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

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

Public Hearings

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L'Honorable juge /
The Honourable Justice
Bruce Cohen

Commissaire

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Vancouver (C.-B.)

le vendredi 6 mai 2011

Errata for the Transcript of Hearings on May 6, 2011

Page	Line	Error	Correction
11	40	200s	2000s
43	12	Karl	Carl
54	43	belie	believe
75	29	without migrating smolts	with out-migrating smolts
78	41	utrification	eutrophication

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No appearance	Area D Salmon Gillnet Association; Area B Harvest Committee (Seine) ("GILLFSC")

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No appearance	B.C. Wildlife Federation; B.C. Federation of Drift Fishers ("WFFDF")
No appearance	Maa-nulth Treaty Society; Tsawwassen First Nation; Musqueam First Nation ("MTM")
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Brenda Gaertner Crystal Reeves	First Nations Coalition: First Nations Fisheries Council; Aboriginal Caucus of the Fraser River; Aboriginal Fisheries Secretariat; Fraser Valley Aboriginal Fisheries Society; Northern Shuswap Tribal Council; Chehalis Indian Band; Secwepemc Fisheries Commission of the Shuswap Nation Tribal Council; Upper Fraser Fisheries Conservation Alliance; Other Douglas Treaty First Nations who applied together (the Snuneymuxw, Tsartlip and Tsawout); Adams Lake Indian Band; Carrier Sekani Tribal Council; Council of Haida Nation ("FNC")
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No appearance	Musgamagw Tsawataineuk Tribal Council ("MTTC")
No appearance	Heiltsuk Tribal Council ("HTC")

TABLE OF CONTENTS / TABLE DES MATIERES

	PAGE
PANEL NO. 33	
JEREMY HUME (Recalled)	
Cross-exam by Mr. Harvey (cont'd)	3/5/8/14/15
Cross-exam by Ms. Gaertner	18/20/39
Cross-exam by Mr. Timberg (cont'd)	42
Re-exam by Mr. Wallace	49
GORDON McFARLANE (Recalled)	
Cross-exam by Mr. Harvey (cont'd)	1/13
Cross-exam by Ms. Gaertner	18/19/23/26/27/29/35
Cross-exam by Mr. Timberg (cont'd)	45
Re-exam by Mr. Wallace	48
VILLY CHRISTENSEN (Recalled)	
Cross-exam by Mr. Harvey (cont'd)	5/8/15
Cross-exam by Ms. Gaertner	17/19/22/25/29/34/37/42
Cross-exam by Mr. Timberg (cont'd)	46
Re-exam by Mr. Wallace	49
GRAHAM GILLESPIE (Affirmed)	51
In chief on qualifications by Ms. Tessaro	51
Ruling on qualifications	53
In chief by Ms. Tessaro	53
Cross-exam by Ms. Grande-McNeill	73
Re-exam by Ms. Tessaro	81

EXHIBITS / PIECES

No.	Description	Page
815	Woodey, Lapointe, Hume, Evidence for Cycle-line Interaction as a Mechanism for Cyclic Dominance in Fraser River Sockeye Salmon (*Oncorhynchus nerka*)	14
816	Guill et al, A three-species model explaining cyclic dominance of Pacific Salmon	15
817	An Assessment of Multi-Species Recovery Strategies and Ecosystem-Based Approaches for Management of Marine Species at Risk in Canada, WWF-Canada	26
818	CSAS Proceedings of the National Workshop on Objectives and Indicators for Ecosystem-based Management - February 2001	32
819	CSAS - Biological Risk Assessment for Yellow Perch in British Columbia - 2008	41
820	Risk Analysis, Fisheries Impacts and Management Options for the Control and Management of Introduced Fish Species in BC Freshwater Lakes and Rivers	42
821	*Curriculum vitae* of Graham Gillespie	52
822	Humboldt squid in B.C. - 2011 Update	56
823	Range Expansion and Trophic Interactions of the Jumbo Squid, *Dosidicus Gigas*, in the California Current	59
824	Emails between Dr. Field and Graham Gillespie re squid tummies	68
825	Document entitled "Funding Summary (SK), G. Gillespie Research/Monitoring Projects"	73

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(C.-B.)
May 6, 2011/le 6 mai 2011

THE REGISTRAR: Order. The hearing is now resumed.

JEREMY HUME, recalled.

GORDON McFARLANE, recalled.

VILLY CHRISTENSEN, recalled.

MR. WALLACE: Good morning, Mr. Commissioner, Brian Wallace, Commission Counsel, and Lara Tessaro is with me. By my reckoning we have another 30 minutes from Mr. Harvey, followed by Ms. Gaertner with a 60-minute estimate. Thank you.

MR. HARVEY: Thank you, Mr. Commissioner. Chris Harvey, for the Area G and UFAWU.

CROSS-EXAMINATION BY MR. HARVEY, continuing:

Q Dr. McFarlane, you mentioned yesterday that the trophic level in the Strait of Georgia was diminished in 2007, I think was your reference, the reference you gave. Is that part of a declining trend?

MR. McFARLANE: No, I -- yes, I did mention 2007 as the year in question because 2007, of course, is the ocean entry year of the 2009 return year. However, 2007 is the low point of the years just prior to it, the few years that I looked at and the 2008 and 2009 ocean entry years were both much better. So 2007 was definitely lower. Is it part of a trend in terms of all those species? I would suggest not. It's, you know, herring did very well in many years up until the early 2000s, chum and pink are doing well, so...

Q You have some means of measuring the trophic level in the Strait of Georgia, do you?

MR. McFARLANE: Well, yes. But what I was referring to was the condition factor of the fish, the smolts of the five salmon species, and of the young-of-the-year herring. So that when you measure condition, you're measuring their ability to how they responded to the food sources available to them at the time.

Q But when you're measuring salmon smolts, you no doubt have difficulty distinguishing between freshwater trophic impacts, and saltwater trophic impacts, would that be correct? Because the salmon are recently emerging from freshwater by the time you see them in the Strait of Georgia.
MR. McFARLANE: Correct.
Q Yes. So if you see them fat one year and skinny the next year, it may be due to freshwater or it may be due to their first week or so in saltwater.
MR. McFARLANE: That's probably a fair statement, but I don't look at freshwater. I would put that question to the freshwater people. But certainly herring don't go into freshwater.
Q No.
MR. McFARLANE: Other species I look at in other areas don't go into freshwater. It's a pretty reliable indicator of the first few weeks in saltwater.
Q But insofar as you rely on herring, herring abundance, of course, changes from year to year quite dramatically, too, does it not?
MR. McFARLANE: Sure, everything changes dramatically from year to year. But you look at overall abundance of all those species in concert, and you look at condition factor of specific species in that specific year. And you can then from that make some observations on what you believe they're responding to.
Q So you believe there's an upward trend from 2007 through 2008, 2009 and 2010?
MR. McFARLANE: An upward trend in condition factor?
Q Yes.
MR. McFARLANE: No.
Q Well, trophic level of the Strait of Georgia.
MR. McFARLANE: No, that's not what I said. I said that the condition factor of the smolts in the years following 2007 was better.
Q Oh, I see. But can you give us any indication of the trophic level in the Strait of Georgia in terms of trends?
MR. McFARLANE: Sorry, I can. What trophic level would you like?
Q Well, the --
MR. McFARLANE: Do you mean the primary levels of food production?
Q Yes.
MR. McFARLANE: Yes, that is available through other

people's work who study the lower trophic level, which is basically the copepod euphausiid biomasses.

Q Yes. And how is it trending?

MR. McFARLANE: How is it...

Q What does the trend line look like?

MR. McFARLANE: I don't know. I haven't looked at that in recent years. My understanding is certainly the physics of the Strait changed in -- or it was different in early 2007. The physics is usually related to the productivity, the timing of the spring bloom. So I suspect that that's where the connection is right now.

MR. WALLACE: And, Mr. Commissioner, there is a whole topic on marine habitat conditions which will come up later in the hearing schedule.

MR. HARVEY: All right, thank you.

Q Mr. Hume, following your question yesterday from the Commissioner, you gave a description of how the fry move, emerging from the gravel along the shores of the lake out into the deepwater in the summer. What happens in the fall and through the following winter?

MR. HUME: Most of the fry are out in deepwater at that stage of their life. Again, they spend the daytime down deep, and quite deep down, say in Quesnel Lake, down 70, 80 metres of water.

Q Yes.

MR. HUME: They'll come up towards the surface as it gets dark.

Q Do they continue feeding through the winter?

MR. HUME: Feeding rates are certainly very much lower. They probably don't feed all that much throughout the winter, no.

Q But it's not --

MR. HUME: Again, it depends on the lake system you're talking about. In the interior lakes like Quesnel, Shuswap, there probably is very little feeding going on in the winter, as coastal lakes, Harrison, Pitt, Cultus, there's still production going on.

Q So in the Quesnel, for example, is it similar to a form of hibernation like the bears go through in the wintertime?

MR. HUME: No, it's not hibernation, it's more the fish are just dormant, I guess, the water's cold, the metabolism is slower, it's slowed down.

Q And when do they go into that dormant phase?
MR. HUME: I can't really say. I believe anything less than about five degrees centigrade, the fish tend not to be very active.
Q Do they rely on their fat or energy reserves that they've accumulated during the summer to get them through the winter?
MR. HUME: That would certainly be a major portion of their metabolic usage, yes.
Q Yes. The graphs we looked at yesterday, with the -- perhaps we could bring it up again at Tab 11, the one that shows the difference in the dominant and the subdominant cycles for various years. And I recognize that you're not comfortable with this because you didn't plot the numbers, and haven't checked them. But assuming they're correct, the top graph seems to show that the daphnia biomass is depleted shortly after the fall equinox.
MR. HUME: The final samples in that would be October, actually, is the final data points.
Q Early October?
MR. HUME: Yeah, early to mid-October.
Q Yes. The fry would still be feeding at that time, though.
MR. HUME: They would still be feeding. The water temperatures would still be around ten degrees or so.
Q That is if there's any food around to feed on, of course.
MR. HUME: Yes. Daphnia are not the only food that they -- it's their preferred prey item, but they also will feed on other planktons that are in the water column at the time, so...
Q The other graph you gave yesterday showed a levelling off of the -- I'm sorry.
MR. WALLACE: Just for the record, Mr. Commissioner, this is Exhibit 814.
MR. HARVEY: Thank you.
Q The other graph you showed yesterday, going from recollection, but it may have been 804, but it showed as sort of a levelling-off phenomenon, and I think you've studied that, and in a moment I'm going to take you to your 1996 paper. But you've determined that there is a levelling-off that occurs in a number of different lakes, is that correct, in fry numbers, or (indiscernible - overlapping speakers).

MR. HUME: That's correct, there appears to be a maximum abundance of fry that the lake can support or will support.
Q Now, a levelling-off like that would have to be caused by available food supply, would it not, because predators wouldn't be able to effect a levelling-off of that nature, would they, in any population?
MR. HUME: Presumably the smaller fry are weakened by lack of food, and the dying off is for whatever reason, presumably more susceptible, one reason would be, a major reason, is they would be more susceptible to predation.
Q Yes. Dr. Christensen, do you have a comment on that phenomenon?
DR. CHRISTENSEN: Predators can impact the situation. The curve you showed us yesterday indicates a Beverton and Holt curve, and there are once again, when you get over a certain number of spawners, you don't see any more recruits.
Q Yes.
DR. CHRISTENSEN: Now, the reason for that can be a question of food supply, but it can also be that there is a certain number of places where these smolts can hide. And those that are not able to be in these optimal places are more susceptible to predation.
Q Yes.
DR. CHRISTENSEN: So it can be a combination. Very often these things are a combination of predators and food.
Q Yes.
DR. CHRISTENSEN: But certainly indicates the carrying capacity.
Q Yes, all right.
DR. CHRISTENSEN: That it's being exceeded with the high-spawning stocks.
Q And by carrying capacity -- well, I see, by carrying capacity you have to take into account both. But, Mr. Hume, you've determined that there is definitely a certain carrying capacity in Quesnel and certain other lakes.
MR. HUME: That's correct.
Q That's correct. Insofar as that is determined by food supply, all the young fry would be equally affected by the lack of food, correct?
MR. HUME: Yes. In the case of sockeye fry, as Dr.

Christensen said, the fry are -- what probably is happening is that they're actually feeding more. They're not getting enough food, and so they actually spend more time feeding up in the upper water column where they are more vulnerable to --

Q Yes.

MR. HUME: -- to predation.

Q Yes. And they'd also be more vulnerable to warm water-caused mortality in the upper levels of the lakes, wouldn't they.

MR. HUME: During the peak of the summer, that's a problem in some lakes, yes.

Q Yes. All right. Well, one more question. I accept that what you say about there being two causes, and that's abundantly plain, but insofar as you determined, for example, in the 2002 brood year in the Quesnel, the smolts were a smaller size, a record small size.

MR. HUME: That's right.

Q That would indicate that the lack of food is having a significant effect?

MR. HUME: Yes, it would.

Q Yes. All right. And in any population, where a population is controlled by lack of food, some people will die of some -- whether it's humans or animals, will die of starvation, others will cope with that starvation, but will be less robust and less fat, correct?

MR. HUME: Yes, that would be correct.

Q At Tab 2 of my binder, there is your 1996 paper, Mr. Hume, along with Messrs. Shortreed and Morton. This paper has been often cited, I've noticed. It's still valid generally in its conclusions; is that fair to say?

MR. HUME: Yes, it is.

Q At page 720, that's 002 on the Ringtail numbers.

MR. WALLACE: I believe that's Exhibit 575.

MR. HARVEY: Yes, thank you, it is, 575.

Q There's a chart "B" for "Quesnel Lake", that shows the escapement increases in recent years, and in the right-hand column near the top passage I'd like to read and ask you about, starting four lines down:

> During the rebuilding period, when escapements were relatively low, rearing capacity of the lakes was not a concern.

> Rather, optimum escapement estimates were based on estimates of spawning ground capacity... Since the 1980s in Shuswap and Quesnel Lakes and 1990 in Chilko, dominant and subdominant brood year returns and escapements have been very high.

And you mention that:

> (Fig. 1, the 1958 return to Shuswap Lakes was also high, but subsequent returns dropped considerably and have been building ever since). Determination of escapement levels that will maximize subsequent adult returns is now crucial to the efficient management of Fraser sockeye stocks. Escapements lower than the optimum will result in reduced adult returns. In any brood year, escapements higher than the optimum entail foregoing harvestable sockeye and will produce (at best) no increases in harvestable sockeye in subsequent brood years. If high escapements result in excessive fry recruitment and if the high escapements are consecutive, substantial and long-term declines in total stock size...may occur, resulting in considerable economic loss.
>
> Since the mid 1980s we have been conducting studies on these three lakes. Our studies are the first that have included detailed investigations of every major lake trophic level (from the microbial community to planktivorous fish) as well as measurement of salient physical and chemical variables. This ecosystem approach has enabled us to produce the first estimates of optimum spawning escapements based on a lake's productivity and on its ability to rear juvenile sockeye.

Now, first I wanted to ask Dr. Christensen whether that is an example of an ecosystem-based approach, because in the sense that it takes into account not just the sockeye, but the carrying capacity and, in other words, the other ecosystem creatures, and also takes into account

socioeconomic matters.
DR. CHRISTENSEN: Yes, that's a fair statement that you made.
Q Mr. Hume, you said yesterday in answer to a question that Mr. Timberg put to you that your research data has been incorporated into forecasting models. Do you mean forecasts of run size?
MR. HUME: Yes, I do.
Q All right. Do you know if your carrying capacity data has been incorporated into the setting of upper benchmarks in the FRSSI model?
MR. HUME: I haven't been involved with the FRSSI model at all, myself.
Q All right.
MR. HUME: But it has been incorporated into the recent stock status report for CSAS just last year.
Q Oh, yes. Before that, was there any similar program or study or model that incorporated your carrying capacity data into escapement?
MR. HUME: Not that I'm aware of.
Q All right. At page 007 towards the bottom, just the bottom right-hand column, there's just the last two lines, then I'll go over to the next page. It reads that "Escapements", this is of course in this paper you study the Shuswap, the Quesnel and the Chilko Lake; is that correct?
MR. HUME: That's correct.
Q You say:

> Escapements greater than 25 EFS/ha [effective female spawners per hectare] (total adult escapements of 1.5 million) to Shuswap Lake...

Sorry, we have to go down to the bottom, Mr. Lunn, at the left-hand column there to pick up the text.

> ...to Shuswap Lake did not produce any more fall fry, peaking at 4900 fry/ha. Similarly, escapements to Quesnel Lake of 15 EFS/ha (total adult escapements of 0.8 million) also did not produce any more fry, peaking at 2600 fry/ha.

Yes, those, you give both the effective female spawners and total adult escapement. So the

Quesnel Lake figure for total adult escapement is 0.8 million or 800,000, is that -- am I interpreting this correctly?

MR. HUME: That's right, yes.

Q In the right-hand column on the same page there's reference to an Alaskan study. Just up, yes, go down just before the heading. Yes. And then Alaska is mentioned, yes, right there. Those eight or so lines at the bottom of that long paragraph:

> In Leisure Lake --

- it says -

> -- a much smaller...lake in Alaska, Koenings and Burkett...found that smolt numbers did not increase after spring fry numbers exceeded 10 000/ha. At densities >10 000 fry/ha...smolt numbers did not increase further, with smolt number declining at the highest fry densities. These results are very similar to the curvilinear relationship we found between EFS and subsequent summer and fall fry numbers in Shuswap and Quesnel lakes (Fig. 4).

So you mention an Alaska study. There has been some good work done in Alaska and you've found that reliable, Mr. Hume, insofar as --

MR. HUME: How do you mean, "reliable"?

Q Well, you haven't any reason to say that they've misapplied their --

MR. HUME: Not for the lakes that they were working on, no.

Q Yes, all right. In the next paragraph under "Juvenile sockeye size" you're discussing:

> Summer fry size in Quesnel and Shuswap lakes did not vary with spawner density...

Et cetera. And then you drop in the next, and then it says, "Fall fry", I'm beginning the next paragraph:

> Fall fry and smolt size in all three lakes declined rapidly as EFS density increased to

about 10 EFS/ha. At escapements 10EFS/ha fall fry size did not significantly decline in either Shuswap or Quesnel lakes (Fig. 5).

So am I interpreting this correctly that there's a decrease in size in fall fry at levels greater than -- or actually why don't you interpret that for me. It seems at some point you have a decrease and then you have no more decrease.

MR. HUME: The initial decrease in growth is very rapid as density increases, but it tends, it levels off at higher densities, is basically all we're saying.

Q All right. So at low densities you get a large size smolt, as the escapement or spawning density increases, the size reduces and then levels off.

MR. HUME: Well, it's a curve, it's curvilinear, but, yes.

Q Yes. And that would be, of course, reducing in size because of a lack of food.

MR. HUME: A decrease in food, yes.

Q Yes. Predators don't -- wouldn't have any effect in that, or any significant effect in that?

MR. HUME: Predators may be part of the reason why the mean size levels off at higher densities, because they'd be, the smaller fry would be more susceptible to predation.

Q Yes. All right. At Tab 6, I have Exhibit 399...

THE COMMISSIONER: Mr. Harvey, I wonder if just before you move on, just so that I understand some of the timeframes here. In chief, Dr. Hume mentioned that his work was incorporated into forecasting models but really didn't give any details around that.

MR. HARVEY: Yes.

THE COMMISSIONER: And then you've just raised that with him based on Exhibit 575, but I don't have any timeframe sense here. In other words, over what period of time was his work incorporated into the forecasting models. Is that still the case, or was it just the case at the time that this study that you referred him to around that time. I just have no sense of timeframe here.

MR. HARVEY: Yes, that's useful.

Q Mr. Hume, there are two things. Your work, to your knowledge, has been utilized for the purpose of forecasting run size; that's returning run

size.
MR. HUME: Yes.
Q Over what time period are you aware that that's been used?
MR. HUME: Almost from the -- for Quesnel and Shuswap Lake we have data going back to 1975, and the time when I joined the Department in 1986 -- '87, the forecast relationship between fall fry and returning adults was being used as one of the forecast elements.
Q Yes.
MR. HUME: And it continues to this day to be one of the items that they ask for in conducting their forecasts.
Q Yes. so the basically ask you for the numbers of fall fry and then they use that in their forecasts?
MR. HUME: That's correct.
Q And that's been ongoing, as you say, for a number of years.
MR. HUME: We usually only do our -- collect our data for the dominant and subdominant runs --
Q Yes.
MR. HUME: -- into the two lakes, and so it's used in those two years, but not in the other non-dominant years.
Q Okay. And then the other matter you discussed was the use of your data in terms of escapement determinations or benchmarks, and to your knowledge your data has only been used very recently for that purpose; is that correct?
MR. HUME: That's correct. That was based on our lower trophic level primary production model.
Q Yes. And by "very recently" in the last year do you mean, or when?
MR. HUME: Well, for the Fraser River, yes, just the last year.
Q All right.
MR. HUME: But in other -- other systems within the province it's been used since early 200s.
Q I see. So I'd like to refer you to Tab 6, if I may, and page 99 of Tab 6. This is Exhibit 399, Pestal and Cass 2010. Page 99 has the Quesnel numbers. And if we look at the 2001 near the bottom, just the last decade I'm interested in. 2001 the escapement, total escapement in the Quesnel system was 3,510,000-odd, according to

this. That compares with your optimum escapement estimate that you mentioned a moment ago of 800,000; is that correct?
MR. HUME: Yes.
Q So it would -- well, I'll leave that comment for argument. And that would be certainly significantly beyond the carrying capacity of the lake as you estimated it, correct?
MR. HUME: That's correct.
Q And then the same happened -- sorry.
MR. HUME: I would say, I believe, I'd prefer to call it the optimum capacity of the lake to produce smolts.
Q Optimum capacity, yes. Thank you. In 2002, well, dealing in 2001, if we look at the results of that, the total recruits, which is mostly four years and some, five years later, but straight across in the right-hand column, 3,700,000, so that's as you would expect, a very low productivity level, correct?
MR. HUME: I'm not sure what you mean by...
Q Yes, all right, well --
MR. HUME: Yeah, okay. Well, it's approximately a one-to-one relationship, yes.
Q All right. Now, 2002, again there is an escapement, this time 3,062,151, escapement that's significantly over your optimum carrying capacity level, correct?
MR. HUME: That's correct.
Q and this time the recruits are much reduced, 640,000.
MR. HUME: Yes.
Q So it looks as though there's a carryover effect of some sort going on here. In other words, or can we -- do these numbers tells us that what's likely happened is that the food, the daphnia and the other food web sources for the sockeye fry from the 2001 brood year were seriously depleted and there was some carryover of that depletion in the following year?
MR. HUME: That's certainly -- certainly the freshwater conditions were one of the components of this. The fall fry were very -- were the smallest we'd observed that year.
Q Yes.
MR. HUME: And we did some subsequent smolt sampling, as well, and they had shown no indication of

overwinter growth in that year, as well.
Q Yes.
MR. HUME: Well, overwinter and early spring growth.
Q Yes. The 2002 brood year, I think, is the year you found that record low 1.9 gram, correct?
MR. HUME: That's correct, yes.
Q Fry size. Dr. McFarlane, is there anything happening in the Strait of Georgia that might have accounted or contributed to the low recruitment from the 2002 brood year? That would be 2004 conditions in the Strait of Georgia, I think.
MR. McFARLANE: 2004 there was a flip between cooler temperatures to slightly warmer temperatures coast-wide, which lasted for a couple of years, three years, actually. So you could say that -- off the top of my head I could say that there was indications of some change in the physical environment, but I haven't looked in detail at the biological thing relating to that particular species.
Q And I'm sorry, I forgot that I was reminded by Mr. Wallace that that's coming later. At any rate, yes, let me move on if I may.
MR. WALLACE: Mr. Harvey, my clock says you're at about the end of your time. How are you doing?
MR. HARVEY: Well, unfortunately I've got a little bit to go. I do consider it quite important, and we are really trying to solve the mystery of the *Murder on the Orient Express*, and it's hard to do that in the space of this time. Would I be permitted to have another 20 minutes?
MR. WALLACE: That's problematic. You've run more than an hour now.
MR. HARVEY: Well, in that case, could I just close then by marking some exhibits.
THE COMMISSIONER: Mr. Wallace, if we could just check with other counsel to see whether we can give Mr. Harvey another 15 minutes.
MR. WALLACE: Ms. Gaertner is going to use her time, as I understand, for this panel but may have less for squid. So perhaps, Mr. Harvey, if you could try and wrap up in five, seven minutes, something like that.
MR. HARVEY: Okay, thank you.
Q The Tab 1 of the documents that I submitted is Exhibit 726. This is the Koenings and Kyle paper in Alaska. I just wanted you to either agree, and

perhaps you've already done this, that this is a well-regarded paper in this field; is that correct, Mr. Hume?

MR. HUME: Yes, it's certainly known. Yes.

Q All right. At Tab 4, a paper co-authored by yourself, Mr. Hume, James Woodey and Michael Lapointe, this is a paper that you participated in; is that correct?

MR. HUME: That's correct.

Q The abstract makes note of examinations of interactions among cycle lines, sockeye foraging appears responsible, et cetera, et cetera. Are these findings still valid, in your opinion?

MR. HUME: Yes, they are.

MR. HARVEY: I wonder if that could be marked as the next exhibit, please.

THE REGISTRAR: Exhibit 815.

EXHIBIT 815: Woodey, Lapointe, Hume, Evidence for Cycle-line Interaction as a Mechanism for Cyclic Dominance in Fraser River Sockeye Salmon (*Oncorhynchus nerka*)

MR. HARVEY:

Q At Tab 5 is Exhibit 576. This is a paper that I think we have to -- yes. We have to turn over to the next page. Yes. A paper co-authored by you, John Stockner and Ken Shortreed; is that right?

MR. HUME: That's right.

Q Still valid, insofar as you're aware?

MR. HUME: Yes, it is.

Q Okay. Exhibit 802 we looked at earlier. This is your paper, a paper you co-authored on Predation by Rainbow Trout. You found that the rainbow trout in some of these studies had 95 percent sockeye fry in their stomach?

MR. HUME: Yes, we did.

Q So rainbow trout are a significant predator of sockeye fry, obviously?

MR. HUME: Yes. Depending on their abundance, which we didn't measure.

Q Yes. At Tab 10, Tab 10 is a 2011 paper by a German scientist by the name of Guill, an English person by the name of Drossel, and certain others. You're familiar with this paper?

MR. HUME: I've skimmed through the paper, yes.

Q Yes. And the authors set out to compare the

population dynamics for sockeye fry in British Columbia in the Fraser, sockeye fry, their predators and their zooplankton food; is that right?

MR. HUME: Sorry, what was the question?

Q Well, as the title indicates, "A three-species model explaining cyclic dominance of Pacific salmon", the three species that are studied are sockeye fry, the predators of the fry and the zooplankton, I think; is that right?

MR. HUME: Well, they didn't actually study any of them, but they used those as explanatory variables in their model.

Q Yes. And they based a lot of their work on your data, I think; is that correct?

MR. HUME: I don't believe they actually used any of my data in their paper.

Q All right. At any rate, is this -- I don't know if Dr. Christensen has had a chance to read this. Is this an example of an ecosystem-based approach, in that not only the sockeye fry are being looked at, but their predators and the food web?

DR. CHRISTENSEN: It's "ecosystem analysis light", I would call it, so considering a small part of the ecosystem.

Q Yes, all right. Are any of you aware of anything similar that's been done by DFO, or been done by British Columbia scientists? I'm just curious as to why it takes a German and an English scientist to put this together.

MR. HUME: Well, first of all, the last author on this paper is a DFO scientist.

Q Oh, yes.

MR. HUME: And certainly we've been looking at cyclic dominance work for a number of years.

Q Yes. But I think the funding for this came from overseas, did it not?

MR. HUME: Yes, I don't expect there was a lot of expenses involved with this paper.

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

THE REGISTRAR: Exhibit 816.

EXHIBIT 816: Guill et al, A three-species model explaining cyclic dominance of Pacific Salmon

MR. HARVEY: Yes, I think I've probably exhausted my time. Thank you.
MR. WALLACE: Thank you, Mr. Harvey.
THE COMMISSIONER: Thank you, Mr. Harvey.
MR. WALLACE: Ms. Gaertner.
MS. GAERTNER: Good morning, Mr. Commissioner. Brenda Gaertner for the First Nations Coalition, and with me Crystal Reeves.

I'm going to take the time this morning, I have an hour allotted to me, I want to do a number of things. First I want to do some clarifications on the reports and use the report. I'm going to have to ask Mr. Hume a couple of clarifying questions, given the work of Mr. Harvey.

And then I want to use the time to use the report, Mr. Commissioner, as a springboard to having a fairly -- a broader level discussion on ecosystem-based management. You'll recall at the beginning of this inquiry that we had Dr. David Close and Dr. Reynolds come and give you some definitional introductions to this notion of ecosystem-based management, and in my experience and my clients' experience, it's a word that's often used, but difficult to implement.

And so I want to use this panel, which includes an expert, an academic and some practitioners to explore some of the challenges associated with operationalizing ecosystem-based management. And so I'm going to use the report as a lifting-off place, more than a drilling-down place, and I have some documents to help us in that work, and that will help the panel get a sense of where I'm going to go.

CROSS-EXAMINATION BY MS. GAERTNER:

Q And I apologize, I wasn't able to speak to the panel or all of the panel ahead of time, so I just want to let you know who I'm representing. First Nations Fisheries Council, which is a provincial organization some of you will be familiar with, and then from the perspective of the First Nations, my client base includes the Haida, three of the Saanich First Nations, so the Strait of Georgia is of course an important component of their territory, and then the tribes on the Fraser, beginning in Chehalis and then going all

the way up to the headwaters of the Fraser. And so the lakes that you've spent a lot of time with, Mr. Hume, sit in the heart of some of those territories.

And I'm going to begin by asking a general question. We posed it for the earlier panel on marine mammals, and I would like to have your expertise on this. At page 11 of the report, and I don't think I need to take you there, but you can go there if you want, there's a statement that says if warmer climate conditions did lead to the -- talks about the impact of warmer climate conditions. You'll see it at the paragraph just above the title "Predator satiation and depensation":

> Another aspect of environmental conditions relates to the impact of water temperature.

And then the last sentence is:

> This is illustrated by Petersen and Kitchell (2001), who used oceanic, coastal and freshwater climate indices and simulations of bioenergetics of key predators...and predicted that warmer climatic conditions can lead to an increase in predation rates in the range of 26-31%.

If warmer climate conditions did lead to an increase in predator rates in the range of 26 to 31 percent, which of the predators considered and those that you have expertise with could become immediate or significant concerns to the long-term sustainability of the Fraser River sockeye salmon. And in addition to the predators, I'd also like you to comment on competitors. I think that's an extremely important component of climate change. And I'll begin with you, Dr. Christensen, and then turn to you, Dr. McFarlane, and then Mr. Hume.

DR. CHRISTENSEN: We would expect that the impact of climate change would be most pronounced in freshwater and in coastal waters. So you would look for those predators as being the key predators. With regard to climate change, the river especially.

Q That pretty well takes the full migration route of

the Fraser River sockeye salmon.
DR. CHRISTENSEN: I didn't mention the open ocean.
Q Oh, I see.
DR. CHRISTENSEN: (Indiscernible - overlapping speakers) the migration route. They continue migrations out there in a big circle, so it's especially in freshwater and coastal waters you would see this effect.
Q All right. Maybe I'll just go to each of the DFO experts who have expertise in both of those. Dr. McFarlane, can we start with you, and then I'll go to Mr. Hume.
MR. McFARLANE: I suspect that the first place I think would be worth looking would be at the large migratory pelagics. Warmer waters generally indicate a change in distribution of many of these species. Both distribution in terms of oceanic to more coastal waters, and in southern predators, in a northward movement pattern. Things like hake, some of the shark species, those would be where I would consider the places to look. Now, having said that, I am not -- I don't believe that those particular aspects of the whole system are controlling what is happening with these species, prey species.
Q Sorry, don't believe they're controlling...?
MR. McFARLANE: I don't believe that this is a result of top-down forcing of predator control on any of the species, let alone Fraser River sockeye. I haven't seen information that would lead me to indicate, or that would indicate to me that any of these predators would selectively choose a specific stock of fish or stocks of fish to and above all others. Biologically and ecologically to me it does not make sense.
Q Okay, thank you. That's helpful. Mr. Hume.
MR. HUME: It's very difficult to choose one or two or any to determine which predators would be affected by climate, warmer climate in cases. Again as Dr. McFarlane said, I would probably look at some of the bigger predators, such as the rainbow trout and pikeminnow. But it's quite possible that near shore predators, such as sculpins, may have a major effect, as well. But I really can't comment on what the effects would be.
Q So it's fair to say that although we're beginning to identify warming climate changes, that the

science is at its infancy in understanding what implications that will have for the Fraser River sockeye salmon, and that we're going to have to develop models and look very closely as these climatic changes begin to show up more clearly.

MR. HUME: I think that would be a reasonable statement.

Q Mr. McFarlane?

MR. McFARLANE: Yeah, as far as that goes, that's a reasonable statement. I think what you need, it's always nice to develop models, but you might want to actually have some data to put into them, so you want to ensure that you're directing some targeted programs at the issues that you think, or the timeframes that you think may be most appropriate.

Q Okay. We're going to get into the relationship between data and models quite a bit, so let's -- and Dr. Christensen?

DR. CHRISTENSEN: Just that it's probably fair to say we have quite limited experience in regards to the Fraser River. But overall in the scientific community, there's a lot of work being aimed at developing models with the underlying data to predict the impact of climate change. But that's a broader scale, it's not at the scale of the Fraser River. And that is there is really very intensive research going on there. So lots of things are happening there.

But you also asked the question of alternative prey, or prey, implications of prey. And one aspect that we have not even talked about in this hearing, or this panel, has been the potential that there might be alternative prey and what happens to the alternative prey. That's where you wanted to go?

Q Yes, we can go there.

DR. CHRISTENSEN: If we look at the amount of Fraser River in the -- when they're out in the ocean, we may be talking of something of the order of giving -- depending on the years, anywhere from, say, 20 to 60,000 tonnes of prey. If we look at what else is out in the ocean, and how the biomasses of those other potential prey have changed in recent years, we've seen stocks that are measured more with a million tonnes disappearing. So much larger amounts of alternative prey has

disappeared. And that's one area where predators may have an increased impact on the sockeye because of the lack of the alternative prey.
I think I made a really bad explanation of that.

Q Do you want to sum it up?

DR. CHRISTENSEN: Sum it up? There is a certain amount of prey out there. If we're losing, say, half of that prey, then the half that's left, which includes the sockeye, may be subject to much more intense predation pressure. We have probably not seen that the number of predators have decreased significantly, but what they can eat have likely decreased in the North Pacific in the last ten or 15 years.

Q So if I understand that correctly, it may be that the sockeye salmon will become much more important in other animals' diets in the ocean conditions, as ocean conditions change. Is that, have I heard that right?

DR. CHRISTENSEN: If we look back, I think this may have happened. What will happen in the future, we still need better numbers for that.

Q All right. Okay. I want to turn, Mr. Hume, I've got a couple of very short questions arising from the discussions we've had about optimum capacities. And I want to take you to Exhibit 399 for a moment. Sorry, Mr. Lunn, I hadn't warned you on that. And in particular the questions that have been asked around the two years in which there was a higher return to the Quesnel River, or Quesnel Lake, sorry, in 2001 and 2002. Have I got that exhibit wrong? Sorry, it's the - what page are the - page 99, thank you. And do you recall 2001 and 2002, Mr. Hume?

MR. HUME: I'm getting on in years, you know. Sometimes I don't remember last year.

Q I know that's sometimes difficult, but perhaps I'll refresh your memory. Do you recall that in those years we were having -- we were struggling on the Fraser with understanding what was happening with the Late runs, and in particular the Late runs that co-migrate at the time with the Quesnel runs there?

MR. HUME: I have some recollection of that.

Q And if you'll recall, we weren't planning to have an escapement of over three million into the

Quesnel that year, were we?
MR. HUME: I don't believe so, but I can't really speak to that authoritatively.
Q All right. So if you look at the types of numbers that were going into the Quesnel, it's clearly a much higher number.
MR. HUME: That's right. Yes.
Q And if I suggest to you that we were not planning to have that kind of escapement go into Quesnel, and that was a result of decisions around co-migrations with the Lates, is that something that rings true to you?
MR. HUME: Yes. Yes, it does.
Q And in fact that reflects perhaps the result of having to take quite a bit of care with the Late runs and we had an abundant return into Quesnel, and that those are the types of tradeoffs or difficulties we're going to have when we begin to implement weak stock management; is that correct?
MR. HUME: Well, I'm not a manager, so I can't really speak authoritatively to that. But my understanding is that the harvest is controlled by -- it's not controlled, but it takes weak stocks into account.
Q For if I also were to suggest that we're still trying to see what implications, if any, that those two years will have in the longer term success of production out of the Quesnel system.
MR. HUME: yes.
Q And similarly, in Exhibit 810, which is the graph, if I could go to that for a moment. If I can go to the bar graph. I heard I your evidence yesterday, Mr. Hume, that the green bars are an example of perhaps a one year, so when we look at the Quesnel, that large green bar could in fact be the years that we just looked at, either 2001 or 2001?
MR. HUME: That's probably 2001, yes.
Q And so in fact the more average would be quite a big significantly lower than that?
MR. HUME: Yes, it would.
Q And did I hear your evidence right, and this is just a clarification, I might have missed this wrong. How are the hatched bars created? Are they lake-specific, or are they a generalization?
MR. HUME: No, they're lake-specific. They're based on limnological work we do on determining primary

productivity of each individual lake.
Q Great. Thank you. One final question. Yesterday we heard a number of times about the words "low survival rates" were used. Can we say anything about the survival rates of Fraser River sockeye salmon fry to smolt stage in terms of population dynamic perspectives, increasing or decreasing over time? I mean, I heard the word "low" often used, and it's a low number, but that could actually be quite a normal number; is that correct?
MR. HUME: Sorry, freshwater survival, or...?
Q Yes.
MR. HUME: Freshwater survival, in the data and the information that we have based on Quesnel and Shuswap fall fry estimates and Chilko smolt estimates is the freshwater survival. So from the egg deposition to smolts or fall fry has not changed. It's not changed, basically a flat line, there's no trend lines available showing them on that dataset.
Q So they've been pretty constant for quite a few decades?
MR. HUME: Well, constant was not the word I would use. I would say there's no overall trend with time.
Q All right, thank you. Now, I'm going to now turn to that more general discussion I wanted to have with Dr. Christensen and Dr. McFarlane particularly. Obviously, Mr. Hume, if you'd like to add to it, please do, but I'm going to focus my questions there.
Dr. Christensen, as an ecologist you'll agree with me that an important part of any system, food webs are just one part of the ecosystem approach. They're not -- we've got to deal with disease, we've got to deal with parasites, we've got to deal with changing environmental conditions. It's a much broader look when we're looking at ecosystem-based management. Do you agree with me on that?
DR. CHRISTENSEN: I will. The entry point for ecosystem-based management is that we are looking at an area, so that's where we start. We don't start with the food web.
Q So when it comes to Fraser River sockeye salmon, we've got quite a large area to deal with in a ecosystem-based management, in fact, it's arguable

that we've got a number of ecosystems.
DR. CHRISTENSEN: Yes, and that's very typical. We often have to be quite pragmatic about how we go about ecosystem analysis. That's one part of ecosystem-based management. And we may well in this case look differently at the freshwater, the coastal zones and the open ocean. But it's necessary to try to integrate all of that information to get a full understanding of what happens to the Fraser River sockeye salmon.
Q And I don't know if, Dr. McFarlane, if this is a more appropriate question for you, because you're a little bit closer to the management decisions than Dr. Christensen. But it's my observation, my clients' observation that it's quite a bit of a significant quantum leap or change from an individual species looking at, you know, like an individual Fraser sockeye stock, salmon stock even, and going to ecosystem-based management. A one-species approach is not an ecosystem-based approach. Would you agree with me on that?
MR. McFARLANE: I would agree with you on that with a number of caveats, and before we get to that, if I may, I would like to have a comment on the alternate species approach, or alternate species discussion that Dr. Christensen brought up.
Q Sure.
MR. McFARLANE: Okay. I mean, that's alternate species in diets is looked at routinely in a number of places, including on the West Coast of Canada, in a number of species. And the comment on that there has been major shifts in some of the other prey species, forage species, with huge reductions is true. But there has also been over the last 20 years huge increases in forage species off our West Coast, ranging from the most obvious one is Pacific sardine, which entered our waters in the early 1990s, and in the 2000s has been estimated to be there minimally at in the neighbourhood of 300,000 to 400,000 tonnes, which is a huge increase in prey, considering that from 1947 to 1992 there was zero fish, not tonnes of fish, zero fish off our coast.

So it's a highly nutritious food for many of these species, and in the diet work I've done, there has definitely been a switch of major predators, but not to salmon, they've been -- the

switch has been to sardine. So that was just my comment on that.

Now, to get to your other question, that focusing in on Fraser River sockeye is just a minor component of an ecosystem-type management approach --

Q Single component, I want to say.

MR. McFARLANE: A single component, I would absolutely agree. And I think Dr. Christensen actually mentioned that indeed you have to look at many, many other factors than just that. So but it is an important component if your question in that particular ecosystem management discussion that you're having with all interested parties is focusing on the Fraser River system, the Fraser River sockeye. You, for example, may not be too interested in developing a marine protected area in the northern part of the Strait if your concern is Fraser River sockeye. But the ecosystem management approach looks at many, many things, and having a marine protected area, or whatever type of area you're looking at where you want to change up something, whether it's building or not building, log boom areas, or any of those types of things, that has to be considered in those context. But all of them together form the ecosystem management approach.

Q And you'll agree with me that that shift from a single-species approach to a geographical multispecies is a complex shift for the Department of Fisheries and Oceans.

MR. McFARLANE: I would agree it's a complex shift for mankind, not just the Department of Fisheries and Oceans. There's many, many other departments that build management strategies for parts of terrestrial and marine ecosystems, including the Strait of Georgia, which don't consider fisheries, or fish concern. So everybody is having a quantum leap forward in starting to consider this, and it's a good thing. I agree entirely with it.

Q Perhaps I'll just use your comment on everything in mankind as a stepping-off place to suggest, as Commissioner Cohen has heard many times from my clients, that an ecosystem approach is not a huge shift for First Nations. It is in fact how they've looked at their territories for a long time, and it is in that -- that approach is

something that will be well worth science collaborating with. Would you agree with me on that?

MR. McFARLANE: I would agree certainly that Fisheries and Oceans and people in other organizations, let's say, in general, should collaborate with all interested parties, including First Nations, absolutely.

Q All right. I'd like to take you to Tab 1 of our documents, and that's a report done by the Western - sorry - WWF, and I'm using this report, Commissioner, particularly for pages 12 and 13. And I'd like to take the witnesses to that because it provides a useful list, in my suggestion, for some of the strengths and weaknesses and challenges associated with ecosystem management. And I'd like you to particularly go to some of the strengths of it, and just have you review those, and provide any comments you might have with respect to the authors' identification of some of the benefits associated with ecosystem-based management. You'll see things like improved habitat conditions. You'll see the movement from single species to multispecies approaches. You'll see the benefits of adaptive management. Those are all things that they speak about. You'll see that it gets more stakeholders involved. And if effectively carried out, it can improve cost-effectiveness over a longer time period. Are those all kinds of comments that from your own experience you would agree with?

DR. CHRISTENSEN: Yes.

Q And some of the weaknesses associated with it, in particular the first one is that:

> Multi-species planning can be...complex, time-consuming, and expensive undertaking.

Would you also agree with that?

DR. CHRISTENSEN: The statement is so general that it's impossible to disagree.

Q Perhaps from a management perspective, Mr. McFarlane, we're going to get into a little bit of the work you've done in the Strait of Georgia, of course, but to do ecosystem-based management, it does require a significant shift, and it's going to require some time consuming efforts, if done

properly with stakeholders, and it's going to require budgets to do that. Would you agree with me on that?

MR. McFARLANE: I would agree with you on that, and I would also like to point out I am not a manager.

Q No.

MR. McFARLANE: My work was in science.

Q Yes. I appreciate that. But you'll agree with me that your work is to inform managers, be they First Nations managers or DFO managers, or otherwise, you're not just doing science for science sake.

MR. McFARLANE: It was always my hope that it would inform managers, yes.

Q And that transition is still a work in progress?

MR. McFARLANE: Well, yeah, and that's a good thing, too. I think everybody should --

Q Yes.

MR. McFARLANE: -- progress.

MS. GAERTNER: Absolutely. Now, I want to take you to Tab 16 of our -- oh, could I mark this exhibit as the next exhibit, please.

THE REGISTRAR: Exhibit 817.

EXHIBIT 817: An Assessment of Multi-Species Recovery Strategies and Ecosystem-Based Approaches for Management of Marine Species at Risk in Canada, WWF-Canada

MR. WALLACE: Mr. Commissioner, I note it's ten after 11:00. Perhaps this seems like we're moving on to something else, this might be an appropriate time.

THE COMMISSIONER: Thank you.

THE REGISTRAR: The hearing will now recess for 15 minutes.

(PROCEEDINGS ADJOURNED FOR MORNING RECESS)
(PROCEEDINGS RECONVENED)

THE REGISTRAR: Hearing is now resumed.

CROSS-EXAMINATION BY MS. GAERTNER, continuing:

Q Thank you, Mr. Commissioner. I'm now going to turn the witnesses' attention to the document at Tab 16 of my list of documents and it's a proceeding of the National Workshop on Objectives

and Indicators for Ecosystem-Based Management that occurred in Sidney, B.C. in February into March of 2001 and it appears by my review of the participants that they are primarily DFO scientists. That's correct?

MR. McFARLANE: Yes, that is correct.

Q Mr. McFarlane?

MR. McFARLANE: Yes.

Q And if I could turn you to page 11 of that document to begin with, there is a list of issues that these scientists have developed as a -- associated with ecosystem-based management and I want to turn you to the very first one to begin with.

> Science must be able to provide indicators and reference points at regionally-relevant scales.

And I just -- and then it goes on to:

> Social and economic objectives and indicators need to be addressed in concert with the biological ones also being considered.

My question for you is why is it that science feels that they have to provide the indicators? Isn't that somewhat dependent on the management questions and the stakeholders and First Nations interests and how this information is going to be used? And wouldn't it be more useful to ensure that there is a collaborative group of people that are coming to some kind of agreement as it's associated with indicators and reference points?

MR. McFARLANE: Yeah, I think that's a fair statement as far as it goes. The -- this particular group met in 2001 and made a conscious decision to only look at what they called the environment, environmental part of the question, not the cultural or social or anything else.

They then moved forward, trying to build a framework which would be useful, remembering that this was early on in these discussions. We're going back ten years. The indicators and reference points that they are referring to that they think science should provide are basically in the context of what they're talking about are

things that science would look at and measure in some way, either directly or indirectly through outputs from models. Whether they're physical, biological in terms of lower trophic level biological or upper scale biological.

So I don't think they were suggesting in any way that when it came to the actual development of ecosystem objectives and how you would use -- they actually in more recent work talk about setting out -- I forget the actual term, but it would be management indicators as opposed to biological or science indicators. So I think this is more a reflection of when they wrote this paper, as opposed to their thoughts on it.

Q All right. And then if you go to the fifth bullet down, they talk about funding challenges and, in fact, they say that:

> Funding opportunities within DFO for terms longer than the existing two to three-year maximum window needs to be created.

So I am assuming there that they're talking about the necessity for having longer-term budgets, so that you could actually plan for three, five, ten-year projects; is that correct?

MR. McFARLANE: I think that's a fair statement.

Q And would you agree with me that when looking at something as challenging as the Strait of Georgia and as challenging as other coastal waters and, in particular, any kind of ecosystem-based management for sockeye salmon, we're going to look at those kinds of longer windows in order to be able to do the work we need?

MR. McFARLANE: I certainly hope we are.

Q And so one of the suggestions or recommendations that you might want to give to the commissioner is to look closely at how science budgets are looked at in this circumstance and he is looking at budgets and you have experienced this, Dr. McFarlane and --

MR. McFARLANE: Yes.

Q -- it's useful, but in order to actually implement these types of objectives, not only do we need to shift in thinking, but we need a shift in how we budget them?

MR. McFARLANE: At this point in my career, I will

agree entirely with what you just said. I think we really need to ensure that science, since we're talking science right now, has funding on a timeframe that will allow them to complete some of these longer-term projects, absolutely.

Q All right. And then I want to go to two more bullets down from that. They list the importance of there needs to involve stakeholders and I'm assuming when science uses the word "stakeholders" they're at least talking including First Nations in that sentence; is that correct?

MR. McFARLANE: I believe they are.

Q

> ... in the development of an ecosystem-based management process as soon as possible.

Now, I just want to drill down on that. I was going to wait for awhile, but let's just get right into this. A management process requires an understanding of what you're assessing? I mean, an assessment doesn't start before management. You've got to have an iterative relationship; is that correct?

MR. McFARLANE: Yes.

Q And so when you're developing your models and you're looking at all of that you need to know who's going to use those models and for what purpose and what are the issues; is that correct?

MR. McFARLANE: I think that's a fair statement.

Q And that in the development of those models there is going to be policy decisions that are going to have to be made in terms of priorities, in terms of funding, in terms of all of those kinds of things; would you agree with me on that?

MR. McFARLANE: Absolutely.

Q Dr. Christensen, would you also agree with me on that?

DR. CHRISTENSEN: Absolutely.

Q All right. And so if we're looking to make these models useful for First Nations and stakeholders, they need to be involved from what I call the get-go, right from the beginning; is that correct?

MR. McFARLANE: I think that's a fair statement, in terms of particularly when we're talking ecosystem-based management research type approaches, yes.

Q And right now, that's also going to require a bit

of a shift in how DFO operates within your organization because science, if science is doing some of these, tends to rely on managers for that; is that correct?

MR. McFARLANE: Tends to rely on managers for what?

Q Managers for discussing policy issues with First Nations.

MR. McFARLANE: Oh, I think that's fair too, yes.

Q All right. So you're not having discussions with First Nations about the kinds of data or the kinds of indicators that they would say is important as part of an ecosystem-based management, are you?

MR. McFARLANE: I think some of the groups work and have meetings with First Nations that would lead to that type of thing, some of the pelagics, the herring groups, meet routinely with First Nations groups to look at proposed herring issues within their zones, plus -- or within their traditional grounds, plus where perhaps where research should be directed. Other groups also do that. Some of the -- I think it's fair and you can question the next panel member on that, but I think there probably is some contact with -- in the invertebrate groups, the shellfish groups, that are the same.

In terms of are they brought -- you know, have we brought everybody together to try and develop a conceptual ecosystem-based list of indicators which include both science-type indicators and social or economic or any other type of indicator, I think it's fair to say no, we haven't done that.

Q That work hasn't been done. But I don't want to make the distinction between science and social here, because from a traditional ecological knowledge perspective, it's very ecological. First Nations have a lot to offer, I would suggest --

MR. McFARLANE: Yes.

Q -- to science; would you agree --

MR. McFARLANE: Yes.

Q -- with me from an ecological perspective?

MR. McFARLANE: Yes.

Q So we don't want to just separate them out --

MR. McFARLANE: Yes. No.

Q -- in the culture and -- you agree?

MR. McFARLANE: Yeah. And I -- you know, I'm used to

talking science, so I'm suggesting that the science indicator -- I'm trying to separate the ecological management type indicators which would include exactly the types of things you're talking about, from the kind of the pure science indicators which are measurements of wind patterns and that may -- that's just where I come from. I may be wrong on that.

Q You may -- I'm just going to ask you to be more inclusive. That's a little bit more challenging for science right now, but from a traditional ecological knowledge perspective --

MR. McFARLANE: Yes.

Q -- one of the challenges for scientists in how they operate is to include that knowledge early into the process; would you agree with that?

MR. McFARLANE: I think that's a fair statement.

Q And that that's something we're going to need to improve on?

MR. McFARLANE: Yes. I -- I think that's a fair statement and I think it applies to not only First Nations, it applies to other user groups where we possibly should open those discussions a little earlier in the process.

Q And I wonder if I could go to page 83 of this document now and Mr. Commissioner, at page 83 you'll see a Canadian case study and witnesses arising from the Arctic and I'm wondering, Mr. McFarlane, if you'll review that, you'll agree with me that that looks like a case study in which community members who are relying on fishing for subsistence in their daily lives were actively involved in the development of the models and in the monitoring; is that correct? Have I read that right?

MR. McFARLANE: I don't know. I haven't read it in detail yet. I assume you've read it right, yes.

Q Are you familiar with the work that's been done in the Arctic, working with First Nations and otherwise to actively partner with them, not as clients but as partners in a high level -- with a high level of consultation, so that the work can be implemented on the ground in a useful way?

MR. McFARLANE: I am familiar that this type of thing has -- work has gone on, joint and partnerships have gone on in the Arctic, yes. I know both of the authors of this report and I've worked with

them for years. Now, it was 30 years ago, but...
MS. GAERTNER: All right. I want to now take you to -- let's just see if I'm finished. Have I marked this as an exhibit? May I mark this as the next exhibit please?
THE REGISTRAR: Exhibit 818.

EXHIBIT 818: CSAS Proceedings of the National Workshop on Objectives and Indicators for Ecosystem-based Management - February 2001

MS. GAERTNER:
Q Now, I think I'll now go to your work more locally, Mr. McFarlane, and Exhibit 812 and 811 are the two exhibits we'll go back to. Now, as I introduced myself today, I introduced the fact that I work for three of the Saanich tribes and when I reviewed this material, and it's my understanding this really is work that's now being done from a science perspective in the Department of Fisheries and Oceans; is that correct, that this has been a science initiative that was completed within the Department of Fisheries and Oceans?
MR. McFARLANE: I think that's correct.
Q And I didn't see anywhere in which you were able to - I'm not saying that it suggested you didn't want to - but that you were able to actually engage the Saanich tribes or any of the First Nations who care very much about the Strait of Georgia in the development of your indicators; is that correct?
MR. McFARLANE: Well, first off, these aren't my indicators. This is a report that's been done by the people working on the framework for managing the Strait of Georgia. I'm not involved in this particular thing, other than early on I was there. However, I think that's fair to say that this is mainly a science initiative at this point and that I don't think there was an awful lot of consultation prior to it. It's a pilot study that was set up in order to basically to determine whether or not that this was a reasonable approach to take and try and work out some of the techniques that would be used for future ecosystem frameworks.

Q All right. And at page 2 of Exhibit 812 there is a clear acknowledgement, as I read it, that the development of a comprehensive ecosystem approach requires collaboration among other DFO sectors and with external partners and interested parties. Again, I don't see First Nations listed there, but is that who you mean when you refer to external partners or when the authors would have referred to external partners and interested parties?

MR. McFARLANE: I think so. Yes, absolutely. It would -- I think at the stage that they develop the actual ecosystem approach, particularly as we're talking defining the objectives and ecosystem management objectives, you would be looking at all interested parties and First Nations would be a major component of that, I think.

Q I guess - and you'll hear a bit of a struggle in my voice perhaps, but I struggle with this notion that once you've done stuff, you're going to figure out -- that at the time of the assessment or later, you're going to ask First Nations. How do you know what to assess if you haven't figured out what people are interested in?

MR. McFARLANE: This particular program is trying to set up a - if you want to call it a snapshot of what we know and the structure of the Strait of Georgia ecosystem now and where it might go in the future under certain types of perturbations perhaps. The -- and I mean, you're correct in saying you can -- you know, you can suggest bringing in people earlier in the process, that could be a good thing at -- from the science perspective though, we're trying to get at the actual structure of the system and make it operational, in this case develop the monitoring tools that are appropriate from a physical and including physical oceanographic climate and biological oceanographic indices, set up long-term monitoring programs, make sure they can become operational, that the funding is there to continue this work, and then to pull together all the information we can in the biological system, link it to the physical system and develop models that give us a reasonable approximation of how the system might work.

At that point, you then can start using this type of information. It becomes one of the inputs

to an ecosystem-based approach of -- to management, as opposed to the assessment of the system.

Q Okay. I'm going to go one step further with you and then I'm going to turn to you, Dr. Christensen, for a moment. But if we could now go to Exhibit 811 and go to page -- on the hard copy, page 3. Sorry, Mr. Lunn, I don't know what the .pdf number is.

MR. LUNN: That's okay.

MS. GAERTNER:

Q And it's in a section called "Why the Need for an Ecosystem-based Approach to the Strait of Georgia" and it looks like there is a to-do list on page 3 for science. If you could just review that, Mr. -- or Dr. McFarlane, again, you'll see my concerns. It appears that science is going to set the objectives and develop the indicators and develop the risk-based frameworks. Why is it that science is doing all of this work by themselves?

MR. McFARLANE: Science is identifying the priorities for science alone in support of the ecosystem-based management. I don't believe that science ever intends or ever intended to develop the priority areas for the ecosystem-based management objectives. So science can, you know -- are setting themselves internally some objectives that they think will provide the best information for a large group of clients or stakeholders or interested parties or, you know, the public in general that will help them to identify management objectives.

Q Right.

MR. McFARLANE: And help them to develop a management strategy.

Q Dr. Christensen from a more academic perspective and perhaps from a more broader-based, rather than just the Department of Fisheries and Oceans here, have you found that when developing models for managers it's useful for the managers to be involved in choosing the objectives and the indicators with you, working collaboratively with you in the development of the model?

DR. CHRISTENSEN: We have often done so and found it very useful. It is -- yes, it is a -- let's just say it's a requirement. But it certainly facilitates it, it makes it much more relevant if

that happens.
Q And, in fact, in the application of the model and the collection of the data and the follow-up questions it is extremely useful for those that are going to use it to be involved in the development of it; is that correct?
DR. CHRISTENSEN: Yes. And this also goes with regards to indicators which I presume you -- did you just step by that or are we still talking about indicators?
Q Sure. We can talk about indicators included in that list.
DR. CHRISTENSEN: That would be another area. What we've seen here is an internal DFO activity, as you have pointed out. There was parallel activities to this that involved academia and the global environment and the DFO activities related to that but what we've seen here is really very specific on the science part. It totally lacks the other aspects of what goes into ecosystem-based management and that's an area where DFO really needs to make progress. This was pointed out in the PICES 2010 report that was -- that we talked about yesterday. Very little is happening on implementation of integrated management here, including on identification of indicators. Much more consultation is needed there, as well. I totally agree with that.
Q And is it your experience that those that carry from time immemorial local information around the -- about the ecological state of affairs could be very useful when developing indicators?
DR. CHRISTENSEN: The people who know about the ecosystem management issues certainly needs to be involved in this process.
Q And Dr. McFarlane, I hope you don't take from my questions a faulting. I'm not intending to communicate that, but rather that that is not typically how science and Department of Fisheries and Oceans have developed their work and that this is a new challenge for you; is that correct?
MR. McFARLANE: Incorporating non-DFO --
Q Traditional ecological knowledge from the base from when you begin to do your work, so when you begin to look at the indicators, when you begin to identify where in the environment you want to create data. I mean, here you are with the Strait

of Georgia, you've gone quite a bit far, you're leading the edge. We're getting reports. And there's no indication that you've taken the first step towards communicating with the Saanich tribes on how to bring that -- how to ground truth that work from the get-go.

MR. McFARLANE: The -- I think that's fair, that at this stage that type of dialogue has not taken place. As I say, this is a pilot study to try and determine the best way of moving forward. I'd presume that the people leading this work will learn from this, from their -- the process, and will modify future strategies or development of future strategies to incorporate the concerns of numbers of people.

Q And then, if I may, can I take you to page 28 of the same document and over to page 29 when we're talking about governance issues for ecosystem-based management? In particular, there is an example from Australia in the Great Barrier Reef - I'm not sure, Dr. McFarlane, whether you're familiar with that, but it appears that they were working closely with the communities.

> This transformation has necessitated for increased pressures on the Great Barrier system from terrestrial run-off, over-harvesting, global warming and the recognition of a new sense of urgency. The new strategies involved internal reorganization and management innovation.

MR. McFARLANE: Yes.

Q Carrying on from there and would you agree that that's the type of thing that DFO is going to need to look at when collaborating and trying to develop ecosystem-based management approaches and operationalizing them on the ground?

MR. McFARLANE: I would certainly agree that that is one of the ways of moving forward with this type of approach and at the present time, DFO is structured in such a way that it's more along species or lines as opposed to area or issue lines. And there's been talk back and forth about how best to overcome that. One of the ways to try and do that was to bring together multidisciplinary types of programs that would

include a number of different disciplines to address these things, but it's in its infancy, no question.
Q All right. Another place that I wonder if you'd like to comment on, Dr. McFarlane, is that my clients often experience a challenge when working with DFO and DFO scientists when trying to push them into looking at things broader and --
MR. McFARLANE: Me too.
Q -- more ecosystem-based is DFO's attachment to historical time series data, and in particular, the scientific comfort that you get from historical time series data. Would you agree with me that when moving into ecosystem-based management we're going to have to prioritize the collection of other data than what we have historically been collecting, particularly as it relates to sockeye abundance data is what we've been collecting over the longest term; is that correct?
MR. McFARLANE: Well, I certainly agree that we have to look at -- I mean, there's nothing wrong with having --
Q No, I'm not suggesting --
MR. McFARLANE: -- historical data to deal with --
Q -- it's -- but --
MR. McFARLANE: But to move to other types of data support, yes, absolutely. There's no question. But, you know, long-term data series are very useful, as are any other type of data that you can use to ground truth any of the things you're looking at.
Q And prioritizing the collection of other data that is necessary will also be important?
MR. McFARLANE: I think so.
Q Now, I want to briefly turn to the recommendations in this report and ask you, Dr. Christensen, you begin in your recommendations with the collection of data and then you go to food habits and diet database and concerted efforts in the marine and then end with the ecosystem model. Were you suggesting that this is a linear approach or would you agree with me that this is completely iterative and needs to be done in -- implemented in an iterative manner?
DR. CHRISTENSEN: Yes. You would probably start with the last one, because that one will influence what

kind of data you need to collect.
Q And in that last one, and in order to be -- move it out of academic and into operationalizing, would you also agree with me that to develop an ecosystem model, it would be very useful to ensure that all of those that will be relying on that model are involved in it and would you like to add that to the recommendations that you've put forward?
DR. CHRISTENSEN: This is Exhibit 783 we're talking about now?
MR. LUNN: I'm sorry, I wasn't there. Sorry.
MS. GAERTNER: Sorry. Yes. I didn't think I needed to take you to the page.
DR. CHRISTENSEN: Well, he was finding it.
MS. GAERTNER: It's okay.
DR. CHRISTENSEN: Sorry. I lost the train there. Could you just repeat?
MS. GAERTNER:
Q Yes. Will you agree with me that if in your view we should begin by conceptualizing an ecosystem model for the Fraser River sockeye salmon or its habitats or -- that to be useful, to make sure that we're using public money wisely, we should develop that model in a very collaborative way, including making sure that those that are going to rely on the model, including First Nations, are involved in the development of that model?
DR. CHRISTENSEN: As a principle, yes.
Q Would you like to make sure that that's a -- is that something you'd like to add to your report? That's not something you mention in your report.
DR. CHRISTENSEN: Our report, no, because our report deals with predation and the scientific aspects of that and that's really what we focus on in the report.
Q No, but you go much farther in your recommendations.
DR. CHRISTENSEN: We can and you mentioned before -- well, I've advised a number of governments on implementation of ecosystem-based management and what you are asking for certainly belongs in that context - implementation of ecosystem-based management. It does not belong in a report about predation. We are just -- I'd just -- we were just sneaking in there what we're saying about ecosystem-based management because we thought it's

important.
Q But it flows from --
DR. CHRISTENSEN: But it's not the focus of the report.
Q But will you agree with me that when looking at predator/prey relationships in a modern context, you're pretty quickly going to go into an ecosystem-based approach?
DR. CHRISTENSEN: The two are very tightly connected, yes.
Q Yes. So it's not that you were throwing it in. It's inevitable when looking at long-term predator/prey relationships in a modern context that you're going to look at it in an ecosystem-based approach?
DR. CHRISTENSEN: Yes.
Q And, in fact, it's my understanding from your work that it's actually the development of these types of tools can be extremely useful on a go-forward basis to not only build consensus amongst those that are trying to manage these fisheries, but also looking to adapt and change over time with the changing environments.
DR. CHRISTENSEN: Yes. And when we develop these tools, our starting point is normally a number of policy questions and those policy questions need to be developed in consultation with all interested parties.
Q All right. I -- sorry, Mr. Hume. I think you thought you might be finished and I forgot to ask you a few questions earlier and I want to pick up on those. In particular, I want to talk about yellow perch in the Interior lakes. Page 22 of the report, it talks about yellow perch being a competitor with salmon in the freshwater lake systems and have spread into the lakes in the Okanagan and the Thompson/Shuswap, which are territories of my clients. And at the bottom of page 22 it states that:

> The available information provides little support for the hypothesis that yellow perch were a major factor for sockeye survival trends over the last three decades.

Mr. Hume, would you agree with that conclusion?
MR. HUME: Yellow perch have only been found very recently in part of Adams Lake near shore and I

don't believe in any great numbers. So, yes, as far as we know, the yellow perch are not a factor in the current regime.

Q I wonder if I could go to commission Tab 29 at page 10. And if I've -- if we've read this correctly at page 10 of this report, it appears that yellow perch has been introduced in lakes in the Lower Mainland, the Fraser and the Thompson. Have I read that correctly?

MR. HUME: Sorry? Whereabouts are we on here?

Q So if we look at the chart at the bottom.

MR. HUME: Chart at the bottom. I believe that's correct. I'm not really totally familiar -- I'm not really familiar with this report, but as far as I know, they're not -- none of these lakes are sockeye-rearing lakes.

Q As far as you know. Okay. And then at page 13 of this report, a model has been constructed which sets out the probability of the arrival, survival, reproduction and spread establishment of yellow perch in different regions and if you look at the Fraser River, Thompson and Lower Mainland, it's high to very high. Now, I take it you weren't involved in these assessments?

MR. HUME: No, I wasn't.

Q Are you confident, having seen these, that they're not in Fraser sockeye-spawning lakes?

MR. HUME: All the information that I have available to me says they're not there, other than as I mentioned, Adams Lake.

Q I wonder if we could go to Tab -- is that our Tab 7 or Tab 2? Our Tab 7. And perhaps you can just help me. It may be that these again are not in any way sockeye salmon-rearing lakes. At the top of page 2, three particular lakes of concern and the Thompson River drainage. Because it seems to conclude there that if the yellow perch enter the Thompson River drainage, the Shuswap Lake, there is considerable risk to the world-famous Adams River sockeye run to a sizeable Interior chinook population and to the COSEWIC-listed endangered coho salmon.

MR. HUME: If they do get into these lakes, yes, it would be -- I --

Q And so they're already in the Lower Shuswap River, it appears, and so this is something that we should be taking care with?

MR. HUME: Sorry? Where does it say Lower Shuswap?
Q
A second lake, Forest, drains --

MR. HUME: Gardom Lake, which flows into the Lower Shuswap River.
Q Right. So they're getting close; is that correct?
MR. HUME: They appear to be getting close, yes.
Q So would you agree with us that we need to begin to take steps to develop management plans for develop -- dealing with this invasive species as it relates to the -- at least the Adams River sockeye run?
MR. HUME: I think it relates to all native fish species, certainly we need to take steps.
Q And so to your knowledge, has DFO moved forward in a management plan for invasive species such as yellow perch in these areas?
MR. HUME: I really can't speak to that. I understand that they're doing work such as this paper here. I don't know what they've done in terms of management plans.
Q You agree with me that given this -- the concerns I've raised with you here, that that's something that's important to be looking at?
MR. HUME: Yes, I do.
Q One final question -- oh, can I have those marked as an exhibit?
THE REGISTRAR: Thank you.
MS. GAERTNER: Thank you.
THE REGISTRAR: Which one first?
MS. GAERTNER: Oh, both. The commission document first.
THE REGISTRAR: Okay. That's at Tab 29?
MS. GAERTNER: Yes.
THE REGISTRAR: That will be 819.

EXHIBIT 819: CSAS - Biological Risk Assessment for Yellow Perch in British Columbia - 2008

THE REGISTRAR: And your documentation at Tab number 7 will be 820.

EXHIBIT 820: Risk Analysis, Fisheries Impacts and Management Options for the Control and Management of Introduced Fish Species in BC Freshwater Lakes and Rivers

MS. GAERTNER:

Q I just have one final question for you, Dr. Christensen, and this arose out of a comment you make at page 79 of your report and I think it would be useful to go to there now. Now, did I hear your evidence yesterday correctly that you aren't actively involved and haven't been actively involved and don't have a lot of information about the Wild Salmon Policy; did I hear that right, or...?

DR. CHRISTENSEN: That's correct.

Q All right. Perhaps you can explain to me what you meant in the sentences that begins:

> The focus of fisheries management on short-term tactical advice...

And we spent a little bit of time yesterday on that. I want to go further.

> EBM calls for evaluating trade-offs which may be severe and which, in turn, have socioeconomic consequences.

You suggest that such trade-offs are seemingly ignored in the Wild Salmon Policy. I was concerned about that. If we can go to the Wild Salmon Policy and perhaps it's Exhibit 8, you go to page 14 of the Wild Salmon Policy there's lists of objectives and that includes maintaining habitats and ecosystem integrity and those all require trade-offs, doesn't it? Don't they?

DR. CHRISTENSEN: They do. One thing is the paper describing the Wild Salmon Policy, another is the actual implementation of it.

Q But, Dr. Christensen, you're not actively involved in that work. This is a very strong opinion. Where did your opinion -- how did you develop that opinion?

DR. CHRISTENSEN: That's a very good point. Maybe this is academic, again going off on a limb on something that I'm not a specialist on. It is my

impression and I should probably have been more careful in what I wrote there.
Q All right. So it may be that there are trade-offs implicit all throughout the Wild Salmon Policy and what we're doing is being challenged by their implementation; is that perhaps a more accurate way of looking at it?
DR. CHRISTENSEN: That is possible. As you point out, I am not an expert on the Wild Salmon Policy.
Q So I notice that at the beginning of your acknowledgements that you've acknowledged quite a lot of conversations with Dr. Karl Walters; is that correct?
DR. CHRISTENSEN: That is correct, yes, but I do not recall any discussions about the Wild Salmon Policy.
Q Oh, so this isn't Dr. Walters' concerns about the Wild Salmon Policy that we're reading here?
DR. CHRISTENSEN: I do not know Professor Walters' concern about the Wild Salmon Policy.
Q All right. So these are your concerns?
DR. CHRISTENSEN: This was -- it also relates to how DFO has been moving on implementation and incorporation of social and economical aspects of integrated management. And what I have read there from -- for instance, from the PICES report, is that this work is at a standstill so I have, as an outside observer seen little progress.
Q All right. So let me just conclude with this question or suggestion to you is that implicit in the Wild Salmon Policy are many trade-offs and that in the work of creating the Wild Salmon Policy, trade-offs were already determined and that the challenge is implementing the Wild Salmon Policy, not working out all the trade-offs.
DR. CHRISTENSEN: Was that a question?
Q Yeah. I'm asking you -- you've suggested that there's no trade-offs in the Wild Salmon Policy and I find that suggestion and my clients find that suggestion troubling. The Wild Salmon Policy reflected a shift in approaches of the management of wild salmon, and implicit in things like habitat integrity and making that an -- and many of the objectives that are set out are trade-offs. You'll agree with me on that?
DR. CHRISTENSEN: Oh, yes.
MS. GAERTNER: All right. Those are all my questions,

Mr. Commissioner.
THE COMMISSIONER: Okay. Thank you, Ms. Gaertner. Mr. Timberg, any re-examination?
MR. TIMBERG: Mr. Commissioner, I have five questions, five topics for re-examination.

CROSS-EXAMINATION BY MR. TIMBERG, continuing:

Q Mr. McFarlane, you were just asked about -- or Mr. Hume, sorry, you were just asked about invasive species. Who at DFO is knowledgeable or is responsible for the invasive species in the B.C. Interior?
MR. HUME: Barry Rosenberg would be one person who would be knowledgeable and Mike Bradford.
Q Okay. And can you just describe for the assistance of the commissioner a bit more about the work that they do? Do you have -- can you provide a summary of their work, just as an overview?
MR. HUME: I can't really speak to Mr. Rosenberg's expertise in -- he's area manager or area chief and so therefore responsible. Dr. Bradford authored a number of the -- it's obviously not ***SARA***, a number of the -- has done a number of reports on --
Q COSEWIC?
MR. HUME: -- reports on various invasive species in B.C.
Q And Dr. Bradford's watching today, isn't he?
MR. HUME: Yes, he is.
Q Okay.
MR. HUME: Was.
Q Mr. Hume, earlier Mr. Harvey was asking you some questions about over-escapement and about the size of smolt that result from years with a large -- large brood years, and he suggested that the resulting smolts were weak or less robust. So my question for you is is there any evidence that smolts migrating from large broods are inherently weaker or less robust than in years where the runs are smaller?
MR. HUME: There's certainly -- there is a size density relationship, so that's larger -- the larger escapements, the smolts tend to be somewhat smaller than the big escapements. Certainly in this 2002 brood year from Quesnel Lake, the Fall

fry that we measured were definitely smaller than anything we'd seen in the previous years, indicating that they were not as healthy.

Q Okay. And so would you -- so -- and that's the evidence you have with respect to whether they're inherently weaker or less robust?

MR. HUME: That's correct. We haven't actually looked at energy content as -- I mean, any smolts in any system.

Q Sorry? I didn't hear that.

MR. HUME: We haven't examined energy content of smolts. All the information, basic information we have on smolt robustness or condition is size and -- is size data.

Q Okay. So that's all of the information we have. And Mr. McFarlane, Chris Harvey was -- or Mr. Harvey was asking you about a question as to whether or not scientists -- whether or not there should be a scientist in chief to draw all science information together. And so I guess my question is - and I think this question was posed to Dr. Christensen, so my question for you is in your opinion, would it be of assistance to have a scientist in chief?

MR. McFARLANE: I guess in theory we do have a scientist in chief. Our Regional Director of Science would fill that role. The --

Q And that's Dr. Laura Richards?

MR. McFARLANE: Yes. There are -- you know, when you're trying to develop programs that -- and prioritize them in some way, I find it useful to bring in much like we talked about in this -- previously in the ecosystem-based approach, is to bring in the groups of people who would be most knowledgeable and most able to help us develop a science program. Based on whatever long-term requirements are needed to keep some of these programs going and also the short-term needs which would be based on things that could come from industry or First Nations or that they have specific questions about specific stocks or specific areas for various species that you might want to address. That would -- they would be brought forward through management groups or through advisory processes and then prioritized within some sort of committee that would look at that and that's generally the way marine fish has

progressed and operated. I'm not familiar -- I don't deal with salmon, so I don't -- I'm not involved in that.

Q All right. Thank you. And Dr. Christensen, you stated that in general, large -- that when two fish meet, that the smaller one tends to become prey of the larger one. You made a statement about large fish generally eat smaller fish in your examination, in your earlier testimony. But will you agree that predator/prey interactions are not determined by size? Instead, their interaction is determined by their morphology, which is their shape, form and structure, and their behaviour?

DR. CHRISTENSEN: No. I don't know any cases where smaller fish -- okay. With fish, yes, I don't know any cases. It's true that you can have marine mammals where the prey is bigger than the predator, so in that point I have to say yes, you're correct. There are a number of -- there's a number of factors that influence this.

Q Right. And you'll agree that many large fish are planktivorous and to not eat other fish?

DR. CHRISTENSEN: Oh, absolutely.

Q And so --

DR. CHRISTENSEN: The biggest ones are only planktivorous.

Q Right. So I just wanted to -- we just need to be a bit careful that we -- it's not always the case that when a large fish runs into a smaller fish, the smaller fish becomes prey? You'll agree with that?

DR. CHRISTENSEN: Yes. A very important detail.

Q And I'd like to take you, following up on the question with respect to the Wild Salmon Policy, if we could turn to Exhibit 8, Mr. Registrar, and page Roman Numeral VI, I think that's page -- at the beginning. If we could go back one page. Thank you. And then if we could go to -- with respect to this issue, Ms. Gaertner just stated that the -- it was implicit within the Wild Salmon Policy that there are trade-offs in the decision-making and I'll suggest to you that it's actually explicit in the Wild Salmon Policy that trade-offs are to be made. And if we -- I'll just read the fifth bullet down:

> Implementation of this policy will involve an open and inclusive process aimed at making decisions about salmon stewardship that consider social, economic, and biological consequences. People throughout B.C. and Yukon will contribute to decisions that reflect society's values for wild salmon.

And then I'll read the tenth bullet down, the second-last one:

> The policy aimed to maintain CUs but recognizes there will be exceptional circumstances where it is not feasible or reasonable to fully address all risks. Where an assessment concludes that conservation measures will be ineffective or the social or economic costs to rebuild a CU are extreme, the Minister of Fisheries and Oceans may decided to limit the range of measures taken. Such a decision will be made openly and transparently.

So will you agree with me that it's explicit within the Wild Salmon Policy that trade-offs are to be made?

DR. CHRISTENSEN: Yes. And meanwhile, I've had the challenge actually to read the statements that Counsel Gaertner was referring to before and just for the record, what I'm talking about there is socioeconomic consequences and that form for trade-offs and my implicit critique for that is that I do not see -- especially in connection with weak stock any clear numbers for what the consequences are of the weak stock consequence -- weak stock management decisions. That's what I was referring to in the report when describing the trade-off were not fully considered there. But, yes, there are words about this. They are mentioning about trade-offs and trade-offs are important in the Wild Salmon Policy, that's correct.

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

MR. WALLACE: Thank you, Mr. Timberg. I have three questions that will just take a few moments, I think.

RE-EXAMINATION BY MR. WALLACE:

Q Mr. McFarlane, if I may start by addressing a question to you arising out of the questions that Mr. Timberg asked you yesterday, you were commenting on the expert report for Project 8 and you indicated that you would add to the species to be considered, hake, dogfish and pollock. You then addressed why the why for dogfish, but not for hake and pollock, as possible sockeye predators. Could you just fill us in then on what aspects of hake and pollock would cause you to include them in the list?

MR. McFARLANE: I think I was referring to if we -- Mr. Timberg asked me about where would I develop a program to address potential impacts on Fraser River sockeye. If we -- so I would look at the timing is crucial, which would be the Spring period, Spring to early summer period, and the types of information is crucial, which would include physical all the way up to higher trophic level information. Of that higher trophic level information, the species that were identified were things like hake, dogfish and pollock and I think those are reasonable species to continue getting work on because they are not only potential predators and although at this point in history, I don't believe that Pacific hake is a predator of sockeye.

It's -- in the Strait of Georgia there's been a tremendous decrease in size at age over time since 1992 and they are well below the limit that we ever find fish in the diet, but that can change again, as it did in the early 1990s, so I would think that you would want to have a program that was at least able to examine the future changes in size at age and other biological parameters for that species.

There's very little known about pollock. It's known it is a fish predator, but it's not a major predator of salmon, at least historically, either in Canadian waters or U.S. waters where the major stocks are. The Strait of Georgia fish are much smaller than, say, Gulf of Alaska or Bering Sea fishes or some of the other stocks in Canadian waters. But, again, it's good to have a -- some of that information available for people.

We don't have abundance -- recent abundance information for either of those species and you would want abundance information, both as a potential predator, if you truly believed that they were impacting, and as a competitor in order to assess the impacts of their competition with salmon. So those -- that was the reason for those species.

I added other species to the list as potential competitors. They are important species in the Strait of Georgia. There's virtually nothing -- no research going on on them and everything that we know about them, it comes from incidental information that we collect during other surveys. And the two I mentioned specifically were leurroglossus and myctophids.

Q Thank you. Dr. Christensen, having heard those comments, do you have any observations on those issues?

DR. CHRISTENSEN: No. These are usual comments.

Q Thank you. Mr. Hume, in discussing the relationship between pikeminnow and sockeye and in Cultus Lake, is there any data on the actual amounts of sockeye consumed by pikeminnow in Cultus Lake?

MR. HUME: Not in recent years, no. We've had very -- quite a bit of difficulty getting that reliable diet data. However, Dr. Ricker back in the 1940s did collect a considerable amount of diet data for Northern pikeminnow.

Q Would you agree with the judgment in the report that's been filed that updating diet data would be a very good thing?

MR. HUME: It would be useful. It's difficult, given the low numbers of sockeye in the lake, it's difficult to get the information on what their predatory rate would be but, yes, it would be useful.

Q Thank you. And finally, Mr. Hume, I wonder -- Mr. Lunn, I'm going to take you by surprise. I apologize. If you could look at -- pull Exhibit 748 which is the expert report on Project 10 and at page 4, I just want to read a brief quote. It's the last full sentence above the recommendations:

Thus --

Or the last few sentences:

> Thus, the recent decline in productivity for Quesnel sockeye might be more attributable to increased spawner abundance than to broad-scale environmental factors that affect other sockeye stocks in the Fraser and other regions. However, other Fraser sockeye populations do not show such evidence. Our data do not support the hypothesis that large spawner abundances are responsible for widespread declines.

We've -- you were asked in questions by Mr. Harvey about these issues and critically with respect to Quesnel Lake and the suggestion from, as I read the report of Peterman and Dorner is that this may be limited to Quesnel and not something where there's similar evidence from other Fraser River sockeye lakes; would you agree with that?

MR. HUME: I guess the short answer is yes. Quesnel Lake, we -- the lower trophic level productivity of the lake has not decreased, according to the sampling that we have done on the lake; however, the returns from since 2002 on the dominant and sub-dominant years have been lower than expected, given -- or lower than -- the return rates are lower than what we've observed in past years. That appears to be -- I'm not sure that we can attribute that to freshwater production or marine survival problems.

Q And has the same phenomenon been observed in other Fraser River lakes?

MR. HUME: No, it hasn't today.

MR. WALLACE: Thank you. I have no further questions, Mr. Commissioner. It's now 12:25. Perhaps this would be a convenient time to break and we start a moment or two -- a bit early, two o'clock or...?

THE COMMISSIONER: No, we'll start at two o'clock and we'll have the two hours this afternoon for the final witness, Mr. Wallace.

Before we break, I wanted to thank the panel members very much for your attendance at this commission and for answering the questions of counsel and for your cooperation in that respect. Thank you all very much.

MR. LUNN: Mr. Wallace, did you want to mark those

redacted c.v.s before we --
MR. WALLACE: Yes. Yes, please. This is simply -- can you just provide us with the numbers of those for the record?
THE COMMISSIONER: Well, just exchange them and that would --
MR. WALLACE: Simply exchanging the c.v.s for, I think, all four DFO witnesses. Oh, it's simply Mr. Hume and Mr. McFarlane's c.v.s.
MR. LUNN: Right.
MR. WALLACE: Those numbers...?
MR. LUNN: One moment.
MR. WALLACE: Numbers 800 and 801, I believe.
MR. LUNN: Thank you. Yes.
MR. WALLACE: Thank you.
THE COMMISSIONER: Thank you.
THE REGISTRAR: The hearing is now adjourned until 2:00 p.m.

(PROCEEDINGS ADJOURNED FOR NOON RECESS)
(PROCEEDINGS RECONVENED)

THE REGISTRAR: Hearing is now resumed.
MS. TESSARO: Good afternoon, Mr. Commissioner. For the record, it's Lara Tessaro, commission counsel. And for the remainder of the day or possibly less, we are hearing from Mr. Graham Gillespie and I'd ask that he be affirmed.

GRAHAM GILLESPIE, affirmed.

THE REGISTRAR: Would you state your name, please?
A Graham Gillespie.
THE REGISTRAR: Thank you. Counsel?
MS. TESSARO: Mr. Lunn, could I ask that you pull up Tab 37 of our documents?

EXAMINATION IN CHIEF ON QUALIFICATIONS BY MS. TESSARO:

Q Mr. Gillespie, is this your c.v.?
A Yes, it is.
MS. TESSARO: Could I ask that this be marked as the next exhibit?
THE REGISTRAR: Exhibit number 821.

EXHIBIT 821: *Curriculum vitae* of Graham Gillespie

MS. TESSARO: I should actually note before I qualify or seek to qualify Mr. Gillespie that with me today is Mr. John Major, who has been assisting with the squid evidence, and Mr. Brian Wallace, at the back of the classroom.

Q So Mr. Gillespie, since July 1994 you have been employed as an invertebrate research biologist at DFO Pacific Biological Station; is that right?

A That is correct.

Q And you're also currently the head of the Shellfish Section at PBS?

A Correct.

Q And in this role -- in these roles, you are responsible for planning, organizing and participating in research into the biology, ecology and population dynamics of commercially and/or ecologically important invertebrate stocks or species at risk in the Northeast Pacific Ocean?

A That is correct.

Q And you have a particular emphasis on bivalves, crustaceans, cephalopods and non-indigenous invertebrates?

A Correct.

Q From the mid-1990s to the early 2000s you've published a number of peer-reviewed reports on the assessment, biology and fisheries of cephalopods, particularly various octopod and squid species, correct?

A That's correct.

Q You've designed and participated in surveys of squid species in B.C. waters, including a survey of the Humboldt squid in 2009?

A Yes.

Q You participate in the PICES working group on non-indigenous species?

A Yes, I do.

Q And you have a Bachelor of Science degree in biology from the University of Victoria obtained in 1985?

A That's correct.

MS. TESSARO: I would submit that Mr. Gillespie should be qualified as an expert in the assessment and biology of squid species in the Northeast Pacific Ocean, including the Humboldt squid.

THE COMMISSIONER: Thank you.

EXAMINATION IN CHIEF BY MS. TESSARO:

Q Mr. Gillespie, could you briefly describe your general duties and activities as an invertebrate research biologist at PBS?
A Generally what we do is develop science information and science advice that is then brought forward through a review process and delivered to managers to help inform and influence their management of fisheries or other management actions.
Q And what percentage of your time would you estimate do you spend in relation to work on cephalopods?
A Fairly small proportion. I would say on average about ten percent of my time.
Q And perhaps for the benefit of everyone in the room, as a matter of taxonomy, what is a cephalopod?
A Cephalopods are squid, octopi or cuttlefish.
Q Thank you. And how many employees of DFO Science in the Pacific Region have specific duties that include working on cephalopods?
A Just myself.
Q I'm going to ask you a few questions about the general biology of the Humboldt squid, life history, distribution, abundance, before we turn specifically to look at its diet. And perhaps you could start by just describing for the commissioner the basic life history of the Humboldt squid, including its migrations into B.C. waters.
A Okay. Humboldt squid are a large migratory offshore species of squid. Their life begins after -- as paralarvae when eggs hatch in tropical waters of the Eastern Pacific and as the squid grow, they take a feeding migration that carries them both north and south from those waters. In most years, that migration has ceased at about the U.S./Mexican border in the north, but more recently we've found them as far north as Southeastern Alaska in the late summer and Fall. They moved north to feed. They grow at a prodigious rate, grow quite quickly, therefore they need a lot of food to fuel not only the

metabolic demands of growth but also undertaking this long-range migration. They generally leave our waters in September/October and return back to the tropics to spawn.

Q And you said that it was only more recently that they began appearing in waters basically north of Mexico. I'm wondering if you could put some years to that?

A There's some evidence of an extension of that range in the 1930s, at least as far as the mouth of the Columbia River. There's pictures of Edmund Ricketts, who ran the biological supply company in Monterey, California, with a Humboldt squid from sometime in the 1930s. The information that I have is they appeared for a few years and then their range shrank back to where it had been before.

We started to get anecdotal reports of large squid in offshore waters from our oceanographers who were undertaking surveys out to Weather Station Papa and those squid were not formally identified as Humboldt squid at the time because they were merely observed. They weren't collected.

Q And that was in the late '90s?

A I'm sorry, that would be in the -- yes, the late 1990s. Yeah. The first confirmed specimens that we had from B.C. waters were in 2004 and then we had increasing abundance from 2004 forward to a peak of abundance in 2009. We don't formally measure abundance. We don't have quantitative estimates. We work from qualitative information like evidence from animals being stranded on the beach, public reports and then catches in commercial and surveys. So we saw a few in 2005, some more in 2007 and then a large abundance in 2009.

Q When you say some more in 2007, are you able to even roughly guesstimate what the abundance might have been or qualitatively characterize it?

A Relatively? Nothing quantitative, but in 2007 we had a few reports from recreational fishers and we had one stranding event at Nootka Island. I belie we also had one squid that was trapped in a predator net in a salmon farm in Nootka Sound, so that's relatively few reports.

In 2009 we had 11 reported strandings,

another seven public reports, a number of reports of catches in commercial fisheries and then our survey in 2009 provided a lot of information on distribution on relative abundance.

Q Would it be fair to characterize 2009 as relatively very abundant in contrast to previous years?

A Yes, it would.

Q And what about 2010?

A In 2010 they did not extend north of Southern Oregon. The northernmost stranding report that I heard of was in Southern Oregon. They didn't appear in Washington or B.C. waters at all.

Q Do we have any predictions from people who are out on the water now, say in California, about whether the squid are going to materialize in B.C. waters in 2011?

A I've been in contact with Dr. John Field, who works with NOAA out of Santa Cruz. He indicated that they hadn't seen any off California as of April. He also indicated that a colleague, Dr. Bill Gilly, who does work on Humboldt squid off Mexico indicated that abundances there were low this year, and his opinion, which I agree with, was that we're not likely to see them in B.C. waters again this year.

MS. TESSARO: Just to finish up on the issue of distribution, perhaps, Mr. Lunn, you could pull up Tab 42 of the commission's list of documents.

Q Do you recognize this document that's on the screen?

A Yes, I do.

Q And what is it?

A This is a presentation that I prepared using information provided by John Field and that I had collected through our own programs that was made to a workshop on the possible causes of decline of Fraser sockeye in 2011.

Q That was a workshop in April of 2011?

A That's correct.

Q And it's -- is it right to think that that's what's sometimes referred to as a synthesis workshop?

A Yes, I believe that's accurate.

Q Just for a handy reference, if we could turn to page 7 of this document. Did you create this slide at page 7?

A Yes, I did.
Q And in terms of the distribution of squid in Georgia Strait, am I right to read that one square --
A Yes.
Q -- that red square that looks close to Campbell River, does that represent just one -- one sighting of Humboldt squid in the strait?
A Yes. It's a single squid that washed up in Campbell River in December of 2009, I believe, so this is an animal that somehow got lost or strayed on the southward migration and took a wrong turn at the north end of Vancouver Island and ended up in the strait.
Q And what about the Strait of Juan de Fuca, can you interpret the map for us there?
A It's the same year, the same month, it's another squid that was found on Vashon Island in Puget Sound.
Q Just stepping back a minute, I should ask you, what generally does this map reflect? Sightings, you referenced one -- the same year.
A Oh, the green dots are research catches from 2009. The blue squares are sightings from 2009. The red squares are strandings from 2009, which -- oh, the red one is commercial bycatch again in 2009.
Q And this would have all been from data collected on your 2009 survey?
A My survey and also surveys that were undertaken to look at high sea salmon distribution, sardines and herring.
Q The final question before we turn specifically to the diet of the squid, could you identify for us -- I've been reminded that I should mark this as the next exhibit.
THE REGISTRAR: Exhibit 822.

EXHIBIT 822: Humboldt squid in B.C. - 2011 Update

MS. TESSARO:
Q Mr. Gillespie, could you remind us or could you identify for us the various hypotheses that have been posited by people for what is causing the squid, the Humboldt squid, to begin its travels north?
A It's -- there's no clear single hypothesis that's

agreed upon at the time. Amongst the candidates are increased abundance of Humboldt squid in their native range and one hypothesis there is that decreased levels of predation because of decreased numbers of predators on juvenile Humboldt squid might lead to an explosion in population and therefore, their range would need to expand to meet their feeding needs.

There are a couple of oceanographic hypotheses. The simplest is just general increased water temperatures and a warming trend. Another is a shallowing of the oxygen minimum layer, a deep water layer that's the boundary between well-oxygenated surface waters and the colder, deeper waters that lack oxygen below. Squid take refuge in this layer, probably as both physiological cooling mechanism and to avoid predators and that oxygen minimum layer has been decreasing in depth, that is, getting shallower and closer to the surface.

And then there's the influence of large-scale oceanographic events like the El Niño southern oscillation which may drive Humboldt squid further north because the surface waters in their southern part of their normal range might be too warm for them and they're avoiding the hot water and moving up into a thermal range that's more appropriate for them.

Q Turning to the diet, I'm going to begin by taking you back to September 2009. And proceeding chronologically, we -- the commission has heard evidence from Dr. Laura Richards about a DFO science workshop that happened on September 30th, 2009. Did you participate in that workshop?

A Yes, I did.

Q And what was the nature of your participation?

A My role at that workshop was to bring forward information on Humboldt squid, their distribution, their diet and the specific question of whether they might prey on salmon.

Q And I believe we have your presentation. I'll get you to confirm that.

MS. TESSARO: It's Tab 40 of the Commission's binder. I'm sorry, this is also, for the record, Exhibit 613F -- oh. Maybe we should just try Exhibit 613F. Is that possible, Mr. Lunn?

MR. LUNN: Sure.

MS. TESSARO: Sorry.
MR. LUNN: That was marked as Exhibit -- oh, Tab 40, I'm sorry. I have the wrong one. That's Tab 40, which is -- appears to be...
MS. TESSARO:
Q And I'm not sure if you need to scroll through this, Mr. Gillespie, to identify whether this is the presentation that you made.
A This is the presentation I made.
Q Thank you. You'll agree with me that as of September 2009 at the time you made this presentation, there wasn't any evidence, to your knowledge, that a Humboldt squid had ever actually eaten a salmonid?
A That's correct, no direct evidence.
Q And your PowerPoint here at Exhibit 613F states that?
A Yes, I believe it does.
Q Do you need to double-check that?
A No. It's the final set of bullets in the summary slide.
Q So we're in the world of -- a world where there is no direct evidence, so perhaps I'll ask you what generally are the limits that determine what a Humboldt squid can or cannot prey upon?
A Well, as pointed out by the authors of the report, you need overlap in time and space between the predator and the prey, so they need the opportunity to determine whether something is prey or not. They need to -- they generally eat animals within a given size range, and then there are possibly considerations around the ability of a particular animal to avoid being preyed upon, its metabolism and its ability to escape an attempted predation.
Q Is that its evasive capabilities?
A Yes, exactly.
Q And when you said there -- as noted in the report, there needs to be an overlap in time and space, do you mean the Project 8 report that was provided by Dr. Christensen and --
A Yes. I'm sorry. I wasn't clear about that.
Q Thanks. That's okay.
A Mm-hmm.
Q Was there any particular literature that informed -- any absence of direct evidence, your -- this presentation that you made in September 2009, what

did you draw upon to be able to present on the biology, diet, habits, et cetera, of the Humboldt squid?

A The primary piece of literature that I used was a CalCOFI paper presented by Dr. John Field in which he had summarized distribution, biology and diet of Humboldt squid in the waters off the U.S., in particular California and Baja California.

Q I think we have that, if we could, Mr. Lunn, pull up Tab 38, please? Mr. Gillespie, is this the article that you just mentioned?

A Yes, it is.

Q For the benefit of everybody here what is the California current?

A The California current is a large oceanographic feature. There's a trans-oceanic current that hits the Western Coast of North America and splits into two directions, the Alaskan gyre which goes north, and the California current, which goes south.

Q And in terms of the continental shelf off British Columbia --

A Mm-hmm.

Q -- are British Columbian waters part of the California current?

A Yes. To a greater or lesser extent, depending on the year, because the -- where that current strikes North America moves north and south depending on conditions in the ocean.

MS. TESSARO: Thanks. Perhaps we could mark Tab 38 as our next exhibit?

THE REGISTRAR: Exhibit 823.

EXHIBIT 823: Range Expansion and Trophic Interactions of the Jumbo Squid, *Dosidicus Gigas*, in the California Current

MS. TESSARO:

Q I don't know if you're able to just very briefly summarize this particular study and what this report -- what the results of this report were.

A My particular interest in this report was surrounding the diet of Humboldt squid in Eastern Pacific waters and closer to British Columbia. It summarizes that they feed largely on small pelagic species, myctophids, juvenile or small schooling rockfish, hake and various pelagic invertebrates,

as well, including other species of squid and pteropods.
Q And the study, you'll agree, did not identify any salmon in the Humboldt squid's diet in the area studied?
A That's correct.
MS. TESSARO: Could we turn to page 141 of this document? I don't know the .pdf number. And perhaps we could highlight out that top graph number "A".
Q Mr. Gillespie, I'm not sure if you've looked at this graph recently and if you haven't, please feel free to explain that, but my reading of this graph is that jumbo squid and salmon generally identified as salmon, are at the same trophic level; am I reading that right?
A Yes, I believe you are, trophic level 4, 4.1, yes.
Q In terms of this particular model that's being used in this particular paper.
A Yes.
Q And what does that mean to a lay person in terms of the likelihood of species at the same trophic level to prey upon each other? Is there anything we should understand from that?
A I don't think there's any impediment between species at the same trophic level feeding upon each other. The trophic level is generally determined by what level -- whether they're feeding on primary production, secondary grazers, intermediate predators and then the top level would be an apex predator upon which nothing preys.
Q Okay. Thank you. Perhaps we'll leave this aside and just ask you to summarize the results -- or, sorry, not the results, the activities of your survey in 2009, what you surveyed, your techniques, what was collected, what was measured.
A Okay.
Q Where and when.
A Yeah. In 2009 we were in talks with people from the U.S. We realized that we were going to very likely have large amounts of Humboldt squid in Canadian waters, so we set out to join a survey that had already been planned. This was a survey of Pacific hake. This is a collaborative survey between the U.S. and Canada and they had been encountering hake on the U.S. leg which precedes

the Canadian leg. So on short notice, we were able to bring together equipment to fish for squid. We were fully intending to sample any squid we got in the trawls that were used to sample hake. We borrowed an automated jigging machine from a commercial fisher in Vancouver and secured squid two-rod reel arrangements and a number of giant squid jigs to hand line for the squid, as well.

Q DFO had to borrow the jigging equipment?

A Yes, we did. Yeah. This was a result of a previous collaboration under new and emerging fisheries where these fishers had attempted to start a fishery for neon flying squid off British Columbia and we have a particularly good relationship with this fisher and knew that he had jigging machines in storage that he wasn't using. We just asked if we could borrow one.

Q And then if you could continue on and tell us what you -- what data you collected, what parameters you measured?

A Okay. We had conferred with Dr. Field to see what information they were collecting in the south because we wanted the data sets to be consistent, so we took his sampling protocol, we collect morphometric information, which is measures of various -- the size of the various body parts. We collected some tissues for genetic analysis. We collected the stomachs. We collected the heads because the heads contain structures called statoliths which are similar to the otoliths in a fish and can be used to determine the age of the animal. I believe that pretty much covers it.

We sampled anything that came up in the trawl. We also did our jigging at night when the trawl machinery was shut down and we weren't fishing and secured the same samples from those squid.

Q On the morphometric data --

A Mm-hmm.

Q -- what were the range of squid lengths? Are you able to explain the general range of lengths of squid and maybe, perhaps, the average length of squid?

A I don't know that I could actually cite the average. The range of squid in terms of total length, I believe, was from around 79 or 80

centimetres to about 137 centimetres, so total length would be measured from the tip of the mantle to the tip of the arms.

Q And compared to squid that are full-grown, fully-grown --

A Mm-hmm.

Q -- are these as big as Humboldt squid get or are they...?

A No. Humboldt squid should get to around 200 centimetres in total length and up to 50 kilograms.

Q So you attended a presentation. You made this PowerPoint presentation. After that, what happened? Were you consulted on -- in relation to giving any advice? Was that the end of your involvement with DFO science managers on that issue?

A I would say yes, I came to provide information to the meeting and did so and after that, I was not required.

Q Were you asked to provide any input on a briefing note?

A No, not directly.

Q Were you asked to provide any input on speaking notes for Members of Parliament?

A No.

Q We're going to ask you about the briefing note to the minister and which Mr. Lunn is both Tab 39 of our materials and also Exhibit 616A. Mr. Gillespie, have you seen this before?

A Yes, I have.

Q Could I ask you to look at the third bullet of the summary box? Does that bullet, and I'll read it. It reads:

> Sea lice from fish farms, Humboldt squid predation and U.S. fisheries could have contributed to the sockeye mortality but are likely insufficient in themselves to explain the poor return.

Does that assessment reflect the discussions at the September 30th, 2009 workshop?

A For the period that I was there, yes, it does.

Q Were you not there for the entire meeting?

A No, I was not.

Q Were you there for the majority of the meeting or

simply...?
A I was there for the first day of a two-day meeting.
Q And if you could turn to page 2 of this document, this memo. Under the heading "Analysis/DFO Comment" there is a bullet number 3 which reads:

> Predation on juvenile salmon in Strait of Georgia. There are no known shifts in predator abundance that could explain increased predation in 2007.

My only question here is that were Humboldt squid implicated in any way by this particular bullet?
A No. Humboldt squid did not regularly occur on the Strait of Georgia.
Q Thanks. And then finally, the third bullet on page 2 that isn't a number, but a bullet reads:

> The following factors may have contributed to sockeye mortality, but not at a magnitude sufficient to explain the poor return in 2009:

Number 1 under that bullet relates to the squid and says:

> Humboldt squid is a voracious predator that has increased dramatically in abundance in Canadian waters since 2007. Salmon have not been identified in their diet. Surveys in 2009 will be analyzed to assess any possible link to salmon.

Since 2007, does that mean that increase has happened from 2008 onwards? Is that your understanding of when abundance increases happened?
A I believe the key word there is "dramatically", so there was evidence of increasing abundance from 2004 to 2007, but the change from 2007 and 2009 could be characterized as dramatic.
Q Thank you. And do you think that this is reasonable advice? Do you think that absent any direct evidence, it's reasonable to advise the minister that predation by Humboldt squid may have contributed to sockeye mortality?

A I believe so in that we still had work to be done. We had samples that were yet to be analyzed. So we could not say definitively they were not implicated.
Q How does that differ from the majority of species we've heard about over the last few days? Salmon shark and lack of information on salmon shark abundance, arrowtooth flounder and the lack of information about its biology? Couldn't any number of species have equally had that advice? Why was the Humboldt squid singled out? That's a lot of questions, but...
A No, I agree with the point that you're making. That's true. As to why the Humboldt squid was singled out, I didn't author the briefing notes, so I couldn't say for certain. My impression would be that Humboldt squid were being discussed quite openly in the media at the time, so they were, for lack of a better term, a hot topic and someone perhaps anticipated that the minister might ask.
Q So this briefing note, this advice to the minister, may have been driven -- your view is it may have been driven as much by what was high-profile as what the scientists may have been discussing?
A Perhaps in the case of Humboldt squid, yes.
Q Thanks. Knowing what you know now, looking back to this briefing note, do you think that this was a bit of a false alarm?
A I wouldn't say so because I don't think we know so much more now that we can still exclude them.
Q And we're going to get to that now. After September 2009 I take it you learned of some direct evidence. Could you tell us what you learned and when you learned it?
A In February of 2010 there were two additional pieces of information. The first was that I was delivered a copy of a presentation made at the Pacific Salmon Commission that showed photographs of a chinook jack from the mouth of the Columbia River that had were typical of a squid bite or a squid attack.

The second piece of evidence was an email from Dr. John Field saying that they had morphologic -- sorry, the second piece of information was from Dr. John Field who said that

they had found a salmon otolith in a squid stomach in the mouth of Juan de Fuca Strait.

MS. TESSARO: Could we please turn to Exhibit 573, which is Tab 41?

Q Very briefly, Mr. Gillespie, I'm going to seek your views on the presentation that DFO scientists made to the Pacific Salmon Commission workshop in June of 2010. And I probably -- if we could go to page 42, I believe. Are you familiar with this presentation?

A Yes, I am.

Q Did you contribute to it?

A Yes, I did.

Q Could we turn to page 48? 47? Under the heading "6.0 Predation", not the first paragraph but the second paragraph that begins with:

> Humboldt squid appeared in B.C. and Southeast Alaska in 2004.

I take it that you'd disagree with that statement?

A We have categorical evidence that it was Humboldt squid that appeared in 2004. We have anecdotal evidence that they were present before that.

Q Moving further along in this paragraph, it reads:

> To date only a few Humboldt squid have been recovered in the Strait of Georgia. Thus, it is unlikely that they are responsible for eating a large number of sockeye smolts, and that even if they do consume sockeye, that they would have a greater impact on Barkley Sound and Columbia River sockeye stocks than to be able to focus on Fraser R. sockeye.

Leaving aside the somewhat confusing grammar of that sentence, do you agree with that reasoning?

A Yes, I do. The squid that were found in the strait were found in December, which would decrease the probability of any overlap with out-migrating smolts. There were only a couple of individuals found in the strait over that time period and at least up to 2007 Humboldt squid had not been seen north of the West Coast of Vancouver Island; therefore, they would have had more interaction with West Coast Vancouver Island stocks than those leaving through Johnstone

Strait.
Q I'd like to read just one sentence fragment there apart from the information related to Georgia Strait and that's again:

> Thus it is unlikely that they are responsible for eating a large number of sockeye smolts.

With that -- insofar as that statement is read by itself, would you agree with that?
A If you mean is the argument restrained to Fraser River sockeye or sockeye in general, I think they had the opportunity to eat sockeye smolts on the West Coast of Vancouver Island up to that point certainly. The term "a large amount" is relative.
Q I take it that it's your view that it was -- well, let me ask in a fairer way. Is it your view that it's possible that --
A Yes. Yes, it is possible that Humboldt squid ate sockeye smolts.
Q Is it possible that Humboldt squid are responsible for eating a large number of Fraser River sockeye smolts in 2007?
A No, I don't think so.
Q So as of June 2010 when we have this presentation, and you and presumably the author, the lead author, Mr. Trudel, thought that it was unlikely that Fraser River sockeye smolts were being eaten up in large numbers by Humboldt squid. Are you aware of any further advice to the minister on that issue?
A No, I'm not.
Q Between September 2009 when you made your presentation and June 2010 were you consulted by DFO or PSC fishery managers who were planning for the 2010 sockeye fishery?
A I had some interactions with the PSC in terms of talking about opportunities to potentially sample Humboldt squid in their test fisheries should they turn up again, but in terms of developing management plans for sockeye, no, I wasn't.
Q As it turns out, there were very -- relatively very high returns of sockeye, Fraser River sockeye, in 2010. I'm wondering if there's any reasonable inference about the role of Humboldt squid given the high returns in 2010? Should one draw anything from that?

A I don't draw too much from it. Let's just say that the coming year will be a better indicator. I would hate to infer anything on two years data.
Q Fair enough. And now if you could describe for us the results of the 2009 survey that you and your colleagues did.
A We collected around 200 stomachs from squid and all of these were sent to Dr. Field in California because he had offered in collaboration with processing of his samples from south of the border to process ours, as well, so that they were all processed in a consistent manner. Of the 200 we sent, we did not process any of the samples that had been taken from trawl-caught squid because we were concerned about bias in the diet information due to a process called net predation. So when a predator is confined in a net with a number of species, you can bias any information about their diet because they will attack other animals in the net and you end up with tissue in their stomachs that may either be species that they would not normally prey upon in a natural setting, or it may skew the ratios of the various species that were present in the stomachs. So we decided not to process the trawl-caught stomachs.
We processed about 160 jig-caught stomachs and of those two presented positive evidence of predation on salmon. The first was one that had otoliths in it that were attributed to salmonids, so either salmon or osmeridae, smelt, and the second -- and subsequent genetic analysis of the bones in that stomach showed that I believe they were chum and pink salmon remains.
Q And maybe we, for your assistance, if we pull up Tab 44 now, it has an email in relation to this. Sorry to interrupt you, but I think this might assist.
A No, no problem. Thank you.
Q Do you recognize this email?
A Yes, I do.
Q And could we turn to page 2 of this email? Or perhaps enlarge as much as we can before the date break. Perhaps with reference to this email, you can continue describing in general the results of the survey with respect to salmon --
A Okay.
Q -- identifies.

A Yes. We had two samples that contained salmon remains. One was initially thought to be coho salmon, based on the otolith morphology, but the otoliths were too eroded to be conclusive. Tissue samples from that indicated that they were four of the 16 bones tested were chum salmon and one of the 16 bones tested was a pink salmon, and the rest of that sample was Pacific herring. The second sample had no identifiable otoliths, but we tested -- the bones were tested from it and all eight of the bones tested were pink salmon. So that basically summarizes the results in terms of salmon predation.

The definitive statement at the end is there were no sockeye in any of these.

Q I'm just wondering about the American --

A Oh, sorry.

Q -- about the American samples, as well. Were there any salmon found in the U.S. samples that form part of Dr. Field's assessment or analysis?

A Yes, there were 20 squid collected at Sekiu, Washington, which is just inside the mouth of Juan de Fuca Strait. Of those 20 squid, three of them contained salmon remains and the total remains from those three squid were three chinook and two coho encountered in those stomachs.

Q And what was that as a relative proportion of the types and volume of prey found in American squid generally?

A Very small proportion.

MS. TESSARO: Could we mark this as the next exhibit, please?

THE REGISTRAR: Exhibit 824.

EXHIBIT 824: Emails between Dr. Field and Graham Gillespie re squid tummies

MS. TESSARO:

Q I realize that I've only asked you about the PSC presentation in relation to juveniles, in relation to smolts and there's a line in this email that we might have a discussion about adults, about -- there's -- so halfway through the second paragraph, the size range of all the salmon encountered based on otolith length, fish length relationships was about ten to 15 centimetres. Does that suggest to you anything about the

capacity of Humboldt squid to prey on adult sockeye or adult salmon?
A This information indicates that the salmon that were taken were juveniles and there is other information in the literature that talks about the range of size that Humboldt squid prey usually fall within.
Q I believe you may be referring to page 32 of the Project 8 report, which is Exhibit 783.
A Yes, that's correct.
Q Could we go back one page? In that first paragraph the authors of Project 8 state in the last sentence that the prey sizes throughout the life cycle ranges between five percent and 15 percent of the squid total length.
A Yes.
Q You've told us that the squid sampled in 2009 ranged from on the small end from 79 centimetres to on the large end to about 137 centimetres?
A Yes.
Q Five to 15 percent. Can you help me with the math?
A Okay. If you use the lower end of the size range and a five percent ratio, you're talking about four centimetres, a prey item that would be four centimetres in length. And if you use the upper end of the size range and the 15 percent ratio, you're looking at something that would be 21 centimetres, so certainly the results of the stomach sampling where we have indication of size fall within that range.
Q And what about Fraser River returning adults, do they fall within that range?
A I would defer more to others who have stronger knowledge of the size of returning adults, but I had discussions with Timber Whitehouse of DFO about what the size range of returns might be. He indicated to me that returning jacks are in the 30 to 45 centimetre range and returning adults are 55 to 75 centimetres in length, which would rule -- using this model, would rule them out as potential prey for Humboldt squid.
Q Thank you. Do you have any other views on this page and the next page of the Project 8 report about the Humboldt squid? Maybe we could expand it out to be the whole page. Did anything strike you as incorrect?

A Not glaringly incorrect. There's one line that says that Humboldt squid did not appear to spawn in the northern part of their range. It's fairly clear from the literature and also from the maturity stages of the squid that we sampled, that they do not spawn in the northern part of their range. But it in no way affects the conclusions of this section.
Q And the last paragraph -- or the first paragraph on the next page.
A Mm-hmm.
Q The last sentence of this paragraph reads:

> If, however, the smolts have had to pass through an accumulation of jumbo squid, it is entirely possible that they could have a strong predation impact on the sockeye.

Now, my understanding, and correct me if I'm wrong, from your reaction to the PSC report authored by yourself and Dr. Trudel, is that your view is that, in fact, it's unlikely that Humboldt squid are having a -- had a strong predation effect on Fraser River sockeye smolts in 2007.
A Yeah. I think that that conclusion is drawn mainly from the lack of information we have on overlap in time and space. Certainly given the behaviour of the squid, the size of the smolts, if there were encounters, there would be predation, but the likelihood -- I don't speak in terms of likelihood. Dr. Trudel does. I say it's certainly possible that if they were encountered, there would be predation and I believe -- I don't want to put words in his mouth, but I believe the unlikely conclusion was drawn from our lack of information on overlap in time and space.
Q It seems to me that a lack of data on one hand has led Dr. Christensen and Dr. Trites to conclude that it's entirely possible that there could be a strong predation effect. But the same lack of data on the other hand has led Dr. Trudel to conclude that it's unlikely that there could be a strong -- that there was, in 2007, a strong predation effect.
A Mm-hmm.
Q What should we make of this?
A If we're speaking about 2007 in particular, we

have no evidence that Humboldt squid were in migratory pathways of sockeye smolts. We found them off the West Coast of Vancouver Island and did not find them further north in British Columbia, which would lead me to support for that year, at least, in 2007 that it was unlikely that they had an impact on out-migrating Fraser River sockeye smolts.

Q Thank you. My final short line of questions - I think I'll only be three or four more minutes - is on research opportunity and funding issues. What's the source of your funding for research and monitoring activities?

A For cephalopods?

Q For cephalopods.

A For cephalopods, is just the regular A-base allocation that comes into my program that focuses on molluscs in general, so bivalves and cephalopods.

Q Is there anything -- is there any funding that you have in your budget specifically devoted towards cephalopods?

A No. I get a small budget for the program and the use of that budget is discretionary.

Q And perhaps we could pull up at this point Tab 43? Are you familiar with this document?

A Yes, I am.

Q Did you prepare it?

A Yes, I did.

Q And could you describe it for us?

A This describes the research and -- oops.

MR. LUNN: So sorry.

A It's okay. This describes research and monitoring projects that were under my supervision and the budgets associated with them, so my regular A-base budget for intertidal bivalves, which would include cephalopods, that's the mollusc budget, was pretty static at about $11,000 a year over that period. And I started to receive some invasive species funding in 2006/2007 which started at about $40,000 and was decreased in 2009 and '10 to thirty-three-six. And then in 2009 and '10 I got directed funding to support surveys for the ***SARA***-listed Olympia oyster that amounted to about 45.8 thousand dollars.

MS. TESSARO:

Q The note at the bottom of this funding summary

notes that no funding directly allocated to Humboldt squid spent $1,000 discretionary in 2009/10 for survey gear and expenses. Is that a sufficient amount of money to do meaningful research into Humboldt squid predation?

A I would hazard it probably is not. We did the best we could in terms of providing gear and using the ship of opportunity to provide sampling opportunities. There's always more or less expensive ways to conduct research and to go out and do a targeted Humboldt squid survey would be very expensive and very difficult to organize because we don't know which years they're going to be in Canadian waters and our cycle for scheduling vessels and everything else is a year in advance.

Q Right.

A So this was largely responsive to the opportunity to sample them in a year when they were going to be in B.C. in large numbers.

Q In the vein of recommendations, is there an alternative between doing a -- your own targeted, as you've said, very expensive survey that is only a Humboldt squid survey, and on the other hand, opportunistically tagging along with the hake survey? Is there some middle ground whereby you have the ability to design your research questions and structure your research without spending money that you don't have?

A I think the middle ground, the tagging along on the hake survey and having people collect samples for us in other surveys is the cheapest alternative and going out and directing a survey of Humboldt squid would be very expensive. Alternatives are to continue looking for other ships of opportunity that might afford sampling opportunities.

If one wanted to focus in on the question of whether or not Humboldt squid ate sockeye smolts, you need overlap in time and space between Humboldt squid, sockeye smolts and someone sampling Humboldt squid. So if we were to focus exclusively on this question, we would be looking for opportunities where that overlap would occur.

Q Are you currently looking into that opportunity at all?

A Given that they didn't show up last year and aren't predicted to this year, not actively, no.

MS. TESSARO: Okay. I'll let Canada get its turn now, but thank you for your time. I'm sorry, I should actually mark Exhibit 822 -- as Exhibit 822 this funding summary. I'm sorry.
THE REGISTRAR: It would be 825.
MS. TESSARO: Thank you.
THE REGISTRAR: Tab 43, is that...?
MS. TESSARO: Thank you, yes.

EXHIBIT 825: Document entitled "Funding Summary (SK), G. Gillespie Research/Monitoring Projects"

MS. GRANDE-McNEILL: Geneva Grande-McNeill for Canada with Tim Timberg. I might be able to significantly cut back my questions if we take the break now, Mr. Commissioner.
THE COMMISSIONER: Let's do that then.
THE REGISTRAR: The hearing will now recess for 15 minutes.
THE COMMISSIONER: Ten I think.
THE REGISTRAR: Ten, ten minutes.

(PROCEEDINGS ADJOURNED FOR AFTERNOON RECESS)
(PROCEEDINGS RECONVENED)

THE REGISTRAR: The hearing is now resumed.
MS. GRANDE-McNEILL: Mr. Lunn, if we could have Exhibit 613F, please.
THE REGISTRAR: Could you announce your name, please?
MS. GRANDE-McNEILL: Yes, it's Geneva Grande-McNeill for Canada with Tim Timberg.

CROSS-EXAMINATION BY MS. GRANDE-McNEILL:

Q Now, Mr. Gillespie, you've talked briefly about this presentation already and noted that it was from the 2009 Causes of the Decline Workshop. I know we've heard evidence from Dr. Richards previously in these hearings on that workshop. Can you just describe for us what the purpose of that workshop was?
A The purpose of that workshop was to bring together species experts, oceanographers, ecologists, modellers, senior management, to basically brainstorm or scope out the potential impacts that could have caused declines, either long-term or in

the 2009 return year of Fraser River sockeye.
Q And who was invited to attend that workshop?
A As I said, species experts, oceanographers, modellers, ecologists, senior management.
Q And at this workshop, were any conclusions as to the role of Humboldt squid in the decline drawn?
A Just that they were included in a suite of potential causes.
Q And I just want to see if I can summarize what I understand from your earlier evidence. Do Humboldt squid overlap in time and space with Fraser River sockeye smolts?
A We believe that the potential is there. We have no direct evidence of it.
Q And do they overlap in time and space with Fraser River sockeye adults?
A Yes, they do.
Q And could a Humboldt squid eat an adult Fraser sockeye?
A Given the information provided by Dr. Nigmatullin's paper in terms of size, that would tend to preclude them. The other consideration is that the prey that Dr. Nigmatullin refers to in his paper are Myctophids which are a very soft-bodied and slow-moving fish. I would postulate that an adult sockeye salmon has a much greater evasive capacity than a Myctophid does.
Q And are Humboldt squid specialized predators?
A No, they're generalists.
MS. GRANDE-McNEILL: Thank you. And if we could have the Commission's Tab 41. Thank you.
Q Now, you briefly discussed this document earlier in your evidence. I understand it's a summary of a presentation that Dr. Marc Trudel made at the PSC Causes of Decline Workshop.
A Yes.
Q And did you contribute information to this presentation?
A Yes, I did, yeah.
Q And what information did you contribute?
A I contributed the chart, Figure 3, within the document and also had conversed with Dr. Trudel about what evidence we had that Humboldt squid may or may not prey on salmon.
Q And if we could turn to page -- I think it's 47. That would be in the section 6.0; is that right?
A Yes. He may have been aware of the previous PSE

presentation that indicated the wound on the chinook jack, but since the otolith information came through Dr. John Field, I would have conveyed that to him.

MS. GRANDE-McNEILL: Thank you. Now, the PSC final report -- well, perhaps we can just pull that up. That's Exhibit 73, Mr. Lunn.

MS. TESSARO: Just for the record, Tab 41 is Exhibit 573.

MS. GRANDE-McNEILL: Thank you.

Q And this document notes that predation by Humboldt squid is unlikely to have impacted the long-term decline of Fraser sockeye as the squid are recent arrivals to B.C. Do you agree with that assessment?

A Yes, I do.

Q And why is that?

A As I said, we had no definitive proof that Humboldt squid were in B.C. coastal waters until 2004. The only anecdotal evidence we had that they were even moving northward was in the mid-'90s and the period of decline was started considerably before that.

Q I note that this document doesn't reach any conclusion as to the likelihood of squid effects on the 2009 Fraser sockeye returns. What's your view on that likelihood?

A As previously stated, there's a fairly low likelihood of overlap without migrating smolts which would be the life stage that would probably be most affected by Humboldt squid predation. So I would agree that they were not likely to have contributed to the low returns in that year.

MS. GRANDE-McNEILL: Thank you. And if we could have Exhibit 822.

Q Now, this is your more recent presentation on Humboldt squid. When did you give this presentation?

A That was in the workshop earlier this year.

Q And where did you give this presentation?

A The presentation was in Nanaimo, Vancouver Island Conference Centre.

Q And I guess what was the forum in which you presented this?

A The forum was largely a reconvening of the previous workshop to return with more information, update any information that had been gathered

since the previous scoping workshop.
Q What was the new information contained in this presentation?
A The new information was the definitive evidence of predation on salmon by Humboldt squid, but the lack of definitive evidence of predation on sockeye.
Q And did these results change your previous conclusion about the likelihood of contribution to the long-term decline or the 2009 returns?
A I would say no in both cases.
Q And what do you understand are going to be the next steps coming out of this workshop?
A My involvement in these workshops has been fairly limited, mainly as a provider of information. I'm not sure what the next steps are, but probably Mark Saunders or Laura Richards would be the people to talk to about next steps in this process.
Q Thank you. Now, you were asked earlier about possible hypotheses on why squid are moving further north, why Humboldt squid are moving further north and you mentioned something called the oxygen minimum layer that the squid like to use.
A Mm-hmm.
Q Is there anyone at DFO doing work on the oxygen minimum layer?
A The oxygen minimum layer is certainly being examined as part of the regular oceanographic work that's carried on at the Institute of Ocean Science. The person that I've had the most discussion with there, or the person who's been the most engaged in terms of the relationship to the oxygen minimum layer in Humboldt squid is Dr. Frank Whitney who's recently retired, but is still active in research at that station and he has colleagues there that would continue to work on that project.
Q Thank you. And I guess the squid are moving farther north. Are they an invasive species?
A The term "invasive species" has a lot of policy implications. I know that the squid arriving in the north has been characterized both in the open literature and the media as an invasion, but we in DFO have a policy definition of what an invasive species is that includes either demonstrated harm

or the potential to cause harm, on either an environmental, economic, social scale. And to qualify as an invasive species, the species has to be non-indigenous which means that it has to have overcome some natural barrier to distribution through human intervention, through anthropogenic means.

In this case, Humboldt squid were already present in the eastern Pacific and had just expanded their range, so under the policy framework, they don't qualify as an invasive species.

Q And were there any human influences on that range expansion?

A It's been pointed out that there's a -- if you follow a certain line of belief that there are tenuous links that human activities have caused climate change that may have influenced the distribution of these animals, but it's not a direct human intervention as an introduction would be in moving it from one place to another.

Q And are you aware of any marine aquatic invasive species that could affect Fraser River sockeye?

A With the exception of possibly some harmful algae that I don't know very much about, no, I'm not aware of any.

Q Thank you. Now, you've mentioned that the squid didn't arrive in 2010 and thus you didn't do any sampling in 2010. Were you prepared to sample in 2010?

A Yes, we were. I had had a commitment of additional funding potential from Mark Saunders and Laura Brown, the two division heads at PBS. I had also made inroads with the PSC sampling teams to see if we could do some sampling in concert with their test fishing. I had made contacts with the service providers that provide at-sea observer coverage and also dockside coverage of ground fish landings for opportunities to sample squid that might have been encountered in either of those fisheries.

Q Thank you. And how much funding were you able to secure?

A I was told that I could spend up to $25,000 to support the survey program if the need arose.

Q Thank you. I want to turn now to ecosystem-based management which -- I know you've been watching

these hearings for the last two days. You've probably heard that conversation unfolding.

When we talk about ecosystem-based management, what does the "management" portion of that word mean?

A Ecosystem-based management -- can I tack it from the other end?

Q Yeah.

A I mean, I'm a science person so I'm more familiar with ecosystem assessments. So ecosystem assessments, as we've heard, is a selection of indicators and looking at the state of those indicators to reflect the health of the ecosystem that we're trying to manage within.

The next step in that progression is basically what we've been talking about here for the last couple of days, is ecosystem-based fisheries management. So you have a single species like a sockeye salmon that's your focal point, somewhere to hang your hat on to begin the conversation, and you try to bring in all of the aspects of the ecosystem that influence that species. I think the ecosystem-based management that Dr. Christensen refers to is a more holistic approach where you don't have that focal point. You're just trying to manage the entire ecosystem to some ideal state that gives you certain benefits.

To be clear, ecosystem-based management is not managing the ecosystem. The only thing you can manage are the human activities within that ecosystem and assess their impacts on a broader scale throughout the ecosystem.

Q And within DFO's sphere, what are the human activities that can affect Fraser River sockeye?

A For Fraser River sockeye, there's a fairly broad suite of human activities that involve upland land use, pollution contaminants, fisheries on all levels, indirect effects through removals or bolstering of other species that might influence them, things like utrification that might affect productivity in certain parts of the system.

Q And can you explain for us the policy context for ecosystem-based management at DFO?

MR. LEADEM: With all due respect, Mr. Commissioner, I think I am going to object to this line of questioning. We weren't given notice specifically

that this particular witness would be commenting upon ecosystem-based management.

Moreover, when he was qualified, we heard no evidence or no background to justify the foundation for this particular line of questioning.

MS. TESSARO: If I could speak to this very briefly. In contrast to Sandy McFarlane, Dr. Ford and the other four DFO witnesses, whose summaries all did reference ecosystem considerations and ecosystem-based management, Mr. Gillespie's does not. So in terms of putting participants on notice, I think Mr. Leadem's comment is a fair one.

THE COMMISSIONER: I was waiting for somebody to object, Mr. Leadem, but seeing as you now have, I think the objection is entirely reasonable. I don't know why Canada is going down the path of questioning this witness about a topic for which he was not qualified to speak, nor was I to understand this evidence such that notice was given to the participants that he would be giving opinions regarding this area. So perhaps you can give me some sense of why you're going down this path?

MS. GRANDE-McNEILL: I'm hoping to bring some clarity to the conversation that's gone on for the past two days. I'm not expecting Mr. Gillespie to be giving an opinion as an expert on ecosystem-based management, but merely as a scientist and someone who works at DFO. The particular question is about the policy context for ecosystem-based management and, as a scientist at DFO, he would be aware of that context.

MR. GAERTNER: Mr. Commissioner, I'm going to have to wade in on this for obvious reasons, given the day. It's Brenda Gaertner speaking. I, too, object to this very strongly. The distinction she is making was alive in the questions that I raised, and could have been discussed with the previous witnesses if we needed to. I would have had further documents and we could have gone forward. I do not think it's appropriate at this point in time.

THE COMMISSIONER: Well, again, the concern raised is reasonable. (A), not qualified as an expert in this field, and secondly, no notice given that this witness was going to be speaking on behalf of

the DFO with respect to the area you're now covering. So I would respectfully suggest that the objection should be sustained.

MS. GRANDE-McNEILL: Thank you. Mr. Lunn, if we could have Project 8, please. If we could turn to page 13, and I'm not sure what the pdf number is.

Q Page 13, as we've already heard, Mr. Gillespie, was the criteria the authors used in determining which predators may be contributing to the long-term Fraser River sockeye declines and the 2009 return. The first criterion listed here is that the prey and the predator must overlap in time and space. Do you have any comment on the application of that criterion in this report?

A As a reviewer or a reader of the report, I struggled a bit in that to determine whether there's overlap in time and space, one needs to understand the spatial and temporal distribution of sockeye salmon. As someone who's not expert in that, I expected more information about that in the report so that I could judge their conclusions in terms of where that overlap in time and space occurred.

Q And can a lack of data on a given predator lead one to conclude that there is no predation impact on Fraser sockeye?

A No, I would say not.

Q And can you comment on the authors' use of data or lack of data to exclude predators from consideration for further research, and in that context, I'm thinking of the six species they've listed at the end of the report.

A I think as we've heard earlier in the hearings, a number of species were excluded from that list because they did not have recent dietary information which, if I was priorizing (sic) species for a research program, I would tend to priorize towards filling information gaps. So species like Pacific white-sided dolphins that had all of the other requisite criteria met in terms of abundance, distribution and opportunity, but a lack of dietary information would have flagged that for me as a species for further consideration, and similarly for harbour seals where the dietary information is somewhat dated and the suite of prey that is available to harbour seals is not static. There are changes in

abundance. There could have been shifting preference at that point. So those two species in particular I felt deserved more consideration for their work.

Q And so if the aim is to determine predation impact on Fraser sockeye, what species not included by the authors in those six would you recommend for further research?

A Those two in particular that I just mentioned. The only other observation I have was I was a bit surprised that more fish-eating birds were not included, not so much in the final selection but in the initial scoping exercise. Things like dipper, kingfisher, herons in fresh water, and diving birds and some other alcids in the saltwater environment.

MS. GRANDE-McNEILL: Thank you. Those are my questions.

THE COMMISSIONER: Thank you.

MS. TESSARO: Mr. Leadem is shaking his head, so that would leave questions for Ms. Gaertner.

MR. LEADEM: Mr. Commissioner, I'm delighted to say I have no questions of this witness. I was going to ask him about how much calamari we could get from a Humboldt squid, but I think I'll refrain.

A We can talk after.

MS. GAERTNER: And actually on the same vein as Mr. Leadem, I'd like to pleasantly say to you, Commissioner Cohen, that I unusually have no further questions today and that hopefully that neither of us fall prey to further work this afternoon.

RE-EXAMINATION BY MS. TESSARO:

Q I have only one question and that is that Ms. Grande-McNeill asked you if you had -- how much money you had secured from Mark Saunders and Dr. Laura Brown, and you said $25,000. For clarity, that money was never actually allocated to you, was it?

A That's correct. I was given discretionary power to spend up to a certain amount, and that money would be found in slippage and other projects if required.

Q And that was just a verbal conversation or did you have that in writing?

A That was a verbal assurance.
MS. TESSARO: Thank you. Mr. Commissioner, I have no further questions of this witness. I'd like to thank him for staying here to the very end of a Friday afternoon.
THE COMMISSIONER: Yes. Thank you very much for your attendance, for being in the courtroom during the hearing today and for your attendance here and for answering questions. We're most grateful for that. Thank you so much.
Ms. Tessaro, I was just, on the record, going to ask you Monday is bringing us what?
MS. TESSARO: On Monday it is Project 2, our contaminants report with our expert Don MacDonald, and Ms. Baker and I will be here.
THE COMMISSIONER: Right. Thank you very much.
MS. TESSARO: Thank you.
THE COMMISSIONER: And we're adjourned until 10:00 Monday morning. Thank you all, have a pleasant weekend. Thank you very much.
THE REGISTRAR: The hearing is now adjourned until Monday at ten o'clock.

(PROCEEDINGS ADJOURNED TO MAY 9, 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.

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