it means that Dr. Peterman also does not identify the Strait of Georgia as the likely geographic site --

DR. WELCH: Correct.

Q -- of the productivity problem?

DR. WELCH: Correct.

Q But he goes on to implicate a foreign effect as far north as Southeast Alaska, because he was, as I recollect his report, which seems like eons ago when we actually looked at it, was he looked at the various stocks all the way from Puget Sound and Lake Washington, all the way north up to Bristol Bay; is that right?

DR. WELCH: I forget if Bristol Bay was in it, but yes, he looked over a very broad range.

Q All right. And he suggested that the problem, "is not confined to Queen Charlotte Sound," but he does not identify a particular cause or issue for the poor 2007 outbound smolt survival?

DR. WELCH: Yes, except the wording, "not confined to Queen Charlotte Sound," is my own interpretation of his results. He's identifying some impacts on survival all the way up to sockeye stocks in Southeast Alaska, which was an important finding.

Q All right. And would you agree, Dr. McKinnell, that you can't really identify a particular cause or an issue for the poor 2007 decline, can you?

DR. McKINNELL: If you're saying that we have the data to conclude the cause --

Q Yes.

DR. McKINNELL: -- I will agree with you.

Q And we may never know? We may never know what caused the 2009 decline, the returning decline?

DR. McKINNELL: I think that's a reasonable comment.

Q And Dr. Welch, would you agree with me?

DR. WELCH: Well, hopefully somebody brighter than us in the next 25 years will answer that question definitively and it will be accepted as that by

the scientific community, at least, but I wouldn't categorically rule it out, but certainly at the current time there are multiple explanations still on the table.

Q Right. And I've sat through many days of testimony and heard many scientists such as yourself, who have preceded you to the panel, talk about various aspects, various contributory factors and, you know, whether it was contaminants, whether it was something else, there seems to be an array of things that could have caused or could have acted in unison to actually achieve the result of a disastrous return in 2009; is that fair to say?

DR. McKINNELL: To me?

Q Yes.

DR. McKINNELL: Yes.

Q Dr. Welch, do you agree with that?

DR. WELCH: Yes, and the purpose is -- of science and of the inquiry, I think, is to winnow down what are the possibilities.

Q Right. And turning, now, to you, Dr. Beamish, I didn't mean to leave you out of the equation.

DR. BEAMISH: I appreciate it.

Q And I was going to get to you.

DR. BEAMISH: Okay.

Q Essentially, you take a different view, as I understand it. You say, "Yes, you can, Mr. Commissioner, find a cause for the decline of the 2009 return, and that cause is the poor production in the Strait of Georgia when the smolts out-migrated from the Fraser River and they encountered no food"?

DR. BEAMISH: Yes, I'll just take a minute just to comment on that just a bit. I agree with you, but I have to qualify just a bit. We don't know for sure whether it was a problem. We did not measure the food. What we do identify in the papers that we submitted was the physical anomalies, which we consider to be very clear and extreme, all right? Unique, almost. And we identify those as most likely contributing to a reduction in prey or food, and then we identify a response, and as I've said, I have never seen anything so clear in all of my career as -- well, that's not quite true. It's one of the things that I've seen that is very clear. And that we saw this synchronous response

by all of the fish in the Strait of Georgia that were feeding in the surface waters in the spring of 2007, so I respectfully do not agree with my colleagues. I think that this is a very clear explanation.

Q All right. You say that it's likely that due to your observations in the Strait of Georgia for the out-migration of smolt in 2007, and the conditions, the physical conditions, the oceanographic conditions, that those did, in fact cause, or likely caused the decline; that's what you say, unequivocally?

DR. BEAMISH: Yeah, contributed. You know, we do also say that the conditions that the fish, after experiencing the poor conditions in the Strait of Georgia, the conditions in the Queen Charlotte Sound and then through into the Gulf of Alaska, would exacerbate what they experienced in the Strait of Georgia.

Q So are you saying that it's a contributory factor, or are you saying it is the cause? I want to nail you down on this.

DR. BEAMISH: Between those two?

Q Yes.

DR. BEAMISH: Of course, it's both, but if you only give me two choices, which I would be uncomfortable with, to be honest with you, I would say, because it's a combination, that -- and I'm sorry I can't give you -- I'll answer your question in a minute, but had they experienced very good conditions, say in the Gulf of Alaska or in the first winter, then the conditions in the Strait of Georgia would not have been so severe. So if you only give me two choices, I'd say the cause.

Q So you say the cause, rather than --

DR. BEAMISH: If you only give me two choices, yes.

Q Well, I'm a lawyer, and I get to do that.

DR. BEAMISH: That's okay, and I'm a biologist.

Q Okay. So I want to now take you -- and you predicate that on a lack of zooplankton data; correct?

DR. BEAMISH: Again, you'll have to just give me a little more information about that. What do you mean, "predicate that"?

Q Well, if you're going to postulate and form a hypothesis that the salmon, specifically the

Fraser River sockeye salmon, are basically not getting enough food in there stomach, then it would be nice to have data that substantiates the zooplankton, what they're normally expected to eat; is that right?

DR. BEAMISH: Yeah, that's why I use the term "prey," but in terms of phrasing the question "as predicated," it's predicated on the synchronous response of all the species. And then it's the inference, if you want, that that synchronous response was a result of a disruption or a -- I'll categorize it as a failure of the prey production during that period.

Q Right. And yet there's no zooplankton data available for you to draw that conclusion from?

DR. BEAMISH: That's true and, you know, there's been some question about that, but I think that that is true.

Q All right. If I could have Conservation document number 7, please? Conservation Coalition document. It's an e-mail exchange. Now, obviously, you did not write this, Dr. Beamish, but I'm hoping it was one of the documents that you may have reviewed prior to coming here. Do you recall reviewing this particular document? It's from Marc Trudel. He's one of your colleagues in DFO, is he not?

DR. BEAMISH: Yeah, I probably did d read this. Just let me take a quick look at it to make sure I -- yes, I think I -- yeah, I remember that.

Q Okay.

DR. BEAMISH: But it's written January the 29th, right, 2010?

Q Yes.

DR. BEAMISH: Yeah.

Q You may not have been back to work by then?

DR. BEAMISH: I was out of my coma.

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

THE REGISTRAR: 1338.

EXHIBIT 1338: E-mail dated January 29, 2010, from Marc Trudel to Dave Mackas, Subject: Plankton in the Strait of Georgia

MR. LEADEM: Now, could we have Conservation Coalition document number 10, please.

Q This is an e-mail exchange and, once again, you may not have been privy to this at the time. The main head of the e-mail is from an Ian Perry to a Mr. Robin Brown and to Mr. Mark Saunders.

DR. BEAMISH: Yeah.

Q Those are colleagues of yours within DFO, are they not?

DR. BEAMISH: Yes.

Q And that was written on May 19th, 2010, and it's title is, Status of Strait of Georgia zooplankton samples and plans for Beamish samples. And if you scroll through, it's quite a little bit of a lengthy one. If you go to the next page. And there's another e-mail attached there from Dave Mackas. Do you see that one, sent May 19th, 2010, to Mr. Robin Brown and Moira Galbraith?

DR. BEAMISH: Well, it's in front of me, yes.

Q Okay. And there's a reference to:

> The Strait of Georgia samples we have in the IOS database are summarized in a powerpoint.

And then the next paragraph says:

> 2007 was unfortunately a minimum in DFO and university sampling effort.

My understanding is that the University of BC was doing a study and that had stopped by that time; is that right?

DR. BEAMISH: There's a little bit of plankton data, but there is so little that I think most of us, you know, look at it -- I mean, plankton data, even when you have extensive data, is not always easy to interpret. So there is a little bit of data, yes.

Q All right.

DR. BEAMISH: Or are a little bit of data, excuse me. I'm also an editor, so I should be careful about my verbs.

MR. LEADEM: Okay. Next exhibit, please.

THE REGISTRAR: 1339.

EXHIBIT 1339: E-mail dated May 19, 2010, from Ian Perry to Robin Brown and Mark Saunders, Subject: Status of Str of Georgia zooplankton samples and plans for Beamish samples

MR. LEADEM:
Q Now, I want to turn, and I want to do this to be fair to you, Dr. Beamish, because Dr. Dill is going to come and give evidence at these proceedings because of a report that he prepared with respect to aquaculture, and that's coming up. And I want to refer you to one of your publications. It's a publication, Conservation Coalition document number 3, please. It's a document entitled, A proposed Life history strategy for the salmon louse, Lepeophtheirus salmonis in the subarctic Pacific, and you were the lead author on this publication, were you not?
DR. BEAMISH: Yes.
MR. LEADEM: Next exhibit, please.
THE REGISTRAR: 1340.

EXHIBIT 1340: *ScienceDirect*, Aquaculture, A proposed Life history strategy for the salmon louse, Lepeophtheirus salmonis in the subarctic Pacific, by RJ Beamish, et al, 2006

MR. LEADEM:
Q And this particular paper was the subject of a commentary by Dr. Dill in that same journal, and if I could just ask Mr. Lunn to pull up Coalition Counsel document number 4, I think should be it. There it is. It's a Comment on Beamish, et al (2007), "A proposed Life history strategy for the salmon louse, written by Dr. Dill, amongst others.
Were you familiar with the fact that Dr. Dill wrote this commentary, Dr. Beamish?
DR. BEAMISH: Yes. It does require a little bit of explanation. Maybe people aren't -- probably wouldn't be ware that, first of all, everyone, I think, is aware that these are -- this issue is a very controversial issue, and the paper that I wrote, the first paper that you exhibited, it requires just a little bit of explanation, because it's important in responding to your comment about Dr. Dill's comment.

Q Yes?
DR. BEAMISH: And, you know, as we speak here, there are literally millions of pink and sockeye headed towards the Fraser River, you know, coming down the coast, and they're loaded with sea lice. Now, that's an exaggeration, but they are. And a lot of those sea lice are mature, in other words, they are going to release eggs. And our life history strategy was an argument, all animals and plants, all animals evolve to optimize or maximize their reproductive ability.

My life history strategy paper, our life history strategy paper, proposed that the reason that the salmon carried large abundances of mature sea lice into the coastal area, because when they eventually go into freshwater the sea lice will die, that the reason for that life history strategy, to bring them back into the coastal area, is that they overlap with the juveniles that are migrating out. And we had evidence for that, and we provided that. And that was how we -- that was one of the mechanisms that we argued that this extremely successful sea lice species is able to maintain its populations, is it has the strategy of bringing -- or of reproducing at the time that juveniles are migrating out.

Now, Dr. Dill disagreed with me. It's not uncommon, particularly with the aquaculture and the fish farm -- or the sea lice issue, for people to disagree with each other.

The normal way of doing that is to write a rebuttal, and I've written some. And when you write a rebuttal to a journal, the journal, then, if they think there's something in that rebuttal, will then send the rebuttal to the author and the author gets a chance to rebut the rebuttal, and they're all published, so that scientists can make up their own minds.

When you write a comment, a comment isn't sent to the author, so the comment appears as you see it. And, in a sense, this is a little bit like a movie critic, okay? So it's legitimate, and the issues are Dr. Dill's opinion, but it was not presented in a way that allowed me to write a rebuttal for it. We have a book coming out, Simon Jones and I, along with other authors, and we have a chapter in that book - the book will be out any

day, now - on sea lice, and we then respond a little bit to Dr. Dill's comment in the chapter -- in the book that will be out any day now.

Q My understanding is that Dr. Simon Jones will be actually coming to testify, so I look forward to --

DR. BEAMISH: Yes.

Q -- asking him some of these questions.

MR. LEADEM: Could I have these, both of these, the original paper by Dr. Beamish, et al, marked as an exhibit, as well as this comment from Dr. Dill --

THE COMMISSIONER: I'm sorry, Exhibit 1340 was the article; is that correct?

MR. LEADEM: Has it been marked? I'm sorry.

MR. LUNN: Tab 3 on the screen is 1340.

MR. LEADEM: All right. So this next one needs to be marked, then.

THE COMMISSIONER: Thank you.

THE REGISTRAR: Exhibit 1341.

EXHIBIT 1341: *ScienceDirect*, Aquaculture, Comment on Beamish, et al (2007), "A proposed Life history strategy for the salmon louse, Lepeophtheirus salmonis in the subarctic Pacific", by LM Dill, et al, 2008

MR. LEADEM:

Q Now, in addition to the debate that was going on between various people, there was also some debate that was going on internally with DFO around the sea lice issue; is that fair to say as well, Dr. Beamish?

DR. BEAMISH: Probably, yes.

MR. LEADEM: All right. And if I could just ask that Conservation Coalition document, I think it's number 1, be pulled up.

Q Now, in preparation before you came here, today, did you have a chance to review this note from Brad Hargreaves?

DR. BEAMISH: Well, this was shown to me, and I did take a -- I had never seen this. This is something that was written in November 2003, and I read a few of these things, and I decided it was not heart-smart to spend too much time on this.

Q All right.

DR. BEAMISH: All right?

Q Well, I'm not going to spend a whole lot of time

on it, but I am going to suggest to you that you did attend a meeting on November 20th, 2003, with the Province and industry on -- to share preliminary information on sea lice issues; is that right?

DR. BEAMISH: Most likely.

Q And in the -- I'm still reading from the first paragraph, and at this meeting you announce that Dr. Laura Richards, Regional Director, had recently instructed him to fully integrate his research on sea lice into the broader DFO Pink Salmon Action Plan, PSAP program. So that part is true as well, right?

DR. BEAMISH: Well, I, you know, there's no indication of where this came -- it was sent to or anyone. It's just some text. So I have no idea what this is.

Q All right.

DR. BEAMISH: It's not sent to anyone. There's no date on it. It's nothing. I mean, where did this come from?

Q Well, I don't know where it came from, other than the fact that it appeared in ringtail, and so it's not my document, it's not --

DR. BEAMISH: That's my point, is that there's just absolutely nothing on here that indicates what this document is all about. It's just some text.

MR. LEADEM: Well, it's a document, on its face, Mr. Commissioner, purports to be from Brent Hargreaves, and let me get this fact established:

DR. BEAMISH: Brent Hargreaves is a colleague of yours at DFO? He's a fellow DFO scientists, is he not?

DR. BEAMISH: Well, I'm not in DFO anymore, but he was when I was there, yes.

MR. LEADEM: Yes. I'm going to seek to tender this as an exhibit, based on the fact that it is a ringtail document, it is from Brent Hargreaves, it does make some comments about Dr. Beamish, and I'm going to ask Dr. Beamish if he wants to respond to them, generally, in a moment, and if he declines to do so, then I'll take that as his answer.

Q So I assume that you've had an opportunity to read this, from Mr. Hargreaves; is that right?

DR. BEAMISH: No, I told you that I looked at it, at first, and I started reading it, and I, you know, unfortunately, things like this, I don't know, I mean, it's too bad that people write this kind of

stuff, but obviously he felt -- and again, I don't know what kind of a document it is.

Q All right. So you never read it through?

DR. BEAMISH: No, I didn't read it through. I told you that I felt that -- I think I said to you I don't think this was a heart-smart thing to do.

Q All right. I understand where you're coming from, in that sense. So, in effect, you're declining to respond to it because you're suggesting to me that you did not read it through and --

DR. BEAMISH: That's true, yeah.

Q All right.

THE COMMISSIONER: You haven't marked it, yet, Mr. Leadem, I don't think.

MR. LEADEM: Sorry?

THE COMMISSIONER: I don't think it's been marked yet.

MR. LEADEM: All right. Can we mark that as the next exhibit, then, please. Thank you.

THE REGISTRAR: 1342.

EXHIBIT 1342: Document purporting to be Memo from Brent Hargreaves to Laura, re - Beamish integration into sea lice

MR. LEADEM: Now, I've been advised that my time is up, it's 11:05, and I think we're approaching the magic hour. Those are my questions, Mr. Commissioner.

QUESTIONS BY THE COMMISSIONER:

Q Just before you sit down, Mr. Leadem, I just wanted to follow up on, just for my understanding, you had put questions to the panel about step-shift and trending, and I just want to make sure I understood the distinction. And I also wanted to just - I can't use the verbatim, obviously - but my recollection is other DFO witnesses talked about 2009 results as being off the chart. I don't know if they used that term, but I think the evidence was that it was a very extreme result in terms of low abundance. And I just wanted to know if the panel could help me in terms of that context, in other words, step-shift, trending, and then 2009 was, using a DFO witness's terminology, an extreme, in terms of the length of time that DFO had kept records about these things, that was

very extreme year.

So extreme, step-shift, trending, what is -- and I guess the other thing I would like to ask them, coming out of your questions, was where you have, and you each expressed your views about the different interpretation you've placed on data that has been collected, as between scientists, what is the common ground position on the standard of proof that you would accepting terms of arriving at a conclusion based upon your divergent interpretations data, or is there common ground, that you have more than one standard that you would be looking to, to measure these different interpretations?

So first of all, the terminology you've used, and its context, and secondly, where you have a divergence of views in terms of your interpretation, is there common ground, in the biology community, around a standard that you'd be looking to, to help others who are not scientists, understand why you've arrived at a particular conclusion?

And I may not have articulated that very well, and if I haven't, I apologize. You can rephrase my question more suitably, if you think you could answer it in a way that would make sense to non-scientists?

DR. BEAMISH: Well, maybe we'll all have a shot at trying to answer that.

THE COMMISSIONER: Great.

DR. BEAMISH: I interpret the question to mean that there was an extreme event in terms of poor return of sockeye in 2009. I'll forget the 2010. And so can the scientific community come together and say that if we had this optimal situation, in terms of we had all of the data that we would like to have, could we come to a consensus and determine -- and come to a conclusion that this was the explanation for the poor return? And my answer to that is, yes, we could do that.

Now, knowing my community, we would disagree on a number of things, but if we had the kind of data that we would like, we would be able to come to a conclusion.

I think that the workshop that we had, sponsored by the Salmon Commission, was a very good attempt at bringing this community together

with imperfect data, and I think that's what you've heard from the three of us, that we have imperfect data, which is why the three of us, which we are friends, even though we disagree, that's why we can't come to a complete agreement on things.

The material that we need to come to a better agreement, I think you've heard from us. We haven't heard -- we haven't come to agreement completely on what research is needed, but in my opinion, some simple things, you know, good monitoring, which we have, good monitoring of the juvenile sockeye out of the Fraser, and a good plankton survey in the Strait of Georgia, and good, physical measurements.

Now, there are other things that would be nice to know; what happens to stocks as they move up through the -- up into the Gulf of Alaska. Once we have that information, we don't necessarily have to repeat it. Those are smaller pieces of the puzzle that would make it clearer, but there are some fundamental things that are missing that make it a little difficult for the scientific community to come to a consensus, but I think that even though there is some disagreement about that June workshop, that was a good group of scientists that took the issues seriously, using the skills that they had developed throughout their career and the existing data to come to a conclusion.

Q Dr. Welch?

DR. WELCH: Commissioner Cohen, I'll break my comments into two parts. First, the terminological issue, the issue of whether it's a step-function or a gradual trend to lower survival is important. And here I'm referring to the question of whether there's a step-function change in survival, marine survival, which is a change in the average value of the survival with some variability around it between two periods, which is what we call a step-function or sometimes a regime shift, or a trend to increasingly worse survival over time.

Now, that may have still had a regime shift at approximately 1990. That's important, scientifically, because we have two reports in front of you from Dr. Peterman and Dorner, and Dr. McKinnell's group that suggest slightly different

things. And based on which of those interpretations of when that change in marine survival happened, whether it was around 1995 or 1992, and the nature of the change after that, whether it's just a change in average value or a trend down, is very important, because it allows the scientist to then go back and start hunting for what the problem is.

If you think it's just a change in mean value, then you'd say, "Okay, the ecosystem has suddenly changed from a blue state to a red state," and you would categorize those types of changes to identify the suite of things that were associated with the change. If it's a persistent change to lower and lower survival over time, you would look for increasing changes in environmental conditions after the change occurred.

So that's an important piece for the scientific community that your Commission will bring out, in that we have two reports that identify a much more broad, geographically-widespread change in time, but we still have some work to do refine some of those details. So that's important for the detectives that are going to go out, now, to look at back in the data to try to better quantify what's going on.

That's my preamble to the more philosophical question of what's the sufficient scientific standard. The philosophical answer, in my view, is that we cannot answer these questions. My friend and esteemed colleague to my left -- to my right, has just said, "Yes, we can," and I fundamentally disagree, and I'll articulate that why.

The gold standard in science is what's called an experiment, and ideally, in fact, what's called the doubly-blinded experiment, where experimental conditions are changed, one group of patients would be given a blue pill and another group of patients would be given a white pill, but the investigator wouldn't know which pill was a placebo and which was the real drug that was being tested for an effect.

That is a very hard standard to reach in marine science. I do think we need to get there. The reason is simply because we get into what's called "observer bias", which is widespread. It's

recognized throughout science, that we're humans. And you can see this in terms of the data you've seen presented in the discussion over the last two and a half days. Dr. Beamish has a set of data that he has chosen certain things that he has focused on as he thinks important, such as the difference in size. My colleague, Dr. McKinnell, pointed out in Exhibit 1303, Table 2, that the weight was higher in 2007, for the animals he caught, even though their length was a little lower. That's not necessarily consistent with a feeding response, that they would be fatter.

So these are interpretational difficulties. They afflict all of us. And the fundamental issue here is that we have too much data that varies in random ways, and we're looking for patterns. But good investigators, scientific or otherwise, can make multiple patterns out of that data, and the real issue to move beyond that, and I fervently believe this, we have to get to a system where we can do experiments, because in experimental science, when physics change to an experimental science in the 17th Century and chemistry in the 18th Century, they made vast strides.

We need to get past the natural history observations that we have, simply because we're too slow, as a scientific community, to provide those answers that you're looking for, and it takes a very long time to correct the record. If we make mistakes, it may take decades for views to change. If we can test theories, such as Dr. Beamish's or others, then we can make much more rapid progress than we do right now. It's possible to do that, technically, but it has not been the case in the past.

THE COMMISSIONER: Thank you. Dr. McKinnell?

DR. McKINNELL: I'll try and make this brief. I think Dr. Welch has covered the main points, and Dr. Beamish has his views.

You know, I like to say, lacking adequate data, imagination is not overly constrained. And as we have said in the PICES report, the observation system that's in place, in our view, was not set up to answer the kinds of questions that are being posed by the Cohen Commission.

We also point out that the biggest extreme in 2009, was its deviation from the pre-season

forecast. We point out in the report that using the data from the Salmon Commission that, in fact, the recruits per spawner, which is kind of a measure of productivity, the median value was lowest for the 2005 brood year, i.e. the 2009 -- sorry, the 2003 brood year, the 2007 return. But there is considerable variability in these data, for certain.

Dr. Beamish pointed out that the PSC report did a good job, but at the time they hadn't even considered all of the factors that we described for Queen Charlotte Sound. Those were only found as a consequence of the PICES report, and then they came to bear and have a larger role to play.

So what the Commission has had to suffer is observing this inner workings of the scientific process, and we apologize for having it bared so openly, but this is an evolution of thrust and parry, and eventually we hope that some good solution will come about.

Have we answered your main concerns?

THE COMMISSIONER: Yes, for my purposes, but I wanted to give Mr. Leadem an opportunity, if he has something to follow up on.

MR. LEADEM: Just a brief follow-up, if I may, Mr. Commissioner.

CROSS-EXAMINATION BY MR. LEADEM, continuing:

Q And I was -- one of your remarks hit home to me, which was that there was an expectation generated, because of the forecasting, that the 2009 return would be larger than what, in fact, transpired. And that, in effect, gave rise to this Commission, because the Commission has been called in to investigate that phenomenon. So if we can reduce it to simply a question of, are our forecasts accurate enough? The answer is obviously, "No." And that's an easily answerable question; do you agree with that?

DR. McKINNELL: The Department relies on only one forecast, the Department's forecast, and doesn't yet have a system to entertain forecasts prepared by others.

Q Right. Is PICES offering?

DR. McKINNELL: We are in the business of providing

advice.
MR. LEADEM: All right. Thank you, Mr. Commissioner.
THE COMMISSIONER: Thank you, Mr. Leadem. And I'm sure, like all of you, I'm probably in Ms. Baker's bad books right now for having taken her off track. So maybe I can offer this apology as well as suggesting we take a 10-minute break instead of the 15-minute break, and if I've taken up other people's times, if we could, say, stretch out the lunch break to come back at quarter to 2:00 instead of two o'clock, if that would assist, I'd be grateful, and I apologize to counsel.
THE REGISTRAR: The hearing will take a 10-minute recess.

(PROCEEDINGS ADJOURNED FOR MORNING RECESS)
(PROCEEDINGS RECONVENED)

THE REGISTRAR: The hearing is now resumed.

CROSS-EXAMINATION BY MS. GAERTNER:

MS. GAERTNER: Good morning, Mr. Commissioner. Brenda Gaertner and with me Crystal Reeves for the First Nations Coalition and I appreciate the opportunity to ask questions of the three panellists, these esteemed scientists, but I just wanted to let you know that from the First Nations Coalition's perspective and the organizations that we represent, we're happy to understand what science has to offer, but we don't expect science to have all of the answers. We don't have that requirement of you. And, in fact, what you do is you offer things to the table amongst those that have other things to offer.
And the other thing I wanted to state, just so you get a perspective of where we're coming, we're not -- and the Commissioner has heard from First Nations talk about this, representatives here, this is a wild stock. It operates in the wild. We don't manage that stock. We actually manage people's response to that stock. So my questions are going to come from that perspective and not require that science know that stock and experiment with that stock such that we're into managing some -- or changing a wild stock into some kind of domesticated stock.

And so I've got -- what I'd like to do, Commissioner, I think I'm going to take about 40 minutes of time and I'll adjust my afternoon time accordingly. It may -- and if I take 45, I'll adjust my afternoon time accordingly. I'll do all of that. And what I'd like to do is just at the beginning, clear up a couple of things, particularly from the discussion that just occurred before the break and a couple of details and then I want to take off from where we can go with some of this and what are some of the routes into understanding this a little bit better.

Q First of all, I'd like to just pick up on this discussion of trends versus steps and I appreciated the evidence this morning. I had a number of questions around that that I don't have to ask now, which is great, but what I did want to ask you, Dr. Welch, you picked up this issue right in your review of the PICES report and I was grateful for that and you suggested a workshop format to respond to that and I'm just trying to get a sense, is this a lot of discussion between Dr. Peterman and PICES or do we have to do a lot of analysis to understand this a bit better or what kind of work is involved? Can we get that work done in a timely manner so that this can be considered by Commissioner Cohen as he's continuing his work, or what have we got ahead of us to try to solve that distinction?

DR. WELCH: Well, I won't speak obviously for the commission. I would guess that it would probably take two or three days of each of the authors of thinking ahead of time, certainly a couple of days at a workshop with some other people that weren't directly involved in the work so that, you know, the narrow focus of each of the authors isn't just there, that people can ask some broader questions. But it's a case of taking the same data and then saying what if we did this instead and then because the two analyses are giving some important but somewhat subtle differences and it would be very interesting to put those together and try to answer those questions. So probably a two- to three-day workshop with scientists beyond just the two groups that develop those reports would do it, so long as the data was ready to go at that time.

MS. GAERTNER: So, Mr. Commissioner, I'll leave that

for your thinking and also for commission staff to consider that, given the import of these two reports on the marine conditions and what we're looking at more broadly in this inquiry, but it would seem to me anyway that it might be useful to get that work done sooner rather than later.

Q And then I wanted to take you, Dr. Welch, again to Tab 2 of my documents, or First Nations Coalition documents. This is an email exchange between yourself and Robin Brown. Do you recall that email exchange?

DR. WELCH: Yes, I do.

Q And this is particularly on the issue of sockeye mortality in the Strait of Georgia versus mortality outside of the Strait of Georgia and we've heard a number of -- we've heard quite a bit about this issue already. But I want to take you to your comments in this email, 'cause it definitely brought some concerns to my clients. At the bottom of the page, beginning with:

> I suspect that there may be some internal politics afoot to have mainly the departmental staff --

And I take it you're meaning DFO staff there.

> -- speak on the sockeye issue so that DFO can be seen to be the lead organization, the source of most of the credible information. But it would be a tragedy if this morphed into the department trying to focus on the Strait of Georgia because (a) they have a better handle on how to study it (and can argue for more funding to do what they are already doing) and (b) because it puts the sockeye mortality problem in the Strait of Georgia BEFORE the smolts start migrating past the salmon farms.

And as we know and we can see from these two days of hearings and as we expect, there is a lot of contention around the implications around aquaculture on Fraser River sockeye.

So I'd like you to talk about your concerns here, explain them to us, and what you meant and then put them into the broader context of where

should we be looking at early smolt -- marine impacts on early smolt migration and why it is that you're suggesting it happen broader than the Strait of Georgia?

DR. WELCH: Yeah. So the obvious point, I think, that's clear is that I was concerned about the view being myopic and too restrictive early in the process. And the reason for that, taking it right back out of this particular issue in front of the commission but a common issue in fisheries is to assume there's a critical period in a certain period of the life history of fish. You will have heard that term used. And then study that to study the, quote/unquote "critical period".

In fact, the theory of critical periods for fish has never been actually established as correct. It's often used as a justification for studying something and it's generally the thing that's easy to do. The more expensive hard things to do are essentially left off the table because it's easy for the scientists to move forwards on a piece of work if it's -- for example, in the Strait of Georgia. That's easier than farther away logistically and it's going to be less cost.

My concern about that, taking it right back to the general scientific issue is that for a hundred years we've done that on recruitment issues in fish without being successful. And I've said for most of my career that that probably indicates that we're -- the critical period theories aren't necessarily correct so we shouldn't use them as a justification for focusing. We should be testing whether those assumptions of a critical period are, in fact, there. And that's the general point that I'd make.

MS. GAERTNER: Thank you. Could I have that marked as the next exhibit?

THE REGISTRAR: 1343.

EXHIBIT 1343: Email correspondence between David Welch, Robin Brown and others

MS. GAERTNER:

Q Now, Dr. Brian Riddell has given evidence, the commissioner has hear him, and in particular in February of this year he also was recommending

that we spend some time looking at the Strait of Georgia but he did in his evidence acknowledge that there are others that think that that might be too limited in scope and he acknowledged that he may be wrong on that. But what he did say was that he was -- that he thought there was merit in that kind of study because going to the ocean is extremely -- going to the broader ocean is extremely costly and it's more difficult and you can recognize salmon, Fraser River sockeye, in the Strait of Georgia as you -- whereas it's more difficult to do that in the larger ocean. Do you have any response to that, Dr. Welch?

DR. WELCH: Well, I would disagree with that, so first off, there's an opportunity cost associated with spending years studying something if it's not necessarily the correct location for the primary problem, so we -- I mean, the Strait of Georgia has been studied for salmon issues now since the 1930s. We're doing a more extensive and more sophisticated job now, but if it's not actually where the problems occur for the, for example, for the mandate of the Cohen Commission, you can do a simple thought experiment and say well, how many years would the Department of Fisheries, would all of the scientists involved, study in the Strait of Georgia before they would conclude that that is not the source of the problem, if in fact it wasn't in the Strait of Georgia? And I think the answer is we would all be dead and gone long before any of the scientists involved would be able to see that.

And the reason is that they're too narrowly focused, there are too many variables going on, and there is not an ability to cut to the core issue and say which of these variables affects it? So you need to understand what survives to leave the Strait of Georgia or survives to leave the Queen Charlotte Strait or survives to reach, say Southeast Alaska in order to bound that problem and better focus the work.

Historically it was not possible to do those types of tests. The reason that I left and started the company that I did was I did think that it was technologically possible to do this. I think we've established that with the pilot studies that have been done, but the other side of

it is people say well, it's very -- both from the United States and Canada, it's very costly. And the difficulty or the point to counter that is that the opportunity costs of studying the wrong problem for many years is an extremely expensive issue for Canada, as well.

Q And this is an example, Dr. McKinnell, of making sure that we ask the right questions and be clear about the right questions; is that fair to say?

DR. McKINNELL: Yes, you want to ask the right -- exactly. I mean, this kind of supports that point. You want to ask the right question and have a mechanism whereby you can reasonably expect to answer it.

Q Thank you. Just before we turn to -- looking forward in our research again, Dr. McKinnell, although we can't say the cause of the downturn is either a step or a trend, is it fairly certain that what we're talking about is the effects of the marine environment when we're looking at the trend versus the -- a trend versus a step?

DR. McKINNELL: It's the most likely cause.

Q Thank you. Now, I'm going to turn to the report and in particular I'm going to go to hard copy page 135 and in this PICES report, Dr. McKinnell, you state that:

> The greatest impediment to demonstrating conclusively whether or not the mortality experienced by the many Fraser River salmon stocks that went to sea in 2000 occurred at sea is the lack of adequate observation.

And further down in that report you say that:

> The lack of observation of salmon at sea at relevant times and space scales severely limits the ability to draw firm conclusions about their fate.

I can take you to the pages, but do you agree that that's generally --

DR. McKINNELL: Sounds like what we wrote.

Q Okay. Thank you. Now, at page 173, and I do want to go to their other --

MR. LUNN: Ms. Gaertner, I'm sorry to interrupt. Can you give me exhibit number --

MS. GAERTNER: Oh, of the --
MR. LUNN: -- (indiscernible).
MS. GAERTNER: The project report is Exhibit --
MR. LUNN: Oh, thank you. The technical report?
MS. GAERTNER: Yes. Sorry. Thank you. I'm sorry. I wasn't meaning to test you in any kind of way.
MR. LUNN: And what is the page number?
MS. GAERTNER: Page 173 hard copy.
Q Again, this was a -- oh, sorry, 173 of the actual document. And I'll just go on. The report states that:

> The current observing system can detect overall productivity changes in many individual populations and on multiple time scales, yet the observation system is not designed to answer why salmon have survived or died at greater than the average rates because it was not designed to do this.

And Dr. McKinnell, that's, of course, a very broad and important statement and I wondered if you could help us understand that. How has it failed? What do you mean? What do we need to do differently?
DR. McKINNELL: Well, I think it relates to the point that Dr. Welch just made about making sure that when you're making your observations you allow -- you make the observations in a location that allows you to rule out one region as a source of the variation that you ultimately observe as the -- in the returning adults.
Q Thank you. Now, I want to go to Tab 1 of our documents which is the 2010 Canadian Marine Ecosystem Status and Trends Report from Department of Fisheries and Oceans. Dr. McKinnell, are you familiar with that document?
DR. McKINNELL: I mean certainly I am aware of its existence and have probably read parts of it.
Q Okay. And I want to go to page 33. In that document there's -- Commissioner, this is a document prepared by Fisheries in Canada about all of Canada's marine environments and speaking to general trends and observations around all of them and at page 33 of that document we talk about climate variability and oceanographic changes and then coastal habitats and in particular they note

that:

> Most marine ecosystem time series are relatively short when compared to meteorological forcing time series which are typically long or longer.

Would you agree that this is a challenge when projecting trends in the marine environment?

DR. McKINNELL: Well, first I should correct myself. I'm not familiar with this document. I thought you were speaking of another one. But in -- but, I mean, this is a true statement that time series in the ocean are generally shorter than time series on land.

Q And this is time series as it relates to --

DR. McKINNELL: Of climate --

Q -- climate and as it relates to scientific information, the gathering of scientific information by scientists?

DR. McKINNELL: That's probably true.

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

THE REGISTRAR: 1344.

> EXHIBIT 1344: 2010 Canadian Marine Ecosystem Status and Trends Report

MS. GAERTNER:

Q Now, as you're familiar, many of my clients and in this case I'm going to speak specifically about the Haida Gwaii and I have of course, been -- have a very long time series relationship to the ocean and at Tab 14 and Tab 7 - and I'd like to bring those up together, there is an example of some work that Haida Gwaii are doing. Just maybe I'll stop. PICES does actually provide advice to other organizations in addition to governments, including, for example, you've been working with First Nations organizations like the Haida Gwaii?

DR. McKINNELL: Not to my knowledge.

Q Oh well, that's the information that I have from our clients. But that's okay.

Now, this report is a part of a larger marine use planning initiative that the Haida Gwaii and the Coastal First Nations and the Department of Fisheries are doing. Tab 14 is a brochure about

the work that's being done and Tab 7 is the accompanying map -- sorry. I did say that wrong. Haida Gwaii is the territory, the Haida are the people. I got that.

If you go to the last page on -- last page of Tab 4 there's a discussion of the Haida marine traditional knowledge study launched in 2007 to research and document Haida knowledge about the ocean and it says that 4,000 locations and 150 marine species have been recorded with some first-hand observations dating back to the 1920s. And then it talks about the accompanying map.

So now I'd like to take you to the map. And if you just scroll down so that you get a sense of the amount of detail that the Haida have been able to, over the last while, map onto and into both the marine and the terrestrial areas of their territory, you can see -- and you can go through it and take you down to the -- yes, let's just keep going to get a sense of the kind of detail that the Haida have been able to provide and if you can go over to the left you'll get a sense of the key. I don't know where the key is in that big --

DR. McKINNELL: Are the bluefin tuna on there?

Q It's to the left I think is the key. There it is. You'll see that there's salmon, there's herring, there's abalone, there's sea birds, there's clams, there's fish and there's seaweed. There's a number of different other species that have been mapped throughout their territory.

Given the need for more data about the marine environment in a longer time series, would you agree with me that this type of mapping is useful for scientists and this type of working closely with First Nations such as the Haida, the Heiltsuk and Vancouver Island First Nations is a useful way of moving forward when it relates to observations and monitoring of the marine environment?

DR. McKINNELL: I mean, certainly it's part of even the scientific process to understand the distribution and ranges of species found in the area that you're interested in.

MS. GAERTNER: Can I have this, both of these, marked as the next exhibit?

MR. LUNN: Together?

MS. GAERTNER: Yes, I think it's useful to have them

marked together.
THE REGISTRAR: 1345.

EXHIBIT 1345: Ocean and Way of Life brochure and map

MS. GAERTNER:
Q Now, in the same breath, Commissioner, you've heard about PNCIMA in the earlier evidence and the work that's being done more broadly, as mentioned one of the things that's happening through PNCIMA in the North Coast is marine use planning and I'd like to go to Tabs 9 and 10. Are you familiar with this work, Dr. McKinnell?
DR. McKINNELL: No.
Q Dr. Welch, are you familiar with this work?
DR. WELCH: No, I'm not.
Q Dr. Beamish, are you familiar with this work?
DR. BEAMISH: Can you just go down to the bottom and I'll see who wrote it?
Q So this is the Coastal First Nations Turning Point Initiative on Marine Use Planning.
DR. BEAMISH: If I just knew the author, I could tell you.
Q I don't think there'll be an author on this document. This is the broad --
DR. BEAMISH: Then I'm not then. I am familiar with a number of the -- some of the work that's being done up there though.
Q I don't think it's contentious about this work. I'd like to have this marked as an exhibit. Let's go back to the question of how to move forward. These types of observations, this type of understand, I appreciate is not the kind of scientific experimental work that you were talking about earlier, but it provides a very, from our client's perspective, a very useful way of understanding the ocean and the ocean's relationship to the land. And I heard Dr. Beamish talking yesterday about the importance of every observation you can make at sea. Will you agree with me, as a panel, that collaboratively working with First Nations using the type of mapping that they're using will be a very useful way of not only determining where it might be useful to do tests, where it might be useful to do observations, but how it is that we're going to

look at the implications of those tests and apply them on the ground.

Dr. Welch, I'll start with you, since we've just made eye contact.

DR. WELCH: I think the map is a very useful inventory of what's present in Haida Gwaii. Where the difficulty in melding the two groups or two approaches comes from is that, for example, under salmon in the key on the map, it indicates salmon but it doesn't indicate which species. So one of the challenges is how do we mesh the traditional ecological knowledge of the First Nations with the very precise data that scientists usually want to work with. So one of our challenges is just to work between two sets of people with different focuses and bring those together.

Q Yes, and we're going to get to that in a little bit, but I appreciate there's a different approach, but that bringing them together will provide a better information base; you'd agree with that?

DR. WELCH: Yes.

Q Dr. McKinnell?

DR. McKINNELL: I can see that there's a utility in sharing knowledge and the reason I asked about the bluefin tuna is because that was a traditional -- at least it's been found in middens on Haida Gwaii. But I didn't see it anywhere on the map and so because they're not currently found in that part of the world. So I think there's an opportunity for information exchange.

Q And Dr. Beamish, do you have anything to add on that?

DR. BEAMISH: You see, I'm a biologist, right? These guys are analysts beside me. I like the species list, I like knowing where animals are and I like having some estimate of how common they are. I use that material and I think in my retirement I think there's a new -- there could be a new species of fish up in Haida Gwaii and I intend to spend some time on it, so my long answer is I use this information and I think it's valuable.

Q Thank you. Now, I'm going to go next to our --

MS. GAERTNER: Oh, I should mark these as exhibits.

THE COMMISSIONER: There were two tabs were there being marked as one; is that...?

MS. GAERTNER: Yes, they can be marked as one.

THE REGISTRAR: That would be Exhibit 1346.

EXHIBIT 1346: CFN Into the Deep Blue Report and CFN Sea of Change Report

MS. GAERTNER:
Q I'd like to go to Tab 12 of our documents. Now, we were just talking about how to bring the information together -- sorry, I'll just wait until Tab 12 is there. Now, after reviewing your report -- or the PICES report, Dr. McKinnell, Russ Jones of the Haida Nation brought to our immediate attention this study which is a study of the -- it's called the Bering Sea Integrated Ecosystem Program and it's led by the Alaska Fisheries Science which is a subset of NOAA, the National Ocean and Atmospheric Administration. Are you familiar with this study?
DR. McKINNELL: I am.
Q And as I read this study and from our client's perspective it reflects a comprehensive strategic plan for conducting and compiling marine ecosystem planning with appropriate oversight by those who are agreeing on questions. They set hypotheses out and then they begin to monitor and integrate the information; is that a fair summary of what they're trying to do here?
DR. McKINNELL: Yes.
Q And in your view, would a model similar to this be useful as we begin to approach more comprehensively marine studies in British Columbia along the Northwest Coast?
DR. McKINNELL: That and the funding that went along with this.
Q Yes. I appreciate that it is actually a costly study and in the Bering Sea, given the approach of it, and so priorities would have to be set as to how we do that, but it actually provided a comprehensive overview of how the research was going to be done at the start, so instead of saying okay, well, we can only afford this much, let's do this, and we can only afford this much let's do that. That's a bit of a piecemeal approach to doing the work. This is an actual comprehensive view in which people have come together, agreed on the questions and agreed on the approach and you would agree that that might

be a useful next step on our coast?
DR. McKINNELL: Having reviewed the initial research plan, I wouldn't characterize it as being so altruistic but I think in the end you get something that seems to have that property.
MS. GAERTNER: Excuse me for a moment.
Q Sure. And maybe just for our benefits here, if you go to Figure I and the figure in the tables which is at page 27 of this document, you'll see that we've got a fairly complex -- well, we've got five sort of hypotheses, we've got a number of different observational pieces of work and then the various different modelling and approaches that would occur and that's the approach they've used in doing that; is that correct?
DR. McKINNELL: Yes.
MS. GAERTNER: All right. Can I have this marked as the next exhibit?
THE REGISTRAR: 1347.

EXHIBIT 1347: Bering Sea Integrated Ecosystem Program Overall Study Plan

MS. GAERTNER:
Q Now, in your view, Dr. Beamish, your counsel through you yesterday put Exhibit 1319 together, which is an article that you wrote with Brian Riddell and I believe the article is fairly recent. It was written in 2009 and at page 591 of that article -- sorry, I don't have the ringtail pages. You set out the scientific group that would -- that you saw as the sort of way going forward into looking at this, and when I reviewed that last night, I was surprised to see that you didn't have a place for First Nations at that table; is that an oversight on your part?
DR. BEAMISH: Well, it's an interesting question. It probably is an oversight, but in putting this together this is a -- this is a board that would comment on the key research that is needed and we wanted to keep it small. And that is the issue. It's not any intentional attempt to ignore anyone. It's an attempt to keep it small. And that's why that's -- that's where it is.
Would a First Nations representative -- should they be on that board? Well, Russ Jones is a good friend of mine. I'd put Russ Jones on

there.
Q And you agree that if that was the board that was setting the questions and setting the -- trying to determine how to approach the research, given that the outcomes of that research could strongly affect First Nations, it might be useful to have them right from the get-go?
DR. BEAMISH: Well, of course that makes sense, but you also -- you also have to have something that's small and that's always difficult because people don't like to be left out when you're making important decisions. But I understand your point and it's a good point and maybe adding one more box might be okay.
Q Thank you very much. I can move on now. I appreciate that after all of this work that where we are is that there's a lot of unknowns and Commissioner, your question earlier about the different between an anomaly and an extreme was very useful for the next place where I'm going is that you also -- we also have a sense that the trend in climate change - now we're going to go to not productivity, the trend in climate change, in the Pacific Northwest Region may be that there's no trend right now. If that's how I understood your evidence, Mr. McKinnell, that we've got 2005 was the hottest since 1972 and 2008 was the coldest since 1972, if I read the report right, and your information we've got 2003 to 2008 significantly variable. Have I got that correct?
DR. McKINNELL: Yes.
Q And so right now at any rate in our oceans, it's perhaps difficult to identify a trend and the effect of climate change?
DR. McKINNELL: The variability is certainly what we're seeing rather than the trend right now.
Q And so the variability might be the trend?
DR. McKINNELL: It might well.
Q Right. And so when we've got a variability as a possible trend, we've got the absolute need to be very precautionary; would you agree with me as it relates to decisions around the productivity of salmon in the marine, that if we've got a continual variation and we don't have a trend, that we've got to be even more precautious about our forecasts and even about how we interpret those forecasts and the returns?

DR. McKINNELL: Well, I think this relates to a point that Dr. Beamish relayed yesterday on Bill Ricker, he said -- I believe he said expect surprises.
DR. BEAMISH: Expect the unexpected.
DR. McKINNELL: Expect the unexpected. And so I think that's wise advice.
Q All right. I'd like to go to -- I have marked all my exhibits so far, First Nations Coalition Tab 13. This is a relatively recent document. I'm not sure, Dr. McKinnell, if you've had an opportunity to read the outcome of this workshop that occurred in June of 2011 by IPSO and the World Commission on Protected Areas. Have you seen this document?
DR. McKINNELL: No. Well, I've seen the cover.
Q All right. So I want to take you to page 7 and 8 of this document. Perhaps Mr. Commissioner, this is a document that's come out of a conference that was held in April of this year at the University of Oxford by -- the event was led by the International Program on the State of the Ocean and it had some outcomes and recommendations and gentlemen, it's -- it's difficult, I suppose, in these circumstances given that we will never be able to be absolutely precise in the immediate - it may take 20 or 25 years, as I've heard earlier, and so we need to know what to do in the meantime while science and First Nations and different perspectives continue. And so I want to take you to page 8 of this and obviously as it relates to climate change we can all recognize the importance of the immediate reduction in CO2 emissions, but the next two are interesting:

> Urgent actions to restore the structure and function of marine ecosystems...

And the necessity to identify as they say protected areas and approaches there.
Do you have any response to that as an immediate response to what we do in the interim before we figure all of these things out? And I'll start with you, Dr. McKinnell.
DR. McKINNELL: You've put a page up. Could you ask me a more specific question than the one you just did?
Q Sure. On the second -- beginning of page 8, the

first recommendation -- I can take you to page 7, which is the recommendations from the workshop, so that's what we're looking at.

DR. McKINNELL: Yes.

Q All right? So they're looking at technical means to achieve the solutions to many of the problems that already exist.

DR. McKINNELL: Yes.

Q And they turn over to the next page and they say:

> Immediate reductions on CO2 emissions...

We don't need to take time to talk about that here. But then more relative to our marine environment they say:

> Urgent actions to restore the structure and function of marine ecosystems...

And they list a number of steps that could be taken to do that. Perhaps take a moment and review that list. And I appreciate this is interplay between science and policy, but these are extremely important matters in the middle of this commission, and so I'd like from your expertise whether or not looking closely at some of those steps to restore the structure and function of marine ecosystems is a useful step in British Columbia right now as it relates to Fraser River sockeye salmon.

DR. McKINNELL: I don't think I can do that in the time we have available. And in part -- I mean, the first bullet is:

> - reduce fishing effort to levels commensurate with long-term sustainability of fisheries and the marine environment;

Do you mean for Cultus Lake sockeye or for Sakinaw sockeye or general? You know, is it -- are you looking for a general response that fishing responsibly is a good idea? I mean, fishing responsibly seems like a good idea to me.

Q Well, one of the things that's spoken about in this document and in the document that commission counsel talked about is making sure at times of uncertainty that we ensure that our fishing takes

into consideration the variabilities that were operating and the absolute importance of making sure that fish get to the spawning grounds. That's a good precautionary step at this stage, given the variabilities in the marine; would you agree with that?

DR. McKINNELL: Well, if I come back to the observations of the years that we've had our greatest focus on, the 2007, '08 and '09, it seems to -- you know, if we look at the observation system we have in place and the decisions that were made on the basis of that observation system, that we ended up reducing fishing when there were no fish or risk to fish and allowing fisheries when there was an abundance. So -- so the -- I mean, it seemed to me that at least at the levels of variability that we were seeing, the right decisions seemed to be made as a -- I'm not an expert on this, but it seemed like they were reasonable decisions for an outside observer.

Q In the interests of time, I'm not going to be able to take you through that whole list. And so I want to take you to the next one.

We've heard generally and understand the department's views on the precautionary principle, but here I thought was an interesting:

> Proper and universal implementation of the precautionary principle by reversing the burden of proof so activities proceed only if they are shown not to harm the ocean singly or in combination with other activities.

What do you think about that approach?

DR. McKINNELL: Well, that, in fact, has been used, the precautionary principle was used once.

Q Well, the precautionary principle, as I understand it generally, in DFO's principles is that you don't make decisions unless you have the appropriate data and if you don't have the appropriate data, you approach it carefully. That's very different than saying we won't proceed to impact the environment unless we prove that it doesn't have an effect on the ocean.

DR. McKINNELL: The principle is -- as I recall the evolution of precautionary approach and precautionary principles as they were established,

I probably first saw them in the early 1990s, and they came to bear on the squid and high seas driftnet fisheries that I was involved with at the time. And ultimately the decision on -- the United Nations General Assembly became a fisheries management organization and of all the possible options for that fishery, they chose the most extreme option, which was to close down the fishery on the basis of the information that we had been collecting, which more or less fit with the idea of the precautionary principle, not the precautionary approach.

Q I wonder if any of the other panel members want to weigh in on either of these two topics. If not, we can move on. You're not being required -- you're not forced to, but if you have a comment on this...

DR. BEAMISH: We don't want to because these are nice things to say and do but in a management agency where we fish and where we log and where we build houses and things, these are difficult issues. And so if you reversed the burden of proof which would be nice to do, there are a number of things that simply wouldn't happen. So it's not an easy thing to deal with. In an ideal world, of course, you'd be able to do that, but, you know, I live in a house and someone cut down some trees for me to live there and so these are tough things to deal with when you have to manage an ecosystem essentially.

Q All right. Let's go to Exhibit 1320 which brings this home a little bit more. This is a document that the Provincial Crown placed before you yesterday, an article by Michael Healey and I appreciate, Dr. McKinnell, that you had some disagreement with some of his data and the observations, but at page -- well, it's Table 1 beginning at page -- I can't see the page numbers on this document. One, two, three, four -- there it is. And if you go over -- go to the implications associated with climate change on -- that's what he's looking at there, and he's taking it at various different stages and Stage 6, 7 and 8, I believe are the marine environments and he says:

> From a management perspective, ensure minimum

anthropogenic stressors during ocean entry phase.

And then:

Ensure remaining high sea habitats are protected from fishing.

And then over onto the next page from a returning adult's perspective:

In the short term, rates of return, growth, et cetera, will be highly uncertain. Manager will need to reduce interception fisheries to ensure sufficient salmon reach spawning grounds. Commercial fisheries will need to be greatly reduced in capacity and perhaps limited altogether at some point.

I'll start with you, Dr. Beamish. When responding to the nature of the uncertainties and when responding to the nature of climate change, do you agree that these are reasonable approaches?

DR. BEAMISH: You know, I did read the paper, but for some reason I didn't read this part of it. I don't know why. I'm going to generalize and say that, you know, Dr. Healey is a pretty good scientist and as I read through these, of course they make sense. But again, they're more of what targets than they are maybe rules. I'm just reading as I'm talking and I'm sensitive to your time, so in general, probably they're useful, but...

Q Dr. Welch?

DR. WELCH: They're generally correct that I'd agree with them, that they do indicate that we're going to have troubles in the future, increasing troubles because of the likely direction of climate change. The broader issue though is that taken more broadly is that these need to be put within a political context of people that rely on the fisheries for many purposes, commercial, sports and so on, and it ultimately becomes a political decision as to how you're going to manage these -- those demands relative to the demand to protect the species. It's going to be a very tough issue to deal with.

Q Do you have anything to add, Dr. McKinnell?
DR. McKINNELL: Just a comment that -- I read the rest of the paper later and I think there's very sensible things that he's saying in this document. But I think it's also preliminary. It's a conceptual view of things and as an analyst and recognizing that the climate and ocean interactions are not simple "X" causes "Y", there are complexities in how they interact and how they will affect salmon. I note that he said in here there is a project going on led by Professor Mantua at University of Washington to look at this more analytically.
Q Thank you. I just have one further question which is that -- well, it's a two-part question. Is there an existing organization that any of you could recommend or would like to recommend as a way of focusing Canada's research efforts for international work regarding Fraser River sockeye salmon in the Gulf of Alaska and in the Bering Sea and then perhaps just to do it as two part, is there an existing organization that you recommend could begin to do the kind of planning for the ecosystem kind of studies that were -- that we talked about earlier as it relates to the Pacific Northwest Coast? Existing organizations that we can look to to try to provide this type of work going forward in a comprehensive way?
DR. McKINNELL: I mean, I think there are existing organizations that could fill the role. This -- I think that you cannot understand Fraser sockeye without cooperating with the United States, simply because they migrate and co-migrate with American stocks through U.S. waters and so I think it's essential that at least there be some opportunity for the U.S. and Canada to be involved in joint research and planning.

If you want to go into the Bering Sea, then you start talking -- you could get -- you know, I would say initially just the Americans but it allows the opportunity for interactions with Russian species of Pacific salmon and then the NPAFC could do that, as well.

As for how you might implement it, PICES is also -- has an agreement with NPAFC to do cooperative work on Pacific salmon and so the organization that I'm from, NPAFC, or the PSC are

all potential organizations.
Q Dr. Beamish?
DR. BEAMISH: NPAFC can do it and Dr. McKinnell mentions that it does have an agreement with PICES and Russ Jones used to be a commissioner for NPAFC and in that long-term research and monitoring plan which I think was submitted as a document here, in there we propose an International Year of the Salmon and I'm going to put some time into trying to get this established. And this is a focus on understanding what's regulating salmon abundances and population dynamics but in the ocean. And I know that countries will cooperate and I suspect that many organizations would sponsor it and I've already proposed to DFO that they step up and lead the parade and I think that that would be a nice way of bringing everyone together that will deal with this. Even though you asked us specifically for sockeye, it would fit perfectly. So yes, NPAFC is the organization that can do this. Within NPAFC we can have a focus which I'm calling an International Year of the Salmon and I think that would highlight the needs that we need to do and I still say to really come to an understanding of the fundamental processes that regulate salmon abundances, even though my colleagues don't think it can be done, I do think it can be done.
Q Dr. Welch?
DR. WELCH: I would agree with the general comments. I'd put more of an emphasis strategically on PICES because it has a broader focus than just on the fish. It's the environment that the fish are in that's equally important and I think as a general comment that there's better science that comes out of the PICES side when those things are brought in than if it's solely within NPAFC, but both of those organizations are there and I echo what Dr. Beamish says about the general thrust. It would be --
Q Sorry --
DR. WELCH: -- tactical differences.
Q Sorry I interrupted, but if you were assuming to us an ecosystem-based approach, I should have said that, but if you're -- in trying to do a broader ecosystem holistic approach, then the PICES from your perspective?
DR. WELCH: Well, you definitely need the environment

in there and within NPAFC it's what we refer to in the business as the fish heads are meeting. It's the people with the salmon biology focus. What they are -- what's lacking within that venue is the oceanographic or environmental understanding on a broader note, so that's the strength of PICES. So the two organizations together can provide much of a...

MS. GAERTNER: Thank you. Mr. Commissioner, those are my questions.

THE COMMISSIONER: Thank you, Ms. Gaertner. Oh, I'm sorry, that document, I may have missed the exhibit number but the international workshop document?

MS. GAERTNER: Oh, I don't think I actually -- I didn't mark that actually. Thank you. Could I have that marked as the next exhibit?

THE REGISTRAR: 1348.

EXHIBIT 1348: IPSO Ocean Stresses and Impacts Summary Report

THE COMMISSIONER: Mr. Lunn, do you know which document?

MR. LUNN: Yes, that was Tab 17 of --

THE COMMISSIONER: Of the -- right, thank you.

MS. BAKER: Thank you, Mr. Commissioner, next would be any re-examination from Canada. I am hoping that we can start the next panel before the lunch break, so I'm hoping any re-examination will be brief.

MR. TIMBERG: Yes, Mr. Commissioner, I have two questions.

CROSS-EXAMINATION BY MR. TIMBERG, continuing:

Q And they're both for yourself, Dr. Beamish. In cross-examination Tim Leadem, counsel for the Conservation Coalition, asked you a question where he hemmed you in, he said what is the cause of the decline, it was at either -- at either Queen Charlotte Sound or Georgia Strait. How would you answer that question if you had more than the two options provided?

DR. BEAMISH: Well, of course, it's both. All right? The process started in the Strait of Georgia. Our work and my interpretation is that there was --

let me say it differently. It makes no sense to think that all of the species in the Strait of Georgia except sockeye salmon were extremely stressed and there's clear evidence for that, and that somehow sockeye managed to avoid that stressor, swim through the Strait of Georgia either in the time that Dr. Welch mentioned or the time that we wrote about in our paper, and then somehow managed to make it to Queen Charlotte Sound and experienced similar stresses that is presented in Dr. McKinnell's report and then somehow mysteriously all got zapped in that period of time. I think that makes no sense scientifically.

So our explanation is that in 2007 there was extremely anomalous physical conditions that clearly resulted in something that's highly unusual with a synchronous response of all of the -- sorry, all of the fish in the surface waters to whatever the stressor was, our interpretation of the stressor is that it had to be associated with prey. And so it's a combination.

Q Thank you. And then Mr. Lunn, if we could go to Exhibit 1294. My second question for you, Dr. Beamish, is again Mr. Leadem brought up Exhibit 1339 which was an email from Dave Mackas which referenced some Georgia Strait plankton data and you said that there's a little bit of plankton data there. So I would like to go to page -- Slide 23, I think it is, and I note this at the bottom says source, D. Mackas. Is this an example of some of the Mackas data that he mentioned?

DR. BEAMISH: I -- probably, yes.

MR. LEADEM: All right. Thank you. Those are all my questions.

MS. BAKER: Thank you. And I have one issue to raise on re-examination with Dr. Welch.

RE-EXAMINATION BY MS. BAKER:

Q Dr. Welch, when Canada was asking you questions about the document which has now been marked as Exhibit 1314, this is the paper you wrote in 2009. I had understood Canada was going to give you an opportunity to actually speak to this document rather than just marking it, so I wanted to give you that opportunity and Canada took Dr. Beamish

to the line in the abstract which noted the average exit time from the Fraser River was four to 5.6 days after release and average residence time within the Strait of Georgia was 25.6 to 34.1 days. I wanted to just turn into the body of the document to page 746. So under the heading Travel Rate and Swimming Speeds you'll see that reference again. It says, the first paragraph in the last line of that paragraph says:

> There was no clear pattern with release date and time taken to exit the Strait of Georgia across the QCS --

Which I understand to be Queen Charlotte Strait --

> -- line --

And you can correct me if I'm wrong on that.

> Average times from release to reaching the QCS line range from 25.6 to 34.1 days.

And then, of course, you've got a map setting out your array on page 738 of this article, as well, which shows your two array lines, one at the Northern Strait of Georgia and one at Queen Charlotte Strait.

So can you just explain why -- if there's a misunderstanding in the abstract and as then incorporated into the paper Dr. Beamish was referred to.

DR. WELCH: Yes, well there's a lexical or terminological difference that in May 2009 when we published the paper, we didn't know that the focus on the Strait of Georgia as -- or the definition if it was going to be as important as it is now, so we were using the term more loosely to include up to Queen Charlotte Strait and the broader reason for that is that there's multiple papers that show Queen Charlotte Strait stocks of salmon as well as the Strait of Georgia stocks of salmon have had very poor marine survival since about 1990. So -- and that's different from the West Coast of Vancouver Island. So it's -- I've used the term loosely here because that whole area including Queen Charlotte Strait has had very poor

marine survival, so it's not just as we're currently defining it, the Strait of Georgia, that does have it.

And finally, if the commission's -- or if people are interested in looking at the rates of travel, Figure 8 on page 747 shows the estimated or the measured rates of travel through the different sections of the system that we could measure, so the Lower Fraser River to Northern Strait of Georgia in that Figure 8 shows it as 170 to 200 kilometres at the bottom, gives the numbers there and the average rate of movement is 15 to 20 kilometres, so that would be about ten days from the Fraser River mouth to Northern Strait of Georgia and then at the far right Northern Strait of Georgia to Queen Charlotte Strait 240 kilometres and the fish are going about 25 kilometres a day most years and that would again be another ten days out. So, now, these are fish that are about 170 millimetres long, 17 centimetres. The wild fish would be ten, 11 centimetres, so they would -- but we know in terms of speeds and scaled by body size that they're equivalent, so you would double those. So instead of ten days for each of those two areas, you would probably double that and take it as 20 days for wild smolts that we have not yet tagged.

Q All right. So if you'll recall in Exhibit 1305 and the paragraph is bounded by the lines 344 to 352, this is where Dr. Beamish --

DR. WELCH: Sorry, what's Exhibit 1305?

Q 1305 is the -- it's called the Residence Time of Juvenile Fraser Sockeye Salmon. It's done by Preikshot and Beamish.

DR. WELCH: Right.

Q So page 13 lines 344 to 352 is where there's this reference to your paper and it says that -- confirming, I guess, the conclusion in your paper as they read it that the tagged fish in your study were 26 to 34 days, only slightly shorter than their estimate for the average residence time, 35 days; was that a correct reading of your report?

DR. WELCH: It's a misinterpretation, because of my loose terminology, so I had used Strait of Georgia but was thinking of it as up to Queen Charlotte Strait. The Preikshot report is calculating to the end of the Strait of Georgia, so about half

that distance. So I would maintain that our estimates would give residence times half of what is indicated here for the Strait of Georgia as the commission is currently considering -- defining that term.

MS. BAKER: All right. Thank you. Those are my only questions, series of questions, on that topic in re-examination. Now, I wonder if we would be able to at least introduce the next panel before the break, which would be great. So thank you very much, gentlemen, for coming back over three days.

THE COMMISSIONER: Yes, again, thank you, Ms. Baker. Dr. Beamish, Dr. Welch and Dr. McKinnell, thank you very much again for your patience and for answering questions and for your attendance at this commission. I'm grateful. Thank you so much.

MS. BAKER: I told them we'd start before lunch, so I want to hold to my word. So we can maybe at least have the two witnesses identified, we have Dr. Irvine closer to the commissioner and Dr. Parsons closer to us and if they could perhaps be sworn in as well. Dr. Irvine's already been a witness in the proceedings, so he could just be re-confirmed and Dr. Parsons could be sworn in.

DR. JAMES IRVINE, recalled.

DR. TIMOTHY PARSONS, affirmed.

THE REGISTRAR: State your name, please?
DR. IRVINE: James Richard Irvine.
THE REGISTRAR: And your name please, sir?
DR. PARSONS: Timothy Parsons.
MS. BAKER: Dr. Parsons --
THE REGISTRAR: What is your response to the affirmation?
DR. PARSONS: I do.
MS. BAKER: It's Dr. Parsons that needs to be affirmed.
THE REGISTRAR: And your response, sir?
DR. PARSONS: I do.
MS. BAKER: Thank you. All right. Perhaps I can just identify the qualifications for these witnesses.

EXAMINATION IN CHIEF ON QUALIFICATIONS BY MS. BAKER:

Q Starting -- I will start with Dr. Parsons. Your

c.v., Dr. Parsons, is in Tab 11 of the commission's documents and that'll be up on the screen for you to have a look at in a minute. Do you recognize that?
DR. PARSONS: Yes.
MS. BAKER: All right. I'll have that marked, please.
THE REGISTRAR: 1349.

EXHIBIT 1349: *Curriculum vitae* of Dr. Timothy Parsons

MS. BAKER:
Q Thank you. And Dr. Parsons, you are -- have been a fisheries biologist for many years, you're a -- you also have expertise in oceanography; is that right?
DR. PARSONS: I'd put it the other way around. I've been an oceanographer many years and am very interested in fisheries.
Q All right. You have a degree, a Ph.D. from McGill going back to 1958?
DR. PARSONS: That's correct.
Q All right. And you are a professor emeritus with the Department of Earth and Ocean Sciences at UBC presently?
DR. PARSONS: Correct.
Q Okay. You were the president of the American Society of Limnology and Oceanography from '69 to '70?
DR. PARSONS: Correct.
Q And you received the Order of Canada in 2006?
DR. PARSONS: Yes. I'm sorry.
Q That's fine. And there's actually a medal named after you with Fisheries and Oceans Canada?
DR. PARSONS: Yes.
Q Which you received?
DR. PARSONS: Convenient. Yes.
Q And you have honorary doctorate degrees from a number of different universities including the University of Victoria, UBC, Tsukuba University in Japan and Hokkaido in Japan?
DR. PARSONS: Correct.
MS. BAKER: Mr. Commissioner, I -- Mr. -- Dr. Parsons' c.v. is set out here and I wonder if I could just ask that he be qualified as an expert in biological oceanography with particular expertise in marine food webs and fisheries oceanography

without taking the time to go through all of his publications which are set out.
DR. PARSONS: Yes, we've written two textbooks which are still selling on the subjects which you mention.
THE COMMISSIONER: Thank you.
MS. BAKER: Okay. Thank you.
Q And Dr. Irvine, your c.v. has already been marked as an exhibit in these proceedings as Exhibit 177?
DR. IRVINE: I don't see it in front of me, but --
Q I know.
DR. IRVINE: -- I'm sure that's correct.
Q It's coming.
MR. LUNN: Just working on it.
DR. IRVINE: It's a very brief c.v.
MS. BAKER:
Q Okay. In light of that, let me see if we can briefly go through your qualifications. You also have a Ph.D. In zoology?
DR. IRVINE: Yes, that's correct.
Q And you have been a fisheries biologist with a focus on salmon and ecology throughout your career?
DR. IRVINE: That's correct.
MR. TIMBERG: I hesitate to interrupt, but Dr. Irvine's c.v. was entered earlier in December as Exhibit 177.
MS. BAKER: I did identify that.
MR. TIMBERG: Oh, okay.
MS. BAKER: As that. Thank you. But you'll see that's the exhibit on the screen.
Q The c.v. that you presented earlier has just got a selected listing of publications that relate directly to -- at that time it was Wild Salmon Policy but also Fraser River sockeye. It's on the second page. But you have authored many more publications than that with respect to salmon and freshwater and marine ecology; is that right?
DR. IRVINE: Yes, that's correct.
MS. BAKER: And I'd like to have Dr. Irvine qualified as a fish biologist with a focus on salmon and salmon ecology in both the freshwater and the marine environment.
THE COMMISSIONER: Yes. Thank you.
MS. BAKER: All right.
Q And just a -- just to follow up on that, your career has looked -- over your -- in your career,

over the first part of your career, you looked at primarily the freshwater ecosystem and then in the latter half of your career, you focused more on the marine ecosystem; is that right?

DR. IRVINE: Yes, that's true. I suppose where my background is a little bit unusual is that I did spend probably the first half of my career dealing with freshwater ecosystem issues, primarily with focus on salmonids and then about a dozen years ago, I suppose, I saw the light, shall we say, or wanted a change and so I made a conscious shift to focus increasingly on the marine environment and I've done that. As I think you're aware, I co-chair the Fishery Oceanography Working Group within DFO, I've had long involvement with the Wild Salmon Policy, so I have quite a broad background.

MS. BAKER: All right. Thank you for indulging me and getting this done before the break.

THE COMMISSIONER: No, that's fine. No.

MS. BAKER: So are we coming back at quarter to? Is that what you had said?

THE COMMISSIONER: Yes. We'll attempt to get back by --

MS. BAKER: Thank you.

THE COMMISSIONER: -- quarter to 2:00. Thank you. We'll just take the lunch break. Thank you, Dr. Parsons and Dr. Irvine.

(PROCEEDINGS ADJOURNED FOR NOON RECESS)
(PROCEEDINGS RECONVENED)

THE REGISTRAR: The hearing is now resumed.

MS. BAKER: Thank you. I'm going to start my questions up with Dr. Parsons.

EXAMINATION IN CHIEF BY MS. BAKER:

Q Dr. Parsons, you have a lot of experience in phytoplankton and community structures in the ocean, so I'm going to ask if you could tell us a little bit about what phytoplankton are and how they work within the ocean in supporting sockeye salmon.

DR. PARSONS: The phytoplankton themselves are the only photosynthetic organisms in the ocean that supply

virtually all the energy for the creatures of the ocean. They're all microscopic single-celled organisms and they come in about 12 or 15 classes of organisms.

They range in size from one micron to 1000 microns linear dimensions. That means they change in size from nine orders of magnitude. What else in this planet changes by nine orders of magnitude in the biological world? From a blade of grass and a giant sequoia are different in size by nine orders of magnitude.

The ecology of grass is a lot of animals graze it and a lot of wild beasts living (sic). The ecology of giant sequoias is that a couple of squirrels might be found in one tree. So what I'm saying here is this enormous range of size of the photosynthetic organisms in the sea is paralleled by a very large range in size of the terrestrial plants.

The dominant class very often in many waters are the flagellates. Now, we refer to flagellates as being the smallest of the algae. The largest of them are called the diatoms, so they range 100 microns and more, the flagellates ten microns and less. What I shall concentrate on is the different ecologies of these.

Q All right. You made a public submission, which we have on the screen here, for the Commission and you state that:

> Food availability for zooplankton and eventually sockeye is not just dependent on the amount of phytoplankton, but on the kinds of phytoplankton in the ocean.

Can you explain that?

DR. PARSONS: Yes. We're back elaborating now on this tremendous size difference. What I'm giving you, Mr. Commissioner, is a trophodynamic concept of the ocean; that is, the feeding of phytoplankton to zooplankton to fish. There are certain areas of the ocean which are the upwelling areas, Benguela Current, the Canary Current and so on, where there is a total dominance of diatoms, of large phytoplankton. These areas are also known as places which produce most of the fish in the world.

There are also areas where you get no fisheries such as the Great Barrier Reef, the Caribbean, the Indonesian Islands. In these waters, the dominant phytoplankton are flagellates.

So if I could give you an analogy as to what the difference is between having those small phytoplankton that feed into coral reefs and having very large phytoplankton that feed into some of the major fisheries: if I was to bring a loaf of bread to my neighbour and he ate it every day, he would have enough calories for the day. If I went to the other neighbour and took him the same amount of bread, but I broke it all up into breadcrumbs and threw it around the house, it would be very difficult for my neighbour to get his loaf of bread. The ecology of his house would be turned over to mice.

So this is the sort of thing that is going on in the ocean. We have the Great Barrier Reef, the Caribbean, dominated by small flagellates, and we have these enormous fishing areas dominated by the diatoms which are a 100 microns in size.

I must make it clear, however, when I talk about coral reefs, I'm talking about an animal which is known as the Cnidarian, which is the same animal as jellyfish. It has two stages: It can either be a coral reef or it can be a jellyfish. So we, in our environment, are much more familiar with jellyfish blooms than we are with coral reefs. So the small flagellates develop ecologies which can give rise to jellyfish populations, the large diatoms give rise to fisheries. These, then, are the two extremes which I want to consider further, depending on the question.

Q All right. In the Gulf of Alaska, what kind of phytoplankton dominates that community?

DR. PARSONS: Yes, good question. I've been across the Gulf of Alaska many times and I've measured the phytoplankton. They are nearly all -- they are all small except during the spring bloom which lasts about a month. So you have an enormous body of water that is dominated by very small flagellates with the exception that the whole of the coastline - that is, the continental shelf of the Gulf of Alaska - is dominated by diatoms. It's a very rich body of water, but it's very

small. But a lot of the young salmonids and many other fish live in that coastal zone, and that is where you have very high predation.

Now, there is an interesting point here that if I say that the biggest area, the Gulf of Alaska, is dominated by small flagellates, does it then have lots of jellyfish? We can compare the Eastern Gyre, which is the Gulf of Alaska, with the Western Gyre which is off the coast of Japan. In the Western Gyre, there is a system from the Okhotsk Sea which pumps iron in the Western Gyre, and the diatoms require iron, and in the Western Gyre, you have very few jellyfish and much bigger, much larger population of fish, commercial fish, than you have in the Gulf of Alaska.

We find that in the Western Gyre, you have diatoms where, as I've already said, in the Gulf of Alaska, you have flagellates.

So what do we find when we go to the Gulf of Alaska? We find a big population of aglantha. It's too deep to have coral reefs, it's too cold mostly to have coral reefs, but we find the other form of the Cnidarian. We find large populations of jellyfish.

So generally I'm giving a picture which looks very sterile as far as being a good place for salmon to feed, but a good place for jellyfish.

Q And is it always the case -- in the Gulf of Alaska in the community structure you've just described, is that a consistent pattern?

DR. PARSONS: No.

Q Can it change?

DR. PARSONS: This is where the whole business of variations in returns of salmon come in. Every now and again this very sterile environment is penetrated by upwelling water, by a thrust of cold water, currents being carried across the Pacific. Every now and again eddies - and eddies are spinning water masses that come off the coast - spin right out into the Gulf of Alaska. And very occasionally we have a volcano which dumps a whole lot of iron into the sea, and I believe - and we'll talk about later - also sets off a change, and sometimes Gobi dust.

So there are three or four different ways in which this rather sterile environment can be enriched by the addition of iron. So there is the

potential always for change.

When I wrote this submission in '04, I wrote it four months before the volcano went up and produced this enormous diatom population. Whether or not there's a connection between that diatom population and the return of the 34 million fish needs to be discussed separately. But, in general, the concept is undeniable that the iron enriched the ocean produced diatoms and traditionally, from what we now about the rest of the world's oceans, anything that produces large numbers of diatoms is going to be very beneficial for fisheries. Hence you have a mechanism here from a sterile environment that's not producing any salmon to the sudden thrust of cold water, putting iron into the environment, and making the whole scene favourable for salmon survival.

Then the next year, this may not happen, so it can drop off again. So hence I think there is a reasonable argument in the size concept of the phytoplankton to say that this could be a mechanism, a trophodynamic mechanism governed by a bottom-up mechanism.

Q Are you aware of any studies that link phytoplankton communities to sockeye production?

DR. PARSONS: Not in terms of the open ocean. It simply has not been studied, but I have two pieces of experience with which I can reinforce my opinions.

In the 1960s I organized experiments on fertilizing Great Central Lake. We did the same thing as may happen in the ocean. We added tonnes of fertilizer to Great Central Lake per week for a period of about three months. Great Central Lake has its own little population of sockeye salmon, so we weren't dealing with the adults. We were dealing with the young parr. Those fish grew 35 percent bigger, and those fish returned in a seven-fold abundance as a result of this fertilization. The phytoplankton produced in that lake, there were lots of diatoms. So, on a mini-scale, this was an experiment in which we could say that it can be used to verify the concept.

In a second set of experiments we conducted here in Canada under an international program, we had things called mesocosms which are giant test tubes. They are between 100 and 1000 tonnes of

seawater. Within these giant test tubes which were located in Saanich Inlet, we could have everything from phytoplankton to fish.

Now, we could control the environment in these test tubes. They were called mesocosms, really. Within these mesocosms we could produce diatoms or we could produce flagellates by governing the amount of nutrients and governing the light intensity.

Where we did that, we found that young salmon -- the salmon were not the same. We were using chum salmon in these experiments. The salmon would grow very well as long as we produced a diatom ecology in these mesocosms. If we produced a flagellate ecology in these mesocosms, nothing but small phytoplankton. We got lots of jellyfish. So it was a very clear experiment. It was the kind of thing I like because you can put your hands on it and there is no correlation at the end to try and r-square of .5 or something. You've got a real result. To me, a real result is what counts.

Q Okay, thank you. Dr. Irvine, I wanted to move over to you now and ask are you aware of any estimations of phytoplankton biomass that can be done using satellites?

DR. IRVINE: Yes, Mr. Commissioner. Satellite imagery is being used increasingly to estimate phytoplankton biomass, but I just want to point out that really what the satellite imagery is doing is simply recording the colour of the surface water. Based on the colour of the water, you can develop estimates of phytoplankton.

I'll just give an analogy from my flight over from Nanaimo this morning. When my flight left Nanaimo Harbour, I was looking into Departure Bay and it's quite brown. That is probably heterosigma. When you get out in the middle, it seems to be fairly unproductive. You get closer to the Fraser, what you're looking at is the turbidity from the Fraser.

So with satellite imagery what you're doing is essentially quantifying the colour. Then there's been quite a bit of field work done to relate the different colour measurements to phytoplankton.

Q And how does chlorophyll relate to this

discussion, because we hear people talking about chlorophyll in the water.

DR. IRVINE: Okay, yes. So chlorophyll is the pigment that's produced by most plants and it's what tends to give them the colour. So with satellite imagery, you're measuring the chlorophyll-a. There's at least a couple of types of chlorophyll in plants, but it's actually measuring the chlorophyll-a production.

Q And, Dr. Parsons, did you have anything to add about the use of satellite imagery?

DR. PARSONS: Yes. Because I've just been talking about --

Q Could you put your mike on?

DR. PARSONS: Oh, I'm sorry.

Q That's okay, thank you.

DR. PARSONS: I'm old; I forget. I've just been talking about diatoms, and what has come up now, to me, most interestingly, is a paper that not only can detect chlorophyll from satellites, but here's the title: "Discrimination of Diatoms from Other Phytoplankton Using Ocean Colour Data". In other words, what we can now do is scan the whole of the Gulf of Alaska, not just for chlorophyll - which is important - but also for the proportion of diatoms. This work was done on the east coast of Canada.

Q Dr. Irvine, have you done some work looking at chlorophyll peaks in Queen Charlotte Sound and the smolt-to-adult survival of Chilko sockeye?

DR. IRVINE: Yes, I have. Because the real beauty of satellite imagery is that it's relatively cheap. The satellites are flying over, circling the globe frequently, and so you're actually able to get measurements from the satellites relatively inexpensively. You don't have to go in the field.

So working with ASL Borstad, I've been doing quite a bit of work with them over the last several years, and they have a lot of expertise in the interpretation of satellite imagery results. So we were trying to look and see if there were links between the information that could be gathered from satellite imagery and sockeye survival for example.

Q Right. And there was a paper in one of the "State of the Ocean" science documents that I think has some of this work in it, which I'd like to take

you to.
MS. BAKER: Has it been marked? Exhibit 1327, so this is the CSAS document 2010/053 and it contains, at page 132 -- once that gets put up on the screen here.
Q This document is a compilation of various articles, and there's one at page 132 which is one by you which looks at marine conditions in Queen Charlotte Sound and whether it limits the marine survival of Chilko sockeye salmon; is that right?
DR. IRVINE: Sure. And I could quickly just walk you through this if you like.

So if we look at the plot, what we have is on the vertical axis we've got what I labelled "marine survival" but it's actually the smolt-to-adult survival, so it does include the freshwater migration. On the horizontal axis is an estimate of the chlorophyll-a production within Queen Charlotte Sound during approximately the first three weeks of April.

The numbers on this plot refer to the ocean entry years, and what we noticed was that in years when there was a relatively high production of chlorophyll in early April, that the survival of the out-migrating smolts was relatively high. So, for example, the three points on the upper right part of the graph, which are '01, '98 and '04 - those being ocean entry years - those three years had relatively high levels of chlorophyll and correspondingly high levels of survival.

So what we did is we just did a simple correlation, so this is not cause and effect. This is simply a correlation. I thought it would be interesting to see how well it worked in a predictive sense. So the red line in the middle is the linear relationship, so that's the line of best fit. If you look at -- there's two dotted lines, and then there's two outside lines that are solid blue. Those are just measures of the deviation around the prediction, if you like, so that the two dotted lines, what they are saying is that there's a 95 percent probability that the actual line fits somewhere between those two dotted lines, and the two solid lines are saying that there's a 95 percent probability that the individual measurements would fit within those two outside lines.

So the two points I should point out are labelled '08 and '09, and those are in red. So those were predictions for the smolt-to-adult survival based on the chlorophyll conditions in those years.

So the '08 ocean entry year is the 2010 return year. So what I was predicting here was approximately a 4.2 percent survival. Now, we now know the measurement, the actual survival, and it's in the order of about 5.8 percent. So this was an underestimate, but the 5.8 was within the confidence limits. So if this relationship holds, and if you read the text, you'll see that I'm very careful to indicate that this is a correlation. This would indicate a relatively low survival of sockeye returning this year.

Now, the reason that we sort of felt that this was worthy of putting in the State of the Ocean report is that there is -- it's not just strictly -- it's a correlation, but there's a plausible mechanism behind it. What we've looked at is if you look at the chlorophyll concentration, which is an index of the phytoplankton, if you look at it earlier than the first three weeks in April or, indeed, if you look at the chlorophyll concentration later than the first three weeks of April, there's no strong correlation.

So the theory is that you have a high phytoplankton production in early April. This, as Dr. Parsons has indicated, results in benefits to the zooplankton community. Sockeye, by the time that they arrive in this area are probably feeding on relatively larger zooplankton so it could actually go through a couple of iterations, so that the time lag between the phytoplankton bloom in April, it would be reasonable to expect that this would result in suitable food organisms for the out-migrating smolts in June.

Q And then the 2007 ocean entry year also shows on your graph or your table that we're looking at here as a very poor return in fact.

DR. IRVINE: That's right. And so that was an actual measurement, so that wasn't a prediction. So the only predictions from this relationship are the '08 and the '09 ocean entry years.

Unfortunately, there are satellite data from

earlier years, but it was a different satellite with different equipment so we weren't able to develop the -- basically to use a longer time series.

Q Do you think, then, that the chlorophyll-a measurements in the peak in April are helpful in allowing us to predict Fraser returns?

DR. IRVINE: Well, I guess the jury is out on that. If we have really poor returns in '09, I'll probably get some sort of medal, but I'm very careful to indicate that this is a correlation which does appear to have a mechanistic relationship, but I wouldn't -- correlations like this have a tendency to break down, and in fact this r-squared of .87 means that we explained 87 percent of the variability around the survival data based on this, and this is statistically implausible to have a correlation this high. It's just that it's such a high correlation and the mechanism seems to be reasonable that I felt it was worth writing up and then making the prediction.

Q All right. Thank you. Over the last three days we've been listening to three of your colleagues talk about the Strait of Georgia and Queen Charlotte Sound and the Alaska coast and also the Gulf of Alaska. We heard people talk about the importance of the marine phase in the Strait of Georgia. In particular, Dr. Beamish testified that, in his view, the early marine phase is critical to the survival of Fraser River sockeye and he tended to focus that discussion on the Strait of Georgia, although he didn't rule out the importance of Queen Charlotte Sound.

Could I ask you, Dr. Parsons, do you have any views on that?

DR. PARSONS: Yes. I don't know if you reproduced the little graph that I drew, probably not.

Q Oh, I think it's in the submission that we just had up on the screen, isn't it?

DR. PARSONS: No, I haven't seen it. All right, let me answer the question, then. All animals go through -- no, it's not that one.

Q Not the page 2?

DR. PARSONS: I sent it to you by email.

Q Oh, number 36.

DR. PARSONS: All animals go --

Q 36.

DR. PARSONS: What?
Q 36.
MR. LUNN: Of this?
MS. TSURUMI: Tab 36 of our...
MR. LUNN: Thank you.
DR. PARSONS: Okay. All animals go through -- yes, if you get it the right way around. Sorry.
MS. BAKER:
Q We don't make people read things sideways.
DR. PARSONS: All right. This is a general growth curve for all animals. There are three stages, and it applies just as much to sockeye salmon. There's an immature stage, there is a juvenile stage and a mature stage.

The immature stage is subject to a great deal of predation. When those fish enter the ocean, they are subject to many birds of prey. They are subject to dogfish and a huge number of other things. So, during that phase, mortality is the big problem.

Then they move offshore and they enter a rapid phase of growth. The curve goes steep. They are adolescent fish. Now it becomes a matter of diet. Can they get enough of the right food to grow fast enough, and that is the period which I've been talking about in the Gulf of Alaska. That is the period which simply has not been covered to any great extent in the documents that I have seen. If they don't get the right food, they're going to fall off that growth curve and be subject to further predation. But if they can stay on that steep curve, you're going to get a good harvest.

Finally, in the mature stage, well, they're coming in towards the coast, and of course they're subject then to the fisheries.

So it's that ocean juvenile stage, Gulf of Alaska, which I think is the one in which we don't really have very much data.

Q Is there much literature on the trophodynamics of salmon in the sea to explain that period of time?
DR. PARSONS: No. That is the problem, because it's expensive to go out and study salmon once they're widely distributed. It can be done much easier in a place like the Strait of Georgia. But once they get out into the ocean, there are no studies, basically, on this. But I think using an

increased number of automated techniques including satellites and so on, that we can probably start to come to grips with that phase later.

Q And Dr. Irvine?

DR. IRVINE: Well, this is something I'd like to speak to maybe later in greater depth, but I mean Dr. Parsons is right. Essentially it's a process that begins in the lake. We have huge mortalities right within the lake from the time the eggs are deposited. So you start with 4000 eggs and then you end up with three or four adults on average returning. So there's mortality at each life history phase.

I do have a slide that I hope I can speak to later that kind of talks about this process right through the life cycle, and in my view, each of these life history stages are important in determining the total returns. So I'd like to return to that at some point.

Q Yeah, I'm just wondering if I should take you to that now or if I should come back to that. Why don't I go there now. I think I know what you're referring to.

MS. BAKER: Could you bring Tab 32 up on the screen?

MS. TSURUMI: Of Canada's documents.

MS. BAKER: Of Canada's documents, sorry, and in there, there was another document that was produced by Canada. It should be the very last one, Tab 48. I don't know if you want -- if those are related or if you wanted to deal with them both at the same time.

Q Is this the document that you wanted to go to?

DR. IRVINE: Yeah, so the two I'm thinking of is this one, but also the PowerPoint, this one. I don't know if you can do a split screen. Maybe we can just start with this one slide, because I think this is important, because I wasn't here yesterday, but I listened to the discussion this morning and on Wednesday.

What I'd really like to do is just very quickly walk through the salmon life cycle and show not only the mortality that occurs at different stages of the life cycle, but also the variability among years in terms of the survival.

So this is a figure that I put together and it essentially relates to the Chilko sockeye, so I've been spending quite a bit of effort over the

last year working with Scott Aikenhead who is a modeller and I'm more of a biologist. So we basically are working on a couple of manuscripts where we're pulling all this together.

But what we see here is the life cycle of Chilko sockeye. The estimates are the mean estimates between 1958 and 2009 with the ranges. So I'm very quickly going to go through this because I think it is instructive. So on the left-hand side of this figure is the ocean. On the right-hand side is freshwater.

So if we start up at the top, you see a picture of two -- a spawning pair of sockeye salmon. On average over this 60-year time series, we have .2 million effective female spawners. Effective female spawners are the number of female spawners that actually spawn. So .2 million, but the range - and these are measured - is between .02 to .6. So a huge range.

Now, we don't actually have estimates that we can rely on for the number of eggs or the number of fry, so I've just applied literature values. So on average you'd expect about 800 million eggs to be deposited on an annual basis for this one population of Chilko sockeye, and an average survival to the fry stage is about 20 percent. So you'd expect to see about 160 million fry. So we've already gone through an 80 percent reduction in survival. If you have conditions which are not conducive to egg-to-fry survival, you'll have much higher mortality, or alternatively, you can have a good year with good survival.

So then the average survival from fry to smolt is about 12-and-a-half percent. So we're now at the smolt stage, so this is where the fish are on their way to the ocean and we're down to 20 million on average. But again, it's varied between .16 and 77 million. So we've gone from 800 million down to 20 million and these fish haven't entered the ocean yet.

So then the next measurement that we have is to the returns. So, again, the mean return estimate which is the returns are -- a lot of people get confused with the terminology. So the returns are the number of salmon that survive to be adults before any fishery. So we have about 1.5 million returns, but again, the range is

between .07 to five million. And then about 13-and-a-third percent of those, on average, survive to become female spawners if you like.

So the point I want to make is that there's mortality that occurs at each life history stage, and it's not constant through time.

So if you could flip to the other, this one here, yeah. I don't know if you can do a split screen, but ideally, if you could have the second page of the Powerpoint presentation on one half -- we'll see how good this fellow is.

MS. BAKER: John is --

DR. IRVINE: Ah, he's great. So get to the second page there, and then what I'd like to do is very quickly walk you through some of these results, because I think they're quite instructive. What I'd like to do is start with Figure 1-D. Now, what that shows, Mr. Commissioner, is the freshwater survival. So this is for Chilko sockeye salmon. This is the survival in fresh water, and I have it arranged by ocean entry year.

What I'd like to point out is that from about 1965 through to about the early 2000s, we have basically a lot of variability, but a negative, a decline in the freshwater survivals. So this is all natural.

Then something happened after about 2005. This is really quite fascinating because suddenly this lake, the freshwater survival is much higher than it has ever been, even during a period of lake fertilization. Now, the two high points, I just want to point out on that graph are the two years that we are the most interested in, so this is the '07 ocean entry year, and the '08 ocean entry year. So those are the two points right up at the very top.

Now, if you would please look at Figure 1-E, and if you could blow that up, please? Now this looks complicated but it isn't. So this is a graph. We could call this a stock-recruit relationship. But what we show on the horizontal axis is the number of spawners, and on the vertical axis is the number of smolts. If you ignore those two triangles, what you see is a relationship that basically asymptotes at about 40 million.

So what this is saying, Mr. Commissioner, if

I'm making myself clear, is that regardless of the number of spawners that were going into this lake, the maximum smolt production, until 2007 and 2008, was about 40 million fish. But suddenly in 2007 and 2008 ocean entry years, we have these two high values. So basically this lake has suddenly shifted in terms of its productivity, and I could talk at length about why I think this has happened, and it's similar to the volcano hypothesis, but I won't. Suffice it to say that we have these two years with very high production.

Now if you would just indulge me and go to Figure 1-F, which is just to the right of this, what we have here is the same kind of graph, but this is for the ocean. So we have the spawners on the horizontal axis and the returns on the vertical axis. So this is simply measuring what was going on in the ocean, whereas the two previous graphs were measuring what was going on in fresh water.

What you see - and again, just ignore the two triangles for the moment - what you see is a lot of variability but no evidence of the plot plateauing, so no evidence of density dependence. But the upward triangle - and I want to make sure I get this right - but the upward triangle is ocean entry year 2008, so that was the year when we had really good returns. The downward triangle is ocean entry year 2007.

So what's happened here is that the ocean survival of the 2007 ocean entry year fish was abysmal, even though the freshwater survival was incredible. So we had huge freshwater survivals for both of these years, but only in the one case did they survive well in the ocean.

Now, if you don't mind, just quickly look at Figure 1-C. The reason I want to point this out is I know there was discussion this morning about whether the '07 ocean entry year was anomalously low. So what we've done here is basically computed the smolt-to-adult survival for two different age groups of salmon, and they're represented by the solid circles and the empty circles. This is a log plot. Basically what's happening here is that we've had increasing marine survival, or smolt-to-adult survival for Chilko sockeye right through until about 1989, 1990, and

this was a recognized regime shift in the North Pacific at that point, and then we've had a fairly consistent period of decline. But again, if you look at that lower triangle, the downward facing triangle, that is the '07 ocean entry year. So it is clearly an outlier. So it is not explained by any of these data, whereas I think all of the other estimates are sort of within reason.

So, Mr. Commissioner, I know this is quite a bit of detail. What I encourage you and your staff to do over the next few weeks or months is to look at these data in more detail, because I think there is a lot of information here that I think helps to understand what's going on with Fraser sockeye.

Maybe if we could just quickly go to the final page of the PowerPoint. So, in my view, Chilko sockeye returns are influenced by factors affecting survival at multiple life history stages. We've been focusing this week, or you've been focusing this week on the ocean, but let's not forget the fresh water, because the fresh water is really the main reason why the Chilko sockeye returned in huge numbers in 2010. So I have to differ with Dr. Parsons a little bit on that one.

So anyway, in summary, the low returns for Chilko in 2009 occurred despite huge freshwater survivals, and they were caused by anomalously low ocean survivals, or at least smolt-to-adult survivals, and the good returns in 2010 were the result of high freshwater survivals. The ocean survivals were in fact just average.

Q Are you able to locate where in the marine environment the mortalities were occurring at such a high level for the 2007 ocean entry year?

DR. IRVINE: Well, what I would say, it would be -- I think they got like a triple whammy. There is not a specific environment. This is something that, in my opinion, the -- to have really anomalously low survivals as we did for the 2007 ocean entry year fish, it would have to be some sort of major catastrophe occurring at some specific location, and there's no evidence of that. So my presumption would be that it would be a cumulative effect of subnormal conditions at multiple life history phases of the fish, and it's a real

anomaly.

It's exactly the sort of thing that you expect to see occasionally in times of climate change.

MS. BAKER: I neglected to mark as an exhibit the graph that Dr. Parsons used to illustrate his answer, and then I would also like to mark these two that are on the screen that Dr. Irvine just reviewed, so perhaps we should do them in order and start with Dr. Parsons' graph or table, figure. It was Tab 36 of the Commission's documents. That's it.

THE REGISTRAR: Exhibit number 1350.

EXHIBIT 1350: Chart titled "Food Chains of the Oceans - Trophodynamics"

MS. BAKER: Thank you. And then we'll mark the two documents that Dr. Irvine just referred to.

MR. LUNN: Do you want to mark those together?

MR. BAKER: No, as separate documents.

THE REGISTRAR: Exhibit 1351.

MS. BAKER: Which one are you marking?

THE REGISTRAR: And 1352.

MR. LUNN: So we just made this (indiscernible - not at microphone). Tab 32 is 1351 and Tab 48 of Canada is Exhibit 1352.

EXHIBIT 1351: Submission 0179 by Dr. Parsons

EXHIBIT 1352: Chilko Sockeye Mortality Patterns by Dr. Irvine, June 30, 2011-07-10

MS. BAKER: Thank you.

Q I'd like to move over to what's been referred to as the volcano theory. So these questions are for you, Dr. Parsons, and if I could just ask you to turn your mike on?

We've heard about a theory based on food availability in the Gulf of Alaska regarding the volcano that occurred in 2008 and how that may have contributed to large returns of sockeye in 2010. Can you explain that for us?

DR. PARSONS: We have submitted - and I don't know if you've included in your submissions - a new paper on this subject authored by myself and Frank Whitney.

MS. BAKER: It's Tab 19 in the Commission's documents,

so that could get pulled up.

DR. PARSONS: So just to run over the events, there's no doubt in the paper by Hamme that iron entered the Gulf of Alaska from the volcano. There's no doubt that an enormous diatom bloom was generated, and further, the zooplankton increased somewhat by a factor of three, a three-fold increase, although the interpretation of that differs depending who you talk to. I connect it myself with the diatom bloom.

This has happened before. It happened in 1956. Two years later in 1958 there were 20 million salmon returning when a volcano erupted in Kamchatka in 1956. So it's not a unique event although it's somewhat a singular event.

In our paper, we do not deny that there can be other events, and I've discussed these already, that you have, for example, a rather sterile water mass which has nothing but flagellates in it. It can be suddenly penetrated by water with a lot of iron in it. That will also produce a result similar to the volcano although I still hold that the volcano was responsible for the massive return.

One question which has come up - and it sort of comes up in what Jim was just talking about - why, when you had both the 2008 salmon and the 2009 salmon in the water at the same time, why did this only affect the younger fish, the 2008 salmon? Our take on that is that what you have taking place is a massive bloom of diatoms which are absorbed very quickly by the zooplankton. The zooplankton will be rather small zooplankton and they will be consumed much more easily by the younger adolescent salmon than the larger 2009 salmon which are still waiting for something big to come along. They've already gone through the stage where they were eating small prey. They're a year older.

Well, the volcano probably did not have time to produce larger zooplankton, euphausiids, a whole host of smaller fishes and so on that they could have fed on. So it doesn't disturb me that the 2008 sockeye, being very young, could respond very quickly to a fall bloom. These blooms can occur for other reasons. They usually extend as far as October so that from August to October,

it's my hypothesis that a massive bloom was generated both of phytoplankton and zooplankton. We know the zooplankton increased by a factor of three, but in the time scales we're dealing with, it would only be the smaller zooplankton that had time to generate. The larger ones would not generate as quickly.

So I can accept there is this division between the 2008 and 2009 events.

Q Sir, when you refer to the 2009 fish, you're talking about the fish that came back in 2009, a very low return.

DR. PARSONS: Yes, I'm sorry. That's the way I'm talking, yes.

Q And were all coastal sockeye stocks that would be up in the Gulf of Alaska able to benefit from this bloom?

DR. PARSONS: This is a question which is, to me, a very large question as to exactly where the salmon were at that time. My take on this one is that if an event occurs out in the ocean that is very favourable towards young salmon, they may probably move out to take advantage of that.

On the other hand, if there are no events in the Gulf, then they may be better to stay near shore because productivity near shore is much greater. On the other hand, predation is much greater near shore, so it's a win or lose situation for a young salmon. If it stays near shore, it gets more food, but it gets eaten more. If it moves offshore, the predators such as the birds and dogfish are much less, and if the food conditions are very good, then it can prosper.

But these are really quite hypothetical answers to a question which we have said is somewhat speculative, but worth recording as a possible mechanism for the 34 million salmon.

MS. BAKER: Thank you. Could I have that marked, the paper that's on the screen marked as the next exhibit?

THE REGISTRAR: Exhibit 1353.

MS. BAKER: Thank you.

EXHIBIT 1353: Parsons and Whitney 2011 manuscript re volcanic ash

MS. BAKER:
Q We've reviewed, over the last few days with Dr. McKinnell the technical report that PICES did for the Commission, and there's some discussion about this theory in that paper. I'd like to just give you an opportunity to respond to some of the comments made at page 126 of Exhibit 1291, which is the technical report.
DR. PARSONS: Me?
Q For you, yes.
DR. PARSONS: Sorry.
Q That's okay.
DR. PARSONS: All right. I have several objections to comments that have been made here. I have an objection right at the top about the --
MR. LUNN: One-two-six, right?
DR. PARSONS: -- volcano.

> The enhanced productivity of chlorophyll in mid to late August likely provided little immediate benefit to immature sockeye...as they do not eat diatoms.

Nobody ever said they ate diatoms. That's like saying lions don't eat grass, all right? So nobody made that connection, so why is he denying the connection as being made? I'm sorry, but I don't follow that.

I also don't follow on page 125. Listen to the following:

> Assuming that the immature sockeye salmon distributions in the Gulf of Alaska in 2008...what they were in the 1960s, immature fish would be feeding in the deep water regions of the Gulf of Alaska that summer.

Okay. If they're feeding in the deepwater region, it means they've passed out of the coastal region. They're off the continental shelf. But then further down, only a sentence later, he says:

> Based on current knowledge, the abundant 2008 smolt year would have been migrating along the continental shelf.

Well, which was it? Were they out on deep water

or were they migrating along the continental shelf?

I have some other smaller objections about how he believes, towards the end of that paragraph, that somehow the volcano food had to be stored over winter. There are no haystacks in the ocean. Food isn't stored that way.

I go back -- no, I think those are the main comments I have.

Q Thank you. And just above the graph, the figure that's on the screen right now, there's a sentence that says:

> The dominant copepods --

This follows up on one of the lines that you did read. He says:

> The dominant copepods with an ability to sequester the enhanced production as stored lipids, would have entered diapause at depth by mid-August.

Was that something you considered?

DR. PARSONS: The major spring bloom starts in May and continues through to June, July and then falls off. That doesn't mean to say there are not lots of organisms for salmon to eat in the Gulf of Alaska. Amphipods, euphausiids, pteropods, all these animals can bloom later in the year and some take advantage of the fall bloom. What he's referring to is the enormous effect of the spring bloom which only lasts for about three months at the most, early from May, June, July. Following that, there's lots of food available from other sources.

Q All right, thank you. Dr. Irvine, do you have any observations or comments on the potential impact of a volcanic eruption in 2008 on the 2010 returns?

DR. IRVINE: Yes, no, I'd like to make a couple of comments. The first is I look forward to reading the manuscript by Drs. Parsons and Whitney 'cause I have a lot of respect for each of those two scientists and I haven't read their paper, and I haven't looked closely at the PICES comments on this issue.

But I have no doubt that, based on what Dr. Parsons has said, that the eruption resulted in an increase in the productivity in that part of the Gulf of Alaska. But when I look at the salmon results - and I'm more of a fish person than an oceanographer - it doesn't quite line up. Dr. Parsons indicated why the '09 returning fish would not likely have benefited from this, but I would like to just point out that when the salmon are in their final year of maturation in the ocean, nutrient sources are extremely important to them because they're essentially getting ready to not only migrate all the way back to the river mouth, but then all the way up the river. So they accumulate a lot of mass, they accumulate -- their lipid concentrations go up. They're also putting a lot of energy towards reproductive product. So I guess I would have expected some sort of residual -- some sort of effect for the '09 returns. But perhaps that's not fair.

But when you look at the actual salmon results, we know that the 2010 sockeye returns to Alaska and to Northern British Columbia, in particular the Skeena and the Nass, were all well below average, the returns to the central coast, in particular Rivers Inlet and the west coast of Vancouver Island, which is Barclay Sound, and the Fraser, as well as the Columbia, were all either high or higher than expected.

But these salmon all went to sea in '08, or most of them went to sea in '08 which was a very strong *La Niña*, which was cold water, and so one would anticipate that the survivals of fish going to sea in a *La Niña* would be reasonable. And in fact Dr. Hyatt, in his annual reports to the "State of the Ocean", forecasted higher survivals based on that particular parameter.

But then the real issue is -- it's very confusing. People talk about returns, people talk about escapements. Well, returns is just sort of one year to the next. We had low returns in '09 and high returns in 2010. Well, those are different groups of fish. There's very little exchange between those two. So really what you want to be looking at is the survival in the ocean.

Now, the figures that I just bored you with

in my previous discussion, we're talking specifically about the smolt-to-adult survival, so the survival from the lake. Certainly for Chilko sockeye, what we saw was that although the returns in 2010 were really, really high, that was not the result of what went on in the ocean. It was what happened in freshwater. The ocean survivals were higher than they had been in relatively recent years, but they were not different than the long-term average. So --

Q It's just like looking at the productivity, for the recruits-per-spawner kind of productivity index?

DR. IRVINE: No, I'm looking at the survival. See, recruits per spawner is different. This is what Peterman does, right, he looks at recruits per spawner. But that doesn't differentiate between the fresh water and the marine. So what I'm talking about with the Chilko, which is one of the rare instances where we can actually separate the mortality in the lake from the mortality that occurs downstream from the lake, and for the 2010 high returns, the reason the returns were so high was largely a result of an unusually high survival in the lake environment combined with reasonable survival in the ocean.

So I guess when I look at it, it's a very sexy -- it's really cool. But I guess I'm a little bit sceptical that it is actually a real reason for sockeye survival in this instance.

Q Thank you. Is there anything you wanted to add in response, Dr. Parson, before I move to a new topic?

DR. PARSONS: Well, I think what we're getting into, from what I gather from Jim, it really depends where the different stocks of salmon are located in the Gulf of Alaska. We don't have a lot of information on this, but Blackbourn published a paper in the late '80s. Welch and myself published a paper more recently. In both those papers, we indicate that different stocks of salmon go to very specific locations in the Gulf of Alaska. They don't swim around taking advantage of whatever they find.

Now, I contacted someone on other animal migrations, birds and reindeer and things, and I said, "Do birds always go from point A to point

B?" "Yes, except for five percent which are wanderers." Now, the point of this is do sockeye from the Chilko go out and mix with all the other salmon, or do sockeye from the Chilko go out to a specific location?

The two papers I've referred to, first by Blackbourn and the second by Welch and myself using radio isotopes, indicate in a cursory manner that sockeye go from one stock location in the rivers and lakes to another stock location. If they do that, then you can expect to have high seas variation.

A recent publication from the United Kingdom shows - and this is very recent - that salmon in the Atlantic do exactly that. They go from one location to another specific location in the ocean. In other words, the ocean isn't just a mixture of all these different stocks. So long as the stocks are going to different locations, it means you're going to have a mechanism which will say this year the Chilko Lake salmon did really well, but the Harrison Lake salmon didn't do at all well. Well, they ended up in different locations where maybe there was a physical difference in the water mass and, going back to my theory, that the diatoms were very rich in that region but 500 miles away where the other stock was located, they didn't get the same effect.

We don't have that information. We need that information.

Q All right. Thank you. I have two questions that I'd like to ask both of you in sequence and they're related. The first question is whether you think that further high seas research needs to be done in the Gulf of Alaska, and if you do think so, how can that work be done? I'll start with you, Dr. Parsons.

DR. PARSONS: What we need is real-time data collections. Look, if you go into a physician's office, he doesn't say I've got a model of you, I'll tell you what's wrong with you. He takes your temperature, he counts your red blood cells and assigns you to a certain treatment.

I grew up in the biology of agriculture and I took a degree in the biology of medicine. In both those fields of biology, there is an analytical approach to the problem. What we need to have is

real-time data on the ocean to be able to form a conclusion the same way as a physician forms a conclusion about you.

How are you going to get it? There are new instruments, gliders, that go 1000 miles into the ocean and come back with all kinds of data. We've talked about satellites. There's electronic tagging, the Argo Float Program, and best of all for me would be a satellite that could measure the amount of diatoms in the sea. If we have those data coming in, we can make a diagnosis that the ocean really does look good for salmon this year. There's too much of a time lag in the kinds of data that we're getting at the moment. We want hands-on data.

And I want to follow this by saying those data should not be put into a model. Physicians don't make a model out of you. There's a tendency now to make ecosystem models which are not predictive. They're very helpful in understanding mechanisms, but understanding mechanisms, that's quite different from being predictive. We need to be predictive on the basis of the most recent data available.

Q And do you see a role for non-scientists in assisting in gathering any of this data?

DR. PARSONS: Yes, I do. I think -- and I've been talking -- I play tennis with a couple of fishermen. They've been out to sea in the Gulf of Alaska and they said if they had a boat that was big enough, 120 feet - not your normal type of fishing boat on the coast - they could probably go out --

MS. BAKER: Sorry.

DR. PARSONS: Oh, I'm sorry. Excuse me.

MS. BAKER: Not allowed to lean back here.

DR. PARSONS: They could probably go out and collect data. What we need from someone is to be able to go out without the expense of a research vessel, which is incredibly expensive, collect salmon, get the exact position of those salmon from PDS system, bring it back and have the salmon identified by genetic analysis, that the salmon they caught at such-and-such a location was a Chilko salmon. This is the way things are leading up in the Atlantic and, as I said, at least two papers in the Pacific.

But I think the fishermen might be willing to do this for a price, but that price would be a lot less than building a lot of research vessels. But it's a very tedious thing to go out and catch salmon in the Gulf of Alaska and find out exactly where they're located.

MS. BAKER:

Q Thank you. And Dr. Irvine?

DR. IRVINE: Well, you know, it's a big question and I think the most important thing, before designing or thinking about any new program, is to be very specific as to the questions you're trying to answer. So are we just trying to figure out what happened with Fraser sockeye? Are we trying to understand the entire ecosystem? Are we trying to predict what's likely going to return? Are we trying to understand the mechanisms?

I agree totally with Dr. Parsons. We do need real-time data, but I think -- I'm sure you've heard over the last several days lots of ideas on projects that should be undertaken, but again, it comes back to what is it we're trying -- what are the questions we're trying to answer?

Partially, I've got some strong views on some of the types of research that I think are appropriate that are much less expensive that would enable us to understand what's going on in the ecosystem. So I'd like to be able to talk about that.

The one really interesting thing with Fraser sockeye is that we've been studying these fish since before I was born, maybe even before Dr. Parsons was born, but I'm not sure about that, but for quite a long time. Despite what you may have sort of gathered over the last few months, our understanding of Fraser sockeye is far better than almost any other salmon species or group of species in the North Pacific. So certainly within Canada, Fraser sockeye is where we've got the most knowledge. But what we haven't done in my view is utilize the information that's been gathered.

One of the projects that I'm really keen on is basically a retrospective examination of scale-growth patterns. So I think probably, Mr. Commissioner, you understand that the scales of a fish are like the growth rings on a tree. So we have scale samples going back over 60 years, and

each of these scales provides an estimate or a measure of the growth between each of the years of that fish. So you've got the freshwater growth, you've got the first marine growth where these fish are relatively coastal and southern, the second marine growth period where they're perhaps largely confined to the continental shelf, and then the final period when they're on their way back. So we have a huge source of information that would enable us to look at things like density-dependent effects in the marine environment over the last 60 years, as well as to be able to look at, for example, if there was a volcano in 1962, we can look at the growth patterns of the fish that were in the ocean in 1962 and we can see whether there was in fact a response. We could do this with the fish that we've been talking about right now simply by looking at the growth patterns.

So, to me, the biggest issue with Fraser sockeye, with the possible exception of climate change, is enhancement in Asia. It's the production of pink salmon from the Soviet Union. This is a huge -- I've been there and I've seen the incredible, the exponential increases in the numbers of pink salmon that are being released into the marine environment.

So if we can go back in time and look at density-dependent effects in the marine environment, we should be able to anticipate more accurately what's going to happen in the future with respect to things like Asian pink production, or climate change, warming. So I'm a strong believer in sort of making better use of the information that we have, because to do that, you're talking about relatively small amounts of money.

I was thinking this morning of some examples, and that was the primary one I thought of. But there's also things like, for instance, we enumerate the smolts that are leaving -- I'm trying to think of things that people haven't talked about probably, so at Chilko Lake there's a video enumeration program of the out-migrating smolts. And what they do is they sample these video images. We have this going back many years, this videotape.

Now, we have the technology now to digitize those images and basically not only estimate the numbers of smolts, but the sizes of the smolts that have been leaving over the last multiple years. So again, that's something that's relatively cheap.

One of the things I'm very interested in is quantifying the variance associated with the survival time series, and that's the plots I was showing with the two different age classes. To do that requires somebody spending probably several months going through filing cabinets of the Salmon Commission to basically get the old data sheets to find out what the actual sample sizes were. I mean, this is not high-tech stuff, but it would enable us to basically understand how accurate our estimates of survival over the time series have been which, to me, is one of the things we're really interested in.

Satellite imagery, we have -- the change in Chilko Lake that I alluded to is perhaps a result of the receding glaciers, and you've got the terminal moraine at the outlet of the glacier that perhaps is providing iron or some other nutrient which is fertilizing the lake which has caused this increase in freshwater survival. So satellite imagery is something that, again, can be better utilized.

Dr. Parsons talked about how satellite imagery now can differentiate between the different types of phytoplankton, basically the good planktors and the bad planktors, the diatoms and the flagellates and things like heterosigma which can be a concern out here.

So I guess my plug would be that we need to think carefully about the questions we're trying to answer, but let's not forget about these huge stores of data that haven't been properly analyzed and samples as in the scales that haven't been properly examined.

Q Is the research on the marine area being well coordinated right now in your view?

DR. IRVINE: Research on what?

Q All of the different marine areas that you've talked about and what could be done. Is there a coordinated plan that is being implemented?

DR. IRVINE: Well, I'm quite involved with NPSC as you

probably know, so Dick Beamish and I have been sort of -- he's been the lead, but I've been the second for quite a few years with some sort of variation. So I've been quite involved NPSC and with PICES. Both of those organizations serve to coordinate research.

You heard this morning sort of the discussion of the pros and cons of NPFC versus PICES, and NPFC tends to be more the fish people, and the PICES are more the researchers, if you like. But the two need to come together. There's opportunities for improvement in terms of coordination. We definitely do have to interact with scientists from other countries. We are doing that. But I really think what we need are clearer objectives on what it is we're trying to achieve and a reasonable understanding of the likelihood of achieving those objectives.

THE COMMISSIONER: Ms. Baker, I think we'll take the break.

MS. BAKER: Okay.

THE COMMISSIONER: And then we'll adjourn at 4:00. I don't know what...

MS. BAKER: I'll talk to my friends over the break about how we're going to deal with the time this afternoon. I have about one question left for these fellows and then I'll be done.

THE COMMISSIONER: All right.

(PROCEEDINGS ADJOURNED FOR AFTERNOON RECESS)
(PROCEEDINGS RECONVENED)

THE REGISTRAR: The hearing is now resumed.

EXAMINATION IN CHIEF BY MS. BAKER, continuing:

Q Thank you. I only have two -- well, two-and-a-half questions left. So the first question I want to ask both of you is we've heard about research priorities in different geographic areas already in this -- in the previous few days, and looking at Strait of Georgia, Queen Charlotte Sound, Hecate Strait, south-eastern Alaska or Gulf of Alaska, looking at those geographic areas, where would you prioritize research needs right now? And I'll ask you to start, Dr. Parsons, and we're just looking at those geographic areas, is what

I'm asking about.
DR. PARSONS: Well, I think where we're missing most data, because it's hard to get to it and it's expensive to operate, is in the Gulf of Alaska. So I would favour some works and programs being started out on the Gulf of Alaska, where I've indicated what we need is real-time data.
Q Okay, thank you. And, Dr. Irvine?
DR. IRVINE: Well, what I think is most important is to be able to continue to partition the lifecycle into different stages and look at the survival. And so clearly we need -- we need a program or should have a program in the Lower Fraser River as other people have talked about, and it's not a difficult -- well, it's not impossible to do. So we have a multi -- basically, you're estimating the portions of the different populations near the mouth, determining the populations based on the DNA, and then what's really important is to have estimates of survival and abundance at at least one site upstream, for example, the Chilko. But that similar project could also be implemented in areas such as Johnston Strait or Discovery Passage. So somewhere in that area, so that you can basically partition the mortality further along in the time series.

Certainly we need work in Queen Charlotte Sound and Gulf of Alaska. There's quite a bit of work already going on in the Gulf of Alaska and also the Bering Sea, so I think the important thing there is to try to collaborate with other researchers and basically piggyback with their programs. I think there's ways that we could expand the focus of existing studies and obtain useful information.
Q And then my last question is for you, Dr. Irvine. You've got the unique experience of having done many years of work in the freshwater, and then again many years in the marine environment. Do you think that we need to add additional resources to the freshwater analysis so fry assessments and that kind of thing in the freshwater environment, or is it time to move more to the marine, which is what we've been hearing a bit recently?
DR. IRVINE: Well, I mean, I tried to demonstrate in my presentation that we don't want to forget about the lakes, because there's a lot of mortality that

occurs in the lakes. Now, I don't know if anybody has spoken to this Commission on all the hydroacoustic estimates of sockeye.

Q They have.

DR. IRVINE: Has that been done?

Q Yes.

DR. IRVINE: Okay. So that, you know, that is something that should continue, but it needs additional verification. I think that we have to be focusing more at the conservation unit level. And so we're still continuing to talk about stocks, we're talking about groups of populations with very different life histories, so that even within Chilko Lake there are two conservation units. These are distinct groups of fish with different life histories. You know, so that I think we have to understand the variability within a taxonomic species, and to do that requires additional work in freshwater.

MS. BAKER: Okay, thank you. Those are my questions. Now, Canada, my friends have been very cooperative with me in giving me time estimates that should allow us to complete today, so Canada is first and he's estimated 15 minutes.

MR. TIMBERG: Yes, and for the record Tim Timberg and Geneva Grande-McNeill for Canada.

CROSS-EXAMINATION BY MR. TIMBERG:

Q A series of questions for you, Dr. Irvine. What's your present involvement in the Wild Salmon Policy, Dr. Irvine?

DR. IRVINE: Well, as you know, I was very involved right through the development of the Policy, but my main role right now is I co-lead Strategy 3 with Dr. Kim Hyatt, and so this is essentially the ecosystem component of the Wild Salmon Policy.

Q Thank you. And is the State of Ocean report linked to the Wild Salmon Policy?

DR. IRVINE: Yes, it is, and I guess my main interest, my main -- one of my main research interests is trying to do a better job of linking what goes on in the ocean in terms of the physical and chemical aspects with fish production. And so this is essentially an aspect of the Wild Salmon Policy is trying to understand better the factors in the ocean that are controlling salmon survival and

production. So that's kind of my, I guess, the official justification for me, co-chairing the Fishery and Oceanography Working Group.

Q Thank you. And, Mr. Lunn, I thought we could put into evidence three more State of the Oceans. If we could go to Canada's Tab 27, and can you identify this 2006 state of the ocean document, Dr. Irvine?

DR. IRVINE: Yes. This is the Science Advisory Report for --

Q So this is the somewhat -- the shorter form of it?

DR. IRVINE: That's right. So right now each year we produce two different documents for the State of the Ocean. We produce -- let me just back up a little bit. So the State of the Ocean is a meeting of scientists that occur annually. It's largely made up of scientists and biologists within Fisheries and Oceans Canada, but also includes university people, provincial people, NGOs and some American researchers. But the intent is basically to bring together the oceanographers, you know people like Dr. Parsons, with the fish types, so people like myself, so we can get together and talk and find out what each other are doing. So we have a workshop, the various researchers make presentations, then these are summarized in what we call a research document.

Q And that's what this is.

DR. IRVINE: No, this is an advisory report.

Q Okay. So I'm just cognizant I only have 15 minutes, Dr. Irvine, so...

DR. IRVINE: Okay.

Q So this is the summary document.

DR. IRVINE: This is the summary document. This one is peer reviewed.

Q Okay.

DR. IRVINE: The other document is not.

MR. TIMBERG: Okay, thank you. If that could be marked as the next exhibit.

THE REGISTRAR: Exhibit 1354.

EXHIBIT 1354: State of the Pacific Ocean 2006, CSAS Science Advisory Report 2007/019

MR. TIMBERG:

Q Okay. And if we could then go to Canada's Tab 29.

And, Dr. Irvine, could you identify this document, the 2007 State of the Pacific Ocean?
DR. IRVINE: Yes, I do.
MR. TIMBERG: Okay. If that could be marked as the next exhibit, please.
THE REGISTRAR: Exhibit 1355.

EXHIBIT 1355: State of the Pacific Ocean 2007, CSAS Science Advisory Report 2008/028

MR. TIMBERG:
Q And then if we could go to Canada's Tab 30, please. And could you identify this document, the 2008 State of the Pacific Ocean document.
DR. IRVINE: Yes, this is the next in the series. Yes.
MR. TIMBERG: And if that could be marked.
THE REGISTRAR: Exhibit 1356.

EXHIBIT 1356: State of the Pacific Ocean 2008, CSAS Science Advisory Report 2009/030

MR. TIMBERG:
Q So, Dr. Irvine, I'm wondering if you could provide us with an update on the current various status assessments that are being done on sockeye salmon, and to assist you perhaps we could pull up Canada's Tab 28.
DR. IRVINE: Okay. So I think what I'd like to point out is that --
Q Perhaps before you start you could give us an overview of what assessments are being done and then maybe we'll go to the specific document so we can understand the various --
DR. IRVINE: Okay.
Q -- assessments that are out there.
DR. IRVINE: All right, thank you. So there are status assessments done on sockeye salmon and other species at different levels. And so the document that's on display right now is produced by the IUCN, which is an international conservation body, and I'm a member of the Salmonid Species Specialist Group within this committee. So this committee, actually they do things like they assess the status of panda bears and polar bears and hundreds of species, but they do it at a worldwide level.
So we, I was on the committee that actually

assessed the status of sockeye salmon through this process, and I think there's a couple of documents that refer to that.

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

THE REGISTRAR: Exhibit 1357.

EXHIBIT 1357: IUCN Red List - Categories and Criteria (version 3.1)

MR. TIMBERG:

Q And if we could perhaps then go to Canada's Tab 33. And Dr. Irvine, can you identify this document titled "Sockeye Salmon" and it has a logo "Red List" in the top left-hand corner.

DR. IRVINE: Yes, I can. This was the background documentation for the IUCN listing of sockeye salmon internationally.

Q And if we could go to page 12. Could you describe for the assistance of the Commissioner how this document is relevant to Fraser River sockeye salmon?

DR. IRVINE: Certainly. So the IUCN is, as I mentioned, this is the international group that assesses the status of all sorts of different species. And I don't quite remember the year this was done, but probably five or seven years ago there was an assessment done on sockeye salmon in the world. And so essentially what you're looking at here are what they call subpopulations of sockeye salmon in the south-eastern range of their distribution. And I think the point I'd like to make is this includes the Fraser, but it also includes sockeye subpopulations right down into -- into the Columbia, and then up into Southeast Alaska.

And the point I think I should make here is that there's a lot of variability in the status of populations of sockeye salmon. And but this is done at a relatively large geographical area, so for instance unit 68 is -- comprises about approximately maybe 40 percent of the Fraser River watershed. So there's a number of different populations that are contained within -- within that group.

So when the IUCN looks at status, it's relatively new that they're looking at it within a

taxonomic species. So traditionally when IUCN has looked at the status, they would look at the taxonomic species. So they'd look at the status of polar bears.

Q Right.

DR. IRVINE: Salmon, of course, are different with all these different populations. So this is one level.

Now, the criteria that the IUCN uses are essentially the same as we use in Canada for COSEWIC and the ***Species at Risk*** designations. And so you've probably heard that there was a COSEWIC report down on Cultus sockeye. There's another one that is being -- that's in preparation for Fraser sockeye, and that will be completed within the next eight to ten months. And that's looking at a much finer geographic unit, in fact, it's looking at it from a conservation unit basis. And I'm sure what will be determined is that within the Fraser there are conservation units that are relatively healthy, and there are conservation units that are unhealthy and that a bunch -- a bunch in between.

Q And who's doing the work on this present COSEWIC assessment?

DR. IRVINE: Well, Dr. Blair Holtby has a contract to do this, and I believe he's working with Dr. Chris Wood. Dr. Holtby presented a sort of preliminary version of the methodology underlying his status designation approach last week at the Biological Station.

So I think the point is that there's -- you can assess status using different metrics, and you can assess it at different levels. So you can use the taxonomic species, you can use subpopulations, you can use conservation units. And so there's this continuum of different biological groupings that you can assess the status of.

Q And can you give an update for the assistance of the Commissioner on Sue Grant's work on conservation unit assessments?

DR. IRVINE: Yes. So my --

MS. BAKER: Sorry, if I could just interrupt for a moment. Mr. Commissioner, I have some difficulty with this. This panel is to deal with marine habitat and I'm not discounting any of this evidence that Dr. Irvine is giving, which I'm sure

is important and relevant. However, we're dealing with the marine theme today and all of our colleagues today will be prepared for the marine theme, not dealing with COSEWIC or ***SARA*** listings or updating on CU status. And I'm not -- I don't know how far along we can go. He's only got 15 minutes. He's got five minutes left and I am concerned that it's not really fair to the other participants to have a bunch of new evidence come in on topics which nobody's prepared to deal with today.

So I don't know what we can do with this. There's only a limited amount of time here today, so it's a very superficial, you know, content that can be given on these topics, which is entirely out of context for what we're dealing with today. So I do have a concern with this examination continuing in this way.

MR. TIMBERG: I'm prepared to move on. Dr. Irvine was a member, and it seemed certainly relevant to the terms of reference.

This morning Justice Cohen -- oh, if I could have that marked as an exhibit, please.

THE REGISTRAR: Exhibit 1358.

EXHIBIT 1358: IUCN - Sockeye Salmon (*Oncorhynchus nerka*) Supporting documentation and summary for Red List assessments at species and subpopulation levels

MR. TIMBERG:

Q Dr. Irvine, this morning the Commissioner asked a question with respect to what's the best way to resolve scientific disagreement amongst scientists. Do you have a brief comment on that?

DR. IRVINE: Well, first of all, you know, with respect to my colleagues, scientific disagreement is common and healthy, and that's how science moves forward. You have to have disagreements. But the way to resolve these issues is essentially through the peer review process. So we've seen a number of documents presented this week that are peer reviewed, and some that are not. You know, I tend to place a lot more influence or weight on those that have gone through a proper thorough peer review process.

Q And what is a proper peer review process?

DR. IRVINE: Well, you know, there's all sorts of levels of peer review, and there's sometimes you'll have review by your peers, and that's not a peer review process. I mean, normally, a good peer review process should have some anonymity, and the better journals will have relatively high rejection rates because it's difficult to get a paper published in a really good journal. So that it's reasonable to expect that, you know, that not everything is worthy of publishing in the primary literature.

Q Do you have a recommendation with respect to the use of peer review and the papers that have been filed before this Commission?

DR. IRVINE: Well, certainly, you know, articles that have gone through a formal peer review process should be given more weight than articles that have not. That doesn't mean that the information in un-reviewed articles is not valid, but it hasn't been proven.

MR. TIMBERG: Thank you. Those are all my questions.

THE COMMISSIONER: Thank you, Mr. Timberg.

MS. BAKER: The next questioner would be Mr. Alan Blair.

MR. BLAIR: Mr. Commissioner, for the record, Alan Blair with Shane Hopkins-Utter appearing for the B.C. Salmon Farmers Association. I have four topics in ten minutes.

Mr. Lunn, could we see Exhibit 1227, please. There's a graph on PDF 144.

CROSS-EXAMINATION BY MR. BLAIR:

Q Dr. Irvine, these questions are for you. The document that we've brought up and the graph in the upper left corner on the screen refers to the increasing of contaminant concentrations in the Strait of Georgia. You're familiar with this graph, of course?

DR. IRVINE: I am familiar with it. I'd like to know which document this is from, though, if I could.

Q Sure. We can go back a bit to the -- can you go back to the --

DR. IRVINE: The first page.

Q -- cover page, Mr. Lunn.

DR. IRVINE: Okay, thank you.

Q Thank you. And my questions relate primarily to

the impact of these increasing concentrations of contaminants in the Strait of Georgia. And in the margin of the -- of the graph, there's a reference to pharmaceuticals and PBDEs, and PBDEs are sometimes referred to as endocrine disruptors; is that correct?

DR. IRVINE: That is correct, but this is out of my area of expertise, and this is a document that was, I believe, 160 pages in length, so I won't be able to speak authoritatively on this particular figure.

Q All right. You were listed as one of the authors, I'm correct?

DR. IRVINE: I'm listed as one of the editors, that's correct.

Q I'm sorry, editors.

DR. IRVINE: Yes. So the authorship is up top.

Q Are you able to comment generally, then, or perhaps not, on whether or not pharmaceuticals that are intended to have biological effects on people can also have biological effects on organisms when they're flushed into the marine environment?

DR. IRVINE: I would rather not. This is out of my area of expertise.

Q I appreciate that.

DR. IRVINE: Thank you.

Q Can we -- it's already marked as an exhibit. Can we go to B.C. Tab number 11, Mr. Lunn. And, Dr. Irvine, the document that is being pulled up is titled the "Fraser river sockeye salmon marine survival decline and harmful blooms of *Heterosigma*" algae bloom.

DR. IRVINE: Yes.

Q We're getting closer to your comfort level?

DR. IRVINE: Closer, yes. No, I've reviewed this paper.

Q Thank you. This paper refers to the fact that *Heterosigma* has been detected in B.C. coastal waters for about 50 years; is that correct?

DR. IRVINE: I believe so, yes.

Q And are you able to indicate whether you're familiar with any linkage of the *Heterosigma* bloom to returning numbers of salmon? Is there a relationship?

DR. IRVINE: Yes, there's -- as presented in this paper, there is a correlation between the

Heterosigma blooms and the survival of Fraser sockeye salmon.

Q And that's fairly set out in a very brief way in the abstract, which is on the screen now?

DR. IRVINE: Yes, this reflects the information in the manuscript, in the paper, yes.

MR. BLAIR: Thank you. Might this be marked as the next exhibit.

THE REGISTRAR: Exhibit 1359.

EXHIBIT 1359: Rensel et al, Fraser river sockeye salmon marine survival decline and harmful blooms of *Heterosigma akashiwo*, 2010

MR. BLAIR: Thank you.

Q Mr. Lunn, Salmon Farmers Tab 10, please. And Dr. Irvine, you're an editor of this document, as well.

DR. IRVINE: That's correct.

Q I wonder if, Mr. Lunn, you could go to page 16 and 17. It's the PDF -- I'm sorry, the PDF pages. And could you split the screen, please, and also bring up Exhibit 1326 - it's like a quiz - and go to PDF page 14. Take a moment, Dr. Irvine. You're familiar with both of these documents?

DR. IRVINE: Yes, I am.

Q My questions relate to the -- if you can look to the left page, left side of the page, the red and the blue in the graph on the left side of the screen. This refers to water temperatures.

DR. IRVINE: Yes. This is a work that was by Dr. Holmes, where he's looking at correlations between sea surface temperature anomalies and albacore tuna abundance.

Q And these water temperatures are on the west side of Vancouver Island?

DR. IRVINE: Well, I'm just reading the text, and it says "Amphitrite Point".

Q Figure 9, it says the southwest coast of Vancouver Island.

DR. IRVINE: Yes, I guess that's correct. Yes.

Q We saw this graph in the last panel, and there were some discussions about water temperatures generally. And so the blue, I understand, indicates colder than normal waters, and red indicates warmer than normal waters for that location? You're familiar with that?

DR. IRVINE: Yes, that's correct.
Q And if you can then look to the other side of the screen, to the other article that I have on the viewer. I understand from -- if you could take a moment to peruse the bottom of PDF page 16, and the top of page -- the next page, there's a reference to catch-per-unit-efforts for juvenile salmon.
DR. IRVINE: Yes, that's right.
Q And as I understand it, when you read those two references together and link them back to the graph on the other side of the split screen, there seems to be a correlation, and that may not be the right word, but I'll start with that, showing that you have higher than normal catches when the water's cold on the West Coast, and lower than normal catches when the water is warm on the West Coast of Vancouver Island. Do you see those references on those documents and do you draw the same conclusions?
DR. IRVINE: Well, actually, the figure on the right is talking about salmon survival.
Q Yes.
DR. IRVINE: And the figure on the left is talking about tuna catch.
Q Yes. But it refers to water temperatures, so the figure on the --
DR. IRVINE: That's correct.
Q -- the figure on the left is reference for water temperature. I appreciate it's albacore, but it's reference for the water temperature.
DR. IRVINE: Yeah. That's correct.
Q So where the water is cold on the West Coast, left side of your screen.
DR. IRVINE: Yeah.
Q You have a high incidence of catch for salmon, right side of your screen, correct?
DR. IRVINE: Well, not catch, survival.
Q I'm sorry survival. And likewise when it's -- the water's warm, the survival is lower?
DR. IRVINE: The water tends to be -- the survival tends to get lower, that's correct. Yes.
Q Would you call that correlation?
DR. IRVINE: Well, this is -- it's a principal component analysis, so it's a different statistical approach. But there is a correlation between -- what we found on the West Coast of

Vancouver Island, and this is work of Dr. Trudel and Dr. Dave Mackas primarily, is that in years that are relatively -- where the sea surface temperature is relative cool, you tend to have a copepod community that's dominated by lipid-rich individuals that tends to favour the early marine growth, survival of the -- of coho salmon and chinook salmon.

Q So these two documents read together, one could conclude that, for example, salmon stocks that migrate up the West Coast of Vancouver Island, perhaps Fraser River, Fraser -- I'm sorry, Harrison Lake sockeye, perhaps some of the Columbia River fish have a higher survival rate in cooler water, in cooler water years than in warmer water, warmer water years?

DR. IRVINE: Well, my recollection is that this figure on the right is, if you scrolled up a little bit, that I think it's --

Q I've scrolled -- I've scrolled already --

DR. IRVINE: It's not --

Q (Indiscernible - overlapping speakers).

DR. IRVINE: I don't think it's sockeye. I think it's chinook and coho, so it's different. All right?

Q Yes. But does the principle that the salmon will do better in colder water than in warmer water hold true?

DR. IRVINE: That's generally true, yes.

Q Yes. So one would expect the higher survival in the cold water years on the West Coast and less survival on the warm water years?

DR. IRVINE: In general, yeah, and you can see '08 was anomalously cool, and those were the fish for sockeye that generally returned in 2010 at high abundance.

MR. BLAIR: Thank you for your time.

MS. BAKER: Thank you. And the next -- did you want to mark one of those documents, Mr. Blair?

MR. BLAIR: I'm sorry, yes, please. Thank you.

MS. BAKER: So the next questioner will be Mr. Leadem.

THE COMMISSIONER: Just before that, is Tab 10 the one you want to mark, Mr. Blair?

MS. BAKER: Is it Tab 10 you want marked?

MR. BLAIR: I'll say yes more closely.

THE REGISTRAR: Exhibit number 1360.

EXHIBIT 1360: Crawford and Irvine, State of physical, biological, and selected fishery resources of Pacific Canadian marine ecosystems CSAS Research Document 2009/022

MR. LEADEM: For the record, Leadem, initial T., appearing for the Conservation Coalition. Could I have Exhibit 1358, please, Mr. Lunn, it's the IUCN document.

CROSS-EXAMINATION BY MR. LEADEM:

Q I can't resist asking you a question about this, Dr. Irvine, now that it's entered as an exhibit and I've had a chance to quickly scan it, because I like what I see. Page 2 of the document I find -- and this is an international group that is providing advice for the conservation of endangered wildlife, and the focus here is Fraser River sockeye specifically. At the bottom of the page I see the key threats to the species identified by the SSG, which is the group that you are a member of; is that right?

DR. IRVINE: That's correct, but I would like to emphasize that the focus is not Fraser River sockeye. The focus is sockeye salmon in the world.

Q Yes.

DR. IRVINE: So this includes right from the Soviet Union through to California.

Q But it did show that Canada, it says that:

> While all of the countries listed above contain threatened subpopulations, the greatest number and concentration of threatened subpopulations were located in the Province of British Columbia, Canada.

And then your counsel took you to the map and that map showed that some endangered sockeye were located actually in the Fraser River, correct?

DR. IRVINE: That's correct.

Q And what I found to be instructive is actually at the bottom of the page there's some advice being proffered by this organization to DFO, so I would imagine that you would be wearing your IUCN hat and then saying to yourself as DFO, for example:

- Emphasize the pivotal role that Fisheries and Oceans Canada play in protecting sockeye salmon, and encourage them to fully implement their Wild Salmon Policy...

So basically you're saying with your IUCN hat on, let's implement this Wild Salmon Policy quickly; is that right?

DR. IRVINE: That's correct, yes.

Q And the second one is also instructive:

- Shift fishing pressure from coastal and lower river locations to more terminal, upriver locations...

Once again that's advice coming from this international group; is that right?

DR. IRVINE: That's correct. Now, that's not specific to Fraser sockeye, of course.

Q No, of course not, but it's to help the endangered species of sockeye that are listed there in --

DR. IRVINE: Well, yeah, there's, I think, an increasing tendency internationally to shift towards more terminal fisheries.

Q Okay. And then my final question to you, Dr. Parsons, and I hope that hopefully we can be brief, is that I like your idea of forecasting, not by modelling but by observational data. And so the question is, is do you think that we could do that with some degree of precision, as well as some degree of cost effectiveness by focusing upon food sources in the Gulf of Alaska, by focusing upon the phytoplankton or the zooplankton in the Gulf of Alaska?

DR. PARSONS: Yes. It has to be done, however, without burdening us with research vessels.

Q Yes.

DR. PARSONS: So that if possible we've got to find ways of using instruments which give us a lot of data relatively cheaply.

Q Right. But you would eliminate the reliance upon modelling, which has forecasting and sometimes, most of the time, off, as we heard evidence of earlier in the year, and you would substitute that kind of a forecast for actual observational data that you can obtain?

DR. PARSONS: Absolutely. You've said it better than I

could say it. We've had too much of modelling which does not predict the next six months of this year. It does help us understand the mechanism, and that is very important. But to predict the next six months of what's going to happen, we need this real time data, the same as the two other professions of biology, agriculture and medicine, use real time data, and we have not seemed to have evolved that in fisheries biology.

MR. LEADEM: Thank you, Dr. Parsons. Those are my questions.

MS. BAKER: Thank you, Mr. Rosenbloom.

MR. ROSENBLOOM: Thank you very much. Gentlemen, my name is Don Rosenbloom. I appear on behalf of Area B Seiner, Area D Gillnet. I have a series of brief questions.

CROSS-EXAMINATION BY MR. ROSENBLOOM:

Q Dr. Parsons, firstly this particular volcanic eruption that has been the focus of your discussion today that took place in 2008, I gather was in the Aleutian Chain; is that correct?

DR. PARSONS: Yes, it was.

Q And are you able to tell us the plume that developed as a result in terms of the drop of volcanic ash, how extensive was that plume? Did that plume spread out throughout the Gulf of Alaska right to the Continental Shelf of the coast, or what?

DR. PARSONS: Well, the best answer to that is in the satellite imagery of the chlorophyll. And the chlorophyll does seem to be distributed throughout the Gulf of Alaska, which doesn't mean that it was necessarily evenly distributed, but it seems that the ash covered pretty well the whole of the Gulf of Alaska.

Q Right. And that being the case, would you not imagine that all stock, all fish stock that mingled in the Gulf of Alaska would benefit from this phenomenon, at least certainly the stock that would be returning in 2010?

DR. PARSONS: Not necessarily. Because as I've mentioned in connection with that, first of all, although the chlorophyll appears from the satellite to be even, it may not have been evenly distributed. And secondly, there's strong

evidence now that different stocks go to different parts --
Q Yes.
DR. PARSONS: -- of the Gulf. And I had contacted a lady salmon biologist in Alaska, and she said, of course, we had no effect from the ash. Well, they already have a lot of diatom growth all along the coast of Alaska. They have different problems. It's not a problem of iron shortage.
Q Right.
DR. PARSONS: So it could have been, for example, spinning gyres out in the Gulf that already had iron. And so it's not a quite a uniform picture as perhaps you're suggesting (indiscernible - overlapping speakers).
Q So to explain away evidence we've heard previously and certainly heard today, that the returns to the Nass and Skeena systems were disappointing in 2010, as opposed to what happened south of, whatever, Rivers Inlet. Would you partly explain that on the assumption that the stock from these various watersheds on the West Coast are congregating within communities within the Gulf. In other words, applying what you know from the Atlantic Ocean experience, and that you have to assume that that's going on in the Pacific and that the Skeena and Nass stock were not benefiting in the same way that the Fraser stock were. Is that your theory?
DR. PARSONS: Yes.
Q Yes.
DR. PARSONS: I would suggest what you're saying is correct, but it is speculation --
Q Yes.
DR. PARSONS: -- until we get some data on that.
Q Yes. Because you don't know as yet, we don't know as yet whether the various watershed stocks are indeed sitting as in community -- as communities.
DR. PARSONS: Yes.
Q My next question to you is obviously the Aleutian Chain is active in terms of volcanic eruptions from time to them. Have you, sir, had the opportunity to determine whether previous significant eruptions, volcanic eruptions within Alaska, have led to some correlation of stock abundance of salmon on our coast.
DR. PARSONS: There is only the one that I mentioned

from Kamchatka.
Q Yes.
DR. PARSONS: And that was in 1956. And again it was a two-year period, and the ash apparently came right across the Gulf of Alaska and the returns in 1958 were 20 million salmon, which sticks out like a sore thumb in the lower levels pre-1958. That's the only other one, other than suggestions that Gobi dust does the same thing.
Q All right. And my last series of questions relate to this very issue of correlation of volcanic activity with stock abundance. Obviously there are other regions of the world where there's active volcanic activity, Japan, in particular, the southern island of Kyushu is an example, other volcanic activity in Southeast Asia, we know of it obviously in Iceland with recent events. My question to you is this, sir. As a scientist, has your community that's focusing in this area done any studies that correlate volcanic activities in these other regions of the world with stock abundance?
DR. PARSONS: We have mentioned one which occurred in the tropics, which greatly increased productivity, and it wasn't connected with salmon. If you go to the Atlantic, the Atlantic is not short of iron. So when the Icelandic volcanoes go up, you don't get any effect of increased Atlantic salmon productivity. So it depends not only on the -- it depends on the location and the timing, because if this happens in the middle of winter, it's pretty hard to get enough light to grow anything. So the volcanic dust coming down, shall we say from a volcano in December, wouldn't have the same effect as a volcano that exploded in June or July, or something.
Q Well, let's take the Asian experience. Is there an iron deficiency in those waters, marine waters?
DR. PARSONS: There is much less iron deficiency in the Western Gyre, which is very similar to the Eastern Gyre. The Eastern Gyre is the Gulf of Alaska. Off the coast of Japan, where they also experience volcanoes, the Sea of Okhotsk entrains a lot of iron into the system. We have no equivalent system. So it would tend to have a much greater effect on the Gulf of Alaska than on the Western Gyre.

Q Well, my precious time is up, but you can't point to experiences in other regions of the world where they had determined a correlation between volcanic eruption and stock abundance; is that fair to say?
DR. PARSONS: It's fair. I couldn't write any papers about other regions, really.
Q Yes.
DR. PARSONS: But I suspect there is probably rather undocumented evidence that that is true.
MR. ROSENBLOOM: I thank you very much.
THE COMMISSIONER: Ms. Gaertner, I don't mind you starting if you can finish at 4:00.
MS. GAERTNER: I'll finish at 4:00.
THE COMMISSIONER: All right, thank you.
MS. GAERTNER: It's Brenda Gaertner for the First Nations Coalition and with me, Crystal Reeves. In fact, Ms. Baker has asked me to finish at half a minute before 4:00 so she could do one thing. So I've got two very quick things.

CROSS-EXAMINATION BY MS. GAERTNER:

Q Dr. Parsons, you mentioned two papers, one by, I heard you say, Blackbourn, and one by Welch and Parsons, that you've reviewed that deal with different stocks going to very specific locations in the Gulf of Alaska; is that correct?
DR. PARSONS: Yes.
Q And you agree that those papers are reliable, at least to begin to confirm that proposition?
DR. PARSONS: Yes, they want to be confirmed, but I think there was an excellent suggestion. Blackbourn was a complete pioneer in his early papers in the late '80s.
Q Mr. Commissioner, we don't have those documents before us, but they do contradict, or at least balance some of the evidence we heard from Dr. Beamish. I would like those tendered, and I wonder if, Dr. Parsons, you could get those to us, so we could have those tendered into evidence. Would you be willing to do that?
DR. PARSONS: Yes, I'll do that.
Q Thank you. Dr. Irvine, I just have two quick questions of you. One is, I might have missed something in this hearing, it's quite possible, but this is the first time I've heard that Blair Holtby and Chris Wood are doing COSEWIC and ***SARA***

reviews on the Fraser salmon; is that new?
DR. IRVINE: My understanding is that they -- they were awarded a contract to undertake that work over the upcoming months.
Q And that's just very recent. And how far is that work, and when do we expect it completed?
DR. IRVINE: I think it's at a very preliminary stage right now.
Q All right. I wonder if -- I guess through your counsel we'll continue to get updated on the work that the Department is doing. And then I was very curious when you said that -- I thought it was very, I guess, helpful that we get practical suggestions on things that can move forward, and this retrospective analysis of scale growth patterns, that's information we already have, why is that information -- why is that work not done?
DR. IRVINE: Resources, or lack of resources.
Q When is the most recent time that you've sought to do this?
DR. IRVINE: Well, I was part of the group that included Dr. Trudel over there that submitted a proposal to do this type of work. And it's kind of interesting, Mr. Commissioner, because the official reason we heard that it wasn't considered was because they're waiting for the Cohen Commission to tell them what to do. So we have actually --
Q But --
DR. IRVINE: Just to elaborate a little bit, we have actually initiated this work this summer with a co-op student. But we're starting with chum salmon. But there's all sorts of -- yeah, so anyway, it would be a project that would likely take -- it would be suited for, say, a post-doc to work on for a couple of years. It's that sort of level of effort that would be required.
Q So for some reason that was refused, but the Blair Holtby and Chris Wood has been accepted?
DR. IRVINE: Well, no, it's totally different funding sources. So I'm not really privy to the decisions as far as COSEWIC funding, but my understanding is that they were awarded a small contract to do an assessment of Fraser sockeye salmon.
MS. GAERTNER: Don't get me wrong. I'm glad the assessments are going done, I'm just curious about how it is. Those are my questions at this time,

Mr. Commissioner.
THE COMMISSIONER: Thank you very much, Ms. Gaertner.
MS. BAKER: Thank you very much, and thank you to the witnesses for coming today. I have one housekeeping matter, which is PPR number 15 has an appendix now prepared, which simply puts together all the cited sources in a big list, and so the list of documents on the website are cited, and there's another list of acronyms. So those need to get added to PPR number 15, just as PPR15A, I think. So those have been circulated already to all the participants' counsel, but they just as a housekeeping matter need to be marked.
THE COMMISSIONER: Thank you very much.
MR. LUNN: Maybe I can just assist with this part. So that will be -- those two documents will be marked as PPR15A.
MS. BAKER: Yes, thank you.

PPR15A: Appendices B and C to PPR15

THE COMMISSIONER: Thank you.
MS. BAKER: Okay. so we are --
THE COMMISSIONER: Yes, thank you to Dr. Irvine and Dr. Parsons very much for your attendance and for answering questions of counsel. Dr. Parsons, if you could deliver -- if you have those documents and they're available, you could deliver them to Ms. Baker. That would be very kind of you. Thank you.
DR. PARSONS: To who?
MS. BAKER: To me.
THE COMMISSIONER: To Ms. Baker, or Ms. Tsurumi, either one.
MS. BAKER: Okay. Well, thank you very much to everybody, and enjoy the five weeks off from this.
THE COMMISSIONER: Well, I'm not sure people are going to be enjoying the five weeks. But I, too, wanted to thank first of all, Commission counsel for the preparation for this hearing, and to participants' counsel very much, not everyone is here today - I'm sorry, I'm often accused of not speaking into this apparatus, but it never really wants to cooperate - not everyone is here today, but those who are here today will know how grateful I am for the cooperation you've shown, essentially from day one, at least in this hearing room.

It's often said judges shouldn't be thanking lawyers for being courteous and respectful and cooperative in the courtroom, but I am of the school that believes it's always good to thank lawyers for being so highly professional in all that you do in this room, and for the degree to which you assist me. It's of immeasurable assistance to me when you show that kind of courtesy and respect and cooperation. I know it's part of your DNA as lawyers, but it's not always shown in the courtroom, from my experience over the course of many years, and it has been in this hearing room and I'm very grateful for that. And I know it will continue as we move towards the closure of our hearings, which get underway on August 18th, according to the cue card here, and end sometime in September. I can't remember when.

So I wanted to thank you for that. I wanted to wish you a healthy and happy break, and hope you don't forget about this Commission and that you'll be thinking about your submissions, and working on those to the extent that you're able to.

And I wanted to particularly thank our crew here. Mr. Registrar, who filled in this week for Mr. Giles, thank you very much for your assistance in doing that; Mr. Lunn, who is on top of his game every day and does a superb job; and to Madam Registrar, who -- Madam Recorder, I should say, I apologize, who also does a superb job for us. All of these people make it possible for us to get through this very heavy and daunting task. So thank you all very much and I'll see you on August the 18th. Thank you.

THE REGISTRAR: This hearing is now adjourned and will reconvene again on August 18, 2011.

(PROCEEDINGS ADJOURNED TO AUGUST 18, 2011 AT 10:00 A.M.)

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

_____

Pat Neumann

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

_____

Karen 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.

_____

Susan Osborne

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.

_____

Diane Rochfort