

**Meeting of the Alaska Department of Fish and Game  
Alaska Hatchery Research Project  
March 5, 2016  
Aspen/Spruce Conference Room, Hilton Hotel  
Anchorage, Alaska**

**MINUTES**

**Facilitator:** Ron Josephson, Alaska Department of Fish and Game (ADF&G)

**Call to Order: 8.40 A.M.**

**Attending\*:** (Name and affiliation)

Science Panel

Ron Josephson – Coordinator (RJ), ADF&G  
John Burke (JB), Southern Southeast Regional Aquaculture Association (SSRAA)  
John H. Clark (JC), ADF&G  
Jeff Hard (JH), Northwest Fisheries Science Center, National Marine Fisheries Service (NMFS)  
Steve Reifentstahl (SR), Northern Southeast Regional Aquaculture Association (NSRAA)  
Thomas (Tommy) Sheridan (TS), ADF&G  
William (Bill) Smoker (BS), University of Alaska (retired)  
Eric Volk (EV), ADF&G  
Alex Wertheimer (AW), NMFS (retired)

Prince William Sound Science Center (PWSSC)

Eric Knudsen (EK)  
Kristen Gorman (KG)  
Katrina Hoffman – Call in  
Julia McMahon (JM)  
Peter Rand (PR)

ADF&G

Chris Habicht (CH)  
Sam Rabung (S. Rabung)  
Kyle Shedd (KS)  
Tyler Dann (TD)  
Erica Chenoweth (EC)  
Scott Kelley (SK)  
Bert Lewis (BL)  
Tom Brookover (TB)

Hatchery Operators

Eric Prestegard, Douglas Island Pink and Chum (DIPAC; EP)  
Another guest, DIPAC (inaudible)

Dave Reggiani, Prince William Sound Aquaculture Corporation (PWSAC; DR)  
Trenten Dodson, Kodiak Regional Aquaculture Association (KRAA; TD)  
Gary Fandrei, Cook Inlet Aquaculture Association (CIAA; GF)  
Mike Wells, Valdez Fisheries Development Association (VFDA; MW)

Processors

Tim Schmidt, Icicle Seafoods (check affiliation)

Invited Guest Presenters

Casey McConnell, Student, University of Alaska Fairbanks (CM)  
Phil McGinnity, University College Cork, Ireland (PM)

Other

Peter Westley, University of Alaska Fairbanks (PW)  
George Covell, formerly PWSAC (GC)

*\* Every effort was made to recognize all attendees; if a name has been missed or listed incorrectly, please contact us to correct the record.*

**Agenda:**

- 1) Contractor Report
  - a. Introduction – Eric Knudsen
  - b. PWS Ocean Sampling – Pete Rand
    1. Proportion of pinks and chums for the total return by year.
  - c. PWS Stream Sampling – Kristen Gorman
    1. Proportion of pink and chum in wild stock systems by district and year; and for the entire PWS.
    2. Processing of additional pink salmon otoliths for streams – Ron Josephson (*Note: this item was presented later in the agenda. See Agenda item 2a: Field Planning, 2016 activities*)
  - d. SEAK Stream Sampling –Kristen Gorman
    1. Proportion of chum in wild stock systems by geographic area
  - e. Overall estimates of run sizes in PWS– Dave Bernard and Eric Knudsen
  - f. 2015 Alevin field sampling – Julia McMahon
    1. Chum salmon in Southeast (Fish Creek)
    2. Pinks in PWS (Stockdale)
  - g. Recommendations and sampling plans for 2016 – Eric Knudsen
  
- 2) Field Planning
  - a. 2016 Activities
    1. PWS Pedigree Streams
    2. Do we need all six?
  - b. 2017 and the future
    1. Southeast Chum pedigree
    2. PWS pedigree

- 3) Budget Planning - Reifenhstuhll
  - a. Priorities?
    1. Pedigree -
    2. Ocean Sampling – has been dropped
    3. Stream Studies – has been dropped
  - b. Fund sources
- 4) Update on graduate studies on Sawmill Creek Chum Salmon – Casey McConnell
- 5) Gene Conservation Lab Presentations and Discussion Items - Chris Habicht, unless otherwise noted
  - a. Salmon stock structure – update
    1. Pink salmon in PWS
    2. Chum salmon in SEAK\*
  - b. Progress on pink salmon genetic markers – Tyler Dann
  - c. Progress on chum salmon genetics
  - d. Priorities for pink salmon pedigree analyses
  - e. Proposals submitted for outside funding
  - f. Timeline and costs of components
  - g. Seeking direction on SEAK chum salmon project priorities
- 6) Technical Documents – Ron Josephson and Chris Habicht
  - a. Technical Document 5 – Advanced parentage simulations: the statistical power to measure relative reproductive success.
  - b. Technical Documents 11 - Prioritization of pink salmon samples and analyses 2015/2016
- 7) Discussion on Manuscripts for Completed Study Aspects – Eric Knudsen and all
- 8) Comments from Dr. Phil McGinnity from University College Cork Ireland (parallels to his work with Atlantic Salmon)

**Notes:**

- *Discussion sections reproduced here are as complete as possible but are not strict transcripts; care has been taken to keep the character and meaning the same during editing.*
- *Audio recording of the meeting is available through Erica Chenoweth, ADFG.*

\* Chum salmon stock structure had no new information to be presented; see discussion section under agenda item 5g. No presentation occurs on this subject.

*Welcome*

Ron Josephson (RJ) – RJ opened the meeting and thanked all for attending, both in person and over the phone. He presented a brief slideshow reviewing the inspiration and origins of the project (the genetic effects of hatchery fish; See

PDF presentation entitled “*Alaska Hatchery Research Project March 5 2016*”). Questions or comments were invited (there were none at this point) and all attendees were invited to introduce themselves (name and affiliations).

## *1. Contractor Report*

### *a. Introduction*

Eric Knudsen (EK) [See PDF presentation entitled “*HW Sci Panel Intro 3-4-16*”] – EK gave a general outline of which draft results were being presented at the meeting, up to and including the 2015 field season, the third major field season of the Alaska Hatchery Research Program. He reviewed the size and scope of the sampling program including summary statistics for the large number of samples collected and biologists involved in 2015, highlighting changes in sampling effort and sampling accomplishments, and thanked all participants.

### *b. PWS (Prince William Sound) Ocean Sampling*

Pete Rand (PR) [See PDF presentation entitled “*Pete\_HW Sci Panel Intro and Ocean*”] – PR reviewed the main objective of the ocean test fishery (to intercept salmon at the entrances of PWS and provide data for an unbiased estimate of the proportion of hatchery to wild salmon, or hatchery fraction in PWS), the survey design, stations and gear sizes and acknowledged and thanked colleagues. He explored the 2015 preliminary results as compared with 2013 and 2014, including total number of samples by species (raw catch data by trip and by station, standardized for catch-per-unit effort) and evaluated run timing, sex ratios, and season lengths. The preliminary 2015 hatchery fractions were reported at 55% for pink salmon and 69% for chum salmon. Certain highlighted trends included a higher mean CPUE for pink salmon than for chum for all three years; sex ratio bar graphs revealed (2013–2015) a consistent male bias across years in the return for pink salmon with a ratio closer to 50/50 for chum; and the timing of arrival by sex in-season showed female pinks arriving later in the run than males, with similar results for chum salmon. Generally, hatchery pink salmon tended to arrive later in the season, with the opposite being true for hatchery chum. 2015 was a strong wild return year, as was 2013 (pink salmon).

- PR – Any questions?
- EK: On your graphs about the timing pattern of entrance, you showed just 2015, but in report we have 2013 to 2015; it improved the scale of graph by leaving out 2013/14. Would you say that what we looked at for 2015 was similar to previous years?
- PR: Yes, all the timing information I show, it’s roughly very similar and consistent across years.

### *c. PWS Stream Sampling*

1. *Proportion of pink and chum in wild stock systems by district and year and for the entire PWS*

Kristen Gorman (KG) [See PDF presentation entitled “*KGorman March 2016 Sci Panel ANC*,” slides 1–24] – KG reviewed the study design and field efforts for sampling adult salmon in PWS streams (32 study streams total: 6 streams pedigree study) in 2015 and acknowledged the hard work of 6 field crews and 2 vessels. Sample collection summary numbers were presented for both pink and chum salmon sampling efforts in 2015. They met their sampling goal on all 28 streams for pink salmon and 12 out of 17 streams for chum salmon. She reviewed preliminary hatchery fraction results for 2015 (by stream and by district), which were noted as similar to previous years: low levels of hatchery fractions detected in east PWS, with the fraction increasing to the west and south. The overall calculation for 2015 for PWS was presented as 10% hatchery pink salmon and 3% chum salmon. Hatchery fraction for PWS chum salmon was pretty consistent across all three years of sampling. (She also noted that all of this is weighted by the dead fish surveyed on the streams and the overall calculation is weighted by the aerial surveys done by ADFG).

d. *SEAK Stream Sampling*

1. *Proportion of chum in wild stock systems by geographic area*

Kristen Gorman (KG) [See PDF presentation entitled “*KGorman March 2016 Sci Panel ANC*,” slides 25–32] – KG reviewed the study design and field efforts for stream sampling of adult chum salmon in Southeast Alaska (SEAK). She acknowledged the hard work of 6 field crews and Ben Adams who led the crews; she was presenting the information on his behalf. She presented sample summary numbers (otoliths only, no pedigree stream sampling) for chum salmon. They met their sampling goal on 16 of the 32 streams sampled.

- KG: Eric (Eric Knudsen) is that because it was a low fish year in SEAK?
- EK: No, actually the fish were a little more available, but still in many streams it’s hard to get 384 samples and with only two to four visits, (where in PWS it was a minimum of three visits so we had more opportunities). There were three or four chum streams that were consistently down in the very low numbers like 5 or 10 fish for the whole season, over all 3 years.

She reviewed preliminary hatchery fraction results for 2015 for chum salmon in SEAK (by stream and by district). She pointed out the creeks with the highest numbers of hatchery fish (Fish Creek, Sawmill Creek, Prospect Creek and Glenn Creek).

- EK: Yeah and to be fair, Glenn Creek only had 5 fish in the sample. One of the big changes for 2015 was Prospect—it went up quite a bit. Kadashan also had just a few fish in the sample.

She presented the overall fraction for 2015 chum salmon in SEAK was 9%, the highest found in the three years of the study. She also presented a summary slide showing the hatchery fractions for PWS pink and chum salmon and SEAK chum salmon for all three years of the study (Slide 32).

- KG – Any questions?
- Attendee: You made a comment about the PWS hatchery proportion, being weighted for dead fish in the streams. Could you describe that?
- KG: Yes, so when we do the analysis, for chum for example. . .for each stream, we weight the fraction of hatchery fish for a given survey on a given day for a stream by the dead fish that were counted on that day, relative to all of the dead fish surveyed for that stream for the entire season. So that's where the weighting of the dead fish comes in. For the district analysis, the fraction for each stream is an average for all the streams in the district and then for the overall calculation, those district fractions are then weighted by the aerial survey information. . . basically the aerial survey fraction information of fish observed in that district for that year.
- Attendee: So that 10% final value, does that incorporate weighting for dead fish?
- KG: It does. At the stream level, but then at the region level we weight it by the aerial survey of all fish.
- Attendee: Did you do that in 2013?
- KG: Yes, these fractions are the overall weighted fractions for 2013, 2014, and 2015.
- Attendee: So you incorporated dead weight counts in 2013 and 2014.
- KG: Yes, that was the same across all three years.
- EK: OK, so just to be clear, the dead count's based on the foot survey of each survey that we do, are used to weight the fraction over the several surveys that were done, so just the stream by stream estimates of the hatchery fraction are just weighted, because sometimes it might be representing only 10 dead fish, where at other times, it might be representing 3,000 dead fish, so you give each survey different weights in that fraction calculation.
- RJ: Because we're only sampling dead fish, we weight it. It wouldn't be fair to take dead fish and say they represent the live fish in the stream because we're only sampling dead fish.
- EK: Right, We had a conversation on science panel last year, because we were using total count live and dead, but then decided to just go with the dead count and science panel talked it over and did that. Any other questions about that?
- Kyle Shedd (KS): Could you explain how you summed it over district again? I get the district to the whole, but from streams to district?
- KG: Yeah, so essentially we weight the fractions on a given stream for a given day, and then we sum those for all the visits of the stream for that

season, so then you get this number here, for each stream, and then, we basically average all the fractions for the streams in given district.

- KS: Are those weighted by aerial surveys for the. . .?
- KG: They're not.
- KS: So they're unweighted based on stream size?
- KG: They're not weighted at the district level, they're weighted at the stream level based on dead counts and then averaged across all the streams in a district
- KS: OK.
- RJ: So, this is just then, I would call it, the raw average, it's not a weighted average, based on the estimate of number of fish in each those streams?
- KG: It's weighted in the sense that the streams going into this average were weighted by the dead counts . . . Does that make sense? There's no weighting beyond the stream level.
- Attendee: What sex ratio did you observe on the streams you were sampling?
- KG: That's a good question.
- EK: We haven't actually analyzed that data. We do have the data. When we talk about the manuscripts we're going to talk about that a little bit. There's opportunity to do that.
- KG: So I did look at that for 2013 and 2014, not for 2015. So maybe I could show you the results that I have later.
- EK: We've dipped into it but we haven't put it in the report yet.
- KG: It was pretty equal.
- Attendee: So you didn't see this male bias that was seen in the ocean sampling.
- KG: Not as dramatic, no.
- Other questions?

e. *Overall estimates of run sizes in PWS*

Eric Knudsen (EK) [See PDF presentation entitled "*HW Sci Panel Run Est Alevin Closing 3-4-16*," slides 1–9] – EK reviewed the calculations (based on Dave Bernard's work) to derive the unbiased estimates of run size and spawning abundance of hatchery-origin and wild-origin pink and chum salmon in PWS. He highlighted the connection between each field component and how samples from each field component provide data for calculating spawning abundance. He then presented preliminary run size estimates for pink and chum salmon in 2013, 2014, and 2015 and showed the key inputs for the 2015 calculations (slides 8 and 9). He reiterated how much depends on even versus odd years for pink salmon; that 2013 and 2015 were large wild run years for pink salmon, while observing that chum salmon had more consistency in the proportion of wild and hatchery spawners across years.

- EK – Any questions on the overall run estimates?

- Jeff Hard (JH): Eric, could you just go over briefly how the variances of catches across years and across species, also.
- EK: Yes, that was an estimate that Dave came up with. It's in the report, the explanation for it. Basically, if you change that number a lot, it doesn't make much difference in the final estimate. He has another more complicated explanation in the report.
- RJ: So the variance out of the catch, is that the number you're talking about?
- Attendee: It's the same number for both pink and chum.
- EK: I should check whether it's the same for pinks or chum. But I think that's what it was. These numbers were generated yesterday morning, so a strong caveat there's a possibility that these numbers could change. But I don't think that they'll change a lot. It's in the ballpark. There are some questions I have about catch that would adjust those numbers in a small amount, so the overall estimate might change to a degree but not much. We'll double-check on the variance.
- PR: For pink salmon, the hatchery run was smaller in 2014. Were the releases consistent at the hatcheries?
- EK: Not sure, but I'm sure somebody else in here knows.
- Dave Regianni (DR): We'd have to look that type of information up, difficult to recall off the top of my head.
- RJ: I think the releases are nominally pretty consistent. One year you can have egg issues etc. But each one of the hatcheries has quite a bit of variability in their survival from release to return from any one year. General pattern is that odd years typically do better than even years, though there are outliers. I think it's pretty consistent to have a hatchery run that close across 3 years. You can look at Valdez, what quite 10 years ago, you had a bust, where didn't fish at all. . . .
- Attendee: In 2009, we had a run failure. . .
- RJ: Yes, other years we've gotten 34 million (the all-time record return is 58 million).
- PR: I'm just wondering if it might be a predator swamping thing, in years of high wild fry output that you might get better survival with hatchery releases? When high output with hatchery releases (listen to audio recording for rest of this comment)
- EK: Possible. . . . In the report for 2013–14, there are several other things that could be done with these estimates that are of interest such as comparing the harvest rates for wild fish compared to the harvest rates for hatchery fish. The other thing is; it does give an opportunity to compare these estimates to the expanded aerial survey estimates that Tommy and his crew do every year, so it's in the ballpark, but there's some interesting differences. It's not part of the study to do that so we're not digging into that, but we might later.
- Attendee: It's interesting to compare your estimate for 2013 (33 million) to Fish and Game's in 2013 (31 million). It's very similar (6% higher). . .

Our estimate right now is 36 million. So that's a bigger difference there in that estimate, 20% higher . . . so it is interesting to look at.

f. *2015 Alevin field sampling*

1. *Chum salmon in Southeast (Fish Creek)*
2. *Pinks in PWS (Stockdale)*

Julia McMahon (JM) [See PDF presentation entitled “*HW Sci Panel Run Est Alevin Closing 3-4-16*,” slides 10–19] – JM thanked all colleagues who participated in collecting whole alevin in PWS and SEAK for the genetic (pedigree) component of the hatchery-wild program and reviewed redd sampling techniques and strategy, which were designed to avoid total destruction of any sampled redd sites and still meet the goal of 250 positive samples per stream. She reviewed the success rate for positive pink salmon alevin samples in 2014 for Stockdale Creek (PWS; 48%) and the success rate for positive samples in 2015 (35%), explaining the slightly lower success rate was likely due to thick ice cover on the stream that year. She reviewed sampling efforts for chum salmon alevin on Fish Creek (SEAK) in 2014 (9% success rate); a low number despite tremendous effort, likely explained by sampling too late in the spring season. She explained that with more sampling attempts everywhere in 2015, they still only reached the sampling goal 16% of the time. They sampled one month earlier in 2015 for both streams and did many more digs on both streams.

- EK: The statement “alevins prevalent throughout” mainly applies to Stockdale, doesn't it?
- Julia: Yes, it does. There was better alevin presence in 2015 on Fish Creek, but it was still spottier than Stockdale.
- RJ: So on Stockdale if I recall, you didn't recover any live alevins down in intertidal area, so was there a considerable amount of spotting when you were there in the summer?
- Julia: I wasn't there; I was at Paddy and Erb.
- RJ: Tommy [Sheridan], do you know? From flying that intertidal area at Stockdale?
- Tommy Sheridan (TS): I don't know. . .
- BS (Bill Smoker): Well, the upper intertidal, isn't that section 2 on your map the upper intertidal?
- Julia (JM): Yeah, Section 2 does have some tidal influence, but it's only on the really high tides, like above 12 foot tides.
- EK: We sampled it partly because there were carcasses there. I don't think there was a lot from the previous spawning season but I don't think we really thought there was a lot of spawning there but we sampled it just to be sure.
- RJ: I think it's good that you that sampled it.
- EK: Some streams do have it at that level. I think a lot depends on how much freshwater is going underneath the substrate in streams like that.

So it can vary from stream to stream, so wanted to be sure we covered it.

- JM: Any other questions?
- Tyler Dann (TD): Yes, does the upper limit of the alevin sampling correspond to the upper limit of observed spawning?
- JM: Oh great question. Thank you for asking! No. Almost. On both creeks, the alevin sampling went within half a kilometer of the final upstream sampling. Those final summer samples taken were very small and out of reach for us in the snow and ice. So we got the majority of the spawning grounds in these first sections of creek.
- Attendee: Did you put any temperature monitors in the streams? Is there any sense of how much the temperature varies in intertidal etc.?
- JM: That's a great question. I don't have complete information for you. I know from personal experience on Stockdale Creek in 2015, temperatures were consistently about 0 degrees Celsius.
- PR: We do have temperature loggers in the streams now, but not then.
- KG: I was going to add, getting back to your question Ron about intertidal spawning, so the 2015 adult sampling was following the 2014 spawning season which was very low. In 2015, I would think we observed more intertidal spawning because there were so many fish in the stream that fish had a hard time getting into the stream. It was quite a bit different, the level of intertidal spawning. the sampling followed 2014
- Attendee: Is it typical that odd years have more intertidal spawners?
- Attendee: I can't recall, but I would imagine this is a function of water levels in streams, the availability of habitat, and the sheer number of fish in the streams. . .it's all a part of it.

*g. Recommendations and sampling plans for 2016*

Eric Knudsen (EK) [See PDF presentation entitled "*HW Sci Panel Run Est Alevin Closing 3-4-16*," slide 20] – EK reviewed plans for the 2016 field season: sampling the same fitness streams in PWS and no sampling of fitness streams in SEAK again until 2017. He presented the dollar amount in savings from 2015 available to spend in 2016 and gave an overview of four potential budget scenarios based on "back-of-the-envelope" calculations, meant to inform later discussions about the 2016 field season, including whether it was worthwhile to charter vessels as opposed to setting up new field camps. No questions were asked at this point about the information presented. He also reminded those who received the preliminary 2015 report to provide questions or comments in any form, as they intend to release a second, more final draft in a few weeks.

- KG: Do you want to mention just that the calculations for pink salmon will probably be redone because we're still waiting for otoliths to be read? So we have numbers in the report but they'll probably change, the fractions will change, a little bit.

- EK: So I know Ron is very aware of this and others too. The targeted number of samples for the fraction estimates have not been included in some of the pink salmon estimates for PWS [in the report]. There's a couple reasons, but we've had some recent communication with the genetics lab. There are some trays that were intended to be part of the fraction estimates in the original design, and they're not in there. In general, I don't think it's going to change the results at all, but if we want to talk about that, whether they should be included or not then. . . . So it's also about the estimate of fractions. Then there are some other things, that when we talk about possible manuscripts, there are some other reasons to include some of these trays into the analysis so we'd have a more robust comparison for other things that we could analyze like distribution of hatchery and wild across streams or over time in streams . . . things like that that those samples would be useful for. Maybe even more useful than for hatchery wild fractions. So that's just more background.

**Break:** 10.15 a.m. – 10.35 a.m.

## 2. Field Planning (**Decision points are in bold type**)

### a. 2016 activities

#### 1. PWS Pedigree Streams

Kyle Shedd (KS) [See PDF presentation entitled “*PWS Pink Power Even Year*,”] – To begin the discussion on 2016 field activity planning, KS presented a brief review of GCL's method of evaluating the effect of field sampling levels on the power to detect potential fitness differences (characterize the distribution of reproductive success for both hatchery-origin and natural-origin fish) in six streams in the pedigree study for PWS pink salmon (off-agenda item). This slideshow was originally presented at the April 2015 AHRP Meeting in Seattle, Washington on PWS pink salmon in 2014. The stream-by-stream analysis uses simulations to evaluate which streams have the optimal combination of favorable factors for the pedigree study (detecting and comparing distribution differences in fitness between hatchery and natural origin male and female salmon) to be successful. Highlights include that Spring Creek is a suboptimal stream due to very few potential hatchery families having been sampled.

- EK: So a quick question about if you were to look at this for Spring Creek for 2013, what would you see?
- KS: For 2013 I'd need to refer to the presentation with that graph, but Spring Creek is really interesting because there are almost 30,000 spawners in odd years and hardly any in even years. And we have a lot more samples from 2013, so the power is a little better but it's still not great because the recipient stray rate there is so low that there's still not a large number of hatchery families.

- EK: And it's low again this year, so now we're talking about the odd years. But if your  $F_1$  sampling proportion is very high, which in 2015 it was, does that give you more power to detect? In other words we got like 70–80% this year.
- KS: Yes, that moves us up the Y-axis.
- EK: I'm just wondering if maybe it's not viable to do it in the even years, but may be viable to do it in the odd years.
- KS: Yes, that's a good question.
- KG: In your power analysis, your axis is the mean RRS of the natural-origin? Would you expect the same for hatchery-origin fish?
- KS: Right, so what these analyses were designed to do is, I looked up lots of distributions under the assumption that the study was designed to detect a 50% reduction in fitness, so for a given natural-origin mean recruits per spawner, that's a distribution, then the hatchery distribution was half of that and then we're sampling from those and seeing if we can find differences. In every case, there is a true difference, but it's just can we detect it with the sampling. And so there's a good chance of finding a 50% reduction of fitness if it's there, but if it's a 10% or 20% reduction, it doesn't have as much power because those distributions are a lot closer together.
- JH: I'm just wondering if this would this be feasible, is it possible to scale the effect size by the straying rate itself, so that, it would give you more power to detect a smaller effect size in streams that had higher straying rate?
- KS: So you would have a better chance of detecting it just because you'd be sampling a greater number of hatchery-origin families.
- JH: Would it be interesting to look at how the proportion of sampling would change if varied both, stray rate.
- KS: So the nice thing about these is that we don't have to vary stray rate because thanks to otolith reading done, we know exactly how many, we've sampled the parents for all these families we just don't know how many offspring they've produced yet. But there are this many potential draws from that distribution, and then how much we sample is how clearly see those.
- JH: Yeah, I'm wondering how small an effect size you can predict for a given sampling effort. . .
- Kyle: That's definitely something we could look at; I was trying to reduce the dimensionality of the analysis to show what's most relevant.
- RJ: So, seems like if 50% hatchery-origin and 50% wild-origin, that'd be the highest power you'd have, all else being equal. . .
- KS: So statistically, you're getting the greatest number of draws from each distribution, but as we've talked about in the past, a high stray rate, technically, a lot of introgression has already occurred. . .(audience) First generation problem) Right.

- Attendee: I was wondering about recruits per spawner, in terms of harvest [inaudible rest of question]
- KS: So this is just recruits per spawner at escapement level, not for the total run.
- Attendee: So we're assuming hatchery and wild are experiencing harvest at the same level. . . [inaudible].
- KS: Yes, if I understand your question, that's an implicit assumption of study, since we're looking at escapement.
- Chris Habicht (CH): So the assumption is that the fish returning to the creek, regardless of whether they're hatchery or natural, experience the same level of harvest.

*RJ has handout for people to look at (See slides 7 and 8 of "Alaska Hatchery Research Project March 5 2016 Intro presentation by RJ)*

*1. Do we need all six?*

- RJ: So this discussion section, I have two things I want to talk about now. One of them, concerning our plans for this coming year and whether or not it's worth sampling Spring Creek (I don't think it would be worth it). Just what we saw in Kyle's presentation, when you only have 3 hatchery origin parents that could possibly be producing any of the returns that are going to be coming back in 2016 it just seems that the probability of finding any of them and seeing if there is a difference is even more remote. So we talked about whether we were going to go there this year in 2015 and we did, but that's a little difference scenario because we had more parents out there.
- Attendee refers to handout: What's in the third row of the handout?
- RJ: The third row are otoliths that didn't get read. So for 2013 and 2014, there's a lot of reasons why an otolith might not have gotten read (lost, crushed, etc.) But in 2015, these are ones we have not processed because we collected 55,000 otoliths and the lab just couldn't possibly do them all.

RJ reminded the group of the number of otoliths that weren't read in 2015 due to the Science Panel's decision to process only 50% of the 2015 otolith samples from Hogan and Stockdale (every other tray) to see if subsampling would be of value. He emphasized how existing monies will not cover everything the program hoped to accomplish: originally all sampling and analysis for pedigree streams for 6 years and all chum salmon streams for 11 years. Single nucleotide polymorphism (SNP; genetic marker) development is proceeding and the GCL has 2 grant proposals out that would allow the processing of Stockdale (just 2 year) and Hogan (both years, even and odd) genetic samples for determining the parentage of natural origin fish; otherwise, sampling has been prioritized over processing to collect samples that would be of value to the study. He confirmed that Paddy, Erb, Hogan Bay, and Stockdale Creeks would continue to be sampled but that continuing to sample Spring and Gilmour Creeks is more open to debate.

- RJ: What I'm nominating is not to sample Spring Creek, even if we only save \$30,000 I think we shouldn't sample it. So does anybody object to that? [No one comments from audience]. **So we're not going to sample Spring Creek.**
- RJ: Now Gilmour, to me, is a bit of a hanger. We started a year behind but it's, right beside Stockdale. We added it because we had Short Creek in 2013 as in our system, but it had a really small proportion of hatchery origin spawners and I think that's persistent at Short Creek, they just aren't there so we dropped it. And we added Gilmour. Now we've got a couple years of Gilmour, it looked to me like the power analysis wasn't great at Gilmour but we could pare down to 4 systems and cut our losses and carry forward with 4 pedigree streams, with the stronger expectation that we can do all 6 years. We kind of have to decide that pretty soon. Yeah, real soon, because we're going to have to write contract for Eric Knudsen. Their contract ends March 22.
- EK: One of our biggest pressures at the moment is if we are going to use charter boats is contracting with them. The Auklet is ready to go, but they need to know.
- EK: I have a couple thoughts about Gilmour. Obviously, we wouldn't do it if it didn't make sense scientifically, but strategically, Gilmour is right near Stockdale, and so from a dollar per sample, it's a pretty good deal if we decide to keep that. Where Hogan and Stockdale are separated by a big sound, they require a different effort. I'm not suggesting Hogan be dropped, just saying.
- KS: I guess I'd also point out from a cost perspective in terms of genotyping the samples, Gilmour tends to have a smaller population, and so sampling the offspring that come back is cheaper in a smaller system, whereas in Hogan there's a lot of fish there and we have enough families sampled but we're going to have a lot of debate to get 50-60% of the offspring could be a huge number as we saw this year with how many fish got sampled. And a lot of those aren't going to have parents because we didn't sample all the parents. So we're going to genotype a lot of fish we don't have parents for in a really big system, as opposed to Gilmour where we sampled a high proportion of the adults, of the parents. So it's still a little bit more bang for your buck.
- KG: Yeah, I was just going to add in terms of Gilmour, because this coming year should be a lower run year, the streams are so close, I think that we stand a good chance that we'll have good sampling coverage
- RJ: So we're going to have a good chance of getting higher proportion of spawners in that system. All these systems we looked at historic average escapements, but we've been thrown a knuckle ball by record runs.

- Alex Wertheimer (AW): Spring Creek is off by itself on the east side, these others are more clustered together, and if you can continue to sample there you have the potential of identifying parents, where you might identify wild stock strain, as well as hatchery.
- RJ: Yes, because potentially we're going to detect fish whose parents spawned in Stockdale or even Hogan Bay and give us some idea of what might be happening naturally
- AW: You pointed that out before and I think that's a really strong reason of trying to maintain sampling with the hope of being able to process those parents.
- RJ: So I think **we're going to stay with Gilmour**. After 2016 sampling, if the dynamics are going to change a little bit, because we're going to be looking at the F<sub>2</sub> fish, the second generation, so in year 5 going we're going to be looking at the fish who were originally hatchery/wild origin produced offspring, and whether those offspring were correspondingly successful. **So in that year, we'll do otolith sampling**, but won't even run any fish that are otolith marked, because we're not going to be looking for those fish anymore, we're interested in those not otolith-marked, because those are the only ones that could possibly be.
- CH: Yeah I think **2016 not running anything but natural origin**. At least initially, that doesn't mean they're not available to run later. You couldn't use them as parents for future work but you can use them looking backward.
- RJ: OK, so they're going to be held in abeyance. That's right. Another cost-saving measure.
- TD: Both of the proposals were written that way.
- RJ: OK, so that's the plan.

*RJ – Discussion commenced on the issue of contracting charter vessels versus setting up additional field camps was re-opened (was touched on briefly under agenda item 1.g; see above)*

- RJ: This whole issue about, kind of a budget item, but while we're here, the whole issue of having those charter vessels or not. I don't see that having those camps is going to save that much money, when you're talking about the whole dynamics of being able to get up in the morning put on your gear and you go out and get in the boat and you work hard all day and you come back wiped out and you get on the boat and you put your gear in the engine room and let it dry out and sit down and eat. As opposed to going back to a camp where you've got to cook and all this. I know what happens in field camps someone has to go back early to get going on dinner. You're going to lose man hours of sampling effort so I would say **go with the contract with the vessel**. I'm just throwing

it that out there now and maybe when we talk about the budget we can circle back to that?

- *Brief comments in support of Ron's statement.*
- EK: We would prefer it that way [using the contractor]. It makes life a lot easier. We're ready to do the one camp at Paddy/Erb because we've got the gear ready to go for Paddy/Erb. It works there, but to set up a whole 2 others is (one for Hogan and Stockdale/Gilmour). . . it's just a big job. We're ready to go the way we are and it's safer and more efficient. . . .
- RJ: I think we're going to go with that unless someone really argues the other way. We really appreciate that you found savings and are going forward. It's like PWSSC has the same vested interest in doing the most we can to learn as much to learn from study as possible.

*\*Processing of additional pink salmon otoliths for stream (this item was originally scheduled for earlier in the agenda but was discussed here instead)*

Ron Josephson (RJ) [See PDF spreadsheet handout [entitled](#)] – RJ reviewed a handout with the group documenting 5 PWS stream systems with additional tissue and otolith samples for potential processing and inclusion in hatchery fraction analysis. These samples had originally been collected in the same tray for the pink salmon stock structure study but did not end up being used in that study (possibly due to being mis-identified as pedigree samples). The number of otoliths already processed for each system was reviewed. In December 2015 RJ, Alex Wertheimer, John Clark, Bill Templin, and Sam Rabung met to discuss the issue and **decided that the otoliths that had been read for Hartney, Fish, Coghill, Cabin and Constantine Creeks were adequate for estimation of hatchery origin proportions and no further monies needed spent on processing.** RJ was revisiting the decision to see if the group wanted to argue for something different. No one did.

*b. 2017 and the future*

- 1. Southeast Chum pedigree*
- 2. PWS pedigree*

Ron Josephson (RJ) acknowledged that **no final decisions for 2017 field planning needed to be made yet**, he questioned which SEAK Chum salmon pedigree streams were most worth keeping in the study. It was seen as obvious that Sawmill and Fish Creeks were worth keeping, but that Prospect and Admiralty Creek may or may not be, depending on future budget constraints.

- TD: And were those two both the low stray rate streams?
- RJ: Yes.
- EK: Yes, they're lower. But this year Prospect was higher than Sawmill.

- RJ: But the expectation was that it would be lower. Course it matters more what was realized not just what the expectation was.
- EK: Fish Creek is an unusual situation, I think. Looking at that creek and spending a lot of time on it, I have a feeling that Fish Creek is not actually a very good chum creek, but that there are so many hatchery fish going in there, that that population is always fed by new hatchery fish, so when you look at it and it's full of chum you think "Hey!" this is a great chum stream. But why are we getting so few alevin in that stream? And the substrate in that stream, except for a couple reaches, is a lot of big cobble, with little tiny patches of gravel, so it looks like a lot of fish area actively spawning but when you can get the redd sampling in, you don't get anything. So it may be that it's just sort of a hatchery supported stream. So when you start looking at the generations, what are you going to be looking at for relative survival?
- Bill Smoker (BS): Well my experience in the early '80s . . . experience was that Fish Creek was pretty substantial previous to hatcheries, but I don't know exact numbers. Alex, do you know of anybody that ever hand-pumped in the old days? Always thought of Fish Creek as a big local source of chum salmon, was a major part of the donor for Gastineau Channel broodstock. I've had experience looking at carcasses, not alevin.
- RJ: Well, that's where we're at on that right now. We don't have to answer that today.

### 3. Budget Planning

#### a. Priorities?

3. *Pedigree -*

4. *Ocean Sampling – has been dropped*

5. *Stream Studies – has been dropped*

#### b. Fund sources

Steve Reifstuhel (KS) – He reviewed the current and projected financial situation of the Hatchery-Wild Interaction Study of the Alaska Hatchery Research Program, mentioning the cost saving measures already decided on in the face of a challenging financial climate, such as limiting the number of years of ocean and stream straying sampling (price down from approx. \$20,000,000 to \$16,000,000). He confirmed the amount of money remaining from what has been collected (about half of the total needed for the study) and that it's enough to fund field work through 2016. He reviewed the three primary components and their costs for the projected years of the study (2012–2023; Prince William Sound Science Center Contract, ADF&G Genetics Lab, and ADF&G Otolith) as well as past funding sources that contributed to the monies collected for the work through 2016 (AK Legislature, Douglas Island Pink and Chum (DIPAC), and Processors). He confirmed that a consortium of 17 processors throughout Alaska have committed to a set amount through 2023, with the

caveat that it has to be matched. With no future money anticipated coming from the Alaska legislature, he described how they have they've negotiated with aquaculture associations (hatchery operators and processors) to come up with a total contribution of \$13,800,000 of the total \$16,000,000 for the project (or \$2.2 million short) as of March 4, 2016. He was optimistic that funding will be acquired to finish the study; several avenues for future funding being pursued such as grant applications etc. Ideas for trimming costs in the future could include having the otoliths read at DIPAC, rather than ADF&G, putting a hold on genetics analysis since it is likely that cost of analysis will come down as years go by. Also, high-level of transparency about how the program spends the allocated monies (partners can look at the books anytime they ask). That's why you have processors and fishermen behind this in a big way.

- Attendee: Do you have any kind of decision process in mind about how we might fund some of these things or are we just going to look at this one year at a time, or how do you want to look at that . . . ?
- SR: I think that the science panel needs to meet and we need to specifically talk about this. And do a little triage and look at it in different elements and then have the whole science panel review that and make decisions that way. So it's got to be maintain good science. . . What can we do and still maintain the integrity of the outcome, obviously, we've got to protect that but at the same time, can we trim, and still get there.
- S. Rabung: Yeah, I would just point out that when you mentioned year by year: the contracting with the contractors is limited to the amount of money we have in hand at a given time. We can't contract for a projected amount of revenue. So we are going to be having shorter contracts unless we get a bigger chunk.
- SR: And so the way the aquaculture associations work, is that they will be earning this money each year. If they wanted to, they could take additional cost recovery and fund a bigger chunk but that means that comes out of fishermen's holds. It's tough thing to swallow so I doubt that that would happen that way, trying to front-load this. One other element I haven't mentioned is that the department does make an in-kind contribution, all the work that is being done at the otolith lab and genetics lab, all this personnel is at value of \$300,000 to \$400,000 annually, and that will get tighter and more difficult as well. That's something we haven't discussed. The department would need to be present when we talk about the future and how we're going to do this. What those constraints are looking like and that's going to be year by year, more and more difficult each year.
- JC: One of the things I've talked about with people is looking to the Northern Fund to start picking up some of the stuff for

Southeast chums. That's a potential path forward. . . could provide some help on this problem. There's a couple of folks here with it.

- SR: So would that take a presentation to them or an application.
- Attendee: They'd take an application.
- SR: And who'd be the contact? Let's talk later about it.
- Attendee: Yeah, it makes lot of sense to go through the Northern Fund for a long-term exercise like this.
- RJ: So, I would think potentially, I don't know how we'd structure this but it could be an application from the otolith lab, or the Gene Conservation Lab. Or really anybody, somebody not even in the department, NSRAA could apply for this.
- Attendee: I think it's better if it comes from group in industry than if it comes from department.
- BS: Could the science center apply? Would that be confusing to them?
- RJ: I don't think so but the Aquaculture groups would be the best. That's a great idea.
- Katrina (on phone), I would love to add a comment to the cost conversation. Of course I'm interested in the comments about the science center's indirect costs and just want to remind you that one of the biggest expenses in the program over the years is the vessel charters. We are only allowed to take indirect off the first \$25,000 of a vessel charter. So there are millions of dollars in vessel cost that indirect is not taken out of. Just keep that in your mind as you're thinking about that.
- RJ: Thanks for letting us know that. That's good to know.

#### *4. Update on graduate studies on Sawmill Creek Chum Salmon*

Casey McConnell (CM) – CM presented data collected on Sawmill Creek (SEAK) in 2015 for chum salmon in conjunction with work for his master's thesis (which primarily focuses on measuring cortisol levels in hatchery and wild chum salmon). His tagging study, which had a 65% recapture rate over 25 total visits to the stream, enabled him to collect 560 otolith pairs, 51% (unadjusted stray rate) of which were hatchery strays. He collected morphological data on all tagged and untagged fish (both hatchery and wild) allowing for analyses of body length, length at age, age at maturity, male body depth, female egg retention, and female lifespan, as well as information on entrance timing and lifespan; all data were also analyzed by sex and origin. Though many confidence intervals overlapped and there were limitations to the statistical power of the study, differences were detected between hatchery and wild fish in most categories (longer length and greater body depth for males at age, greater age at maturity, and female egg retention were slightly higher for wild fish than for hatchery fish).

- JB: One thing, obviously, is we manipulate the age of hatchery fish by the size at release, so when you say a hatchery fish you have to consider that too. It's not just a hatchery fish, if DIPAC raised it to

2.5 grams at release, versus release at 1 gram versus etc. You're obviously looking at the situation in hand, but there are easy things to explain a lot of those outcomes. You need to take that into account before we see a headline that hatchery fish are always 4 year old. . .there are other qualifications exactly

- CM: Yeah, so one of the aspects of my thesis is the ecological consequences of straying, and that's one of the things, that different hatchery protocols do make different results. . . .
- Attendee: And there's a reason for that too. Obviously the objectives are different, a natural stream has its own picture that it paints and a hatchery is a very different picture. Those things explain a lot of differences you found, that's why we want to do 2 generations obviously here to see if some of those initial things don't go away very quickly. Maybe the collective effect even of what you see is still positive. And that is one of the reasons we started this whole study.
- CM: Yes.
- JC: What are the objectives? Yeah, it occurs to me, that when you're looking at is stock differences and you have the potential of looking at another chum salmon stream. . .you can compare those differences. This sounds like a stock comparison to me.
- CM: So, you're suggesting, to look at another creek?
- Sam: Right, the strays may not be from that creek, but a different creek, so it's a different stock. Are you going to look at another wild stream and compare those sizes and shapes and age at return to see if just a stock difference?
- CM: So for my thesis, I won't be doing that. I believe SSSC was doing some morphometric differences on all the streams. So they mirrored the morphometric measurements and location data there so those comparisons could be made in the future.
- Attendee: Good. It's intuitive that the system spawned in can affect size and shape dramatically.
- BS: Is there more than one otolith mark present in these fish?
- CM: Yes, different age classes have different marks year to year, yes, but all the release sites have the same mark every year.
- PR: In terms of secondary sexual characteristics, you measured body depth and snout length. We're just measuring body depth and not snout length, so you see the same pattern?
- CM: Yes, so wild male snout lengths were larger than hatchery snout lengths when standardized against the body.
- JH: What are your objectives? What is the point of the study?
- CM: The original purpose of this study was to look at cortisol concentrations in relationship to differences between strays and wilds, because cortisol has been linked to olfactory imprinting and remembering the smell of the home river, and then also linked to decreased survival, high concentrations of cortisol linked to

accelerated senescence. In obtaining those cortisol concentrations, it was very easy for me to do these other measurements and mirror the Sitka Sound project as well. And I also collected other environmental data, dissolved oxygen and fish density counts and stuff like that, dissolved oxygen, for more of the ecological consequences of strays being present.

- RJ: So you collected cortisol? But you haven't analyzed yet?  
CM: I just got the last of my cortisol data back yesterday. But from the earlier stuff that was run, I do have some results back from that.
- RJ: Basically, you get the cortisol, find out if it was hatchery or wild and one or the other might have higher levels?
- CM: Yeah, and I was going to see if that made a difference in their lifespan or egg retention rates and link it to other things.
- RJ: So, as an indicator of those fish being more stressed because presumably the strays might be, of course, I know about your study, when I talk to people about it, it's kind of like if you come into a house you've never been into you're not very comfortable. But if you come into your own home you're very comfortable. You're calmer. So I'm thinking this cortisol, these strays, they're looking for something because they can't go to where they want to go. That's my general explanation.
- CM: Yes, it is, pretty much. So, what I've found so far is that there hasn't been any significant difference between wild and hatchery cortisol concentrations. I also sampled chum that returned to DIPAC, that were presumed to be hatchery homed fish, so I'd get an idea of what a hatchery cortisol profile looked like from the fish that returned home versus the hatchery fish that strayed and there is no difference. There are male and female differences but not origin.
- EK: One of the things I might point out is that because Casey was on Sawmill Creek and we weren't scheduled to sample it for DNA tissues, but since he was there we got him to sample not all of this fish, but 80% of the samples! One of the reasons that I suggested that he do that is because Sawmill Creek is an ideal creek to sample . . . when you have not the best circumstances in 2013–14 for our study. So the panel might decide to grab onto this 2015 data as baseline into the future, because we got way better sampling in 2015 than the previous 2 years. So we have those samples available. The otoliths have already been read but the DNA tissues are just available if you all want to use them.
- Attendee: So do you have genetic samples for most of these?
- CM: Yes. So I didn't start taking genetics from the untagged carcasses until after the second week when I coordinated better with Sitka Sound and with Eric. But I did have the genetic clips from the fish that I tagged since I already had them out and

anesthetized on the table, I was able to take a clip. So a little bit at the beginning and then full coverage through the last 2/3rds. . . And here's one for the geneticists. Is this a chumpy? We found quite a few of those this year.

- RJ: So I think right now it wouldn't be a bad idea, if you said you're interested in some samples from the Sitka Sound sampling in southeast, or some data?
- CM: Yes. So, Peter. . .
- PR: Yes we can talk about the plans of using morphometric data from Sitka Sound in your. . . .
- CM: Yes, so doing this one year is just a point estimate. If I only did this one year I wouldn't have a good snapshot of what is really occurring or if those differences hold true through time. And so one of the things that I would like to do is to use the morphometric data from the prior years to corroborate my results.
- RJ: I don't see any problem with that whatsoever. I think I sent an email, you'd need to acknowledge that you got it from us and there's a statement like if there's errors in the data, the department is not responsible etc.

**Break for lunch:** 11.56 a.m. – 1.01 p.m.

#### 5. Gene Conservation Lab Presentations and Discussion Items

##### a. Salmon stock structure–update

##### 1. Pink salmon in PWS

Chris Habicht (CH) [See PDF presentation entitled “*a Population Structure odd-year,*”] – CH reviewed the study design for the population structure of pink salmon in PWS, both contemporary and historical, that Wei Cheng is conducting. He described the progress made in analyzing 2013 samples and reviewed collection locations. He described the three central methods used in exploring the genetic data (homogeneity tests, multidimensional scaling (MDS), and fixation indices). Homogeneity tests confirm that detectable genetic variation exists. MDS visualizations showed divergent populations and he discussed possible hypotheses to explain relationships; work is still being refined. He showed the results from comparing contemporary and historical hatchery collections, which indicate that hatchery populations are stable over time, genetically. The fixation index  $F_{ST}$  which measures the proportion of the all the variation that can be accounted for by differences among populations, was 0.2%, for 2013 pink salmon in PWS which is comparable to the findings of previous work done within similar-sized geographic areas. He also gave an update on progress in analyzing the 2014 and 2015 samples and outlined plans and the reviewed the timeline and funding status for future work which will include analyzing the odd-year samples, examination of genetic variation through time within years, and comparing contemporary and historical natural populations. All work is fully funded and will be completed by the end of 2017.

- Attendee: So it's fascinating . . . the outliers are always intriguing, like Snug harbor. That was really impacted by oil spills . . . could it be a recent founding event?
- CH: Do you mean like a population bottleneck? She didn't see any evidence of a reduction of heterozygosity in that population, which is what you might expect to see in a really bottlenecked population.
- BS: So I heard there might be tide height structure. . is there anything in this that could relate to that?
- CH: So not in this piece that Wei did. In the first year, 2013, she only collected samples above the mean high tide level. She didn't try to collect in the intertidal zone
- Bobs: So it's not as if some of the populations are intertidal and other aren't?
- CH: Well, there are some populations that spawn further upstream and that's the only place you're going to sample them. That could have an effect. Lagoon might be like that, I'm not sure. In the 1999 study they found that downstream populations were more similar to each other and they found a bit more variation among the upstream collections. Wei is going to be able to hit on some of that with microsatellites by looking at some of that historical data and I think in 2014, you saw she had 10,000 samples that she's analyzing. I think she did do some intertidal and upstream collections.
- Alex: Is there any difference in the samples between hatchery and natural populations in regards to heterozygosity?
- CH: Uh, not in terms of heterozygosity. So these are microsatellites, incredibly variable. So you have very little power. Basically, every fish is a heterozygote with these because they have so many alleles. So it's hard to tell using heterozygosity. I think relationship among collection allele frequencies, you know like MDS, is a better way to get a feel for how similar they are, between hatchery and wild populations. And they're jammed in there in the middle, except for VFDA.
- Attendee: Did you look at allele richness?
- CH: I don't think she did, she tried to. It would be a very large number. But I'll pass that back to her. I think it's going to be high. Yeah, that's a good point.
- Attendee: So you've got information back to 1991, but it would be really interesting to get a window as to what the structure was like prior to hatchery building. I realize that there's no scale archive to draw on. Is there any hope of looking?
- CH: So, there was a study done in the 1970s on population structure using allozymes. The sample size was around 40, it's hard to read tea leaves from that study. There are no tissues that we can run that I'm aware of but if anybody knows of any we'd be very interested in them, in going back further.

- SR: Is there anything pre '64. .
- CH: Yeah, it'd be fascinating. Not that I'm aware of. . .
- KG: When you say that there's structure in PWS, are the samples from both hatchery and wild fish combined in the analysis?
- CH: So yes, when she did that analysis of overall homogeneity test, she combined everything. My gut feeling is that if you exclude the hatchery samples, you'd still find it. Snug Harbor and Totemoff are some of the most divergent collections. All you need is one that's different and it produces a positive result.

*b. Progress on pink salmon genetic markers*

Tyler Dann [See PDF presentation entitled “*b Progress on pink salmon genetic markers,*”] – TD acknowledged the partnership between ADFG and the Seeb laboratory at the University of Washington in identifying genetic markers for this study. He reviewed why single nucleotide polymorphisms (SNPs) are the best candidate marker type for high-throughput genetic lab work and the experimental design for the fitness component of the research program. He described the methods used and the progress made so far in the SNP development process including RAD sequencing, construction and analysis of linkage maps and analysis of minor allele frequencies (MAF), all of which are helping to narrow down the list of candidates to the 200 most powerful SNPs for resolving fish parentage. He reviewed the timeline and funding status for SNP development work which is anticipated to be completed in the fourth quarter of 2016, at which point samples can be genotyped with the new marker set.

- TD: Questions?
- BS: Is the equipment volatile? Is it changing in the market place? We hear there's a lot of advancement. . .
- TD: There is. . .so we're planning this right now status quo with the equipment that we have, but we're looking into other ways of genotyping more efficiently, with some of these sequence-based approaches.
- EK: Does timing chart there mean in the 4<sup>th</sup> quarter of 2016, you would be ready to process samples?
- TD: Yes, we would be ready to genotype. Now there is also all the extraction that goes into preparing samples for genotyping and then the genotyping. This project has large sample sizes, and so with our staff and other projects that we have going through the lab, the extraction time also needs to be built in. But yeah, we will have the SNPs ready for genotyping.
- RJ: So that would be at the end of this calendar year that SNPs would be ready for genotyping?
- TD: Yes.
- KG: Can SNPs be used to look at population structure like microsatellites?

- TD: Yes. A very good question and I meant to point that out in the beginning. So there's a big difference between the SNPs that we're trying to identify for the fitness part of the study and microsatellites or other genetic markers that are used to describe structure. There are a ton of SNPs that could be very useful for answering a bunch of different questions, but we're really trying to identify those that are just variable in all the populations for parentage; but there's a lot of potential for population structure work and Mixed Stock analysis work.
- EK: To follow onto that then: once you have the data that you need to do parentage, could you use that same data to look at population structure among these streams that are in the fitness study?
- TD: You could, but the SNPs wouldn't be very useful for that because we're going to consciously choose SNPs that are variable among all populations.
- EK: Right, so if you're going to doing a population study, you might go in the other direction as far as your focus on SNPs.
- TD: Yes, if we were going to try and do mixed stock analysis, we would have a different measure. Instead of minor allele frequencies something like  $F_{ST}$ , something that shows great divergence among pops, which likely means some of those are variable for that SNP and some are nearly fixed.

c. *Progress on chum salmon genetics*

Kyle Shedd [See PDF presentation entitled "*c. Progress on chum salmon genetics*,"] – KS reminded the group that SNPs were already available for chum salmon, unlike pink salmon, so the work is focused on narrowing down options to the optimal set of 200 for the pedigree and fitness component of the study for chum salmon. He reviewed progress made on choosing candidate markers, which began working with an initial 188 SNP marker set for analyzing MAF and parentage analysis of brood year 2013 chum salmon from Fish Creek (SEAK) to the 2014 alevin samples (presented this work at the April 2015 AHRP meeting) and that additional genotyping and analysis is being completed for another 96 candidate SNPs on the same samples listed above as well as the 4 fitness streams in SEAK to see MAFs. He expressed confidence that the genetic marker set will be finalized and ready for genotyping in the Spring of 2016. He reviewed the timeline and funding status for chum salmon tasks. No funding has been secured for work after the second quarter of 2016. The Fish Creek 2013/2014 alevin analysis draft report will be released at that time. He outlined the remaining work that would begin in 2017, if funding is secured.

d. *Priorities for pink salmon pedigree analyses*

Kyle Shedd [See PDF presentation entitled "*d. Priorities for pink salmon pedigree analyses*," Slides 1–12] – KS referred to a technical document on prioritization (Technical Document 11) which explores how to prioritize the analysis of odd- and even-year pink salmon samples. The 2013 and 2015 samples would be the

first to be analyzed for adult-to-adult parentage analysis for the five fitness streams in the study. He explained that due to changes from the original program design and large, unanticipated run sizes that more samples are available for analysis than the original program budget and laboratory capacity was designed to accommodate. Factors the Gene Conservation Laboratory (GCL) recommend considering in prioritizing which samples to analyze in a financially constrained climate include focusing on the most promising systems rather than trying to analyze a little bit of all of them (depth over breadth), focusing on genotyping only natural-origin fish in the second generation in 2015, and focusing on streams with the highest statistical power (best chance of success). He reviewed his definition of statistical power (how often do we expect to detect an effect that already exists?) and what variables both in and out of the sampling teams' control affect statistical power; the number of samples collected is what we have the most control over and dictates how well a system is being characterized. He presented graphical scenario work that created a framework allowing us to predict the estimated statistical power of each stream given proportion sampled. He highlighted that the availability of aerial survey and stream walk data from 2015 on the fitness streams enable a better understanding what proportion of offspring of total escapement were sampled in a given system. Even with the inherent uncertainty of such survey methods, he was able to use the data to project approximately what proportion of escapement were successfully sampled and therefore where we sit in the graphical framework for each of the 5 streams. This information fed into the final prioritized list for GCL, which listed Stockdale Creek Adults as the highest priority (see Slide 9 for complete details). He presented a timeline for all work involved in successfully analyzing the samples (genotyping tissues and reading otoliths to final report would be projected to March 2018).

*e. Proposals submitted for outside funding*

Chris Habicht [See PDF presentation entitled “*d. Priorities for pink salmon pedigree analyses,*” Slides 13–17] – CH described the two grant proposals submitted for outside funding to support AHRP: one to the North Pacific Research Board (NPRB) and the other to NOAA Fisheries, Saltonstall-Kennedy Grant Program. The NPRB grant would fund genotyping and analysis of Hogan Bay pink salmon adult samples for 2013 and 2014 (all samples) and 2015 and 2016 (natural-origin samples only). The NOAA Saltonstall-Kennedy grant would fund the analysis of Stockdale Creek pink salmon adults for 2014 (all samples) and 2016 (natural-origin samples only).

*f. Timeline and costs of components*

Chris Habicht [See PDF presentation entitled “*e. Timeline for GCL tasks*”] – CH gave an overview of the timeline for all GCL tasks associated with AHRP samples currently in the lab and their funding status, noting that the chum salmon stock structure running in the background on independent funding (not part of AHRP) should be done by the end of 2016.

Chris Habicht [See PDF presentation entitled “*f GCL Budgets 2*”] – CH reviewed the original funding plan for GCL tasks from AHRP and then revealed the reality of where money has gone for Fiscal Years 2014, 2015, and 2016 (Approximately 40% of funding originally dedicated to genetic analysis was reallocated to the field contractor to acquire more samples; most of what GCL has spent has gone towards SNP development contract with the University of Washington and Wei’s pink salmon stock structure lab and staff time). He noted that additional funds will be required for program management and genotyping to complete the remaining genetics work.

- Attendee: Were you going to talk about chum salmon stock structure,
- CH: Not chum stock structure. There’s been no new development since we last met in stock structure for chum work. It’s being done on the side, it’s not funded by this program. Bill expects to have something done by the end of 2017.

*g. Seeking direction on SEAK chum salmon project priorities*

Chris Habicht [See PDF presentation entitled “*f GCL Budgets 2*”] – CH presented a summary of the SEAK chum salmon samples in-house at the genetics lab (adults and alevins). He reviewed the work accomplished so far, including preliminary analysis of the 2013 adults to 2014 alevins as part of the SNP marker selection tasks, which yielded a total of 25 families. He asked for guidance from the science panel as to whether or not to move forward with the 2014 to 2015 adult-to-alevin analysis and shared the projected expense for task completion as \$148,000, with data analysis being completed by the third quarter of 2017.

- AW: I’d say yes. This would essentially wrap this, right? It would be the only information other than the preliminary stuff from 2013–14 on chum until years into the future.
- Chris: Right
- AW: It seems from that perspective, that these are important samples.
- CH: It’ll be a funding issue.
- Attendee: I think we need to talk about it.
- CH: We just wanted to raise it. There is something we can do with chum. . . we’re not going to be able to do anything with chum until the 2017 collections get taken. And basically a question of to do it or not.
- SP: We might have some questions for you too.
- JC: What do you think the price per sample would be?
- CH: The price per sample is \$35 that would cost us to run on the current existing platform, which is the Fluidigm platform. We’re in the middle of putting together a bid to genotype by sequencing platform. Depending on whose numbers you listen to, it should be cheaper.
- JC: We keep hearing the price goes up every year.

- CH: Well, inflation goes up every year too.
- JC: [inaudible].
- CH: OK, well we can talk about that. So there's genotyping by sequencing that basically genotypes and then you look for the SNP variation. So it's much more time consuming or much more complicated on the analysis in because you have a huge amount of data. Bioinformatics is a problem but in some ways simpler in the laboratory. So we're looking at that to see if we can get some cost savings in the lab.
- RJ: Thank you. So this new machine is the one that we were talking about 3 months ago or so? There was some email exchanges about what it would cost and how it depends on certain things. That's the machine he's told us is going to save lab costs but have more complicated analysis costs because of so much data.
- CH: So we try to look at the whole package. Because you could save money in one thing but end up spending more money on something else. The capital cost of the machine and the running cost of the machine and then there's all the work that has to be done to prepare the samples before they go into the machine, and then all the work that has to be done when the data comes out of the machine. All of those parts get pooled together. We think, and again we've never worked with a machine like this, and we talk to different people and they give us different numbers. Some of them sound really rosy, including the people who are actually doing this for fisheries work. But until we get it in hand and we start working with it, it'll be hard to know what the price is going to be. There's definitely the potential for savings. That's all I can say.

6. *Technical Documents* (**Decision points are in bold type**)

- a. *Technical Document 5 – Advanced parentage simulations: the statistical power to measure relative reproductive success*
- b. *Technical Document 11 – Prioritization of pink samples and analyses 2015/2016*

- RJ: I sent out a synopsis on Technical Documents to the science panel. Thirteen of them have been given titles and 2 of those haven't been submitted for review so 11 have been through science panel for review and we're done with them. I mentioned this to the group that you oversee Chris in the Thursday teleconference. The first one was "Defining Relative Reproductive Success: which fish count?" Is a live fish in the stream that hasn't spawned yet, are we counting it or not. So we decided that it has to be a fish that spawned those are the fish we're worried about. I believe that's right.
- CH: So, we want to count any fish that returns to the stream and dies in the stream.

- RJ: Right, not necessarily spawns, but dies. I don't need to read all of these over. There are 2 outstanding documents in my mind and one of them Kyle just talked about: Technical Document 11 which was the idea about the decision between Stockdale and Hogan and the other streams. So I think that one's done also. **There were some comments from the Science Panel on that and I think between myself and Kyle, he can incorporate that into the published document.** And then the other one was Technical Document 5, which showing how all that power analysis works, like today, the same sort of thinking given returns-pre-spawner, numbers of adults sampled, that kind of thing. There were a lot of comments about that initially and some of it had to do with a stream situation you're dealing with a finite population etc. I don't know if that's all been resolved. I printed about half of it. It's a 90-page document but most of it is tables and graphs. I don't see there's a reason why we couldn't put that out there. The information, the thinking we had at that point in time, addressing the different considerations that need to go into thinking about our ability to detect differences in spawning success. And sample sizes. I think what we could add to this document is that subsequent to this, we increased effort to go sample more adults, because getting more adults was necessary for us to be able to make determinations about differences in reproductive success. So **I feel like this document could be done also.** Some kind of explanations on science panel comments.
- CH: So is your idea to put a section on the back of each document that would be the Science Panel comments? Like an appendix?
- RJ: There is a place for that, called "Science Panel Review and Comments. I haven't gotten into these documents and written anything but for the first one I said, "This document is acceptable to the Alaska Hatchery Research Group Science Panel." Some of these, here for number 9: This document covers some of the long and well-established procedures for scale aging in Southeast Alaska. There were no comments from the Alaska Hatchery Research Group. **This document is acceptable.** It's good to have it documented. Same with the Technical Document on Tim Frawley and Eric Lardizabal's work. There weren't any comments on it either and I'm not surprised. These are just background methodology. So, I think even the last science panel they were trying to get closure on documents, so we can have them out there, so that people that might want to know more about this project, can have some confidence and know that what we're doing is well-founded.
- CH: So when you say "Have it out there," I think the idea was to put it onto the website for the AHRP as finalized technical documents, is that what you were thinking?

- RJ: Yes and I think also putting them in ADFG Regional Information Report or Fishery Data Series.
- TD: I think Regional Information Reports, or something similar, like WASSIP,
- Attendee: And then they go up on the website, once their approved by the Science Panel.
- RJ: Yes.
- Attendee: I think it's always valuable that if the Science Panel does have comments on a technical document to make that part of the document so that they are actually appended to the end of the document. The idea behind these is the communication between the labs doing the work, or whoever is doing the work, and the Science Panel . . . documenting that communication.
- RJ: The first group that were written, maybe somebody else kept them but all of my archived emails after I retired, got lost so I don't have those, even though I thought I had them in the archive box. . . the folks that do this spent a lot of effort trying to recover those documents and were very disappointed they couldn't find them because they thought they had them locked in but they're lost so it wasn't.
- KS: I think part of Eric's question is, as we append science panel comments to these documents, I know in the past there were long email chains and if everyone is comfortable having, we wanted to make sure everyone was okay having their emails copy and pasted into public document, on the website, public facing. If people wanted the chance to revisit those and make formal comments.
- TD: maybe paraphrasing would be appropriate
- RJ: There aren't all that many, but there are some.
- Attendee: I think it's worth it for you to put in. This is standard operating procedure. Make sure that space doesn't go empty.
- RJ: So the one with the most comments was Technical Document 11, about the prioritization of pink salmon analysis and some of these comments are about the new machine etc. It's good for people to know there's some back and forth on this stuff. I can work on that. **I'll send them to the Science Panel one more time to look at them if they want and if no response**, we'll move forward. Make sense?
- Alex: I thought your commentary that you just threw out here on Tech Document 5 was really good. Maybe we can add that in the sense that showing how these documents are then used to adapt the study design and reallocate funding.
- RJ: Yeah, we can talk about elements of funding in that too.

## *7. Discussion on Manuscripts for Completed Study Aspects*

- RJ: This is not a totally new topic. We've got a bunch of data now, and we've got year-end project completion reports from the science center, but we don't have anything in a peer review publication that talks about what we found in terms of the hatchery portion estimates (stream-by-stream, region-by-region), estimates of total returns, the numbers of natural spawners and hatchery spawners and that data. So one of the things we want to do is tell our story outside of this group that already knows 90% of what we've talked about today already. So unless we get them out there not just to read them but to reference them. . . . Peter was talking to me about wanting to use some of this for looking at if there is a relationship of stream type that might result in more or less straying? Well, maybe there is, maybe there isn't. It's not something we've looked at in this study. Chris Habicht and I looked at it for Chinook salmon, or tried to a long time ago. Anyway, so how are we going to do this? At one time I was expecting that we would contract someone to write up this stuff. There's not the question of whether we want to spend the money on a contractor to write a report or not.
- AW: I mean I'd be an advocate of people that done much of the work including incorporating those that have leadership roles in the design to be also the people that bring this into the peer review literature. What I think could be really useful is if like Eric and his colleagues to propose what a manuscript they see coming out of this work. Estimation of hatchery fraction, and how that could be split up into different manuscripts and who would lead on that, and for the Science Panel to review and consider. Have that discussion on how do you fund this and how do you move forward.
- RJ: So a somewhat similar process to the technical documents where we have a Science Panel review and comments then final publication.
- AW: You mean in terms of once the manuscripts are being produced bring it back to the Science Panel. I was a little bit before then. You could use EK's proposals as a discussion framework for seeing if that looks reasonable, and I would think it would also include, I mean maybe one attitude is that once they get done with this field season, they're done. But just see how you split this up in the sense of is PWS going to be two manuscripts? Three manuscripts? SEAK chum, going to be a separate manuscript? How do you split that up--who would be in the lead, responsible and who would the co-authors be?
- EK: So just as a little more background, we do have some ideas about how we would organize some manuscripts, we have a rough list of that put together. But I like Alex's idea that if we could flesh those out a little more and then send them to Ron and to the Panel. Leave it up to the Panel to decide who else would be authors but

the other thing I would add is that we, in our present budget, we have allowed some time for Pete and Kristen to work on manuscripts from the first 3 years of data. As well as finishing the 2015 report. We'd really like to participate in, and we're ready to do it, and we have ideas about it. We're ready to proceed if that's what you're tossing out. I think you're suggesting that we outline what each manuscript would be, what hypotheses we'd be testing or were appropriate, what data's available. Some things we haven't talked about we could explore it a little bit and share what we have and talk about it. The obvious parts like the hatchery fractions, you've seen it all, at least on the surface. So that's where we stand on it.

- AW: Seems like there'd be different classes of manuscript, like the ones that address the primary objectives are going to be the highest priority in our view. And then ones like what streams are associated with what straying or environmental conditions or difference in size or sex ratios or whatever. There is a goldmine of data there. Those would be more ancillary and secondary to making sure we get the primary products out there that we structured the whole study for.
- EK: The two at the top are the stream hatchery fraction would be probably first and then things related to it, and then the ocean sampling, might be second,
- AW: Would you separate the hatchery fraction into pinks and chums in PWS or combine them or?
- EK: Probably one manuscript
- Alex: And how about the two geographic areas?
- EK: We'd combine them into hatchery fraction in streams for both areas.
- AW: So you'd have one big manuscript with both species and both areas?
- EK: That's what we've thought about so far.
- RJ: So the ocean sampling, that would include estimates of hatchery and wild spawners, total return, etc. I mean ocean sampling is just to get that one statistic, the proportion of hatchery and wild fish that returned that year. Sitting by itself, you can do that follow-up analysis . . . John Bernard and John Clark have been working on it.
- BS: So, we've seen one master's thesis patched onto the project today: Do we have any concern about reviewing that, or design of study, or, it's not clear to me. Was it just a happenstance or did it come through the science center?
- EK: Peter could talk about that,
- PR: So, Casey is the first of the DIPAC fellows funded by DIPAC. Pretty early on we had conversations and it worked out, but it didn't formally go through the Science Panel.

- Attendee: [inaudible] So we're not trying to referee.
- Sam Rabung (SR): Steve had to leave but he and I have been crunching numbers, and something I wanted to point out again is that we have a cash flow deficit going forward. So that money on paying for publication work means we'll have less money for sampling. That's the reality, right now. Just wanted to say that.
- EK: One quick response to that is, after this meeting, I referred to those budget estimates as back-of-the-envelope. Basically, I tried to present it as different scenarios so that you all could decide but once we get our marching orders, we'll be able to sharpen our pencils and see what the real cost would be, both including and not including that work on the manuscripts. I don't think it's going to take too much to do the manuscripts because we've done the majority of the work. Pete and Kristen are good at doing it and they're fast (way faster than me). I think it would be pretty efficient
- SR: This year we've got it covered, but when we start SEAK sampling again it's going to get more expensive. That's when the real crunch comes. That's one year away so what we don't spend now is still available for that.
- RJ: I'd just add, as it's already been mentioned that the fishermen now are pretty much the ones paying for this. So they're going to have a strong pull. If they tell us that it's not an acceptable line item, it's going to be pretty hard to argue against them. But we'll work it out. I believe the story needs to be told.
- AW: The job's not over till the paperwork is done
- BS: I've been involved in some peer review or some assessments etc. Yeah we know this study's out there, but there's no data from it, etc. There's a real need from that standpoint to have at least these tech docs and annual reports available.
- TD: Along those lines, we were thinking of trying to publish some of what Kyle's done, the simulation work which I think would just make final reporting easier, as we'd be having the components finished already.
- BS: Isn't there one already in PLOS? Chum study?
- TD: No. And if it helps the funding conversation, the timeline for our proposals is that we'll hear back in May.
- RJ: Oh okay, that's great. Very good. So the opportunity to go request funding from the Northern Fund, the conceptual proposals will be due in August. We'll be sure to put that on the calendar and work with someone to put in a request for that. That's money we didn't know about. The earliest that money would be available is in early to mid-2017.

**Break:** 2.31 p.m. – 2.48 p.m.

*8. Comments from Dr. Phil McGinnity from University College Cork Ireland (parallels to his work with Atlantic salmon)*

Phil McGinnity – Professor McGinnity reviewed some of his work studying the impacts of escaped farm salmon on natural salmon production in the Atlantic, specifically on systems in Ireland such as Burrishoole River. He noted some of the biggest net penned salmon producers in the world are Scotland and Norway. He noted that there has been declining recruitment in freshwater regions over a long period of time, but that many factors could be contributing to the phenomena. His work focuses on how changes in fitness or productivity can be measured and understood, from ecological to genetic factors, such as genetic introgression. The biological impacts of levels of introgression are relevant to both academia and industry.

Questions?

- JH: I noticed you had a little bubble up there referring to epigenetics, I wondered if you could expand on that, your thinking on that, and how it relates to plasticity etc.
- PM: Right, if you come back to those studies [in his presentation]. . .it seems that hatchery fish, wild fish, big difference in performance. It could be ecological, it could be genetic, it could be whatever. But one of the things is that a lot of information seemed to come into the fore with this epigenetics, where the environment is causing genetic changes, non-heritable changes, but they go over generations and I was doing some reading about this, and mentioned earlier, I don't fully understand it. What do you mean? How could it work? There's a very good study on human cancers (I can't think of the reference). They were studying the link between stress and health, and they had data to show that a lot of cortisol levels (stress hormones) could actually make changes to the genome/gene expression. I thought about this in fisheries and fish are stressed, produce a lot of. . . there's a response there. And that can have an impact in the genome (methylation) and that has affect in gene expression which is how you realize phenotypic differences. That's something that is going to be big in the future: can we start to measure these things? Can we start to look at the environments these animals were raised in and their impacts on the genome? There's another study, a famous study on Dutch women during the world war years, under stress, scarce food, they were producing offspring that were much smaller than themselves but that actually went on for two or three generations subsequently. This is tied into an epigenetic thing. Can have effects that affect the genome but not genetic in the classic sense but can have a generational problem.
- AW: Your farms, the salmon industry . . . are the sustainability groups labeling them as sustainable? In general?
- PM: There's a new scheme under the World Wildlife Fund they have a certification scheme. Marine harvests are very anxious, have

committed themselves to bring in most of their production in terms of the scheme. That's one of the areas I was looking at.

- AW: This is marine harvest?
- PM: Yes, Norwegian salmon farming but they're a worldwide organization. They're very anxious to comply with the standard that's being proposed. That's OK. That's grand. They're quite stringent. One thing for example, they do a lot of rearing in Scotland, in fresh water lochs (lakes), the smolts are put into the lakes, and because they're put into the lakes, they produce a much more superior smolt than what we see in these services. Very fond of that in Scotland, maybe 30 or 40 million in net pens of these smolts, however it doesn't comply with the certification. So they're anxious about that. Well, how will we get certification? I said I don't know. It has to do with stuff that goes on down in Chile but the regulation applies right through the distribution of the farm. One of the things I said you could do is you profile potential recipient populations. Do this on a regular basis and say "you've had no impact." Some way of proving that you've had no impact. They were going about it a bit different. They said well we're going to have more stringent containment. That's how they were going to work it. My reaction given that, that's brilliant and that's part of the solution but accidents happen. And not only that, but sometimes accidents happen and fish escape but they don't have any impact. Last winter we had a big storm system sweep through Ireland, 300,000 salmon escaped, we've never seen anything of them since. As if they went into the sea and disappeared. So in a way to protect the industry itself, it should be profiling these populations and looking for measurements of introgression. So certification is big on the list. And this kind of story is very important. There's a number of parameters and one of them is introgression. Now, what's happening in Norway is they sample all the farms genetically, so that if some escape, they can trace them back to their farm of origin and there are penalties.
- RJ: So that's all just genotyping though. . they don't do any marking?
- Presenter: That's right. They don't do anything physical marking. And they only deploy it when there is an event.
- RJ: So then the industry has to pay for all that processing?
- PM: Well, I'm not too sure. The government I think pays. . .but then if the problem is assigned to you, then you're fined. And it probably doesn't help your licensing applications in the future.
- Attendee: So what happened to all the schemes looking at sterile polyploids, is that kind of an arcane issue?
- PM: Absolutely not. That is back on the agenda bigtime as a potential resolution to this particular problem.
- Attendee: Is there any use of interspecies sterile hybrids?
- PM: Yes, there was quite a bit of research between brown trout and salmon and the hybrids. They're sterile, so there's capture. And there's

a greater propensity for interspecific hybridization going on for hatchery fish than captured fish

- Attendee: Are those hybrids themselves sterile?
- PM: Yes, for the most part. Not entirely, but yes for the most part.
- Attendee: Do you think that it goes to some degree to ameliorate some of the effects? [inaudible end of sentence]
- PM: Well in fact, there is still a productivity impact, there's capture of 4 or 5% of the gametes that would have been. . . . It's more of a productivity/ecological thing rather than a genetic thing.
- Attendee: Yes, it seems like a numbers game, if the numbers were the other way around [numbers on presentation slide currently not available] maybe you could argue that. . .
- PM: Now, you just reminded me of something else. When I showed you that early Norwegian data. Now, you can't predict. . . there's fish farming areas that don't have big impact. There are areas where there doesn't seem to be much introgression and then there's other areas that there's quite a considerable amount of introgression. There's no clear relationship . . . I think it's similar to what you were finding in your results yourselves. Some rivers take on a lot of introgression. Norwegians interpret this as saying it's to do with the status of the recipient population. If the recipient population is healthy, robust, strong, large, doing their business, then the level of introgression will be quite small. If there's stress, there's some acidification, the numbers are low, they've been overfished, some kind of environmental stressor, they are really subject to introgression. So, again, it's about the status of the recipient population.
- PR: I wanted to ask the same question that Bill did: what about making triploids? In Europe, I would have thought those are considered as GMOs (genetically modified organisms) and are way off the table.
- PM: I would have thought that, but from what I understand is that it's coming back on the table big time. The problem is, there did seem to be some resistant to triploidization because some people seemed to be making the connection with GMOs, that triploidy was a GMO concept which it is and isn't. Yeah, it's a manipulation, raise the pressure, raise the temperature. Someone was saying this was the solution, it was the easiest way. Now, there is a problem, under cool conditions in the sea, no problem, when it's warm, say in Irish marine waters or southern Norwegian waters. If the temperature goes up, then some of those come under quite a bit of stress. And one of those things is that it's kind of a welfare issue. These fish may be stressed and things. It depends on who's looking at the data. But from what I understand from a certain line up the coast of Norway there's no problem. It's really a solution. They've gone into other things like marine protected areas, national rivers, other zones. There's a range of different

management responses. But the triploid thing, it's really back on the agenda.

- PR: One of your case studies was a hatchery where they were raising fish up to juveniles and then releasing them? Is that right? Or are these all farms?
- PM: Right, well some of these studies we were doing ourselves these are more like a study you do with captive bred. So the others would be the release of smolts.
- BS: It's not an enterprise as we know it
- PM: No, that's totally research. Originally it was designed to help the commercial fisheries, when they were putting coded wire tags in fish. There was an intercept fishery off the west coast of Ireland and they were reporting levels of recapture.
- PR: I thought there was a hatchery study for supporting sport fisheries.  
..
- PM: Yeah, you're getting into something slightly different now. Enhancement. When you take fish out of the wild, bring them into the hatchery and raise them to a certain age and release them, or supplement. Interestingly in Wales, the Welsh river authority has just closed all their supplementation hatcheries this year. The Scots are planning to do it; the English are planning to do it. In Ireland it's very strict doesn't really exist
- PR: What brought that about?
- PM: This kind of material. Material from your part of the world, data from the Pacific northwest is very much the driver of it.
- TD: Thanks for the European perspective. You gave a great overview of different measures and impacts to fitness: productivity, genome scale changes and adaptive potential, and I wonder what could you provide us with a scenario looking at multiple generations and potential introgression . . .when looking at variation that might buffer overall populations? We're measure things such as productivity. Do you have any suggestions to our approach right now?
- PM: The project that you're working on looks quite strong. I hope it will answer your questions. I think one of the things that might be useful is it might be supplemented by some of this experimentation, some of the experimental stuff in conjunction with the pedigree stuff, could be really a powerful solution. The difficulty with the pedigree stuff is that some of the things are attributed to ecological and genetic factors. . . It's hard to partition those things out. What actually is causing the differences in performance? So maybe the experimental bit would be helpful. I was very lucky . . . we had this research station, I managed to cajole them into doing these experiments. As you know there are very few places worldwide that can do that sort of work. Putting experimental fish into the wild is a difficult task; you need permissions and so on. But if it could be possible to do that type of work, I think it'd be incredibly powerful.

*ADFG staff member Tommy Sheridan shared some interesting notes about his graduate research.*

Tommy Sheridan (TS): But I'm happy to have the opportunity to share a little bit about what I'm up to. Unknowingly, you all are participating in my graduate program. I'm a graduate student though Oregon State University; I've been taking fisheries classes through OSU for about 10 years. And it's grown over time. About this time last year, I was approached by Robert Lackey, who was a professor and he had an interest in taking on an undergrad student. So Oregon State has developed a program called Professional Science Masters (PSM) in Fisheries and Wildlife Administration. It's a distance program. All of the classes have been distance, I couldn't leave my day jobs so Oregon State has developed their programs in such a way that I don't have to. I do have some components where I'll go down and be in Corvallis and other ports. It's experiential, not thesis based. But I will have 2 internships, still proposed and haven't been signed off on yet. But one is with the PWS aquaculture corporation. In September of last year I was appointed to serve on the PSWAC board of directors in an ADFG ex-officio seat. It just struck me as really fitting what the PSM was looking for an experiential internship. I was also appointed to the Science Panel and I've been working with Ron on that, we've got an application that needs a signature and I'm glad that folks can contribute if they like. It's not going to involve anything in the way of a product, per-say, it's more experiential. So being a part of this process and watching you all work is going to. That's the bulk of my program. I'm also doing a graduate minor in rural studies, with a public policy professor at Oregon State and we're interested in growing it beyond its current grounds and we're looking at a PhD. At this point I'm focused on being a full time student, with a full time job, and 2 kids under 4 years old. But I'm a glutton for punishment and looking forward, throwing it out there. If you need a grad student or have an interesting idea for a project, talk to me. If members of the Science Panel are interested in seeing the write up for the internship, I'm happy to share it. I shared it with PSWAC as well they had some good changes. It's fairly straightforward. It's all about getting the students out into the world and interacting with whatever process it may be. I can say there are no students at OSU that have the opportunities that I have. Questions?

RJ: If you could send that around to the Science Panel, I think they'd be interested.

*Closing Thoughts* (**Decision points are in bold type**)

- EK: I have one thing I want to make sure we're heading toward being settled on, and that is **our assignment for 2016. I think I heard: no Spring Creek.** I guess a basic question is what level of effort on sampling in the streams that we are going to the sample? The best way to describe it really is, what proportion of the population should we sample? Once we know that, we can gauge our effort to try and do that and then I can do the budget. We know it won't be as many this year. If I had an idea for what proportion, I think we could gauge how many people to put on each crew.
- RJ: I want Kyle and Jeff to both write a number down. . . . (laughter)

- RJ: Who else could decide it? Here's my number: 80% sampling. I think this is a critical year. Because we're looking at 2014 where had a pretty good effort and not enough spawners, I think we've got a better chance of answering stuff this coming year than we do with what we collected in 2015. I think 2015 the samplers did great but in some ways it was still a disaster. The numbers blew them out of the water . . . sample processing couldn't keep up. I think the best chance.
- Attendee: I vote for Ron's number.
- CH: I really like that too. I mean next year you're going to have this huge number from last year, so you're back to being swamped.
- EK: To get 80% I think we might be able to cut back a little bit on effort. We'll look at the run sizes and how much work it takes. We'll see.
- RJ: The number of fish you have coming back is. . .but you also have environmental conditions and when you have a really wet year, fish just get blown out of there. You guys know. You've seen it all.
- EK: But in that case, we'd rather have more people working on any given day, before the rain hits the next day and washes them out. OK. We'll think about it some more.
- RJ: We appreciate that. Anything else? Science Panel, you want to get a teleconference together next week? Want to wait until we get Eric Knudsen's budget? Maybe just talk about it at that point in time.
- EK: **Are we firm enough to give the charters a firm verbal confirmation?**
- RJ: **Yes, I'm sure we're going to do that.** You don't have a contract, but there's no reason not to think that you wouldn't be going out there sampling, in my mind.
- EK: So it's good to pin that down before they get cold feet. The ones we work with have worked with us, they know the areas etc.
- RJ: Thanks to all for coming!

**Meeting Adjourned: 3.43 P.M.**