**ALASKA STATE LEGISLATURE**
**HOUSE RESOURCES STANDING COMMITTEE**
February 1, 2016
1:03 p.m.

**MEMBERS PRESENT**

Representative Benjamin Nageak, Co-Chair
Representative David Talerico, Co-Chair
Representative Kurt Olson
Representative Paul Seaton
Representative Andy Josephson
Representative Geran Tarr

**MEMBERS ABSENT**

Representative Mike Hawker, Vice Chair
Representative Bob Herron
Representative Craig Johnson

**COMMITTEE CALENDAR**

OVERVIEW(S): FISCAL EFFECTS OF COMMERCIAL FISHING & MINING BY BOB LOEFFLER, INSTITUTE OF SOCIAL & ECONOMIC RESEARCH (ISER)

- HEARD

SALMON GENETICS BY JEFF GUYON, NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION, AND BILL TEMPLIN, ALASKA DEPARTMENT OF FISH & GAME

- HEARD

**PREVIOUS COMMITTEE ACTION**

No previous action to record

**WITNESS REGISTER**

BOB LOEFFLER, Professor
Public Policy
Institute of Social & Economic Research (ISER)
University of Alaska Anchorage
Anchorage, Alaska
**POSITION STATEMENT:** Provided a PowerPoint presentation, "Fiscal Effects of Commercial Fishing, Mining & Tourism."

JEFF GUYON, PhD, Supervisory Research Geneticist
National Marine Fisheries Service (NMFS)
Alaska Fisheries Science Center's Auke Bay Laboratories (ABL)
Juneau, Alaska
POSITION STATEMENT: Provided a PowerPoint presentation, "Genetic Stock Composition Analysis of Salmon Incidentally Caught in Alaska Federal Groundfish Trawl Fisheries."

BILL TEMPLIN, Principal Geneticist
Gene Conservation Laboratory
Division of Commercial Fisheries
Alaska Department of Fish & Game (ADF&G)
Anchorage, Alaska
**POSITION STATEMENT:** Presented a PowerPoint presentation, "Alaska's Genetics Program, Genetics applications for fisheries management."

**ACTION NARRATIVE**

1:03:16 PM

**CO-CHAIR DAVID TALERICO** called the House Resources Standing Committee meeting to order at 1:03 p.m. Representatives Olson, Seaton, Josephson, Tarr, Nageak, and Talerico were present at the call to order.

## OVERVIEW(S):
## Fiscal Effects of Commercial Fishing & Mining by Bob Loeffler, Institute of Social & Economic Research (ISER)

1:04:06 PM

CO-CHAIR TALERICO announced that the first order of business is a presentation on the fiscal effects of commercial fishing, mining, and tourism by Bob Loeffler of the Institute of Social & Economic Research (ISER).

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BOB LOEFFLER, Professor, Public Policy, Institute of Social & Economic Research (ISER), University of Alaska Anchorage, said he is a half-time professor at ISER and works half-time with a small consulting firm, Jade North. He began his PowerPoint presentation, "Fiscal Effects of Commercial Fishing, Mining &

Tourism," by acknowledging his co-author in the study, economist Steve Colt.

MR. LOEFFLER, in response to Co-Chair Talerico, stated he has a master's degree in civil engineering from Stanford, a master's degree in regional planning from Harvard, and a master's degree in hard knocks. He advised that approximately 10 years ago, the Department of Commerce, Community & Economic Development published what it called "The Net Benefits" reports, which included commercial fishing, mining, and tourism and his presentation is a continuation of that. He clarified he is not talking about the net benefits of commercial fishing, mining, and tourism, rather he is talking about a very small slice of that - only the fiscal impacts. What he means by that is what the government receives in revenue versus what the government spends in revenue. The net benefits, of course, are much greater. For example, commercial fishing has a huge effect on employment, income, community health, and social objectives, but he is not talking about that, he is only talking about the fiscal impacts. He noted the conclusions in his presentation are his and Steve Colt's, not those of the university.

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MR. LOEFFLER turned to the slide entitled, "Economist-speak," and explained that the fiscal effects are solely the revenue the state receives minus expenditures to promote or expand the industry. He reiterated that they do not include the economic effects of jobs, income, and revenue to business.

REPRESENTATIVE SEATON, with regard to the fiscal effects, state revenue versus state expenditures, asked whether the revenues that are shared with municipalities are included in the state revenues.

MR. LOEFFLER responded that he will discuss them separately because they are critical. He confirmed that they are included in just the state revenue.

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MR. LOEFFLER turned to the slide entitled, "Figure 1. Commercial Fishing," and noted it is a bit different than the figure contained with the committee packets. He said the striped boxes on the right-hand side are what Representative Seaton asked about - they are revenues the state shares with local government and are about $50 million. The importance of those is that it

is about equal to state revenue sharing, so commercial fishing is a very important component of the fiscal health of municipalities. The green bar below that is what goes to the state, and the other two are just state expenditures only.

REPRESENTATIVE SEATON asked whether when Mr. Loeffler says "state and local revenue" that it is only revenue collected by the state or does it include local head tax in tourism, or a local fishing landing tax.

MR. LOEFFLER explained that the state revenue is what is retained in the general fund or the permanent fund, the local revenue is the major local sources. He further explained that it would be the pass through to fish tax and taxes that are in the local fish taxes, and that it does not include sales tax or property tax by the locals. He pointed out that it is not a comprehensive income that the locals get, but it's the major sources of income. He related that on the expenditure side, he is only discussing state expenditures, and that the local expenditures are much less than the state's. He pointed out that commercial fishing, including state and local revenues, brings in a lot more than the state expends. He pointed to the operating budget and said it changes somewhat, the state's operating budget is about $8 million less in fiscal year (FY) 2014 than what the state expended to manage or promote the industry. When including the capital budget, the difference was about $27 million in 2014.

MR. LOEFFLER turned to the slide entitled, "State Commercial Fishing Revenue: $70.2 million," and stressed that these are state only, about $70 million. He said half of that he calls "'True' Taxes" where the legislature decides what to do with them. One-third are "'Pass-through' Taxes" wherein an industry agrees to tax itself for a specific purpose, such as a hatchery or marketing, and the taxes are then collected by the state and allocated to the purpose often through the capital budget. The last slice on the slide is fees used for agency management. If a person was a fisherman, he explained, the two green slices would look the same - just paying the state.

MR. LOEFFLER addressed the slide entitled, "State Commercial Fishing Operating Budget: $78.3 million." With respect to the operating budget, he said about two-thirds [65 percent] is for the Department of Fish and Game (ADF&G), mostly the Division of Commercial Fisheries. He noted that this only includes state general funds and does not include federal funds or other special purpose funds from another source. It is what the state

expends and what the state gets, so federal revenue and expenditures are not included. Roughly 20 percent is by the Department of Commerce, Community & Economic Development (DCCED), essentially fisheries marketing, and 9 percent is from the Department of Public Safety (DPS) mostly the Division of Alaska Wildlife Troopers where it performs commercial fishing enforcement, and the remaining other is 7 percent.

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CO-CHAIR NAGEAK inquired whether the public safety portion includes wildlife troopers.

MR. LOEFFLER replied that it includes the portion that is used for commercial fishing.

MR. LOEFFLER returned to his presentation and noted that revenue goes up and down, so the revenue is averaged for the years 2010-2014 and is updated at 2014 dollars. Turning to the slide entitled, "Capital Budget: $18.5 million," he said the capital budget for the three years of 2012-2014 looks at the portion that was used for commercial fishing. For example, for a hatchery the proportion of the amount caught by the commercial fishing industry was looked at and that portion of the capital project was allocated to commercial fishing. He said about $20 million was spent over those three years, which he expects is greater than what will happen over the next three years.

MR. LOEFFLER moved to the slide entitled, "Municipal Revenues: $50.8 million," and said [the municipal share] from the fisheries business landing tax is $25 million, $5 million is [the municipal share] from the fisheries resource landing tax, and about $20 million is municipally imposed special taxes. He said it does not include sales tax or property tax. Mr. Loeffler then noted that the caveats include: the values are all estimates and the conclusion is not necessarily accurate for any portion of the industry, even if it is good industry-wide. For example, according to the Alaska Department of Fish & Game (ADF&G), the average revenue for a salmon permit for the upper Yukon was about $1,100, but for a seining permit on the Alaska Peninsula was about $200,000. So, some places bring in more money and some places cost more to manage - there is a huge difference between fisheries. The third caveat is that prices/values fluctuate tremendously year by year. Some years prices are high and runs are big so fishermen get a lot of money and the state gets a lot of money. And some years the prices are bad; for example, the price in Bristol Bay this year was

$0.50, so the 2015 taxes coming in will be much less. The fourth caveat is that when people around the state think of industries they think of oil.

MR. LOEFFLER pointed to the slide entitled, "Alaska mandates unitization of oil fields to prevent this" [picture is of numerous oil wells side by side]. One of the objectives is to make money for the state, he said, but that is not what fisheries are about. Displaying the slide entitled, "We do not mandate unitization of fisheries to prevent this" [picture is of numerous commercial fishing boats fishing side by side] he explained that inefficiencies are allowed in fisheries because of what it does for communities, social health, employment, and people allowing their children to come to their set net sites. The state manages fisheries partially for sustainable fisheries, but socially it manages the fishing industry for very different purposes than it manages oil. He stressed it is important to realize that the fiscal impacts are only a very small slice and said, "I know when you think of the commercial fishing industry, you think of it on a much broader basis." Displaying the slide entitled, "Figure 1. Commercial Fishing," he said the basic conclusions from the fiscal side are that the state spends a little more than it takes in on commercial fishing if the capital budget is included, but the communities receive about $50 million out of commercial fishing.

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REPRESENTATIVE TARR asked whether the capital budget side was done over a five year [period].

MR. LEOFFLER responded that the revenues were over five years and the capital budget was over three years because over those three years they looked at capital projects from the Department of Natural Resources (DNR), Alaska Department of Fish & Game (ADF&G), Department of Environmental Conservation (DEC), and Department of Commerce, Community & Economic Development (DCCED) only and performed a computer search to determine which ones might be relevant and there were 3,100. Then another computer search was performed to narrow it down to about 400 and then researchers had to read them all.

REPRESENTATIVE TARR said she has not had a chance to review the lengthy report and asked whether the report provides greater detail about how that was assessed. She advised that her question relates to the Chinook salmon research effort, and that "we have bumped up our capital budget spend over the ... most

recent past in that area." She further asked whether that gives the legislators a good number on the capital side, or whether legislators should have extended the time period to get outside of the big chunk of money going there.

MR. LOEFFLER replied that if there was an unusual high amount during 2012-2014, it would be reflected in these numbers, although divided by three. He guessed that it is possible, if this box is slightly higher than it otherwise would be, that the overall conclusions are probably still valid - "that considering the operating budget doesn't quite pay, capital budget there's a slightly larger deficit if you include communities, it's very important for communities."

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REPRESENTATIVE SEATON observed from the slide entitled, "Figure 1. Commercial Fishing" that it is obvious the state spends more than it takes in. But, he continued, when looking at the right-hand side, the state actually is taking in more but giving away a big portion of it. He surmised that if, without restructuring the tax to industry, the percentage the state shared with municipalities went from 50 percent to 25 percent, then the state would be about on par with the total budget including capital.

MR. LOEFFLER answered yes, although he assumes capital would be less, and it would be robbing Peter to pay Paul as it is all Alaskans who live in communities.

REPRESENTATIVE SEATON remarked that the state is in a fiscal situation and he appreciate Mr. Loeffler presenting all of the industries to determine where the legislature comes from because building more state deficits is unacceptable. He said, [the information is helpful] in trying to determine which pieces go together, whether to raise taxes on the industry to get to a breakeven point, and noted that that distribution will have to be considered.

MR. LOEFFLER quipped that he is pleased to present the information and pleased he does not have to make the decisions.

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REPRESENTATIVE JOSEPHSON remarked that, broadly speaking, one of the revenue proposals with the least attention in newspapers is the fisheries tax. He asked what that would do to the $70.2

million, and why it is believed that the administration supports it and finds that it is affordable.

MR. LOEFFLER stated that he does not feel comfortable speaking for the administration, but that he does feel comfortable with these numbers.

REPRESENTATIVE JOSEPHSON asked whether Mr. Loeffler knows what the tax would bring in.

MR. LOEFFLER replied that, on average, in 2014 dollars the fisheries business tax brought in $22 million, and the fisheries resource landing tax, the state's share only, brought in another $6.3 million. Therefore, it brought in $28.3 million on average and when raising it by 20 percent it brings in 20 percent more. He reiterated that it includes the state's share only and if the local share is added it is the amount [depicted in green stripes in the Figure 1 graph.]

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MR. LOEFFLER specified that the picture on the slide entitled, "Mining," is of the Fort Knox [Gold Mine] pit and tailings lake. He then moved to the slide entitled, "Figure 2. Mining," and said that state revenue for mining is somewhat different. Although it brings in close to $100 million, the cost to manage mining is much less, roughly $10 million over those five years. When including the capital budget it doesn't change much because the capital budget for mining is relatively small - there were only two projects spread over the years that were looked at. The amount to localities is about $22 million and is not spread as broadly as the fishing industry, it is in those localities where the large mines are located. The $22 million comes from the Red Dog Mine, Greens Creek Mine, Kensington Mine, Fort Knox Mine, and to a lesser extent the Usibelli Coal Mine. He said that the Red Dog Mine is about the only taxpayer in the Northwest Arctic Borough, the two biggest taxpayers in Juneau are Greens Creek Mine and Kensington Mine, and Fort Knox is the largest taxpayer with the exception of the Trans-Alaska Pipeline System in Fairbanks.

MR. LOEFFLER displayed the slide entitled, "State Mining Revenue: $96.4 million," and noted that, to the state only, mining brings in 6-8 times its cost. About 40 percent of the revenue to the state comes from the mining license tax, one-third from corporate income tax, and mining rents and royalties are 20 percent but are only for the mines that are on state land

- Fort Knox Gold Mine, Pogo Gold Mine, and the Usibelli Coal Mine - plus the placer mines.

MR. LOEFFLER pointed to the slide entitled, "State Mining Operating Budget: $10.7 million," and said that roughly two-thirds is the Department of Natural Resources (DNR), although some of the costs DNR passes through to other agencies in that for permitting of the state's large mines there is an unusual situation where the state does the permitting and enforcement and bills the company through a voluntary procedure. When the Alaska Department of Fish & Game (ADF&G) performs fish studies in preparation for mine permitting, that is typically paid for by the company but included in the DNR budget. Of interest, he noted, the Department of Law (DOL) for mining is shown separately because it is a larger amount that reflects "you don't do much in mining without being sued."

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MR. LOEFFLER turned to the slide entitled, "Capital Budget: $4.0 million," and advised that there were really only two capital projects over those three years, which averaged about $4 million a year. He then turned to the slide entitled, "Municipal Revenue: $22.5 million," and advised it includes the Northwest Arctic Borough, Fairbanks North Star Borough, City and Borough of Juneau, and the Denali Borough.

MR. LOEFFLER addressed the slide entitled, "Mining Caveats: averages don't represent all segments." He said that the mining average doesn't represent all of the industries because the placer industry is very different from coal mining. Drawing attention to the slide entitled, "Revenue dependent on prices," he observed that for mining, this study would have been very different 15 years ago when gold prices were $250 an ounce. This is because, like the commercial fishing industry, mining revenues depend on metal prices and the amount mined. When gold and zinc prices were really low the state did not get much revenue. So, historic mineral prices have gone up and historic mining revenues have gone way up.

MR. LOEFFLER turned to the slide entitled, "Revenue *not* Included," and pointed out that there are important revenues not included in the state's revenues for mining. The Usibelli Coal Mine spends almost $20 million a year shipping coal on the railroad. He said this study did not include that as a revenue to the state for two reasons: first, if revenue is included the cost must also be included and the costs of the railroad are

proprietary; and second, the railroad is not part of the general fund in a sense in that it is a corporation. He offered his understanding that the railroad does not receive operating appropriations from the legislature and it does not give the legislature revenue and therefore it was not included for this report. There were about $12 million in payments to the Alaska Industrial Development and Export Authority (AIDEA) for the Red Dog Road and those payments pay back AIDEA bonds. He explained that AIDEA owns the Red Dog Road and it tolls zinc travel over the road, which pays back the bonds AIDEA spent plus a little more, thereby making a profit that AIDEA keeps internally and a portion is paid to the legislature.

MR. LOEFFLER brought attention to the slide entitled, "Figure 2. Mining," and reported that mining brings in $6-8 million to the state. In addition there is $22 million in revenue to local municipalities.

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REPRESENTATIVE SEATON inquired whether the local revenue is additional local mining taxes.

MR. LOEFFLER replied yes, and said it includes the property taxes from Greens Creek on the mine in particular, and it does not include property taxes for "related stuff." It also includes the local taxes and Payment in Lieu of Taxes (PILT) from the Red Dog Mine to the Northwest Arctic Borough.

REPRESENTATIVE SEATON understood that those were locally assessed and were locally assessed in basically two areas.

MR. LOEFFLER responded yes.

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REPRESENTATIVE TARR referred to the slide entitled, "Capital Budget: $4.0 million," and observed that it states two projects spread over five years.

MR. LOEFFLER responded that it is an error, the five years should be three years.

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REPRESENTATIVE JOSEPHSON asked whether the best source to compare tax rates on the mining industry is from the Fraser Institute.

MR. LOEFFLER answered no, a variety of reports are done. Dr. Otto [ph] prepared a report for the Alaska Department of Commerce, Community & Economic Development about 8-10 years ago, and the World Bank has prepared reports as well. He offered to send the committee the important parts of that comparison.

REPRESENTATIVE JOSEPHSON inquired about expenses for remediation such as at the Illinois Creek and Rock Creek mines.

MR. LOEFFLER explained that the state did not pay anything for those. Illinois Creek Mine was paid for by the mining so there was no state expenditure.

REPRESENTATIVE JOSEPHSON understood $20 million of remediation was needed for Rock Creek Mine.

MR. LOEFFLER replied the state did not pay for that.

REPRESENTATIVE JOSEPHSON asked whether the remediation has been done.

MR. LOEFFLER responded he does not know about Rock Creek, but he knows a lot about Illinois Creek.

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REPRESENTATIVE TARR stated she is aware that the mines have to bond for the reclamation work, but state employees would oversee that work so there would be some impact [to the state].

MR. LOEFFLER apologized and said there are some state salaries involved in that, although a lot of that is billed back to the company. With regard to Illinois Creek Mine it was not because the company went bankrupt, but he does not know what happened with the Rock Creek Mine.

REPRESENTATIVE TARR requested more information in sorting that out because in her experience, the bonds do not cover the costs of the remediation and if the company goes bankrupt then any leftover remedial costs would have to be picked up by the state. She said this has happened in the past, but maybe not on the aforementioned examples.

MR. LOEFFLER agreed it has happened occasionally with placer mines and money has been taken from the bond pool of bonds that the placer miners have paid. With respect to the large mines, Nixon Fork Mine and Illinois Creek Mine went bankrupt. Nixon Fork was on federal land and other than occasional trips out there to inspect there were no federal expenditures, and it is back in business now in temporary cessation. Illinois Creek Mine went bankrupt in 1996 and he considers it a success story in that it was reclaimed without any state expenditures except state salaries, and the result was a "permanent fund, if you will," just to manage Illinois Creek Mine and monitor it for 30 years. It is now at $1 million, which the state holds and is state money, in case something goes wrong with the remediation. Therefore, the state has not spent any state funds other than the incidental salaries, which would be in the state operating budget so they'd be counted for remediation of any of the placer or large mines in Alaska.

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REPRESENTATIVE JOSEPHSON related that his sense from the community is that the potential impact of mining can't be seen for decades, whereas any harm coming from the fishing and oil industry is seen by the general public as less likely. He asked how to calculate those expenses and whether this perception is unfair.

MR. LOEFFLER answered yes. He said that the Mount Polley Mine disaster was clearly a catastrophic example and "we have not had that in Alaska." He pointed out that if a mine is reclaimed without a lot of open water, "they are very unlikely." However, the ongoing chronic effects don't often require years and years, they often show up. Mr. Loeffler continued:

> I will say that Alaska has certainly the country, certainly maybe the hemisphere, possibly one of the world's best monitoring systems. ... Now I'm not talking as an ISER employee, I'm talking back from to monitor the long term ... water quality impacts. And really that goes back to the excellence of Fish & Game. It was invented by Fish & Game where they do bio-monitoring of the algae, the mid-level microbial, the fish. Fish & Game monitors the water quality. So that level of monitoring is actually extremely good in determining if there is some long term effect. Now you can of course have acid mine generation that

doesn't show up for years afterwards and that of course is possible. We're relatively confident we have some idea of the acid generation of our mines and we have had two - Greens Creek and Red Dog have been operating since 1990, so that would be 25 years. Red Dog has obvious acid generation potential and Greens Creek has some as well, but ... that's been part of their ongoing reclamation.

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REPRESENTATIVE SEATON referred back to the discussion regarding mining taxes and opined that the bond was not sufficient for the Illinois Creek Mine but the belief was that there was enough gold to pay. The bankruptcy situation occurred and after that the state increased the bonds to ensure those would be covered.

MR. LOEFFLER agreed the mine was under-bonded but said a bond was not required at that time. A Department of Environmental Conservation (DEC) bond was required but the state bond was capped. In roughly 2002, the law was changed to allow for full bonding. He reminded the committee that he was director [of the Division of Mining, Land and Water] at the time, and said he was pleased to help push that bill.

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CO-CHAIR NAGEAK [referring to the slide entitled, "Revenue dependent on prices"] asked whether the fluctuation between 2004 and 2012 in gold revenue has anything to do with the life of the mine and then finding another mine and receiving more revenues from the new mines.

MR. LOEFFLER replied that he thinks it was a combination of the price of gold and the price of zinc. Responding further to Co-Chair Nageak he said the price of gold went way up and the dip is probably due mostly to the price of zinc. Much of the state's money comes from Red Dog Mine, which is a zinc mine with no gold.

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MR. LOEFFLER next addressed the topic of tourism. Displaying the slide entitled, "Figure 3. Tourism," he said tourism is a much harder industry to analyze because it is a collection of products and services, and a lot of what is done to manage tourism is also done to help Alaskans. For example, sport

fishing is managed to help tourists, but it also helps Alaskans. Another example is the state giving a capital project to the Anchorage Museum and 50 percent of its visitation is tourists and 50 percent is Alaskans bringing their kids. And the same is true to some extent for many of the other things.

MR. LOEFFLER turned to the slide entitled, "State Tourism Revenue: $54.3 Million," and reported that the tourism industry brings in about $80 million to local communities, which is a significant amount of money and many communities rely on tourism for the fiscal health of their government. When discussing state expenditures solely, the state brings in about $18 million more than its operating budget, and roughly equal when including the capital budget. He explained that the difference when including the capital and operating budgets would be roughly equal for state revenue and expenses only. Approximately half of the revenue is cruise ship taxes that were all put in in 2006, a little over one-third of it is hunting and fishing licenses, and the remainder is the state portion of vehicle rental tax and corporate income tax.

MR. LOEFFLER drew attention to the slide entitled, "Operating Budget Cost: $35.9 Million," and explained that for the Alaska Department of Fish & Game (ADF&G) it is mostly sport fish, and the question is how much of the Division of Sport Fish is a tourism expenditure and how much is to help Alaskans. He explained that for the report it was determined that 43 percent of the visitor days in sport fishing are by tourists and therefore is 43 percent of [ADF&G's] general fund budget. He advised that another major portion is the Department of Commerce, Community & Economic Development and a lot of that is essentially the tourism marketing initiative.

MR. LOEFFLER displayed the slide entitled, "Operating Cost Assumptions," and pointed out that tourism, unlike fishing and mining, has many economic assumptions to determine. So, for the report, 20 percent of DNR's Division of Parks & Outdoor Recreation's budget was used because the parks get about 20 percent of the visitation from tourists, 43 percent of ADF&G's Division of Sport Fish budget, and 14 percent of ADF&G's Division of Wildlife Conservation general fund because 14 percent of the state's hunting and fishing licenses are bought by outsiders.

MR. LOEFFLER moved to the slide entitled, "Tourism Capital Budget: $19.4 million," and said that about 110 capital projects had some portion of which was for tourism, roughly $20 million a

year. He turned to the slide entitled, "Municipal Revenue: $82.6 million," and said local government gets a lot from tourism: 13 percent of the pass through taxes are from cruise ships, visitor related sales tax industry, bed tax, and dockage and moorage revenue which is Ketchikan and Juneau's assessment on cruise ships.

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MR. LOEFFLER turned to the slide entitled, "Tourism Caveats," and reiterated that tourism is difficult to estimate and the expenses overlap in that what is done for tourists is also done for Alaskans. He noted that it requires many economic assumptions in that the average from a bear hunt or a Bristol Bay lodge may not be the same as for the trains.

MR. LOEFFLER moved to the slide entitled, "Revenue *not* Included," and stated that the report does not include the $21 million that the railroad gets from out-of-state visitors because there is a cost associated with it and the revenue money does not come to the legislature to appropriate. The Alaska Marine Highway System was different in that it receives approximately $20 million a year in non-resident fares, but its costs are so much greater than its revenues. It was determined that without tourists the marine highway might run a few less ferries and then the state would save money. In fact, he related, previous analyses have included the Alaska Marine Highway System as a net cost, but he and Mr. Colt disagree that getting $20 million from non-residents cannot be a net cost because "that's too weird." It is included here and committee members can think of it however they wish.

MR. LOEFFLER turned to the slide entitled, "Figure 3. Tourism," and said the conclusions are relatively robust in that many local communities rely on the total $80 million, "but that with respect to the state and the state only, with respect to the operating budget we get in a little more, with respect to ... include the capital budget ... in 2014 it's roughly equal."

1:47:19 PM

REPRESENTATIVE SEATON acknowledged the margin of error, and noted the situation in the center graph of Figure 3 of expenses/ capital costs, especially when adding something on for ferry costs possibly being more than revenues. He understood the governor has a bill regarding the extra amount allocated to Juneau and Ketchikan of approximately $7.00 per person that

would stay with the state. He asked whether Mr. Loeffler has analyzed the bill to know where on the graph that would put the state line instead of municipal line.

MR. LOEFFLER said he does not know what the governor's projection is.

1:48:19 PM

MR. LOEFFLER brought attention to the slide entitled, "Some Observations: Management Cost," to provide his observation about how little it costs the state to manage the mining industry. Turning to the slide entitled, "Revenue as [Percent] of First Market Value: Similar among the industries," he noted that he and Mr. Colt took what he would call the "first market value," which is ex-vessel value, the value of minerals, the "GDP" of tourism, and looked at the state's revenue as a percent of that. Much to his surprise, he reported, they were all pretty similar. Today, mining would be significantly down due to metals prices and fishing would be down due to fish prices. However, overall for the five year period covered by the report, he was surprised that these three industries were relatively similar. Responding to Representative Seaton, he explained that "GDP" is the expenditures by tourists in the state.

MR. LOEFFLER lastly reviewed the slide entitled, "These industry revenues do not compare to oil," and said when people think of industries they think of oil, and that all of these industries are a very small portion of what oil brings in. He then drew attention to the slide entitled, "A Final Caveat..." and remarked that these industries are most important for their economic portions - for people who set net, for keeping the Northwest Arctic Borough a borough, for all of the things that industries do to support the state of Alaska. He said his presentation today is just a small portion of those fiscal impacts.

REPRESENTATIVE TALERICO commented that the legislature is moving forward and vetting a lot of revenue proposals and several are within the topics that Mr. Loeffler just brought forward.

1:51:13 PM

The committee took an at-ease from 1:51 p.m. to 1:56 p.m.

**Salmon Genetics by Jeff Guyon, National Oceanic & Atmospheric Administration, and**

## Bill Templin, Alaska Department of Fish & Game

1:56:55 PM

CO-CHAIR TALERICO announced that the final order of business is an overview on salmon genetics by the Alaska Department of Fish & Game and the National Oceanic & Atmospheric Administration.

1:57:02 PM

BILL TEMPLIN, Principal Geneticist, Gene Conservation Laboratory, Division of Commercial Fisheries, Alaska Department of Fish & Game (ADF&G), said that he supervises the gene conservation laboratory within the Division of Commercial Fisheries.

1:57:15 PM

JEFF GUYON, PhD, Supervisory Research Geneticist, National Marine Fisheries Service (NMFS), Alaska Fisheries Science Center's Auke Bay Laboratories (ABL), provided a PowerPoint presentation entitled, "Genetic Stock Composition Analysis of Salmon Incidentally Caught in Alaska Federal Groundfish Trawl Fisheries." He said his presentation relates to the salmon work being performed at the Auke Bay Laboratories, but highlighted that they also work on a number of different fish species, including herring in Lynn Canal and Prince William Sound. Genetics are used to distinguish between closely related rockfish species, and through a collaborative studies a new species of sand lance was discovered. He explained that they collect a sample from a fish, take the biological data, digitize it into a genetic term called genotyping, and that each dot represents an individual fish. He said the reason being that when fish are caught at sea they determine the impacts of the harvest of those fish.

DR. GUYON turned to the portion of his presentation regarding "Genetic Stock Composition Analysis of Chum Salmon Bycatch from the 2013 Bering Sea Walleye Pollock Trawl Fishery." The issue, he noted, is the large pollock fishery in the Bering Sea that catches over a million tons of pollock. That fishery is quite clean, but because it is so large the fishermen encounter other species, including chum salmon. Genetics are used to determine where those chum salmon are coming from and what the impacts are of catching those chum salmon. He drew attention to the slide entitled, "Chum Salmon Bering Sea Bycatch," and pointed out that the size of the chum salmon bycatch peaked in 2005. In 2013,

about 125,000 chum salmon were incidentally taken in federal trawl fisheries in the Bering Sea. Analyses have been done in the past to determine where those stocks of fish are coming from and these analyses have used scales and allozymes, a protein variant for genetic studies. Much of the work NMFS performs synergizes with state agencies. From 2005-2013 microsatellites, another genetic marker, have been used and for 2013 the sample set was 4,123 fish. The good news, he pointed out, is that all these different analyses by the University of Washington, Alaska Department of Fish & Game, and the National Marine Fisheries Service have produced similar results.

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DR. GUYON turned to the slide entitled, "Our Stock Grouping," and said they try to determine where fish are coming from by describing different groups of fish. The baseline used is the baseline developed in Canada through collaborations with different groups. Each dot represents populations of fish. Chum salmon that are caught in the Bering Sea can be caught from throughout the species range; therefore, a baseline is needed that encompasses populations throughout the entire species range. Those populations are grouped into six different regions so the stock composition re-partitions the fish back to those six regions.

DR. GUYON turned to the slide entitled, "2013 Chum Salmon Bering Sea Bycatch, Statistical week," and advised that the pollock fishery is separated into an "A season" and a "B season." The "A season" is the spring season where a lot of pollock is caught but not a lot of chum salmon. However, within the "B season" fishermen start to pick up chum salmon. The genetic samples are picked up in the "B season" and the sample distribution closely mimics the actual catch distribution. He explained that each dot on the slide entitled, "2013 Chum Salmon Bering Sea Bycatch, Number of 'B' season chum salmon bycatch per vessel," represents an individual vessel fishing in the Bering Sea during the fall "B season." He picked out a dot and said it would have harvested over 3,000 incidentally caught chum salmon, and with that is shown the number of genetic samples that were collected. The line on the graph represents a sampling rate of 1 in 30, and he expressed amazement that hardly any vessels deviate from the 1 in 30. Therefore, he explained, there are over 100 different vessels, all with different observers, going through the different distribution points, such as Dutch Harbor, Sand Point, Kodiak, Seattle, and Anchorage, and these are getting shipped to Auke Bay Laboratories and at the end this is what the lab gets.

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REPRESENTATIVE SEATON understood that the vertical axis of the graph is the number of genetic samples and the bycatch is per vessel. He asked whether that means the number of samples is directly related to the number of salmon caught.

DR. GUYON replied exactly right. It was a simple approach to sample 1 out of 30 fish encountered, but the ability to get to that required some restructuring of the observer program and it was a large process. He noted that it is amazing, given the number of vessels, that they were able to do that.

REPRESENTATIVE SEATON surmised that the purpose is to demonstrate that the lab is effectively sampling no matter what the catch per vessel, thereby, accurately sampling about 1 in 30 of each of the fish so there is not a skewed distribution base.

DR. GUYON agreed.

CO-CHAIR TALERICO presumed that the catch percentage does not vary on a per capita type basis, that they are all reasonably close regardless of the volume they actually take.

DR. GUYON agreed and said the sampling rate is exactly the same. He reiterated that each dot on the graph is an individual vessel in the "B season."

REPRESENTATIVE SEATON surmised that they could have quite different bycatch rates. The chart indicates the sampling rate of the number of chum salmon that they had, even if some of the vessels were "dirty fishing" and getting lots of bycatch and others were getting fewer bycatch. The chart is saying that the sampling effort was 1 in 30, no matter what.

DR. GUYON agreed.

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DR. GUYON turned to the graph on the slide entitled, "Chum Salmon Bering Sea Bycatch - Proportions." He explained that the stock composition results are shown in red, but cautioned that the sampling was performed differently in different years. He said these are the six different stock group, and the Y axis is the proportion. In 2013 about 15 percent of the fish came from SE Asia, which is Japan mostly; about 45 percent of the fish

came from Northeast Asia, which is Russia. So about 60 percent of the fish are Asian in origin and about 40 percent are from North America with this distribution. He noted that this stock composition gives a proportion of the catch. He then turned to the slide entitled, "Chum Salmon Bering Sea Bycatch - Number," and explained that the actual numbers of fish are determined by taking those proportions and multiplying them by the actual numbers of fish to determine the potential impacts. For example, the proportion from Western Alaska was multiplied by the number of chum salmon that were encountered in the bycatch to come up with the estimate of about 22,000-23,000 fish that came from Western Alaska.

DR. GUYON stated that the slide entitled, "2013 Chum Salmon Bering Sea Bycatch, Area 517," indicates the stock compositions by time and area of where the chum salmon are intercepted in the Bering Sea in order to determine whether there are differences that might assist in making regulations. He explained that the slide entitled, "CIAP-WASC chum salmon collections," highlights the collaborative project working to determine whether some of the stock grouping of chum salmon in Western Alaska could be further differentiated. The collaboration included: Western Alaska Salmon Coalition (WASC), a group of organizations from Western Alaska; University of Alaska Fairbanks; Alaska Department of Fish & Game; and the National Marine Fisheries Service (NMFS). Currently, he said he is saying that a certain number of fish come from Western Alaska, but they could come from the Yukon River, the Kuskokwim River, and other places in Western Alaska.

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DR. GUYON turned to the portion of his presentation entitled, "Genetic Stock Composition Analysis of the Chinook Salmon Bycatch from the 2014 Bering Sea Pollock *(Gadus chalcogrammus)* Trawl Fishery." He related that this is recent information that has to do with the large pollock trawl fishery in the Bering Sea and is about the Chinook salmon that are also taken incidentally in addition to the chum salmon. The study is to try to determine where those Chinook salmon are from. Turning to the graph entitled, "Chinook Salmon Bering Seat Bycatch," he pointed out that the purple line shows the magnitude of the Chinook salmon bycatch in the Bering Sea from 1992-2014. The bycatch peaked in 2007. There is an "A season" in the spring and a "B season" in the fall, and the purple line is the total bycatch of those two seasons. The study is using scales and snips, a genetic marker, to determine where the Chinook salmon are from.

Like with the chum salmon, researchers are getting similar results using different techniques. In response to Representative Tarr, he reiterated that the "A season" occurs in the spring and the "B season" occurs in the fall.

DR. GUYON continued his explanation of the slide, noting that the salmon samples are partitioned to determine where they are from by using a genetic baseline developed by Bill Templin of the Alaska Department of Fish & Game. Referring to the maps on the next two slides with Mr. Templin's name on the bottom right, DR. GUYON explained this baseline is comprised of 172 populations; each dot on the maps is a population of fish that have been aggregated into 11 stock groupings. The samples that have been gathered will be partitioned in to those 11 groupings.

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DR. GUYON displayed the slide entitled, "2014 Chinook Salmon Bering Sea Bycatch," and pointed out that the blue line is the bycatch broken down by the different statistical weeks for the A and B seasons. [The Y axis on the left is the bycatch] and [the Y axis] on the right represents the samples that were taken. The dots are the samples they have.

REPRESENTATIVE JOSEPHSON asked whether the graph indicates that during the time of harvest of Chinook salmon there is more bycatch.

DR. GUYON replied that the actual harvest of pollock is not being shown here. He explained that most of the time the "A season" encounters more Chinook salmon bycatch than the "B season," although that is not always the case as there are differences in different years of when Chinook salmon are encountered.

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DR. GUYON turned to the slide entitled, "Chinook Salmon Bering Sea Bycatch - Proportions," and said the results shown are for seven years of analysis [2008-2014]. He cautioned that consideration must be taken because of how the samples were collected. The graph shows that 50 percent of the samples came from the coastal Western Alaska in 2014, and that the majority of samples encountered in the Bering Sea are from river systems that flow into the Bering Sea. He said there is representation from all of the different stock grouping that are in the baseline, but the majority of fish come from river systems that

flow into the Bering Sea. This is different than what is seen in the Gulf of Alaska, he said.

DR. GUYON then addressed the portion of his presentation regarding the "Genetic Stock Composition Analysis to the Chinook Salmon Bycatch Samples for the 2014 Gulf of Alaska Trawl Fishery," which is a report that just recently came out. He said the pollock fishery in the Gulf of Alaska (GOA) is smaller than that in the Bering Sea. There are other trawl fisheries in the Gulf of Alaska, including rockfish and arrowtooth flounder that incidentally catch Chinook salmon, but do not tend to catch chum salmon. Displaying the graph entitled, "Chinook Salmon GOA Bycatch," he explained that it shows the magnitude of total bycatch (in purple), bycatch from the GOA pollock trawl fishery (in red), and other fisheries (in green).

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REPRESENTATIVE OLSON asked whether the bycatch has been broken out by vessel.

DR. GUYON answered that there is information by vessel, but some of the data is protected under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). So, how the data is aggregated is more complicated.

REPRESENTATIVE OLSON said he has heard anecdotally that it was limited to several vessels.

DR. GUYON replied that he will be addressing this in a few slides. Continuing his presentation, Dr. Guyon said that the previous stock composition analysis was performed by the Alaska Department of Fish & Game and University of Washington in previous years, and with the National Marine Fisheries Service in the following years. And once again, he pointed out, the chart shows the same thing which is always a good thing.

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DR. GUYON turned to the slide entitled, "2014 Chinook Salmon GOA Bycatch - Pollock," and said it may get to Representative Olson's comments. He explained that the blue line represents the bycatch that occurred and the dashed line represents the sample set. The manner in which bycatch is enumerated and samples collected is different in the Gulf of Alaska than in the Bering Sea due to the smaller size of the fishing vessels. He explained that it is more difficult for the National Marine

Fisheries Service (NMFS) to put an observer on smaller boats as opposed to the larger vessels in the Bering Sea. As such, some of the numbers get extrapolated. There is systematic random sampling with proportion to cruise. This is then normalized by using a weighted approach to come up the stock compositions. It was found, he pointed out, that not a lot of fish are from the Bering Sea, but rather are flowing stocks that include the Pacific Northwest, British Columbia, and the Gulf of Alaska.

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REPRESENTATIVE SEATON asked how the timing of this collection compares with the timing of the "A season" and "B season" in the Bering Sea.

DR. GUYON answered that the timing is similar because there is a spring fishery in the Gulf of Alaska that is divided into both the "A season" and "B season," and how they've done that is for various historical reasons. In the fall there are "C" and "D" seasons, however there is some fishing that occurs outside those boundaries.

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REPRESENTATIVE TARR noted that there is another effort reviewing the origin of certain fish, particularly Chinook, to determine what is going on with the population numbers. Some of that is consistent with what Dr. Guyon studies are seeing as far as the origin from British Columbia and the western coast of the United States. She recalled that there was surprise to find that the [Chinook] were coming from such great distances; for example the origin of salmon in the GOA being all the way down in British Columbia. She further recalled that this information came from the Kenai River Sport Fish Association. She asked whether Dr. Guyon had the same reaction of surprise regarding the geographic distribution.

DR. GUYON replied that the scale pattern analysis suggested there would be differences between the Gulf of Alaska and the Bering Sea. A lot of the work in the Bering Sea is coming from results from 2010 and 2014, and they are inherently quite reproducible from one year to the next year. He offered that he has been surprised by how one stock composition is done one year and, then given the changes that occur in the fishery, that it's been relatively stable.

REPRESENTATIVE TARR queried whether the finding that the salmon were coming from as far away as the west coast was a surprise.

DR. GUYON responded that researchers also had coded wire tag data and recoveries of coded wire tags have come from California groups up into the Bering Sea. So, there was an understanding that salmon do make a longer migration based on some of the tag recoveries. What did surprise him was not picking up many fish from the river systems that flow into the Bering Sea - finding how much that went down.

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REPRESENTATIVE SEATON said he represents the legislature on the "West Coast Fisheries Task Force" for various states. He advised that a few years ago the Klamath River was experiencing the biggest run it had ever had during the same time that Alaska was experiencing very small runs. He asked whether the pattern of recovery that Dr. Guyon is seeing is based on the abundance in certain river systems and their production.

DR. GUYON answered that the samples are from fish that fishermen are trying not to catch, which is different than in a regular fisheries survey sampling, so sometimes it is difficult to extrapolate. However, a lot of times it is the only data that researchers have. He expressed that it is worthwhile to continue doing analysis every year and that by continuing the analysis from one year to the next year allows researchers to get to some of those questions.

REPRESENTATIVE SEATON asked whether wild stocks versus hatchery stock are included in any of the analyses that are being done.

DR. GUYON replied that researchers work with the North Pacific Fishery Management Council and the data has been presented. The council has a science and statistical committee that has asked that some of the data be extrapolated from coded wire tag recovery and use it in conjunction with Dr. Guyon's genetic data to determine the proportion of hatchery fish being caught for Chinook salmon. In a month or so there will be discussions on attempting to do something like that.

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DR. GUYON addressed the slide entitled, "Rockfish - GOA Chinook Bycatch," and highlighted that there is not a requirement for the National Marine Fisheries Service to collect these samples.

Therefore, these samples are collected by industry at industry's own expense and sent to him for analysis. He noted that the rockfish fishery depicted on this slide is for areas 620 and 630, which are right off Kodiak. The industry collected in a census approach - a genetic sample was collected from every single salmon that the industry encountered in both 2013 and 2014. The samples were sent in for analysis and the stock composition show in the chart is the result of that analysis.

DR. GUYON discussed the slide entitled, "Arrowtooth Flounder - GOA Chinook Bycatch," and pointed out that industry also collected these samples at industry's own expense and with no requirement to do so. In 2013 and 2014, it was opportunistic sampling as opposed to census and the chart depicts the stock composition for those two years.

DR. GUYON concluded with the slide entitled, "Acknowledgements," and noted that it acknowledges everyone who assisted in the analyses. The amount of time, money, and effort that has been put into collecting these samples is amazing and a tribute to all the hard-working folks in the observer program. Those hundreds of observers are working under very difficult conditions. The Alaska Department of Fish & Game helped out with the baseline and some of the statistical work. The Alaska Groundfish Data Bank and the Alaska Seafood Cooperative are the two industry groups that collected the samples from the rockfish and arrowtooth flounder fisheries. Funding for this work came from the National Marine Fisheries Service, and NMFS was funded for a while through the Alaska Sustainable Salmon Fund with a matching grant from the North Pacific Fisheries Research Foundation, an industry group.

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REPRESENTATIVE JOSEPHSON noted that the Department of Environmental Conservation (DEC) at one time did more fish tissue sampling out of Southeast Alaska. He understood that the budget for that was cut in half. He asked whether Dr. Guyon or Mr. Templin are familiar with the budget cut and whether it impacted their work.

MR. TEMPLIN replied he has no information related to the budget cut and said that sampling for fish goes on in Southeast Alaska under a number of programs. He offered to find the information for the committee.

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MR. TEMPLIN began his presentation entitled, "Alaska's Genetics Program, Genetics applications for fisheries management." He noted that Dr. Guyon's presentation is a large-scale project that provides direct information in a very consistent manner to help fisheries application, especially in federal fisheries, while his overview is of all the other things that the State of Alaska uses genetics to help achieve its management goals and mission. Turning to the two slides entitled, "Why does ADF&G have a genetics lab?" he advised that ADF&G's mission is to:

> protect, maintain, and improve the fish, game, and aquatic plant resources of the state, and manage their use and development in the best interest of the economy and the well-being of the people of the state, consistent with the sustained yield principle.

MR. TEMPLIN explained that the genetics lab provides information and assessment that gives the department the information needed to improve management, allow for the development of new uses for resources while at the same time protecting the resources for the future. To achieve that, the laboratory provides four main services: 1. To provide an understanding of the resource, such as where the fish are coming from, whether the fish are different from each other, whether the fish in one stream are the same as the fish in another stream; 2. Help develop capabilities for management by providing tools, such as those being used by Dr. Guyon to look at the bycatch on the open ocean; 3. Assess genetic risk of human activities; therefore, the lab is involved in permitting of hatchery or fish resource uses, and the lab is becoming increasingly involved in mariculture, which includes marine invertebrates and seaweeds; and, 4. The lab has direct applications to inform or assess management actions, how the department can help provide the best economic opportunities while also providing for the escapement necessary for future production.

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MR. TEMPLIN turned to the slide entitled, "Questions that use genetic information," and outlined seven questions. 1. Did exposure to oil cause genetic injury in pink salmon populations in Prince William Sound? 2. What species of salmon is this? The lab is often sent tissue from fish that no one is able to identify. So, one application is that the lab helps to identify Atlantic salmon escapees from farms in British Columbia. 3. Is this crab a hybrid? Many of the crab fisheries have different

regulations for two different species and for the hybrids between those species. 4. Which broodstock are these hatchery salmon from? 5. What is the genetic structure of these populations? This is one of the most important areas that the lab works in because of the theory that salmon in different locations will be genetically distinct from each other because they are isolated. The genetics laboratory allows the going out and taking of measurements that can then be used for management. 6. Where are these fish going? For example, the lab takes samples from the Pilot Station test fishery on the Lower Yukon River and assesses the percentage of Canadian fish moving past Pilot Station, which is immediately useful information performed in-season so that the managers will know how many Canadian fish are passing. 7. Whose fish are being harvested? This is always a question in fishing communities. For example, in Southeast Alaska the lab has assessed the stock structure of the harvest of Chinook salmon and has directly used that information for applications in the Pacific Salmon Treaty.

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MR. TEMPLIN discussed the first of five slides entitled, "Applications: Understanding the Resource, Example: Red king crab population structure." He said this work began in the laboratory in the 1990s. It had direct forensic applications to a situation where someone was saying they had captured red king crab in one area, but the evidence was that they had captured it in another area. Enforcement elected to let genetics decide and that is how the genetics laboratory first started and was eventually funded. [Referring to the map on the first slide] he explained that red king crab occur across the North Pacific and all the way from the Sea of Japan over to Southeast Alaska. It would be expected that king crab would be different across that that area, but how to manage with that information when one does not have that information. Turning to the second slide in the group [a map of Alaska in grey with yellow dots], he said each dot represents samples that were taken in crab producing areas throughout the state and one sample from Russia.

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MR. TEMPLIN addressed the plots on the third slide in the group. He explained that each dot is a population and that on this space the closer any two dots are the more genetically similar they are, the further apart they are the more genetically distinct they are. Thus, this is a map in genetic space rather than geography. He noted there is a lot of space between the

red dots on the right. The yellow dots come from the Western Gulf of Alaska and Eastern Bering Sea across the Alaska Peninsula. Of the three blue dots, one comes from Russia, one Norton Sound, and one from the Aleutians - geographically there is a wide amount of area between the blue dots, but genetically there is not as much distinction. Returning to the red dots, he pointed out that the top red dot on the far left is Seymour Canal in Southeast Alaska, so the red dots indicate that the populations are distinct genetically even though they are geographically very close together.

MR. TEMPLIN moved to the fourth slide in the group to elaborate regarding the pattern of diversity. He explained that the arrows show where the groups of dots originate from, and that the height of the dot in the plot is a measure of its genetic diversity. Moving towards the east geographically, the level of diversity among populations decreases. Turning to the fifth slide in the group, he discussed the implications of the aforementioned for fisheries management. First, gene flow and ice-age isolations provide information on the pattern of how this population structure has occurred over time and so it offers a sense of what might happen in the future as well. Second, red king crab might be managed on a small geographic scale in some regions, given it was seen how distinct red king crab populations were from each other in Southeast Alaska, a small area, while it was seen by the blue dots across a wide area that they are less distinct - so in some areas genetic concerns might be more important than in other areas. Third, this can be used as guidance for possible stock enhancement. Projects are being undertaken, not by the state, looking at enhancing red king crab populations. This type of information is very important for the permitting side of what the department does in guiding human activities.

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MR. TEMPLIN turned to the first of seven slides entitled, "Applications: Develop Capabilities, Example: Chinook salmon coastwide baseline." He noted that Dr. Guyon already showed a section of the Chinook salmon coastwide baseline. So, what he would like to show the committee is how the lab works together with different groups, thereby making it more efficient and less expensive. In regard to the Chinook salmon, he said ADF&G, National Oceanic and Atmospheric Administration Fisheries, and the University of Washington worked together to get various aspects of this coastwide baseline together. Turning to the second and third slides in the group, he noted that some Russian

samples were needed because the fish caught in Alaska are from everywhere, including Russia. The lab worked through the North Pacific Anadromous Fish Commission in a collaborative way to obtain samples from Kamchatka. In addition the lab received samples from the Pacific Northwest and from Southeast Alaska by working with the Auke Bay Laboratory. The lab also worked with its partners in the Pacific Salmon Commission as well as many laboratories up and down the west coast of the United States and Canada.

MR. TEMPLIN moved to the fourth slide in the group and reported that the samples and information generated from all of those laboratories were used by the ADF&G lab to put together a baseline of 172 populations of Chinook salmon from throughout the salmon's natural range. Each color and shape of dot on the map represents groupings and there are about 14 groups. These groups can actually be distinguished into much smaller groups, but for large-scale applications it does not make sense to get down to the last little river.

MR. TEMPLIN displayed the fifth slide in the group and stated that another way to show genetic relationships is to use what is called a tree. In the tree, each dot represents a population and each color relates to the same color depicted on the map. Dots that are closer together are more genetically similar to each other. He pointed out that Western Alaska - Norton Sound, Lower Yukon, Kuskokwim, Bristol Bay - are yellow squares on the map and on the tree these yellow squares are a tight cluster, indicating the level of genetic diversity in that very large geographic area. Other places, however, have lots of distinctions. There are a lot of very interesting geographic patterns; for example, in the Upper Yukon and Yukon Territories are reddish or purple squares and moving down the Yukon are the green squares and then when it dumps out into the Bering Sea are the yellow squares. There is a pattern of distinctiveness up and down the Yukon River which is handy for the department when using genetics in Chinook salmon on the Yukon River.

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REPRESENTATIVE TARR inquired whether there is general agreement among the researchers about how the 172 populations are defined so that everyone is talking about the same 172 population.

MR. TEMPLIN replied that that is the reason why the lab works together with many partners up and down the coast and throughout the range so everyone can all come to an agreement on the best

ways to organize these. That way the information is consistent report to report. He pointed out that the western United States and British Columbia are grouped because the sample size there was too small to be able to distinguish individual units "that they like to use down there but it is very helpful for them to know that in Bering Sea bycatch that there is at least a unit of ... British Columbia and a unit of west coast U.S. and they are in agreement with that." This baseline is currently being doubled and the number of snips, genetic markers, is being increased by a factor of about four. When that project is completed there will be much more resolution in this baseline and much more ability to distinguish. This will therefore increase Dr. Guyon's power to provide more information from the bycatch, and the department's ability will be greatly increased for Southeast Alaska.

REPRESENTATIVE TARR noted that the 172 populations were further broken into 11 different groupings [by Dr. Guyon] and into 14 groupings by the lab. She surmised that this is because each agency has different research needs. She further surmised that someone wanting to know more about population 172 would be confident that the data describing this population would be the same population.

MR. TEMPLIN answered correct. Basically, the National Marine Fisheries Service is using this baseline and these designations, but for the sake of providing more certainty around groups at the cost of resolution among groups, NMFS has chosen to group a few. So, it is hierarchical in that manner and NMFS has basically combined a few of these groups.

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REPRESENTATIVE SEATON referred to the slide with the tree and asked whether these are the closest relatives; for example, the Cook Inlet appears to be segmented away from the Seattle area. He recalled that in the past people have transported fish from one location and introduced them into others. He surmised that this current genetics information indicates that those genetic stocks did not take and the state is left with a quite different stock than that from the Washington area.

MR. TEMPLIN replied correct. That is the lab's evaluation when asked questions about whether these long distance transports of fish actually had an effect or took. Not only is the group of blue dots distinct from the ones down south, but they are fairly similar within themselves as well. This indicates that whatever

location those hatchery fish may have been planted in, it did not necessarily change their fundamental genetic signature. He added that "Neighbor Joining," as written in the bottom right of the slide, is a type of tree. There are a large number of different ways to organize these trees, and $F_{ST}$ is the measure of distance.

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MR. TEMPLIN brought attention to the sixth slide in the group with the subheading, "Stock-specific migration in the Bering Sea" and the citation "Murphy et al. 2009, *Stock-Structured Distribution of Western Alaska and Yukon Juvenile Chinook Salmon from United States BASIS surveys,* 2002-2007." He said one application that has been very useful for ADF&G in regard to treaty issues on the Yukon River, is knowing about the distribution of juvenile Chinook salmon in the Bering Sea during their first year after leaving the rivers. He explained that the darker the color on the map, the more Chinook salmon were captured in the trawl surveys in these areas; for example, in locations outside the river mouths. However, there are also areas where the salmon potentially mingle. The map on the right shows genetic stock identification of those fish from those different sections - Mixture 1, 2, and 3 moving south to north. What this basically means is that the fish on the north are identified as coming from the Yukon River, whereas the fish on the south are identified as coming from the Kuskokwim and Nushagak rivers. He said this work is very helpful and the work has been expanded upon and has become an index that is useful for forecasting Chinook salmon returns to the Yukon River.

REPRESENTATIVE SEATON asked whether the term "coastal" in the upper right legend means the Kuskokwim River.

MR. TEMPLIN responded yes and pointed out that the coastal group is the group of yellow boxes on the previous map. He said, "I've taken a whole big project and kind of crammed it down to give it to you in a couple of minutes and so I cut one piece out and that would be that this ... just north of the island here is kind of a valley in the abundance of Chinook salmon, and so because of the size of these fish, their age, the time that they would have left the rivers, we assumed that anything that was identified as coastal north of this island would come from the Lower Yukon, and anything south would be coming from the Kuskokwim/Nushagak area." Some of that is an assumption on the speed of time in which juvenile salmon can swim and their distribution in the ocean, but it can be seen that the dark and

blue portions in the pie chart for salmon which come from the middle and Upper Yukon River are not seen in the chart farther down south.

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MR. TEMPLIN turned to the last of the seven slides in the group and the second of two slides with the subheading, "Stock-specific migration in the Bering Sea." He said samples were obtained from across the Bering Sea, Gulf of Alaska, and the coast of Russia. This information can be used to get a sense of the movement of Chinook salmon across the North Pacific, Gulf of Alaska, and Bering Sea. Information from these samples corroborates prior studies with coded wire tags, he reported, but in much more detail and depth. It is also useful information for the Chinook Salmon Research Initiative and understanding ocean ecosystems.

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MR. TEMPLIN addressed the first of 17 slides entitled, "Applications: Assess Genetic Risk, Example: Chum salmon hatchery/wild interaction." He said a question often asked is how there can be so many Chum salmon in Prince William Sound without having effects on wild populations. He explained that a study was performed to get an answer and that he will walk the committee through the fundamental ideas by reviewing the next 16 slides:

> I've got five circles at the top, those are five different populations, their color indicates genetic nature. You can see they're all distinct from each other. Over time if they continue spawning in the same location, it'll maintain that structure. We know that wild salmon have some amount of straying amongst themselves, but it happens over a long period of time and it comes to an equilibrium over time which is what we really see. What we're looking at is the result of the past years of straying and returning to their own ... streams to spawn. Alright, so that's the system basically, over time pretty stable. Now we're going to take fish from one of these streams and we're going to put it in a hatchery and greatly increase it. Alright. And over time we expect because it is being brought back into the hatchery, not going back into the wild system, over time it will become

domesticated, it will change, it will get used to living in a hatchery, being born in a hatchery, not necessarily born in the stream. This is a human activity, it's what we do, it's how Holsteins came about, or bugs, right, dogs change over time. So, if we put this hatchery now in this area and we allow the hatchery, you see the hatchery straying. The idea is the hatchery will have a much higher stray rate, maybe not a rate, but number of fish because you're producing a lot of fish. But even if it's not a large number, it's still some of these fish potentially be showing up in the wild streams and over time those streams will become to look more and more like the hatchery. Now that's the theory. But nobody's ever really gone and measured it, does this really work, does this really happen? We do know that some streams are going to be resistant ... the hatchery fish may not do well in the stream or the hatchery fish may never stray there. Right. So, in the Prince William Sound we've got these streams ... each black dot is a major Chum salmon spawning location. We had samples from four of those, four of the natural populations and one from the hatchery. These samples came across time, from back we had scale samples that we could get DNA from, pre-hatchery, and we're able to go and take samples nowadays so that now we can compare for ... genetic change over time. So here's what we have ... we have these contemporary samples down here at the bottom, we've got the historical samples, and we can compare them to the hatchery. What did we end up with? Here's another one of those trees, I just have flattened it out a bit. If the populations were becoming more like the hatchery in a large way, you would expect all the contemporary samples to be centered, or close to the Wally Noerenberg Hatchery [WNH], the hatchery itself. But instead what we came across was that a lot of the genetic structure remains within these populations even after 30 plus years of Chum salmon production in Prince William Sound. You can see the historical and contemporary samples from each of these locations are closer to each other than they are to any other population. If you look up here and you see Wally Noerenberg right in the middle of Wells River, it's because the original population for Wally Noerenberg Hatchery is the Wells River. There was a little bit of Beartrap that was brought in, but no indication that it had an effect. One other thing

that we'd like to look at is how much is there change, and how much is it changing over time. Effectively this plot here is a comparison of the old sample to the hatchery on the ... X axis on the bottom, and the contemporary sample to the hatchery on the Y axis. Each dot is a genetic marker and we would expect, comparing these, if there was no effect that all of these black dots would line up on that blue line. Okay. The red line is the trend through that cloud of dots and so the difference of the red line from the blue line is a measure of how much it's changed towards the hatchery. Okay. If there's a change towards the hatchery, that red line will become more and more horizontal. Alright. And we can see that the effect here is very different, Wells is almost horizontal but Wells was also the original hatchery. Constantine, very little change over 30 years, that red line is very close to the blue line. This is all described in a paper that is publically available.

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REPRESENTATIVE SEATON surmised that the Wells River was the original genetic source.

MR. TEMPLIN clarified the Wells River was the main source.

REPRESENTATIVE SEATON asked whether within the hatchery the Wells River stock changed its genetic composition and then is straying into the Wells River streams and overwhelming the preexisting genetic composition.

MR. TEMPLIN responded that he did not believe that could be said yet, because the Wells River was the original population, the main population that contributed to the hatchery. He explained that there are many potential reasons for this and more study would have to be done. A hatchery/wild interaction study is currently ongoing, funded in part by the State of Alaska and the processors. He opined that two reasons could be that because the original stock came from Wells River that strays from the hatchery might do well in the Wells River. He noted that Siwash Creek is actually closer to the hatchery and has recorded sometimes as much as 50 percent stray fish and for some reason it is not being affected much by the hatchery. He opined that it may have to do with the hatchery fish returning at a time that is not optimal.

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REPRESENTATIVE SEATON said in order to determine whether the spread between the red and blue lines indicates the genetic change to the base population, it would have to be assumed that the population was taken from Wells River and put it in the hatchery. Although, if it was put right back at the same genetic there wouldn't be anything seen. So, he surmised, it would have to be assumed that the Wells River stock significantly genetically changed through the hatchery operations and then some of that spread back to Wells River. He said he was trying to determine how there could be this drastic differential in the parent population.

MR. TEMPLIN answered that he has taken a lot of information and condensed it down. The red line is a measure of "introgression rate," the movement of genes from the hatchery into the natural populations; for example, if hatchery fish successfully spawn in the stream some of those genes are now in the gene pool. So, this is a measure of how fast or whether that is even occurring. Also, he noted, when reviewing the spread of the dots, Wells River is a cloud whereas Constantine is stretched out, which is an indication of the amount of genetic difference between Wells River and the hatchery, and Constantine and the hatchery. So, there is a continuum upon which he would have to do these and it would be another study. Yes, he said, this indicates that over time that these populations are becoming slightly more like the hatchery but it does not measure how or where that is happening.

REPRESENTATIVE SEATON advised he is trying to clarify because the public is listening to the hearing and this study has several potential meanings that must be figured out.

MR. TEMPLIN agreed that there are several potential meanings in this and said it is carefully laid out in the paper.

MR. TEMPLIN continued his presentation, noting that the implications of the study are that the population structure is not visibly eroded, introgression rates are highly variable among locations (some places there is resistance and some places there are changes), and both distance from the hatchery and life history can effect that introgression rate.

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REPRESENTATIVE TARR referred to a documentary that was produced in the last couple of years regarding efforts to restore wild

salmon populations along the western coast and the dam removal. One of the challenges discussed within the documentary was that populations have been so weakened that they are not strong enough to rebound on their own. She asked whether, as the red line comes closer to the horizontal, that means the wild stock has been diluted, and should Alaska be similarly concerned about the strength of those populations going forward.

MR. TEMPLIN answered that the distinction between the State of Alaska's hatchery system and the hatchery systems in the Pacific Northwest is that those in the Pacific Northwest are mainly rescue and supplementation type hatcheries that are trying to build up populations from harm that was caused. Alaska's hatcheries are generally systems designed to create fish to be caught. Therefore, Alaska's previous scientists developed a genetics policy to guide hatchery programs as well as a large number of regulations and statutes that guide Alaska's hatchery programs, and put sideboards on it to keep this from happening.

MR. TEMPLIN responded to Representative Tarr's second question by saying, yes, if all of those red lines were horizontal it would indicate there was quite a bit of change happening and a change in the direction of the hatchery population, and that would be a big warning to the state that some of its management is not working.

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MR. TEMPLIN elaborated on the remaining slides in his PowerPoint presentation, beginning with the slide entitled, "Applications: Inform/Assess Management, Example: Western Alaska Salmon Stock Identification Program [WASSIP]." He advised that WASSIP was funded by the legislature and was the biggest thing of its kind ever done anywhere. He related that Area M had a long history of differences of opinion on the interception fishery and in many instances decisions were being made without much information. In the early 1990s there was the idea of using genetics and a study provided information. But there was still a lot of concern about what was going on. U.S. Senator Ted Stevens stated he would be willing to pull political support together to fund a large-scale collaborative genetic project "If, and only if, the stakeholders could agree on the necessary information, the study design, and results." A miracle happened and a large group of organizations got together and formed an advisory panel [WASSIP] and signed a memorandum of understanding to guide this study. The study looks at every fishery from Chignik all the way around the coast up to Kotzebue Sound.

MR. TEMPLIN pointed out that the length of the coastline is about 3,300 kilometers. Approximately 278 fishery strata were identified for Chum salmon and [307] for Sockeye salmon. The numbers of individuals to be genotyped [74,445 Chum salmon and 81,932 Sockeye salmon] do not look large, but at the time of the study a typical laboratory might put between 5,000 and 20,000 fish through per year. The study had to 75,000 Chum and 82,000 Sockeye in about a year and a half. He said the Chum salmon baseline basically has about 36,000 individuals and about 300 populations covering everything from Korea to Washington. Regarding what kind of information is received from such a study, he pointed out that one of the big questions [needing to be answered] is, What stocks are caught in my fishery? Other questions include: How many fish of each stock were caught in my fishery? What fishery catches my stock? He noted that these questions were done for both Sockeye and Chum. This very successful study has been very useful and is still being used; for example, a large number of proposals for Area M are being based upon this WASSIP information.

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MR. TEMPLIN discussed the six remaining slides entitled, "Applications: Inform/Assess Management, Example: Port Moller Test Fishery - Inseason." He explained that in this fishery, the department provides real time information inseason as the fishery is happening to guide management. He advised that this information is used by managers, fishermen, and processors. The Port Moller Test Fishery takes place in lines off of Port Moller stretching towards Cape Newenham. It looks at fish passing through this line towards Bristol Bay and the questions being asked include: Which stocks are these coming from? How are they distributed? How many are there? He brought attention to a news release that goes out to managers, fishermen, and processors that provides real time information about the fish that are coming through or not coming through. This test fishery is now a global fisheries management tool of interest to Russia, Japan, and Korea.

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**ADJOURNMENT**

There being no further business before the committee, the House Resources Standing Committee meeting was adjourned at 3:09 p.m.